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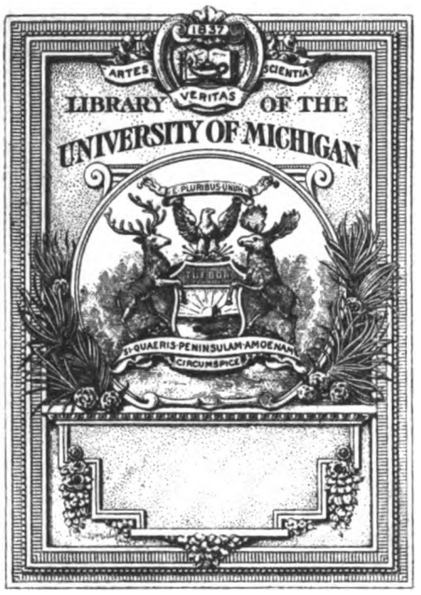

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INDEX TO VOL. LV

Electrical Review and Western Electrician

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AUTHORS OF ARTICLES IN VOL. LV OF THE ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

Abbott, W. L., Central-Station Economies 832
Adams, Alton D., Rise of Generator Capacity* 589
Income from Cotton Mills* 986
Agnew, P. G., and M. G. Lloyd, The Regulation of Potential Transformers and the Magnetizing Current* 242
Effect of Phase of Harmonics upon Acoustic Quality 487
Atchison, J. C., Jr., and Fred Kleinschmidt, Heat Insulation and Efficiency of Electric Heating Apparatus 252
Baker, Joseph B., Details of Watt-Hour meter Manufacture* 278, 326, 386, 426, 458, 526
Barringer, A. H., A 2,750-Volt Direct-Current System* 1240
Barrows, W. E., Jr., The Methods of Comparing our Various Sources of Artificial Light 1138
Bell, Dr. Louis, The Problem of Domestic Lighting 470
Bishop, Charles R., The Advantages to Electric Companies of Central-Station Steam Heating 887
Bonham, W. R., A Concrete Case of Tungsten Economy 597
Bridge, A. H., Electric Supply System of a Scottish Coal-Field* 579
Brown, L. C., Electrical Equipment of the Battle Creek Shops of the Grand Trunk Railroad* 103
Campbell, Duncan T., Advertising, Direct and Indirect 836
Carichoff, E. R., Current-Limit Control*... 540
Carpenter, G. E. L., New-Business methods of the Electric Light and Power Company at Hamilton, Ont. 1000
Cleveland, John A., Getting Power Business 492
Cravens, George W., Catenary Trolley-Line Construction* 626
Ethyl Alcohol from Wood Waste* 425
Daniels, C. E., Installation, Operation, Care and Repair of Electric Motors in Industrial Operations* 795, 845, 892, 945
Davis, C. D., and W. R., Domestic and Foreign Registration of Trade Marks. 925
De Courcy, A., The Bellene and Tosi Directional Wireless System; the New Experiments* 838
Deutsch, S., Architects' Wiring Specifications 834
Doane, S. E., The Illuminating Engineer.. 479
Draper, George H., The New Congressional Heating, Lighting and Power Plant at Washington* 1125
Dunlap, Orrin E., Electrical Facilities for Getting Perishable Freight to Market. 844
What Constitutes a Good Lubricant?.... 1103
Durand, C. L., The New Electric Railroad in Switzerland* 204
The New Electric Locomotives for the Simplon Tunnel 938
Ehrlich, Howard, The Electrical and Mechanical Installation in the Hotel La Salle* 418
Eustice, A. L., Commercial Tests on Systems of Illumination* 472
Fisher, H. W., Losses, Induced Volts, and Amperes in Armor and Lead Cover of Cables* 238, 282, 331
Gradenwitz, Dr. Alfred, The Plant of the Victoria Falls and Transvaal Power Company* 1180
Hall, Leon M., Modern Application of Electric Motors to Mine Hoisting* 1199
Harris, Max, Progress in the Westinghouse-Nernst Lamp System* 507
Hart, Joseph H., The Absolute Standard of Light 595
Hering, Carl, Laws of Electrode Losses in Electric Furnaces* 993, 1082
Hermann, Henry, Distorted Waves and Their Analysis by a Simple Method*... 97
Hobart, H. M., The Determination of the Circle Coefficient of the Induction Motor* 1073
Hubbard, Charles L., Mechanical Draft.... 786
Hutchings, O. H., The Supply of Electric Current to Other Towns from a Centrally-Located Station 248
Hutchins, C. C., A New Method of Measuring Light Efficiency* 1194
Kershaw, John B. C., The Manufacture of Articial Nitrates from the Air in Norway* 155
Recent Progress in Electric Steel Refining* 490
Industrial Smoke Prevention in Hamburg* 788
Electrolytic Bleaching 994
Kleinschmidt, Fred, and J. C. Atchison, Jr., Heat Insulation and Efficiency of Electric Heating Apparatus 252
Kline, W. J., Some Remarks on District Steam Heating 1133
Knowlson, James S., Central Stations in Towns of Less Than 4,000 Population* 160
Koester, Frank, The Wetterhorn Cable Road of the Grindelwald Glacier, Switzerland* 61
Electrically Operated Cogwheel Railway, Montreux-Glion, Switzerland* 1043
Three-Phase Traction Systems 1087
Lincoln, J. C., Meat Curing by Electricity. 1233
Little, J. O., Central-Station Advertising. 600, 790
Liversidge, H. P., Chart for Calculation of Voltage Losses* 194
Lloyd, E. W., Compilation of Load Factors* 110
Lloyd, M. G., and P. G. Agnew, The Regulation of Potential Transformers and the Magnetizing Current* 242
Effect of Phase of Harmonics upon Acoustic Quality 487
McLaren, John, Extended Uses of Electricity on Board Ship....594, 638, 737
Mayer, Clarence, Methods and Costs of Underground Circuit Construction* 1121
Mitchell, A. J., Developments in Arc Lighting 477
Mulock, Gilbert, Public Lighting Fixtures for Arc Lamps* 1037
Nichols, Howard M., Data on Direct-Current Motors 210
Odwald, K., Flame Arc-Lamp Carbons*... 706
Oram, H. J., The Electric Propulsion of Ships 1141
Owens, H. Thurston, Street Lighting Abroad* 930
Street Lighting in Newark, N. J* 989
Pack, R. F., Practical Accounting for Electrical Companies 801
Parker, C. A., Getting Back to First Principles 942
Getting After Unwired Houses 1146
Perkins, Frank C., A Remarkable 7,000-Horsepower Electric Rolling-Mill Motor Equipment* 1144
Perkins, J. H., New Methods and Specifications for Street Lighting 643
Rae, Frank B., Jr., and E. B. Rowe, The Illumination of Mills and Factories with Small Units* 503
Richards, W. E., The Commercial Organization of An Electric-Light Company and Its Relation to the Public 251
Rowe, E. B., and Frank B. Rae, Jr., The Illumination of Mills and Factories with Small Units* 503
Schroeder, Henry F., Tungsten Sign Lighting* 479
Schweitzer, E. O., Lubricating and Electric Brushes for Commutators and Collector Rings* 532
Scott, C. H., Power Used in the Re-Manufacture of Lumber, with Special Reference to Central-Station Energy for That Purpose 414, 484
Sharpsteen, S. H., Printing-Press Data for Electric-Motor Salesmen and Engineers 298
Smith, Claude, The Supply of Electric Current to Other Towns from a Centrally-Located Station 248
Tiedeman, John E., The New Down-Town Street-Lighting System of St. Louis*.. 1136
Underhill, Charles R., The Design of the Marcel Deprez Electromagnet* 234
Watson, S. J., Development of Electrical Undertakings 1039, 1134, 1186
Weedon, William S., The Titanium Arc*.. 1035
Westerfield, William, Diplomacy in Business 1077
Willey, D. A., Work on the Roosevelt Irrigation Project in Arizona* 284
Young, H. W., A Rational Method of Installing Service Meters* 1131
Zanzig, F. C., The Rouge-Faget Permutator* 1078

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INDEX TO VOLUME LV

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

JULY 3 TO DECEMBER 25, 1909

Articles Marked * are illustrated; (E) indicates "Editorial"; (R) indicates "Reviews of Current Engineering and Scientific Literature."

A

Abrasives, production of in 1908..... 545
Accident and quick recovery*..... 154
Accidents on Indiana electric lines, increase in 338
Accidents on New York City railways, fewer 623
Accidents on New York railways..... 941
Accidents on New York roads, fewer..... 22
Accidents on Pennsylvania roads..... 463
Accounting for electrical companies, practical, by R. F. Pack..... 301
Accumulators, electric locomotive with Edison 980
Accounting for small central stations, system of 1234
Acoustic method of tuning for wireless telegraphy* 333
Acoustic quality, effect of phase of harmonics upon, by M. G. Lloyd and P. G. Agnew 487
Advertising, central-station, by J. O. Little* 600, 790
Advertising, direct and indirect, by Duncan T. Campbell 836
Advertising, follow-up system of*..... 599
Advertising, getting back to first principles in, by C. A. Parker..... 942
Advertising in season..... 791
Advertising in small towns, novel methods of 15
Advertising made effective by appealing to children, central-station*..... 493
Advertising, testing 599
Advertising, timely 944
Advertising, without 538
Aerial exhibition, international..... 578
Aerial tramcars 941
Aeronautics, Hudson-Fulton 119
Aeronautics, school of..... 535
Aeroplane inventions 791
Aeroplane records, notable..... 202
Agreement, important distribution (E)..... 724
Air, dielectric strength of..... 739
Airships, dangers of atmospheric electricity to 538
Alaska, wireless operation in..... 951
Alaska-Yukon-Pacific Exposition, electrical days at*..... 390
Albany & Hudson reorganization plan approved 538
Albany & Hudson Road, receiver for..... 671
Albany & Hudson sold..... 550
Albany & Southern bond issue..... 588
Alliance of telephone and telegraph companies, proposed 8
Allis-Chalmers Company annual report..... 801
Alternating-current lines, telegraph and telephone systems as affected by..... 780
Alternating-current rectifier vibratory*.... 891
Alternator group of 11,200 horsepower for Buenos Aires central station, turbo-tandem (R)..... 171
Alternators, regulator for (R)..... 215
Aluminum casting foundries needed..... 431
Aluminum contract, large..... 1091
Amalgamation, electrochemical 545
American Electrochemical Society..... 878
American Exposition, Berlin..168, 431, 623, 1223
American Institute of Electrical Engineers 582, 677
American Institute of Electrical Engineers, Convention of (E).....3, 45
American Institute of Electrical Engineers, December meeting 1077
American Institute of Electrical Engineers, Joint meeting of Seattle Section and Northwest Electric Light and Power Association .....341,..547
American Institute of Electrical Engineers, newly elected associates and members of 826, 985
American Institute of Electrical Engineers, 239th meeting 780
American Institute of Electrical Engineers, 240th meeting 981
American Institute of Eletrical Engineers, 241st meeting 1228
American Institute of Electrical Engineers —Armour Institute Branch..... 948
American Institute of Electrical Engineers Chicago Section, joint meetings of, with Electrical Section, Western Society of Engineers.....622, 823, 975, 1174
American Institute of Electrical Engineers Lewis Institute Branch..... 921
American Institute of Electrical Engineers —Pittsburg Section 675, 799, 1023, 1225
American Institute of Electrical Engineers —Seattle Section, joint meeting with Northwest Electric Light and Power Association 341, 547
American Monorail Company..... 297
American Society of Engineering Contractors 71
American Society of Mechanical Engineers 642, 924
Americal Telephone and Telegraph Company secures control of Western Union 978
American Telephone denies control of Western Union 1174
American Telephone-Western Union..... 435
American Telephone-Western Union combination, President Vail on..... 1022
American Telephone's wonderful possibilities 209
American Trade Press Association, annual meeting 921
American waterpowers 591
Ammeter for currents of great intensity and high frequency, thermal (R)..... 439
Among the contractors and supply men.. .....549, 701, 899
Annual meeting, American Trade Press Association 921
Annual meeting, Electrical Trades Association of Chicago..... 976
Annual report of city electrician of Chicago 211
Appeal, Worcester (E)..... 571
Application of electricity to propulsion of naval vessels 1250
Arc, counter electromotive force in electric. 792
Arcs at Boston, increase of flaming (E).... 1069
Arc lamp, enclosed*..... 933
Arc lamp, fluid-electrode*..... 885
Arc lamps, public lighting fixtures for, by Gilbert Mulock*..... 1037
Arc lighting, developments in, by A. J. Mitchell 477
Arc, titanium, by William S. Weedon*..... 1035
Architects' wiring specifications, by S. Deutsch 834
Arctic explorers, motors for..... 651
Arctic plant life and auroras..... 1024
Argentine international exhibition..... 8
Argentine, wireless in.....460, 694
Armour Institute Branch—American Institute of Electrical Engineers..... 948
Arno galvanometer, measurements of telephone currents by (R)*..... 171
Arsenals, electric drive in Italian..... 997
Art in public lighting (E)..... 917
Artificial light, methods of comparing our various sources of, by W. E. Barrows, Jr. 1138
Artistic possibilities of electricity..... 302
Ashtabula, Ohio, automanual telephone exchange at*..... 1092
Assited electric generating plants..... 534
Assisted plants (E)..... 525
Associated Gas and Electric..... 1003
Association of Edison Purchasing Agents.. 535
Association of railway electrical engineers (E) 724
Atmospheric electricity, dangers of to airships 538
Auroras, Arctic plant life and..... 1024
Australia, electrical developments and problems in Western..... 541
Australia, electrical opportunities in.....1134
Australia, electrification in..... 674
Australia, wireless in..... 1158
Australian central station, new..... 1091
Australia, machinery development in..... 998
Austro-German waterpower dispute..... 1049
Automanual telephone exchange at Ashtabula Harbor, Ohio*..... 1092
Automobile, long trip of electric..... 305
Automobile works, centralized light, heat and power service in large..... 1182
Aviation, chair of..... 5
Avogadro centenary 253

B

Baloon, try wireless with..... 9
Baltimore's electric light and power companies 384
Barge Canal reservoirs for power, may use 958
Battery-charging device, new..... 591
Battery, how to make a simple dry..... 546
Battle Creek shops of Grand Trunk Railroad, electrical equipment of, by L. C. Brown* 103
Battleships, turbines for American..... 732
Bell mergers, Missouri attacks..... 1071
Bell push, an indicating (R)*..... 73
Bell Telephone, of Buffalo..... 675
Bell Telephone of St. Louis..... 435
Bellini and Tosi directional wireless system; the new experiments, by A. De Courcy* 838
Betterment expenses, subdividing by municipalities (E) 142
Bible, electricity in (R)..... 347
Birmingham, England, electrical development in 1097
Bituminous producer in double role in sheet-metal factory 541
Blacksmith, enterprising 1042
Bleaching, electrical (R)..... 72
Bleaching, electrolytic, by J. B. C. Kershaw 994
Block signaling, railway..... 948
Block signals, Indiana Railroad Commission urges work on..... 1198
Blower in rolling mill, electrically driven converter (R) 438
Bolt Head wireless station*..... 692
Bombay Cathedral, electric fan installation in* 539
Bomb outrage, Chicago's latest..... 4
Bond issue authorized..... 588
Bonds, traction company to issue..... 739
Books, may see lighting company's..... 200
Book publishing consolidation, technical... 65
Book reviews (E)..... 277
Book Reviews.
A History of the Warfare of Science with Theology, by Andrew Dickson White 291
Alternating Currents, by Alfred W. Marshall 290
Alternating-Current Motors, by A. S. McAllister 700
American Street Railway Investments.. 296
An Introduction to the Science of Radio-Activity, by Charles W. Rafferty..... 291
A Study of Electrothermal and Electrolytic Industries (Part I.), by Edgar A. Ashcroft 290
Atlas der Elektropathologie, by Dr. S. Jellinek 296
Boiler-Feed Water, by Frederick A. Anderson 292
Conductors for Electrical Distribution, by F. A. C. Perrine..... 293
Direct and Alternating-Current Testing, by Frederick Bedell..... 848
Dynamos and Motors, by William Suddards Franklin and William Esty.... 848
Dynamo Laboratory Manual. Vol. I. William Suddards Franklin and William Esty 848
Electric Furnaces, by Wilhelm Brochers 290
Electric Lamps, by Maurice Solomon... 292
Electric Power Conductors, by William A. Del Mar 700
Electric-Railway Auditing and Accounting, by William H. Forse, Jr..... 295
Electric-Railway Power Stations, by Calvin F. Swingle..... 292
Electric Railway Troubles and How to Find Them, by Paul E. Lowe..... 296
Electrical Circuits and Diagrams (Part II.), by Norman H. Schneider..... 294
Electrical Illuminating Engineering, by William Edward Barrows..... 292
Electricity Explained, by J. Calvin S. Thompkins 848
Elementary Electrical Calculations, by T. O'Conor Sloane..... 296
Elementary Manual of Radio Telegraphy and Radio Telephony, by Prof. J. A. Fleming..... 343
Erecting Work, by Hubert E. Collins.. 849
General Lectures on Electrical Engineering, by Charles Proteus Steinmetz 290
Harper's Machinery Book for Boys, by Joseph H. Adams..... 295
Heany Electrical Engineering, by H. M. Hobart 290
High-Tension Underground Electric Cables, by Henry Floy..... 24
How to Understand Electrical Work, by Willliam H. Onken, Jr., and Joseph B. Baker 291
Hydroelectric Development and Engineering, by Frank Hoester..... 291
Internal Combustion Engines, by William M. Hogle..... 296
Knocks and Kinks, by Hubert E. Collins 849
Lessons in Telegraphy, by Charles Henry Sewall 294
Making Wire Outfits, by Newton Harrison 294
Motorman's Practical Air Brake Instructor, by George R. Denehie..... 700
Natural Sources of Power, by Robert S. Ball 1098
Naval Electricians Text Book, by W. H. G. Bullard..... 294

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Book Reviews—Continued
Patents as a Factor in Manufacturing, by Edwin J. Prindle..... 295
Pipes and Piping, by Hubert E. Collins. 849
Practical Alternating Currents and Alternating-Current Testing, by Charles T. Smith..... 290
Practical Armature and Magnet Winding, by Henry C. Horstmann and Victor H. Tousley..... 294
Practical Calculation of Transmission Lines, by L. W. Rosenthal..... 293
Questions and Answers About Electrical Apparatus, by W. B. Clayton and J. W. Craig..... 24
Railway Signaling in Theory and Practice, by James Brandt Larimer..... 848
Shop Tests on Electric-Car Equipment, by Eugene C. Parham and John C. Shedd..... 294
Smoley's Tables, by Constantine Smoley 295
Social Engineering, by William H. Tolman..... 295
Stationary Transformers, by William T. Taylor..... 293
Steam Power Plant Piping Systems, by William L. Morris..... 292
Steam Tables and Diagrams, by Lloyd S. Marks and Harvey N. Davis..... 292
Steam Turbines, by Hubert E. Collins.. 849
Submarine Cable Laying and Repairing, by H. D. Wilkinson..... 294
The A B C of Railroad Signaling, by W. H. Elliott..... 848
The Copper Handbook, by Horace J. Stevens..... 291
The Design and Construction of Induction Coils, by A. Frederick Collins.... 293
The Protection of Railroads from Overhead Transmission Line Crossings, by Frank F. Fowle..... 700
The Theory of Electric Cables and Networks, by Alexander Russell..... 293
Transformers, by Gisbert Kapp..... 293
Water-Power Engineering, by Daniel W. Mead..... 290
Webster's New International Dictionary 1098
Welding and Cutting Metals by Aid of Gas or Electricity, by L. A. Groth... 848
Wireless Telephone Construction, by Newton Harrison..... 294
Booklet, attractive*..... 791
Booklets of central stations, some effective*..... 1150
Boston & Maine to use waterpower..... 300
Boston consolidations approved..... 475
Boston electrical show.....429, 622, 918, 974
Boston electrical show*..... 1027
Boston Edison gross earnings show signs of increase..... 886
Boston Edison lecture course for 1909-1910. 237
Boston street lamps, rates for (E)..... 411
Boston street railways merger..... 703
Boston tunnel contract signed..... 691
Boy, giving poor a chance..... 337
Brass smelting, induction furnace for..... 126
Brush electromagnetic rail-brake (R)..... 28
Brazil electrical development in..... 789
Brazil, more electrical projects in..... 263
Brazil, telegraphy in..... 676
Brazil telephones in..... 429
Breakdowns in electrical machinery, causes of.....948, 996
Brennan monorail system..... 979
Brennan monorailway, gyroscopic balancing and (E)..... 973
Breweries, electric power in..... 486
Bridge stock sale opposed..... 417
British electrical industrial association..... 117
British electrical industry..... 1104
British government takes over Lloyds and Marconi wireless stations..... 694
British Illuminating Engineering Society.. ..... 992, 1193
British insurance company's report on breakdowns in electrical machinery.... 948
British patent act, first year's results of... 596
British telegraph and telephone official visits Chicago..... 726
British telephone rates..... 210
Bronx Gas and Electric Company..... 578
Brooklyn Rapid Transit Company's annual report..... 430
Brooklyn Rapid Transit pension plan..... 1225
Brooklyn Section—National Electric Light Association..... 1041
Brooklyn Subway, bonds authorized for.... 940
Brooklyn subway contract signed..... 923
Brunette making..... 166
Brunswick Terminal and Railway..... 703
Brushes for commutators and collector rings, lubricating and electric, by E. O. Schweitzer*..... 532
Buenos Aires, alternator group of 11,200 horsepower for central station at (R).. 171
Buenos Aires, subway for..... 825
Buffalo, industrial exposition in..... 726
Bug and moth trap, electrical..... 1208
Bulk and retail service, discriminates between..... 165
Bump, Milan R., in charge of construction on Spring River plant..... 373
Bureau of electricity, Japanese..... 527
Business good, electrical..... 1205

C

Cable another Atlantic..... 385
Cable company work stopped..... 730
Cable controversy in Newfoundland..... 694
Cable, Europe-Argentine 1179
Cable, for an all-British..... 195
Cable monopoly, no American..... 435
Cable laid in 1881-1882 in perfect state..... 489
Cable line, no all-red..... 432
Cable press rates cut..... 19
Cable rates reduced, British..... 460
Cable rates, to reduce..... 197
Cable road of Grindelwald Glacier, Switzerland, the Wetterhorn, by Frank Koester*..... 61
Cable systems, the world's..... 19
Cable, to send money by..... 1181
Cable, will pick up old..... 336
Cables, all-British 831
Cables and commercial telegraphs, ocean.. 950
Cables in collieries, protecting underground 593
Cables, losses, induced bolts, and amperes in armor and lead cover of, by H. W. Fisher*.....238, 282, 331
Cadmium amalgams and the Weston normal cell 1085
Calcium carbide factory in Mexico..... 1243
Calcium carbide, world's production of..... 1050
California electric companies combine..... 147
Canada, electrical standardization in..... 1050
Canada, electrification in..... 211
Canada, telephones in..... 950
Canada's exports of electricity and natural gas 578
Cancer, removing by electricity..... 1071
Candlepower of Boston street lamps (E).... 2
Capstans in dockyards, electric..... 15
Car equipment merger, big..... 851
Car heating, Public Service Commission orders for 1070
Car, improved trolley..... 676
Carbons, no increase in price of..... 287
Carbons, tariff on..... 256
Carborundum in radiotelegraphy (R)..... 73
Card-index files for advertisers (E)..... 233
Cargo-handling appliances, electric..... 431
Carlsbad, electric railroad in..... 1046
Cars are licensed, decides street..... 208
Cars on Broadway, New York City, new.. 1046
Cars, pay-within 468
Cars, space between Chicago street, to be enlarged 17
Cascade Tunnel, electro system of Great Northern Railway at..... 981
Casualties, Chicago street-car..... 726
Catalogue classification association..... 195
Catenary Trolley-line construction, by George W. Cravens*..... 626
Cedar telephone and telegraph poles..... 544
Cell, alternating-current primary (R)..... 346
Cell, cadmium amalgams and Weston normal 1085
Cell, new primary..... 691
Cells, characteristics of dry*..... 198
Cement merger, $25,000,000..... 263
Cement unloader, motor-driven*..... 894
Census agents for manufacturers, special... 678
Central bureau formed for traction lines.... 1046
Central District and Printing Telegraph Company taken over by American Telephone and Telegraph..... 299
Central Electric Accountants' Association, meeting of 598
Central Electric Company purchases Chicago
Central Electric Company purchases Chicago real estate.....390, 463
Central Electric Railway Association.....
.....297, 464, 873, 1045
Central Park to be properly lighted..... 992
Central-station advertising, by J. O. Little* 600, 730
.....
Central-station advertising, getting back to first principles in, by C. A. Parker..... 942
Central-station advertising made effective by appealing to children*..... 493
Central-station customers, unique manner of interesting 944
Central-station developments in Massachusetts (E) 668
Central-station economies (E)..... 819
Central-station economies, by W. L. Abbott 832
Central-station experts wanted, two (E)... 1172
Central station, improving old (E)..... 1020
Central-station investment, units of (E).. 620
Central station, new Australian..... 1091
Central-station operation in Chicago..... 921
Central-station operators, co-operation between (E) 456
Central-station plant for United States Navy Yard 435
Central-station statistics, value of (E).... 621
Central-station steam heating, advantages to electric companies of, by Charles R. Bishop 887
Central station, supply of electric current to other towns from a centrally-located (E) 231
Central station, supply of electric current to other towns from centrally-located, by O. H. Hutchings and Claude Smith. 248
Central stations, gas engines for small..484, 535
Central stations, ice making as a means of improving load factor (E)..... 367
Central stations in small communities (E). 141
Central stations in towns of less than 4,000 population, by James S. Knowlson*.... 160
Central stations, some effective booklets of* 1150
Central stations, steam heating in connection with 784
Central West, hydroelectric power in (E).. 915
Certificate rights upheld, receivers'..... 200
Chair of aviation..... 5
Charge decisions by Massachusetts Commission, minimum (E)..... 1115
Charges for electric supply, fair (R)..... 259
Charges, ready-to-serve and minimum-rate (E)..... 523
Chart for calculation of voltage losses, by H. P. Liversidge*..... 194
Chicago & Milwaukee Telegraph Company sold 1120
Chicago, annual report of city electrician of 211
Chicago arranging for complete electric lighting of its streets..... 1070
Chicago, central-station operation in..... 921
Chicago Consolidated Traction..... 851
Chicago Electric Club.....22, 65, 166, 207, 253, 460, 583, 622, 677, 726, 735, 779, 822, 871, 918, 980, 1023, 1072, 1120, 1222
Chicago electrical show.....
.....791, 870, 1022, 1181, 1226
Chicago, electrification of railroad terminals in (E) 619
Chicago, gigantic consolidation of public utilities rumored in 671
Chicago, Joliet & St. Louis Railway to enter Chicago 1234
Chicago Press Club, Mr. Insull at..... 824
Chicago's proposed subway..... 463
Chicago, railroad terminal electrification made mandatory in..... 624
Chicago railway wages (E)..... 620
Chicago Section, American Institute of Electrical Engineers, joint meetings of with Electrical Section, Western Society Engineers.....622, 823, 975, 1174
Chicago Section, Illuminating Engineering Society 991
Chicago subway, to care for..... 849
Chicago to receive enormous sums from public utility corporations..... 169
Chilean government studying electrification 941
China, German electrical enterprise in..... 19
China Light and Power Company purchased 592
China, wireless in..... 544
Cincinnati proposed municipal subway..... 1097
Cipher telegraph rates advanced..... 380
Classification, changes in patent..... 799
Cleanliness of light sources..... 794
Cleveland Electric Club entertains..... 870
Cleveland's subway project criticized..... 633
Cliff Electrical Distributing Company..... 391
Clock, new electric (R)..... 171
Coal, buying of, on heat-unit basis*...482, 835
Coal-cutting machinery in Great Britain.. 432
Coal dust, utilization of..... 923
Coal-field, electric supply system of Scottish, by A. H. Bridge*..... 579
Coal mines, electricity in (E)..... 323
Coal mines, electricity in (R)..... 73
Coal mines, electricity supply in..... 247
Coal mining industry, electricity in..... 641
Coal mining, safe use of electricity in..... 334
Coal production in Pennsylvania..... 286
Coal, production of in 1908..... 417
Coal, purchase of on heat-unit basis..... 676
Code rule, delay in new..... 437
Coercion decision in Germany..... 975
Cogwheel railway, Montreux-Glion, Switzerland, electrically operated, by Frank Koester* 1043
Coke-oven gas, cheap electric power from.. 1188
Collieries, protecting underground cables in 593
Colliery, electric power in New South Wales 597
Collisions, device for preventing..... 1088
Color value of Moore tube, test of..... 792
Colorado, bulk power supply in..... 67
Columbia Gas and Electric Standard Oil in 582
Columbia University, December meeting of Electrical Engineering Society of..... 1185
Comments on the development and operation of hydroelectric plants, by Henry L. Doherty 1228
Commercial Cable Company's taxes..... 694
Commercial conditions at home and abroad, improving 1026
Commercial department forms and methods, advantages to be derived from.... 15
Commercial organization of an electric-light company and its relations to the public, by W. E. Richards..... 251
Commission, action against Canadian hydroelectric 469
Commonwealth Edison Branch, National Electric Light Association, annual banquet of 873
Commonwealth Edison Company..... 1152
Commonwealth Edison Company, annual meeting and report..... 953
Commonwealth Edison Company lady employes, annual outing for..... 635
Commonwealth Edison Company submits profit-sharing plan to employes..... 71
Commonwealth Edison enlargements..... 671
Commonwealth Edison stockholders to vote on increasing capital stock..... 391
Compass, to test new recording..... 698
Compass, registering (R)..... 258
Competition of high-pressure gas (E)..... 1067
Concrete construction for power plants.... 1023
Condense, does it pay to (E)..... 917
Condenser dielectrics, pure wax sheets for 127
Condensers, Meirowsky high-tension (R)*.. 258
Condensers, standardization of (R)..... 346
Conductors, safety suspension for high-tension* 891
Conduit companies sued..... 5
Conduit Construction, high-speed*..... 68
Conduit construction, methods and costs of underground, by Clarence Mayer*..... 1121
Coney Island & Brooklyn Railroad Company 416
Congressional heating, lighting and power plant at Washington, new, by George H. Draper* 1125

Digitized by Google

Connecticut electric roads..... 844
Connecticut, railway legislation in..... 578
Connecticut river power..... 119
Connecticut River power in Massachusetts (E)..... 232
Conservation course for engineers..... 1124
Consolidated Traction Company, proposed reorganization plans of..... 633
Consolidation, Monmouth (Ill.) public service..... 623
Consolidation of public utilities in Chicago, rumored..... 671
Consolidation, technical book publishing.. 65
Consolidations approved, Boston..... 475
Constant current, new machine for*..... 695
Constantinople, electric lighting for..... 476
Conta arc lamp without regulating mechanism (R)..... 215
Continental Telegraph and Telephone Company..... 726
Contractors and electrical supply men, among (E)..... 525
Contractors and supply men, among..... .....549, 701, 899
Control, current-limit, by E. R. Carichoff*. 540

CONVENTIONS.
Alabama Light and Traction Association..... 1072
American Association of Electric Motor Manufacturers..... 1071
American Electrochemical Society..... 799
American Institute of Electrical Engineers.....3, 4, 45, 48
American Mining Congress..... 469
American Physical Society..... 586
American Railway Master Mechanics' Association..... 18
American Society of Civil Engineers.... 166
American Society of Mechanical Engineers 1030, 1176
American Street and Interurban Railway Accountants' Association....253, 741
American Street and Interurban Railway Association..... .....79, 235, 462, 538, 632, 670, 725, 740
American Street and Interurban Railway Claim Agents' Association..... 752
American Street and Interurban Railway Engineering Association..... 741
American Street and Interurban Railway Manufacturers' Association..... 757
American Street and Interurban Railway Transportation and Traffic Association..... 747
Association of Car Lighting Engineers 591, 646, 672, 724, 733
Association of Edison Illuminating Companies 336, 465
Association of Iron and Steel Electrical Engineers..... 159
Association of Railway Telegraph Superintendents..... 108
British Association for the Advancement of Science.....237, 428, 494
Canadian Electrical Association..... 20
Colorado Electric Light, Power and Railway Association.....163, 754
Convention of Illuminating Engineering Society (E)..... 667
Conventions, electric railway (E)..... 725
Empire State Gas and Electric Association..... 1023
Federation of Trade Press Associations. 636
Illinois Independent Telephone Association..... 977
Illinois State Electric Association..... .....673, 779, 874
Illuminating Engineering Society..... .....339, 460, 597, 667, 679
Indiana Electric Light Association*.... 370
Indiana Railroad Commission..... 799
International Association of Municipal Electricians 481, 587
International Independent Telephone Association.....760, 1072, 1119, 1190
Kansas Gas, Water, Electric Light and Street Railway Association..... 623
Manufacturers' Association..... 433
Massachusetts Electric Light Association..... 332
Master Car Builders' Association..... 24
Michigan Electric Association.....286, 381
National Association of Cotton Manufacturers..... 541
National Association of Railroad Commissioners..... 1196
National Commercial Gas Association.. 1224
National District Heating Association.. ..... 974, 1031
National Electric Contractors' Association.....14, 70, 113, 144, 187, 190
National Electric Light Association, New England Section..... 585
Northwest Electric Light and Power Association 341, 547
Northwestern Electrical Association.109, 1070
Ohio Electric Light Association..... .....70, 118, 143, 148
Ohio Society of Mechanical, Electrical and Steam Engineers..... 1070
Ohio State Electrical Contractors' Association..... 209
Old Time Telegraphers' and Historical Association and Society of the United States Military Telegraph Corps..... 417
Order of Rejuvenated Sons of Jove.... 635
Pennsylvania Electric Association.....5, 574
Railway Signal Association..... 871
Society for the Promotion of Industrial Education..... 634
Society of Automobile Engineers..... 335

CONVENTIONS—Continued
Street Railway Association of the State of New York..... 108
Vermont Electrical Association..... 625
Western Association of Electrical Inspectors 211, 678, 920
Wisconsin Electrical Association....109, 1070
Wisconsin Electric and Interurban Railway Association.....109, 1070
Cookers, to hire out electric..... 385
Cooking, electric—an Englishwoman's experience..... 976
Cooking, schools of electric (R)..... 393
Copper consolidation certain..... 1026
Copper consumption..... 287
Copper exports..300, 481, 550, 678, 871, 923, 1008
Copper imports and exports for September 923
Copper market situation..... 202
Copper merger, plans for..... 1233
Copper output in Japan..... 591
Copper production for August..... 550
Copper production for October..... 1050
Copper reforms adopted..... 241
Copper sheets, heat transmission from electro-copper plated..... 1202
Copper situation.....339, 637
Coppers, tractions buying..... 250
Copper wire, specifications for hard-drawn 119
Copyright law, new..... 168
Cornell University—Commencement and announcements..... 13
Cost of deferred maintenance (E)..... 524
Cost of power..... 798
Cost of power in a 3,000-kilowatt turbine plant (E)..... 621
Cost of power production in two central stations (E)..... 1220
Costs in two turbine stations, comparative (E)..... 773
Cotton exposition, international..... 102
Cotton mills, income from, by Alton D. Adams..... 986
Cotton-mill loads (E)..... 368
Counter electromotive force in electric arc 792
Coupling, electromagnetic friction..... 1085
Crowded car, what is a?..... 630
Cuba, department of publicity for..... 117
Cuba, telephones in..... 673
Curing ham by electricity..... 894
Current, cheap yearly rates for electric.... 1185
Current-limit control, by E. R. Carichoff*.. 540
Current, supply of electric to other towns from a centrally-located station (E).... 231
Current, supply of electric, to other towns from a centrally-located station, by O. H. Hutchings and by Claude Smith.... 248

D

Dam, collapse of deprives Southern Nevada of power..... 118
Dam failures, Necaxa and other (E)..... 276
Dean Electric Company absorbed..... 676
Decision relating to waterpower rights, important..... 739
Dehydration of transformer oil..... 1026
Delaware County Electric Company..... 69
Demonstration house, a British electrically-equipped..... 241
Dentistry, X-rays in..... 637
Denver Company prosperous..... 208
Denver Electric Club organizes..... 1118
Denver Gas and Electric Company, reorganization..... 116
Denver members of Institute give luncheon to Secretary Ralph W. Pope..... 726
Denver, the old and the new strikingly contrasted at*..... 886
Department of Water Supply, Gas and Electricity, New York city..... 1024
Depreciation of electric railways (E)..... 1
Deprez electromagnet, design of Marcel, by Charles R. Underhill*..... 234
Deprez type of electromagnet, design of (E) 233
Deschutes Irrigation and Power Company, receiver asked for..... 469
Destructor plant, performance of..... 785
Detector for wireless work, new..... 476
Detroit, traction situation in..... 918
Detroit United Railway franchises..... 1101
Development of electrical undertakings (E) 1021
Development of electrical undertakings, by S. J. Watson.....1039, 1134
Development in England, review of electrical..... 1188
Dielectric strength of air..... 739
Dinner to Mr. and Mrs. Edison.....336, 465
Diphtheria toxin, X-ray and..... 1024
Diplomacy in business, by William Westerfield..... 1077
Direct-current system, a 2,750-volt, by A. H. Barringer*..... 1240
Disinfecting, electrolytic, results of Poplar (London) plant..... 342
Discontinuance of service for non-payment of bills..... 691
Dispatching, telephones for..... 337
Dispatching trains by telephone.....430, 433
Display room, can a, be conducted on a profitable basis?..... 12
Distance, measurement of by electric and sound waves..... 950
Distillation of turpentine, electric..... 1142
Distribution agreement, important (E)..... 724
Distribution of electrical energy by farmers' co-operative societies..... 730
Dividends, shares handsomely in telephone 236
Dock, electrical floating..... 998
Docks, electric pumps for London..... 1143
Doherty, Henry L.*..... 1223
Draft, mechanical, by Charles L. Hubbard 786
Dredge, electric..... 302
Dry battery, how to make a simple..... 546
Dry cells, characteristics of*..... 198
Dry storage batteries..... 584

E

Earthquakes, predetermination of..... 922
Easton Gas and Electric Company, growth of*..... 1150
Easton, Pa., slogan sign at*..... 237
Economic Power and Construction Company to be examined..... 598
Economic, central-station (E)..... 819
Economies, central-station, by W. L. Abbott..... 832
Economy Light and Power Company dam, another suit against the..... 1184
Economy Light and Power Company decision..... 825
Economy power dam, another suit brought against ...*..... 1184
Edison and Steinmetz*..... 677
Edison baseball game at New York..... 24
Edison Electric Illuminating Company.... 825
Edison Electric Illuminating Company, of Brockton, in new office..... 677
Educating the factory owner..... 1179
Effect of bark on timber preservatives..... 1243
Eiffel tower wireless plant*..... 542
Electric clock, an*..... 1225
Electric Club of Chicago.....22, 65, 166, 207, 253, 460, 583, 622, 677, 726, 735, 779, 822, 871, 918, 980, 1023, 1072, 1120, 1222
Electric cooking versus gas..... 1256
Electric development in Birmingham, England..... 1097
Electric drive in Italian Arsenals..... 997
Electric drive in textile mills..... 1050
"Electric home," popularizing (E)..... 1173
Electric narcoses and resuscitation (R).... 215
"Electric Shop" brochure..... 1149
Electric supply, fair charges for (R)..... 259
Electrical developments and problems in Western Australia..... 541
Electrical developments in Victoria, Australia..... 928
Electrical engineer, Geological Survey, junior-United States Civil Service Commission..... 904
Electrical exhibition for San Francisco.... 978
Electrical enterprise in Australia..... 1227
Electrical notes from Great Britain..... .....66, 288, 461, 696, 926, 1128
Electrical openings in Russia..... 1135
Electrical opportunities in Australia..... 1134
Electrical show, Boston*.....918, 974, 1027
Electrical show, New York*...463, 699, 753, 774
Electrical show, next Chicago.791, 870, 1022, 1181
Electrical show, Toledo.....975, 1179
Electric Storage Battery Company..... 215
Electrical Trades Association of Chicago, annual meeting 870, 976
Electrical undertakings, development of (E) 1021
Electrical undertakings, development of, by S. J. Watson 1039, 1134, 1186
Electrically driven Hungarian steel works* 1247
Electrically heated household appliances... 934
Electricity and fertilizers..... 688
Electricity for an awakened nation (E)... 572
Electricity in Arden residence of late E. H. Harriman*..... 528
Electricity in mines (E)..... 819
Electricity, international congress of radiology and..... 1091
Electricity versus gas for train lighting... 1246
Electric's long trip..... 305
Electrification, Chilean government studying..... 941
Electrification, Illinois Central Railroad again balks at..... 824
Electrification in Australia..... 674
Electrification in Canada..... 211
Electrification in England, further railroad 538
Electrification in Great Britain..... 798
Electrification in Japan..... 168
Electrification in Russian capital, tramway 1003
Electrification made mandatory in Chicago, railroad terminal..... 624
Electrification, more 60, 844
Electrification, New Haven..... 18
Electrification, New York Central extends its..... 342
Electrification of Australian railways..... 537
Electrification of industries..... 738
Electrification of New Jersey Coast lines.. 247
Electrification of railroad terminals in Chicago (E)..... 619
Electrification on the Southern Pacific (E) 142
Electrification opportunities in Latin America..... 941
Electrification plans in Germany..... 166
Electrification plans, Southern Pacific..... 197
Electrification plans, St. Paul..... 116
Electrification problem, a practical man's opinion on..... 509
Electrification, railroad..... 12
Electrification, Southern Pacific.....144, 351
Electrification tests in France..... 675
Electrification, waterpower resources and railway..... 698
Electro-analysis, advances in..... 921
Electrochemical amalgamation..... 545
Electrochemical development in Norway... 739
Electrochemical developments in South Africa, new..... 691
Electrocution, resuscitation after..... 1024
Electrode factory for Scotland, new..... 995

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Electrode losses in electric furnaces, laws of, by Carl Hering*.....993, 1082
Electrode, tungsten as a valve..... 732
Electrodynamic storage problems, some.... 1201
Electrolysis, damage by..... 1047
Electrolysis problem in Winnipeg..... 948
Electrolysis, removing hair by (R)..... 72
Electrolysis situation in Dayton..... 541
Electrolytes, validity of Ohm's law for... 546
Electrolytic amalgamation, gold recovery by 995
Electrolytic bleaching, by J. B. C. Kershaw 994
Electrolytic copper staybolts and pipes caused unreliable 545
Electrolytic disinfecting, results of Poplar (London) plant 342
Electrolytic iron 690
Electrolytic iron (R)..... 171
Electrolytic metallic films, tension of..... 994
Electrolytic process, new..... 995
Electrolytic tinning (R)..... 122
Electromagnet, design of Marcel Deprez, type of (E)..... 233
Electromagnet, design of Marcel Deprez, by Charles R. Underhill*..... 234
Electromobile favored 584
Electrophoning Lord Rosebery's speech... 951
Electroplating, improvements in (R)..... 346
Electropneumatic dispatch tubes..... 1243
Electroscope method, apparatus for measuring radioactivity by (R)*..... 170
Electrotechnic Club, of Fort Wayne..... 827
Electrotherapeutics, new system of..... 1145
Emergency equipment for injuries to passengers, street car..... 1208
Enclosed arc lamp*..... 933
Energy-direction indicator (R)*..... 122
Fond Rapids, electric power from (E)... 868
Engine, new crude-oil internal-combustion 1042
Engineer and draftsman—United States Civil Service Commission..... 1025
Engineer illuminating, by S. E. Doane... 479
Engineer's Standardized Publications Association 195
Engines for small central stations, gas..... 535
England, further railroad electrification in 538
England, review of electrical development in 1188
English mining situation..... 998
Ethyl alcohol from wood waste, by George W. Cravens*..... 425
Europe, electrical progress in..... 635
Europe, largest power station in..... 533
Europe, telephone in..... 695
Europe, waterpower in..... 1189
Example, a good..... 144
Exemplary boulevard illumination, an*..... 1244
Excavated by electricity..... 342
Exchange, international aerial..... 578
Exchange, Philadelphia electrical..... 144
Exchange warehouse for Chicago, machinery 655
Exhibits at Denver Conventions returned free 462
Exhibitors at New York electrical show... 699
Exhibit meeting at Dayton, Ohio..... 70
Experts wanted, two central-station (E)... 1172
Explosion in switch boxes..... 637
Explosion, waterhammer and steam..... 1090
Experts, electrical (E)..... 277
Exports for May, electrical..... 64
Exports for June and past fiscal year, electrical 297
Exports for July, electrical..... 635
Exports for August, electrical..... 825
Exports for September, electrical..... 922
Exports for October, electrical..... 1181
Exports of manufacturers, 1789-1909..... 550
Exports, to help American..... 428
Exposition in Berlin, American.....168, 623
Exposition in Buffalo, industrial..... 726

F

Factory lighting 991
Factory lighting, Mr. Howe talks on at Grand Rapids 919
Factory owner, educating the..... 1179
Fan installation in Bombay Cathedral, electric* 539
Fans popular in the Philippines, electric... 256
Faraday Society 164
Fare to Coney Island, demand five-cent.... 236
Farm production, increasings by electricity 1142
Farmers co-operative societies, distribution of electrical energy by..... 730
Farmers' telephones in the South..... 543
Fertilizers and electricity..... 688
Fertilizers, manufacture of nitrate..... 828
Financial reports of electrical companies 26, 120, 169, 212, 254, 303, 345, 391, 436, 494, 552, 602, 649, 702, 802, 896, 952, 1002, 1051, 1099, 1152, 1203, 1251
Fire alarm, electric lights to flash..... 584
Fire alarm service for Los Angeles..... 1233
Fires fighting forest with the aid of the telephone 489
Fire hazards, electrical..... 9
Fire streams, conductivity of..... 13
Fiske, John Chamberlain, tribute to..... 195
Fishing by telephone..... 586
Flat rate in Pasadena..... 1224
Five-hundred thousand-volt transmission line 1243
Flaming arc at Boston, increase of (E)... 1069
Flash to test wireless..... 5
Flight of time, in the..... 210
Flame electrode arc lamp*..... 885
Flower-pot system of advertising*..... 599
Forest products investigation, joint laboratories at Madison for..... 924
Forty-Second Street Railway, Metropolitan lease of 873
Forty-Second Street road to be sold..... 299
France, electrification tests in..... 675
Franchises, cannot tax..... 121
Franchise in Ottawa, Ill., Chicago publisher seeks lighting 683
Franchise value, right to (E)..... 772
Franklin Institute 726, 1138
Freight-car surplus, big decrease in..... 209
Freight classification and rate decisions, an interesting 116
Freight classification, reparation in case of differential rates on..... 531
Freight, electrical facilities for getting perishable to market, by Orrin E. Dunlap 844
Fuel and energy problem of the South..... 207
Fuel question, peat and*..... 829
Fulton exhibit at Engineering Societies building 588
Fulton Light and Power Company is awarded $299,000 828
Furnace developments in Mexico, electric.. 584
Furnace, electric, chance for..... 956
Furnace for brass smelting, induction..... 126
Furnace for iron extraction, new electric.. 690
Furnace, function of the electric..... 106
Furnace, new electric transformer*..... 689
Furnace test, melting..... 481
Furnaces, automatic temperature regulation of (R) 392
Furnaces, Kjellin and Röchling-Rodenhauser electric* 6
Furnaces, large electric (R)*..... 347
Furnaces, laws of electrode losses in electric, by Carl Hering*.....993, 1082

G

Galvanometer, measurement of telephone currents by Arno (R)*..... 171
Galveston to use arch lighting..... 560
Gas, competition of high-pressure (E)..... 1067
Gas-driven generator set, an interesting (R) 28
Gas, electrically manufactured water*..... 1025
Gas engines drive Belgian station..... 1041
Gas engines for small central stations.484, 535
Gas engines, indicating 691
Gas, natural (E)..... 867
Gasoline cars, Rock Island orders..... 338
General Electric and Westinghouse companies' patent agreement..... 678
General Electric Company to increase plant 71
General Electric earnings..... 437
General Electric to improve plants..... 257
Generating station at Stepney, London, England, new..... 937
Generator capacity, rise of, by Alton D. Adams* 589
Generator set, an interesting gas-driven (R) 28
German electrical enterprise in China..... 19
Germany, electrification plans in..... 166
Germicide properties of ultra-violet rays.. 1025
Getting back to first principles, by C. A. Parker 942
Geysers, electric* 1143
Glace Bay wireless station destroyed by fire 553
Glass that conducts electricity..... 901
Going value (E)..... 413
Gold recovery by electrolytic amalgamation 995
Government foes into electric power business 798
Governmental supervision of electrical supplies at Guatemala..... 1227
Governor's Island, electric light and power on 933
Grand Rapids, Mr. Howe talks on factory lighting at 919
Grand Trunk Railroad, electrical equipment of Battle Creek Shops, by L. C. Brown* 103
Great Britain, electrical notes from*..... .....66, 288, 461, 696, 926, 1128
Great Britain, restricted telephone development in 841
Great Northern Railway Company, electric system of at Cascade Tunnel..... 981
Grounding of secondaries..... 987
Guns, electric system for harbor..... 208
Gyroscopic balancing 1185
Gyroscopic balancing and Brennan monorailway (E) 973

H

Hair, removing by electrolysis (R)..... 72
Hale's Bar, power at (E)..... 47
Ham curing by electricity..... 894
Hamilton, Ont., new business methods of electric light and power company at, G. E. L. Carpenter..... 1000
Harmonics, effect of phase of upon acoustic quality, by M. G. Lloyd and P. G. Agnew 487
Harriman, electricity in Arden residence of late* 528
Haskins, Caryl D., a notable address by.... 107
Haskins' fluid-electrode arc lamp*..... 885
Haulage, cost of electric..... 948
Havana winter festivities..... 425
Hazard in Indiana, linewire..... 823
Head of water, definition of..... 119
Headlights, electric locomotive.....69, 538
Headlight, engineers endorse electric..... 380
Headlight tests, locomotive..... 886
Heat, transfer of (E)..... 2
Heating apparatus, heat insulation and efficiency of electric, by J. C. Atchison, Jr., and Fred Kleinschmidt..... 252
Heat losses in a power station..... 1243
Heat transmission from electro-copperplated copper sheets..... 1202
Heating in connection with central stations, steam 784
Heating, public Service Commission orders for car 1070
Heating, some remarks on district steam, by W. J. Kline 1133
Heating, "Quartz" system of electric (R)*. 214
Helium production from the complete series of uranium products, rate of..... 584
Hell Gate, to harness..... 299
Hexane, electrical conductivity of pure (R) 29
Hoist for handling pier cars, electric..... 592
Hoisting, electric mine (E)..... 1019
Hoisting, electric mine (R)..... 29
Hoisting, modern applications of electric motors to mine, by Leon M. Hall*.... 1199
Holes, measuring by electricity..... 1091
Home, electricity in..... 200
Hopfelt incandescent lamp, researches on (R) 259
Horse clipper and groomer, electric*..... 1202
Hospital, electricity in..... 732
Hotel La Salle, electrical and mechanical installation in, by Howard Ehrlich*... 418
Hotel La Salle, equipment of (E)..... 413
Household appliances, electrically heated. 934
Houses, getting after unwired, by Charles A. Parker 1146
Hudson & Manhattan Railroad..... 432
Hudson Company's earnings..... 953
Hudson fete, lights for..... 431
Hudson-Fulton aeronautics..... 119
Hudson-Fulton celebration....479, 646, 669, 684
Hudson-Fulton celebration—An unprecedented illumination scheme for New York and the Hudson River..... 240
Hudson-Fulton celebration, special price on lights for 300
Hudson tunnel opening..... 16
Human endurance decision in Indiana..... 923
Humidifier, electric 944
Hydroelectric commission action against Canadian 469
Hydroelectric development and auxiliary steam plant at Lansing, Mich.*..... 1235
Hydroelectric plant for St. Lawrence River 947
Hydroelectric plant in an old-world village. 1188
Hydroelectric plants, comments on the development and operation of..... 1228
Hydroelectric plant in Nyassaland..... 731
Hydroelectric plant, Kilbourn*..... 374
Hydroelectric plant, output of (E)..... 412
Hydroelectric plant, unique..... 546
Hydroelectric plant, Zurich..... 483
Hydroelectric power in central West (E). 915
Hydroelectric problem, a (E)..... 142
"Hydroelectrics" in Switzerland..... 847

I

Iceland, Waterpower in..... 1091
Ice making as a means of improving load factor of central stations (E)..... 367
Illinois Central may lower rates..... 19
Illinois Central Railroad again balks at electrification 824
Illinois Electrical Exhibitors' Association.. 877
Illinois Tunnel Company goes into receivership 1153
Illuminating engineer, by S. E. Doane..... 479
Illuminating engineering and electric lighting number (E)..... 456
Illuminating Engineering Society, Chicago Section 991
Illuminating Engineering Society, Convention of (E)..... 667
Illuminating Engineering Society, New England Section 1071
Illuminating Engineering Society, New York Section 792, 990
Illuminating Engineering Society of Great Britain 23, 683, 992, 1193
Illumination and decorative features of the 1910 Chicago electrical show*..... 1226
Illumination at Poughkeepsie, special carnival* 475
Illumination, commercial tests on systems of, by A. L. Eustice*..... 472
Illumination, lamps for residence.....246, 991
Illuminations, New York's..... 582
Illumination of Minnesota State Fair*..... 884
Illumination scheme for New York and Hudson River in connection with Hudson-Fulton celebration 240
Improved single-phase motor..... 1249
Incandescent lamps, determining the degree of vacuum of 1140
Income from cotton mills, by Alton D. Adams* 986
Income from tungsten street lamps*..... 668
Independent telephone rates raised..... 1256
Independent telephone situation..... 925
Index files for advertisers, card (E)..... 233
India, development of waterpower in..... 590
India, electrical sales possibilities in..... 977
India rubber, new substitute for..... 354
India, wireless apparatus in..... 825

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Indiana, human endurance decision in..... 923
Indiana, interurban traffic in..... 299
Indiana Municipal League..... 69
Indiana Railroad Commission decides steam and electric railways must interchange 23
Indiana's state attorney objects to electric signs 300
Indicating gas engines..... 691
Inductance in resistance coils..... 985
Induction motor, determination of and circle coefficient of, by H. M. Hobart*.... 1075
Industrial operations, installation, operation, care and repair of electric motors in, by C. E. Daniels*..... 795
Industrial purposes, electric power for (E) 573

INDUSTRIAL SECTION.
A. A. automatic kitchens,* A. A. A. Mfg. Co. 804
A B C flaming arc lamp*..... 1208
Acheson graphite, unctuous,* A. G. G. 805
Acheson Graphite Company's hydro-electric plant 261
Allis-Chalmers Company reports good business 310
Allis-Chalmers lighting transformers,* A.-C. Co. 902
Allis-Chalmers sales of pumping machinery 1102
Allis-Chalmers steam turbines..... 708
Allis-Chalmers steam turbines, orders for 124
Ammeter, Leeds & Northrup mercury* 128
American Mills Company's offices, intercommunicating telephones at,* W. E. Co..... 216
"Any Angle" tungsten lamp.* N. I. L. Co. 217
Appleton, Wis., twenty-four-hour service at. E. S. B. Co..... 442
Arc lamp, A B C flaming*..... 1028
Arc-lamp displays at Hudson-Fulton celebration, Western Electric Company's* 954
Arc lamp, Hawthorn flaming.* W. E. Co. 496
Arc lamp, Henry multiple alternating-current and direct-current.* L. E. Co. 1056
Arc lamp illumination for iron-working shapes.* W. E. Co..... 1206
Arc lamp, intensified.* G. E. Co..... 508
Arc lamp, new Westinghouse series-multiple direct-current.* W. E. & Mfg. Co. 556
Arc lamp, Sunray.* S. E. L. Mfg. Co.. 1054
Arc lamps for various phases of illumination.* C. L. K. Co..... 1102
Arc lamps to be changed in Newark, flaming. E. A. L. Co..... 1027
Arc-lighting system, series alternating-current.* F. W. E. Wks..... 554
Arcs, new features of Holophane*..... 351
A. S. A. lamp-cord adjuster.* A. S. A. Mfg. Co. 30
Aurola flaming arc lamps for alternating current equipped with rapid striker.* C. L. K. Co..... 497
Awards, Alaska-Yukon-Pacific. G. E. Co. and J. A. R. S. Co..... 804
Baker electric, royalty buys B. M. V. Co. 444
Barometer, electrical P. B. G..... 506
Beardslee chandeliers, new type of.* B. C. Mfg. Co..... 499
Benjamin reflector sockets.* B. E. Mfg. Co. 956
Benjamin tunsten fixtures with hooded enamel steel reflector.* B. E. Mfg. Co. 653
Bissell sewing-machine motors.* B. M. Co. 602
Boats, electric motor..... 443
Boiler and stoker equipment, unique... 260
Bradshaw car skid.* L. E. Co..... 398
Brake, Westinghouse magnetic..... 261
Bristol portable electric pyrometer with thermo-electric couple.* B. Co..... 557
Brushes, Speer carbon. S. C. Co..... 756
Buckeye conference, successful..... 444
Cable consignment, big submarine telephone.* W. E. Co..... 31
Carbons, flame arc-lamp, by K. Odwald.* C. L. K. Co..... 706
Cars for New Haven suburban service, motor.* W. E. & Mfg. Co..... 760
Car skid, Bradshaw.* L. E. Co..... 398
Central Electric exhibit at Illinois state convention* 1103
Central Electric high-tension disconnecting switches.* C. E. Co..... 176
Central Electric Opalux tungsten fixtures* 307
Central Laboratory Supply Company changes name* 654
Centrifuge, motor-driven.* F. W. B.. 394
Chandeliers, new type of Beardslee.* B. C. Mfg. Co..... 499
Chicago Public Library, "electrocuted" air for 395
China, first modern telephone plant for W. E. Co..... 353
Circuit-breakers on lines of Southern Power Company.* W. E. & M. Co.. 1252
Circuit-breaker, Westinghouse type GA condenser lead.* W. E. & Mfg. Co... 32
C. M. B. continuous-current rotary converter.* C. & Co., Ltd..... 264
Coal dust as fuel. F. & C..... 956
"Compensarc" for motographic machines.* F. W. E. Wks..... 34

INDUSTRIAL SECTION—Continued.
Composite telephones provide additional facilities.* W. E. Co..... 606
Condenser design, modern; a good example and remarkable test result.* W. M. Co..... 1052
Condit disconnecting switches.* C. E. Mfg. Co. 398
Contactor panel, high-tension.* G. E. Co. 1205
Crane load, storage battery for.* B. W. Co. and "D. P." B. Co., Ltd..... 957
Creamery, modern methods in.* N. A. F. Co. 709
Cutler-Hammer motor-speed regulators* 399
Cutout box, improved metal-clip wood.* A. E. Co..... 78
Cutouts for arc-lighting service, new.* G. E. Co..... 76
Dale lighting specialties.* D. Co..... 502
Delivery, a prompt. I. A. G. Co..... 173
Department store pneumatic cash system and motor equipment in.* W. E. Co. 1157
Detroit ironclad meter box and fused switch.* D. F. & Mfg. Co..... 555
Diamond Rubber Company, new wire building for 705
DuBois single-cylinder throttling gas engines. DuB. I. Wks..... 557
Dwyer tubing machine.* D. M. Co.... 263
Edgerton's lamp cleaner and adjuster.* E. E. E. 757
Electric drive for printing establishments.* G. E. Co..... 1154
Electric drive in automobile works. A.-C. Co. 1256
Electric fireless cookstove, an*..... 1255
Electric Vehicle reorganization..... 78
Electrically-heated devices for holiday trade.* G. E. Co..... 1104
"Electrocuted" air for Chicago Public Library 395
Electrotype establishment, individual motor drive in.* C.-H. Mfg. Co..... 218
Elliott mechanical stoker.* R. Mfg. Co. 440
Emery adjustable tripod.* F. E. & Mfg. Co. 903
Engine, Rothschild.* R. E. Co..... 173
Entrance tubes, high-tension.* C. E. Co. 1027
Excello flaming arc lamps, newest types of.* E. A. L. Co..... 498
Excello series flaming-arc lamps*..... 306
Excello series flaming arcs in Michigan Avenue, Chicago 354
Exhibit at Denver, Western Electric... 651
Exhibit at Denver, Westinghouse..... 654
Exhibit of the Railway Supply Manufacturers' Association, electrical manufacturers at 33
Factories and mills, illumination of, with small units, by E. B. Rowe and Frank B. Rae, Jr.* H. Co..... 503
Fan Controller.* W. L. E. Co..... 127
Fault finder, Middleton magnetic.* M. Bros. 441
Federal vacuum cleaner.* F. E. Co... 1158
Feed-water filters, Blackburn-Smith. J. B. & Co..... 708
Fire and a quick installation. K. S. & S. Co. 1101
Fixture design, novel.' M. V. Co..... 556
Fixtures, Wakefield Brass Company's.* F. W. W. B. Co..... 499
Flame arc-lamp carbons, by K. Odwald.* C. L. K. Co..... 706
Flaming arc lamp, A B C*..... 1028
Flaming arc lamps for alternating current with rapid striker attached, Aurola.* C. L. K. Co..... 497
Flaming arc lamps, newest types of.* E. A. L. Co..... 498
Flaming arc lamps to be changed in Newark. E. A. L. Co..... 1027
Flow indicator.* A. W. Von L..... 306
Fuse, new type of.* L. B. E. Mfg. Co. 1027
Galvanometer protecting device, new.* Q. & Co..... 607
Gary, rail-handling magnets at.* E. C. & Mfg. Co..... 174
Gas-electric motor cars for Third Avenue Railroad.* G. E. Co..... 956
Gas-electric motor cars for Southern Railway. G. E. Co..... 1007
Gas engine for chemical works, Westinghouse 217
Gas engine installations aggregating 210,000 horsepower.* A.-C. Co..... 560
Gas engines, DuBois single-cylinder throttling. DuB. I. Wks..... 557
Gas plant, electric power in. A.-C. Co. 1054
General Electric awards at Alaska-Yukon-Pacific Exposition 710
General Motors Company's plans..... 710
Generators and synchronous motors, Wagner.* W. E. Mfg. Co..... 443
Graphite in lubrication. A. G. Co..... 903
Graphite, unctuous Acheson.* A. G. Co. 805
Grand Cone Paragon.* F. W. P.....75. 855
Hawthorn flaming arc lamp.* W. E. Co. 496
Heavy multiple alternating current and direct-current arc lamp.* L. E. Co.. 1056
Hemere combined meter panel and cut-out.* W. C. 262, 400
Hobson's class.* W. S. Co..... 656
Hoist, large electric mining.* W. E. & Mfg. Co. 607
Hoist, Lidgerwood electric.* L. Mfg. Co. 808

INDUSTRIAL SECTION—Continued.
Holophane arcs, new features of*..... 351
Holophane-D'Olier reflectors, developments in—Campaign to develop industrial-plant lighting* 308
Holophane reflectors, new types of.* H. Co. 1007
Hydraulic valves, special.* W.-S. Co. 853
"I-Comfort" system of illumination, progress with.* N. X.-R. R. Co..... 509
Illumination, a simple method of comparing intensity of.* C. E. Co..... 31
Illumination, brilliant-store front.* C. L. K. Co..... 497
Illumination of mills and factories with small units, by E. B. Rowe and Frank B. Rae, Jr.* H. Co..... 509
Illumination, progress with "I-Comfort" system of.* N. X.-R. R. Co..... 509
Industrial-plant lighting—Developments in Holophane-D'Olier reflector*..... 308
Instruments, Robert Switchboard.* R. I. Co. 651
Insulating material for floors, new pliable 705
Insulators, Westinghouse strain.* W. E. & Mfg. Co..... 756
Intensified arc lamp.* G. E. Co..... 508
Iron-working shops, arc lamp illumination for.* W. E. Co..... 1206
Jacks, two new hydraulic.* W.-S. Co.. 30
Japanese government buys more American telephone apparatus. W. E. Co.. 1256
Jewel electric washers. A. W. Co..... 705
Kimble variable-speed alternating-current motor.* K. E. Co..... 354
Kitchens, A. A. automatic.* A. A. A. Mfg. Co. 804
Kozesnik safety third-rail system.* K. S. E. T.-R. Co..... 955
Lagonda automatic cut-off valve.* L. Mfg. Co. 444
Lamp, "Any Angle" tungsten.* N. I. L. Co. 217
Lamp bases, drawback on imported. G. E. Co..... 903
Lamp changer, adaptable.* I. A. Co.... 856
Lamp cleaner and adjuster, Edgerton's.* E. E. E..... 757
Lamp-cord adjuster, A. S. A.* A. S. A. Mfg. Co..... 30
Lamp, Hawthorn flaming arc.* W. E. Co. 496
Lamp, intensified arc.* G. E. Co..... 508
Lamp system, progress in Westinghouse-Nernst, by Max Harris*..... 507
Lamps, Excello series flaming-arc*..... 306
Lamps for railway service, tantalum.* B. E. Co..... 710
Lamps for various phases of illumination, arc.* C. L. K. Co..... 1102
Lamps, some interesting features about tungsten* 500
Leeds & Northrup mercury ammeter* 128
Lepel wireless system in Jamaica..... 502
Lidgerwood electric hoist.* L. Mfg. Co. 808
Life-saver, tungsten.* A. A. L. Co..... 502
Lighting specialties, Dale.* D. Co.... 502
Lightning arresters and grounding devices, Lord.* L. E. Co..... 125
Lightning arrester, Vac-m.* N. E. S. Co. 651
Line signals, new type of self-restored magneto.* W. E. Co..... 559
Locomotive, Roan type gathering.* W. E. & Mfg. Co..... 128
Locomotives for New York, New Haven & Hartford Railroad Company, geared freight:* W. E. & Mfg. Co..... 652
Lord lightning arresters and grounding devices.* L. E. Co..... 125
Lubricant, what constitutes a good, by Orrin E. Dunlap..... 1103
Lubricator, what constitutes a good. K. G. 608
Lumber cars run by electricity. G. L. Co. 606
Magneto, simple low-tension.* G. A. & B. Co. 76
Magnetos and the automobile. J. S. B. Mfg. Co..... 125
Magnets at Gary, rail-handling.* E. C. & Mfg. Co..... 174
Magnets, lifting.* C.-H. C. Co..... 397
Matrix-drying table, Wesel-Westinghouse electric.* F. W. Co. and W. E. & Mfg. Co..... 1155
Maximum demand meters. A. E. G... 1256
Meter mox and fused switch, Detroit ironclad.* D. F. & Mfg. Co..... 555
Meters, improved line of pocket.* H. E. I. Wks..... 853
Meters, new direct-current portable.* W. E. & Mfg. Co..... 308
Meter panel and cut-out, Hemere combined.* W. C. 262, 400
Meter-testing rheostat.* G. E. Co.... 351
Metropolitan Building, lighting and power plant of.* C. W. Co. and I., P. F. 904
Middleton magnetic fault finder.* M. Bros. 441
Mill motors.* G. E. Co..... 854
Mills and factories, illumination of, with small units, by E. B. Rowe and Frank B. Rae, Jr.* H. Co..... 503
Mining hoist, large electric.* W. E. & Mfg. Co. 607
Mining machinery, recent installations of. W. E. & Mfg. Co..... 76

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INDUSTRIAL SECTION—Continued.

Moore Electrical Company, new factory for 705
Motor car for Third Avenue Railroad, gas-electric.* G. E. Co..... 956
Motor cars for Southrn Railway, gas-electric. G. E. Co..... 1007
Motor drive, example of individual.* R. Bros. & Co..... 603
Motor drive in an electrotype establishment, individual.* C.-H. Mfg. Co.... 218
Motor drive, next best thing to individual. D. Mfg. Co..... 556
Motor equipment and pneumatic cash system in a department store.* W. E. Co. 1157
Motor-Generator set, special.* R. Bros. & Co. 1008
Motor, Kimble variable-speed alternating-current.* K. E. Co..... 354
Motor starters, new line of.* E. C. & Mfg. Co. 172
Motors, adjustable speed commutation pole.* T. E. Co..... 400
Motors, Bissell sewing-machine.* B. M. Co. 602
Motors, mill.* G. E. Co..... 854
Motors, new single-phase.* G. E. Co.. 1004
Motors, sewing-machine.* G. E. Co.... 856
Motors, small.* G. E. Co..... 704
Motors, synchronous, and generators, Wagner.* W. E. Mfg. Co..... 443
Multinola, an electrically-operated multiple phonograph.* G. S. I..... 1205
Nernst-lamp improvements.* N. L. Co. 174
Nernst lamps, improvement in. N. L. Co. 127
New Haven suburban service, motor cars for.* W. E. & Mfg. Co..... 760
Oil tempering, bath, electrically heated.* G. E. Co..... 958
Opalux reflectors, car lighting with.* C. E. Co..... 78
Opalux tungsten fixtures, Central Electric* 307
Ozone deodorizer in Chicago Creamery.* N. A. F. Co..... 709
Paragon ground cone.* F. W. P....75. 855
Pass & Seymour receptacles, new.* P. & S. Inc..... 1208
Pattern-making, electric drive in.* W. E. & Mfg. Co..... 77
Phonograph, an electrically operated multiple: the Multinola.* G. S. I.... 1205
Pittsburgh transformer, high-voltage.* P. T. Co..... 176
Pole firm, new white cedar. C. C. Co. 508
Pole yard view, an interesting.* K. S. & S. Co..... 126
Porcelain electrical specialties.* M. & E. Mfg. Co..... 354
Pothead, all-porcelain.* C. S. & I. Co.. 1156
Printing establishments, electric drive for.* G. E. Co..... 1154
Printing machines, motor-starting switch for. A. Mfg. Co., Ltd..... 350
Printing-press controller.* G. E. Co.... 901
Printing-press controllers.* G. E. Co... 1254
Pump for motor tires, electric. E. E. C. 1155
Pumping machinery, Allis-Chalmers sales of 1102
Pyrometer with thermo-electric couple, Bristol portable electric.* B. Co.... 557
Quick switchboard shipment. K. S. & S. Co. 1253
Rail bender, electrically driven.* W.-S. Co. 606
Railway exhibits at Denver..... 757
Railway service, tantalum lamps for.* B. E. Co..... 710
Railways flexibility of telephone system for electric.* W. E. Co..... 650
Receptacles, new Pass & Seymour.* P. & S. Inc..... 1208
Rectifier, new electric. P. A. E. Co.. 1056
Reflector sockets, Benjamin.* B. E. Mfg. Co. 956
Reflectors, new types of Holophane.* H. Co. 1007
Reflectors, Wheeler fluted street.* W. R. Co. 499
Regulator, Curtis turbine used, by W. J. Davis, Jr. G. E. Co..... 807
Relay, new overhead inverse-time-limit by Harold W. Brown.* W. E. & Mfg. Co..... 74
Repair department, Westinghouse Electric and Manufacturing Company's new* 1204
Rheostat, meter-testing. G. E. Co.... 351
Rigid type gathering locomotive.* W. E. & Mfg. Co..... 128
Robbins & Myers Company—"A Successful Enterprise."* 348
Robert switchboard instruments.* R. I. Co. 651
Rolling exhibit at the Alaska-Yukon-Pacific Exposition* 262
Rosettes, two-piece molding.* P. & S. 124
Rotary converter, C. M. B continuous-current.* C. & Co., Ltd..... 264
Rotary-shaft engine.* R. E. Co..... 173
Safety box, new patent.* W. E. Co..... 655
Screw machine, remarkable performance by motor-driven automatic.* N.-A. Mfg. Co..... 806
Series electric pump for motor. E. E. C. 1155

INDUSTRIAL SECTION—Continued.

Sewing-machine motors, Bissell.* B. M. Co. 602
Sewing Machine Motors.* G. E. Co.... 856
Shaving and massage mirror, electric.* F. E. Co..... 602
Shock absorber, tungsten.* B. Mfg. Co. 852
Shop, electrical equipment for large. A.-C. Co. 1104
Shovels, two giant electrically driven power.* W. E. & Mfg. Co..... 260
Sign of the times.* W. E. Co..... 653
Signals, new type of self-restored magneto line.* W. E. Co..... 559
Speed regulator, pressure-controlled motor.* C.-H. Mfg. Co..... 399
Speer carbon brushes. S. C. Co..... 756
Speer carbon exhibit at Denver..... 852
Staples, new line of insulated. J. G... 603
Stoker, Elliott mechanical.* R. Mfg. Co. 440
Stoker equipment, unique boiler and... 260
Storage battery for crane load.* B. W. Co. and "D. P." B. Co., Ltd..... 957
Storage battery for twenty-four-hour service, supplementary. E. S. B. Co. 127, 220, 307
Store-front illumination, brilliant.* C. L. K. Co..... 497
Subway transformers.* M. E. Co..... 498
Sunray arc lamp.* S. E. L. Mfg. Co... 1054
Switch, combined disconnecting and transfer.* C. E. Co..... 1101
Switch for printing machines, new motor-starting. A. Mfg. Co., Ltd.... 350
Switches, Central Electric high-tension disconnecting.* C. E. Co..... 176
Switches, Condit disconnecting.* C. E. Mfg. Co. 398
Tallor's goose, new type of.* C. E. Co. 1156
Tank switch, new Watson-Stillman automatic* 394
Tantalum lamps for railway service.* B. E. Co..... 710
Tantalum, new 200-volt. G. E. Co..... 308
Telephone bracket, convenient and practical.* J. C. F..... 394
Telephone plant for China, first modern. W. E. Co..... 353
Telephone receivers for wireless transmitters.* H.-C. E. Co..... 30
Telephone switchboards, new line of central-office.* W. E. Co..... 352
Telephone system for electric railways, flexibility of.* W. E. Co..... 650
Telephone system in jewelry manufacturing plant, installation of intercommunicating.* W. E. Co..... 1100
Telephone train dispatching, high-efficiency transmission circuit for, by H. L. Burns.* W. E. Co..... 900
Telephone train dispatching, large railroads adopt. W. E. Co..... 1008
Telephone train dispatching on "Nickel Plate" Railroad. W. E. Co..... 957
Telephone train dispatching on Santa Fe. W. E. Co..... 1056
Telephone train-dispatching system at Erie terminal, Jersey City, intercommunicating.* W. E. Co..... 1006
Telephone at American Mill's Company's offices, intercommunicating.* W. E. Co..... 216
Telephones provide additional facilities, composite.* W. E. Co..... 606
Testing set, new dial decade.* Q. & Co. 33
Testing set, new portable.* L. & N. Co. 807
Textile industry, steam turbine in. A.-C. Co. 603
Textile mills, electrical equipment of, D. H. Braymer.* W. E. Co..... 309
Textile-mill service, low-pressure turbine in.* W. M. Co..... 173
Third-rail system, Kozesnik safety.* K. S. E. T.-R. Co..... 955
Thordarson toy transformers.* T. E. Mfg. Co. 656
Toaster, new type of electric.* S. E. H. Co. 1155
Toggle bolt, Wrigley.* T. W. Co..... 852
Tough tungsten lamps pass safely through a railroad wreck. G. E. Co.. 1253
Tower wagon, electric. S.-S. Wks.... 506
Tower wagon, electric railway.* G. V. Co. 1055
Train dispatching, high-efficiency transmission circuit for telephone, by H. L. Burns.* W. E. Co..... 900
Train dispatching on "Nickel Plate" Railroad, telephone. W. E. Co..... 957
Train dispatching on Santa Fe, telephone. W. E. Co..... 1056
Train-dispatching system at Erie terminal, Jersey City, intercommunicating telephone.* W. E. Co..... 1006
Train lighting turbo-generator sets for.* G. E. Co..... 261
Transformer, high-voltage Pittsburgh.* P. T. Co..... 176
Transformer, largest self-cooling ever built.* W. E. & Mfg. Co..... 1007
Transformers, Allis-Chalmers lighting.* A.-C. Co. 902
Transformers for tungsten street lamps.* V. E. Co..... 505
Transformers, low-voltage.* O. J. G.... 759
Transformers, subway.* M. E. Co..... 498
Transformers, Thordarson toy.* T. E. Mfg. Co. 656
Transformers, underground. O. Co.... 1104

INDUSTRIAL SECTION—Continued.

Tripod, Emery adjustable.* F. E. & Mfg. Co. 903
Triumph Electric Company's new factory at Cincinnati*..... 604
Triumph Electric Company's new plant, inauguration of 954
Trolley car, Westinghouse type "R"*.. 398
Trolley wheel, new.* F. K..... 127
Tube, tracks laid in Pennsylvania..... 506
Tubing machine, Dwyer.* D. M. Co... 263
Tungsten fixtures with hooded enamel steel reflector, new Benjamin.* B. E. Mfg. Co. 653
Tungsten lamps, some interesting features about* 500
Tungsten life-saver.* A. A. L. Co..... 502
Tungsten lighting system, Westinghouse series. W. E. & Mfg. Co..... 506
Tungsten, new 150-volt..... 264
Tungsten, new 200 to 250-volt.* G. E. Co. 220
Tungsten street lamps, transformers for.* V. E. Co..... 505
Tungstoller Company plan for co-operation based upon commercial common sense 510
Turbine-blade guessing contest at the Denver railway convention. A.-C. Co. 757
Turbine installation, novel. A.-C. Co... 904
Turbine in textile industry, steam. A.-C. Co. 603
Turbine in textile-mill service, low-pressure.* W. M. Co..... 173
Turbine used as regulator, Curtis, by W. J. Davis, Jr. G. E. Co..... 807
Turbines, Allis-Chalmers steam..... 708
Turbines, orders for Allis-Chalmers.... 124
Turbo-alternators, Westinghouse..... 555
Turbo-generator sets for train lighting.* G. E. Co..... 261
United States Light and Heating Company orders 350
Vac-m lightning arrester.* N. E. S. Co. 651
Vacuum cleaner, Federal.* F. E. Co... 1158
Valve, Lagonda automatic cut-off.* L. Mfg. Co. 444
Vehicles, electric commercial. G. V. Co. 760
Vehicles, operating costs of commercial electric. G. V. Co..... 307
Voltmeter for 200,000 volts*..... 1253
Voltmeter, Westinghouse coreless.* W. E. & Mfg. Co..... 442
Wagner generators and synchronous motors.* W. E. Mfg. Co..... 443
Wakefield Brass Company fixtures.* F. W. W. B. Co..... 499
Wall-paper trimmer, motor-driven.* A. A. & Co..... 808
Walpole Rubber Company, Limited..... 501
Washers, Jewel electric. A. W. Co.... 705
Watson-Stillman automatic tank switch, new* 394
Wayne bell-ringing transformers.* Ft. W. E. W..... 1254
Weber Gas Engine Company reorganized 804
Welding for bonding electric railways, electric.* E. R. I. Co..... 901
Well-driller, electrically driven.* K. D. Co. 396
Wesel-Westinghouse electric matrix-drying table.* F. W. Co. and W. E. & Mfg. Co..... 1155
Western Electric arc-lamp displays at Hudson-Fulton celebration* 954
Western Electric Company, Dallas house of 397
Western Electric Company's Pittsburg exhibit* 805
Western Electric exhibit at Denver.... 651
Western Electric exhibit at Detroit.... 126
Westinghouse contracts for Japan, some 606
Westinghouse core-loss voltmeter.* W. E. & Mfg. Co..... 442
Westinghouse Electric and Manufacturing Company's new repair department* 1204
Westinghouse exhibit at Denver..... 654
Westinghouse installations, some new 351
Westinghouse-Nernst lamp system, progress in, by Max Harris*..... 507
Westinghouse series-multiple direct-current arc lamp, new.* W. E. & Mfg. Co. 556
Westinghouse series tungsten lighting system. W. E. & Mfg. Co..... 506
Westinghouse Storage Battery Company 354
Westinghouse strain insulators.* W. E. & Mfg. Co..... 756
Westinghouse type GA condenser-lead circuit-breaker.* W. E. & Mfg. Co... 32
Westinghouse type R trolley car*..... 398
Westinghouse turbo-alternators..... 555
Wheeler fluted street reflectors.* W. R. Co. 499
Wire and Telephone Company of America changes name..... 1028
Wire plant for the South, large. A. S. & W. Co..... 1103
Wireless transmission, telephone receivers for.* H.-C. E. Co..... 30
Wire-testing machines, motor-driven.* W. E. & Mfg. Co..... 262
Wrigley toggle bolt.* T. W. Co..... 852
Infringement decision, motor..... 622
Injuries to passengers, street car emergency equipment for..... 1208

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Insects, destroying, with the aid of the electric light 476
Inspection at Peoria, Ill., electric..... 251
Inspector of electric-light plant, assistant—United States Civil Service Commission 250
Installation question, interesting (R)..... 438
Institute library, gift to..... 480
Instructors for Chicago technical high schools 460
Instruments, causes of error in electrical measuring (R) 259
Instruments, tariff on scientific (E)..... 572
Insulation and efficiency of electric heating apparatus, heat, by J. C. Atchison, Jr., and Fred Kleinschmidt..... 252
Insulation on lines near the sea (R)*..... 28
Insull, Mr., at Chicago Press Club..... 824
Insull, Samuel, to speak before Chicago Electric Club 726
Interborough check for police-pension fund 789
Interborough makes wonderful traffic record 678
Interborough-Metropolitan denies claim of $7,450,000 1003
Interborough-Metropolitan plans 464
Interborough Rapid Transit..... 256
Interborough interest in its employes..... 247
Interborough wins franchise case..... 18
Interior wiring rules, New York..... 1132
International Congress of Radiology and Electricity 1091
International congress on mining and metallurgy 264
International cotton exposition..... 102
International Harvester Company installs individual electrical drive..... 283
International Traction Company..... 588
Interstate Commerce Commission..... 393
Interstate Railways Company..... 1234
Interurban-railway situation in Massachusetts (E) 916
Interurban traffic in Indiana..... 299
Inventors, $10,000 prize for..... 385
Investment, units of central-station (E)... 620
Iowa telephone companies prosper..... 1034
Iowa telephone merger enjoined..... 753
Iowa, trolley earnings in..... 14
Irish cathedral, electric lighting for..... 933
Iron, electrolytic 690
Iron, electrolytic (R)..... 171
Iron extraction, new electric furnace for... 690
Iron mines, electricity in Canadian..... 1071
Irrigation in Arizona, work on Roosevelt project, by D. A. Willey*..... 284

J

Japan, copper output in..... 591
Japan, electrification in..... 168
Japanese-British exhibition 429
Japanese bureau of electricity..... 527
Japanese commissioners at Pittsburg..... 919
Japanese electrical manufacturing company, big 596
Japanese honorary Commercial Commissioners at Schenectady*..... 755
Japanese study wireless 949
Japanese visit power plant..... 494
Jeffery & Co., Thomas B., plant of, at Kenosha, Wis.*..... 1182
Joint pole lines in New York city..... 920
Jones enclosed arc lamp*..... 933
Juniata Water and Power Company, receiver for 469

K

Kentucky Electric Company bonds..... 735
Kilbourn hydroelectric plant*..... 374
Kings County Electric bond issue.....783, 1003
Kings County Electric..... 1223
Kitchen machinery on shipboard, electrical 997
Kjellin and Rochling-Rodenhauser electric furnaces* 6
Klondike, electrical developments in..... 481
Kneaders, electrically driven 535
Knights of the Shield..... 543
Korea, telephone and telegraph stations in 469, 695

L

Laboratories at Madison for forest-products investigation, joint 924
Laclede Gas deal terms..... 18
Lamp, new electric miner's safety..... 933
Lamp, researches on new Hapfelt incandescent (R) 259
Lamp without regulating mechanism, Conta (R) 215
Lamps, candlepower of Boston street (E).. 2
Lamps, conservation of our natural resources through use of high-efficiency (E) 457
Lamps for residence illumination..... 246
Lamps, German taxes on electric..... 430
Lamps, income from tungsten street (E).. 668
Lamps in England, metal-filament..... 598
Lamps, rates for Boston street (E)..... 411
Lansing, Mich., hydroelectric development and auxiliary steam plant at*..... 1235
Latin America, opportunities for electrification in 941
Latin-American street railway franchise... 1047
Law, to test corporation..... 1071
Law, wireless ship 15
Laws, liberalizing street-railway..... 8
Lewis Institute Branch, American Institute of Electrical Engineers..... 921
Library, gift to Institute..... 480
Licensed, decides streets cars are..... 208
Light, absolute standard of, by Joseph H. Hart 595
Light and power plant in youngest town in country 439
Light company and its relations to public, commercial organization of, by W. E. Richards 251
Light, destroying insects with aid of electric 476
Light efficiency, new method of measuring, by C. C. Hutchins*..... 1194
Light, methods of comparing our various sources of artificial, by W. E. Barrows, Jr. 1138
Light sources, cleanliness of..... 794
Lighting abroad, street, by H. Thurston Owens* 930
Lighting and illuminating engineering number, electric (E) 456
Lighting and power rates, school-house (E) 869
Lighting, art in public (E)..... 917
Lighting as a comprehensive problem, street (E) 455
Lighting, Chicago arranging for street..... 1070
Lighting, developments in arc, by A. J. Mitchell 477
Lighting, European system of electric train 1076
Lighting, factory 991
Lighting fixtures for arc lamps, public, by Gilbert Mulock* 1037
Lighting for Central Park..... 992
Lighting for Constantinople, electric..... 476
Lighting for Irish cathedral, electric..... 933
Lighting, Galveston to use arch..... 560
Lighting in exchange for advertising..... 297
Lighting in Oklahoma City, park*..... 203
Lighting, new methods and specifications for street, by J. H. Perkins..... 643
Lighting of Lincoln Park Boulevard, Chicago* 1244
Lighting plant for Pennsylvania terminals and tunnels 60
Lighting plant, storage battery in..... 936
Lighting projects, special street..... 596
Lighting rates, reduction in St. Louis..... 432
Lighting, remote-control switch for street (R)* 214
Lighting system of St. Louis, new downtown street, by John E. Tiedeman*.... 1136
Lighting, the problem of domestic, by Dr. Louis Bell 470
Lighting, tungsten sign, by Henry F. Schroeder* 479
Lightning arrester for telegraph and telephone lines, vacuum..... 1135
Lights better than police patrol, electric... 64
Lights for Hudson fete..... 431
Lights for United States military posts, electric 286
Lights, special price on 300
Lincoln Park Boulevard, Chicago, lighting of* 1244
Linemen, protection demanded for..... 535
Liquid fuel and marine practice..... 339
Litharge exposed to atmospheric agents, behavior of 598
Live-wire hazard in Indiana..... 823
Load-factor, one way to improve..... 642
Load factors (E) 93
Load factors, compilation of, by E. W. Lloyd* 110
Load-factors in motor-driven installations (E) 232
Load, power (E) 188
Loads, cotton-mill (E)..... 368
Loads, some motor (E)..... 94
Locomotive for Pennsylvania Railroad, electric tunnel 940
Locomotive headlights, electric.....69, 538
Locomotive headlight tests 886
Locomotive with Edison accumulators, electric 980
Locomotives for Simplon tunnel, new electric, by C. L. Durand*..... 938
Locomotives in German and Austrian mines, novel eelctric storage-battery*.. 536
Logging by electricity 1056
London County Council trolleys..... 339
London Physical Society 245
London railways to replace four-year-old turbine equipment 1091
London's subway system 336
Long Island Electric 385
Long Island Electric Railway Company.... 464
Lond Island Railroad Company wants $16,500,000 389
Long Island Railroad's extension nearly finished 801
Long Island road to issue $16,500,000 debentures 532
Lubricating and electric brushes for commutators and collector rings, by E. O. Schweitzer* 532
Lubricating hint 550
Lumber, power used in the re-manufacture of, with special reference to central-station energy for that purpose, by C. H. Scott 414, 484
Luncheon to Ralph W. Pope..... 726

M

McAdoo tube expansion 584
McAdoo tunnel opening, interesting celebration at 203
McCall Ferry Power Company..... 835
McCalls Ferry Power Company's reorganization plans 17
McCalls Ferry Power plans extended..... 121
McCalls' Ferry power plant sold..... 1179
McCalls' Ferry power plant, work resumed on. 546
McKinley's electrical interests, Congressman 208
Machine-tool motors, standardization of.... 1049
Machinery, causes of break-downs in electrical 948, 996
Machinery development in Austria..... 998
Machinery exhibition warehouse for Chicago 655
Machinery show for 1910 at Manchester, England 1135
Mackay Companies 872, 1003
Mackay Companies' plans 300
Mackay denies rumors, Clarence H..... 695
Magnetic detector for slot machines..... 338
Magnetic storm ties up wires..... 647
Magnetic-survey yacht Carnegie*..... 196
Magnetic testing at the Bureau of Standards 23
Magnetism, law temperature in..... 550
Magnetizing current, regulation of potential transformers and, by M. G. Lloyd and P. G. Agnew*..... 242
Mail, electric subway for..... 71
Mail, interurbans carrying 333
Mains, erecting overhead in difficult places (R) 305
Maintenance, cost of deferred (E)..... 524
Manchester (Eng.) machinery show for 1910 1135
Manhattan bridge opening 1119
Manhattan Elevated pays $1,582,038 to New York city 69
Manila traction report 633
Manufactures in Europe, America..... 578
Manufactures, special census agents for... 678
Marconi's work in wireless telegraphy rewarded by Nobel prize..... 1118
Mare Island navy yard, power plant for.... 435
Marine practice, liquid fuel and..... 339
Martin, T. C., permanent secretary, National Electric Light Association (E).. 573
Maryland trolley lines unite..... 1198
Massachusetts after Western Union..... 12
Massachusetts, central station developments in (E) 668
Massachusetts Commission, minimum charge decisions by (E)..... 1115
Massachusetts Institute of Technology, advanced instruction in electrical engineering at 1174
Massachusetts, interurban-railway situation in (E) 916
Massachusetts Street Railway Association to have special train to Denver convention 235
Massachusetts street-railway legislation... 64
Mathematics, value of 1077
Mattoon, Ill., without lights..... 390
Measuring holes by electricity..... 1091
Measuring instruments, causes of error in electrical (R) 259
Measuring light efficiency, new method of, by C. C. Hutchins*..... 1194
Meat curing by electricity, by J. C. Lincoln 1233
Mechanical stokers utilize cheap fuels..... 1243
Mechanical draft, by Charles L. Hubbard.. 786
Melville and Macalpine reduction gear*.... 1130
Melrowsky high-tension condensers (R)*... 258
Merchants' and Manufacturers' exchange building for New York, new $6,500,000* 241
Metallic films, tension of electrolytic..... 994
Metal-filament lamps in England..... 598
Mercury interrupter, new*..... 1081
Mercury motor-meters (R)..... 29
Merger authorized 834
Merger, important telephone..... 1127
Merger, independent telephone companies plan 259
Messages, new method of transmitting..... 543
Meter and service wiring, rules for..... 460
Meter expenses (E)..... 669
Meter manufacture, details of watt-hour, by Joseph B. Baker*.....386, 426, 458, 526
Meter, new electric..... 593
Meter report for May, New York city..... 17
Meter tests, August 548
Meter tests, electric 471
Meter tests, report on..... 753
Meters, Baltimore to test..... 253
Meters, rational method of installing service, by H. W. Young*..... 1131
Meters, reports on electric..... 432
Metropolitan application denied..... 21
Metropolitan lease of Forty-second Street Railway 873
Metropolitan lien injunction..... 1185
Metropolitan-New York City Railway..... 244
Metropolitan-New York City Railway hearing 202
Metropolitan plan soon to be announced... 5
Metropolitan property must be sold..... 1077
Metropolitan Securities 735
Metropolitan Securities Company 209
Metropolitan Street Railway's affairs..... 495
Mexican mines, electricity for..... 336
Mexican mines, electrical development in.. 548
Mexico, electric furnace development in... 584
Mexico, electrical opportunities in..... 1042
Mexico, interesting electrical developments in 674
Mexico, possible opportunities in..... 299
Michigan telephone companies must report earnings 1003
Milking cows by electricity..... 1189
Mills, electric drive for textile (E)..... 325
Mills, electric drive in Brazilian..... 546
Mills, electric power in New England..... 147

Digitized by Google

Military posts, electric lights for United States 286
Mine cages, electric recorder for..... 730
Mine hoisting, electric (E)..... 1019
Mine hoisting, electric (R)..... 29
Mine hoisting, modern applications of electric motors to, by Leon M. Hall*..... 1199
Miner's safety lamp, new electric..... 933
Mines, effect of electric power on Transvaal gold and coal 737
Mines, electric development in western.... 541
Mines, electrical development in English... 64
Mines, electrical development in Mexican.. 548
Mines, electricity for Mexican..... 336
Mines, electricity in 995
Mines, electricity in (E)..... 819
Mines, electricity in Canadian iron..... 1071
Mines, electricity in coal (E)..... 323
Mines, electricity in coal (R)..... 73
Mines, electricity in fiery..... 235
Mines, electricity supply in coal..... 247
Mines, standardization of electrical equipment in 828
Mining and metallurgy, international congress on 264
Mining electricity in South African..... 546
Mining industry, electricity in coal..... 641
Mining, safe use of electricity in coal..... 334
Mining situation, English 998
Minimum charge decisions by Massachusetts Commission (E)..... 1115
Minimum rates, results of (E)..... 723
Minneapolis enterprise backed by St. Paul company 337
Minnesota State Fair, illumination of*..... 884
Mishawaka, Ind., special tungsten lighting in* 236
Money by cable, to send..... 1181
Monmouth, Ill., public service consolidation 623
Monorail system, Brennan 979
Monorail systems in India..... 847
Monorailway, gyroscopic balancing and Brennan (E) 973
Monorailway projected, high-speed..... 608
Montana Rapid Transit Company..... 1198
Mont Blanc funicular railway..... 598
Montevideo's trolley systems 389
Moore tube, test of color value of..... 792
Morgan gets telephone lines..... 1233
Mortgage, power company files..... 899
Mortgages, two large 698
Moth and bug trap, electrical..... 1208
Motor, an improved single-phase..... 1249
Motor, determination of circle coefficient of induction, by H. M. Hobart*..... 1073
Motor-driven cement unloader*..... 894
Motor-driven installations, load-factors in (E) 232
Motor equipment, remarkable 7,000-horsepower electric rolling-mill, by Frank C. Perkins* 1144
Motor infringement decision 622
Motor loads, some (E)..... 94
Motor-meters, mercury (R) 29
Motor traction, vibration in*..... 631
Motors, data on direct-current, by Howard M. Nichols 210
Motors for Arctic explorers..... 651
Motors in industrial operations, installation, operation, care and repair of electric, by C. E. Daniels*.....795, 945
Motors in industrial operations; installation, operation, care and repair of, by C. E. Daniels* 845, 892
Motors, modern applications of electric to mine hoisting, by Leon M. Hall*..... 1199
Motors, speed control of electric..... 1096
Motors, standardization of machine-tool... 1049
Motors, synchronizing device for closed-circuit* 924
Motors with speed control, three-phase.... 1143
Moving sidewalk in New York..... 923
Mugdock wireless 1050
Municipal plant loses money..... 1239
Municipal tramway, successful British..... 633
Municipal tramway system for Australian town 831
Municipal wiring, poor..... 988

N

Naples, large electric power station for (R) 304
National District Heating Association..... 159
National Electric Light Association, Brooklyn Company branch 22, 1041
National Electric Light Association's commercial programme committee meets... 1227
National Electric Light Association, Commonwealth Edison Branch, annual banquet of 873
National Electric Light Association, membership increase in..... 936
National Electric Light Association to investigate terminology..... 1070
National Electrical Contractors' Association (E) 187
National Telephone and Telegraph Company incorporated 202
Natural gas (E)..... 867
Navy Department supplies.....65, 168, 235, 252, 266, 375, 430, 598, 695, 825, 921, 977, 1185
Navy wireless tests..... 951
Nechako and other dam failures (E)..... 276
New Mexico, dam break inspected by chief engineer of Panama Canal..... 674
Newly created electric waves..... 1095
Newark, N. J., street lighting in, by H. Preston Owens* 989
New business methods of electric light and power company at Hamilton, Ont., by G. E. L. Carpenter..... 1000
Newcomb, interesting incident in life of (E) 233
New England Section, Illuminating Engineering Society 1071
Newfoundland, cable controversy in..... 694
New Haven road sells its street railroad securities 114
New Haven's developments 923
New Haven's subway plans..... 247
New Orleans, "boosting"..... 635
New Orleans Railway and Light Company to issue bonds 70
New Orleans Railway and Light Company, refinancing of 336
Newspaper, new telephone..... 837
Newspaper reporting extraordinary..... 732
New York & New Jersey Telephone Company's past earnings..... 699
New York Central extends its electrification 342
New York City Interborough..... 844
New York City, new cars on Broadway.... 1046
New York city, transportation problem in. 634
New York Edison Company offers power.. 873
New York Edison entertains Philadelphia Electric employes 548
New York electrical department news..... 1024
New York Electrical show*.....463, 753, 774
New York electrical show entertainments. 825
New York electrical show, exhibitors at... 699
New York Electrical Society.....872, 1076, 1138
New York Electrical Society, commercial development of wireless telegraphy.... 16
New York elevated business improving.... 1225
New York, moving sidewalk in..... 923
New York, New Haven & Hartford Railroad Company, statement of..... 896
New York Public Service Commission appropriation 1118
New York Public Service Commission, Engineering department promotions..... 306
New York Public Service Commission's decision reversed 147
New York Public Service Commission's exhibit 698
New York Public Service Commission to exhibit 432
New York Public Service Commission, transportation engineer for..... 256
New York railways, accidents on..... 941
New York Section, Illuminating Engineering Society 792, 990
New York's illuminations..... 582
New York State Public Service Commission 96
New York State Public Service Commission to advertise for subway bids..... 114
New York's street and electric railway traffic 678, 698
New York subway plans..... 1222
New York Subway situation 591
New York Telephone Company deal..... 634
New York, telephone inquiry in..... 1119
New York telephone merger, details of..... 636
New York telephone mortgage..... 698
New York, Westchester & Boston Railway Company 342
New Zealand mines try electric pumping.. 384
Niagara Falls, development of..... 675
Niagara Power Company and its competitors 252
Niagara power company, new..... 735
Nitrate fertilizers, manufacture of..... 828
Nitrates, manufacture of artificial from air in Norway, by John B. C. Kershaw*.. 155
Nitric acid, manufacture of from air in Austria by Process of Salpetersaeure-Industrie-Gesellschaft (R)*..... 392
Nobel prize for Marconi's work in wireless telegraphy 1118
Non-payment of bills, may discontinue service for 691
Northwest Electric Light and Power Association, joint meeting with Seattle Section, A. I. E. E..... 34
Norway, electrochemical development in... 739
Norway, single-phase electric road in..... 941
Norwich & Westerly receiver..... 675
Numbering, Chicago adopts systematic system of house 433
Nyassaland, hydroelectric plant in..... 731

O

OBITUARY:
Buchanan, William I. 814
Buck, Leffert L. 182
Caldwell, John 1110
Clark, Robert 138
Cochrane, Edward G..... 716
Deacon, George Frederick..... 137
Defebaugh, James Elliott..... 1062
Dolan, Patrick H. 41
Dresser, A. E..... 1164
Dudley, W. W..... 40
Durant, George F. 1014
Fairchild, Frederick 1062
Frey, John C. 316
Gildersleeve, David H..... 270
Hanley, Stephen 716
Harriman, E. H..... 566
Harrison, Hugh Erat..... 450
Hoffman, George William..... 1014
Hovey, Elwyn G..... 137
Hughes, Walter Scott..... 41
Kellogg, Milo G. 662
Knight, Charles S..... 406
Lines, George O..... 910
Lyon, William Warren, Jr..... 316
McFarland, William D..... 270
Newcomb, Simon 138
OBITUARY—Continued.
Pitcairn, Robert 270
Porter, Albert V. 1110
Raymond, Hon. Francis H..... 1110
Reynolds, C. C..... 40
Sargent, Sarah J. 41
Schuyler, Capt. Herman P..... 361
Sheehan, Paul 963
Stetson, J. E..... 450
Van Arsdale, Robert M..... 1110
Watson, Albert P..... 40
Whitney, Alfred Rutgers..... 863
Wood, Orrin S..... 41
Wulstein, Martin J..... 716
Ocean waves, electricity from..... 1050
Ohio Electric Light Association's convention (E) 143
Ohio telephone deal completed..... 872
Ohm's law for electrolytes, validity of..... 546
Oklahoma City, park lighting in*..... 203
Ontario government finances power plan... 117
Operating engineers, proposed society for. 547
Opening in Germany for electrical hearing devices 1227
Opportunities in Mexico, electrical..... 1042
Order of Rejuvenated Sons of Jove, Chicago has headquarters for..... 1071
Oregon Electric Railway mortgage..... 1003
Osiris prize award..... 119
Ottawa, Ill., Chicago publisher seeks lighting franchise in..... 683
Outing of Commonwealth Edison lady employes, annual 635
Outing of Philadelphia Electric Company at New York 548
Output of hydroelectric plant (E)..... 412
Oven, popularizing the electric..... 124
Ozone, production and uses of..... 539

P

Panama, developmens at 947
Panama, electrical news from..... 846
Panama, telegraphy at 886
Park lighting in Oklahoma City*..... 203
Parsons turbine in ship-building..... 432
Patent act, first year's results of British.. 596
Patent classification, changes in..... 799
Patent-law decisions, English..... 23
Patent suit ended..... 872
Patents, annual report of commissioner of (E) 95
Peat and the fuel question*..... 829
Peat, electricity from..... 988
Peat fuel for large electric plant..... 1227
Peat industry in 1908..... 548
Pen, anti-forgery electric..... 1022
Pennsylvania Railroad completes Bergen Hill tunnel 114
Pennsylvania Railroad dissolves advisory board 287
Pennsylvania Railroad, electric tunnel locomotive for 940
Pennsylvania terminals and tunnels, lighting plant for..... 60
Pennsylvania tubes through, two more..... 623
Pennsylvania tunnels inspected..... 1046
Penny for telephone slot, new..... 337
People's Incandescent Light and Heating Company to give demonstrations of electric heating 1150
Peoria Gas and Electric..... 247
Peoria, Ill., electric inspection at..... 251
Permits for waterpower, western..... 923
Permutator, Range-Faget, by F. C. Zanzig* 1078
Phase of harmonics, effect of upon acoustic quality, by M. G. Lloyd and P. G. Agnew 487
Philadelphia Electric Company to install additional arc lamps..... 1037
Philadelphia electrical exhibition..... 144
Philadelphia Rapid Transit..... 24
Photographs, new solution of problem of transmitting (R)..... 438
Photography, new method of instantaneous Roentgen 922
Physical Society of London.....117-245
Pictures, transmitting across Atlantic..... 1071
Pinchot still suspects a power trust..... 674
Piping, improving station wiring and minor (E) 275
Piping in power plants, painting..... 193
Pittsburg Electric Booster Club.....1072, 1120
Pittsburg incline to be rebuilt..... 700
Pittsburg Section, American Institute of Electrical Engineers 675, 799, 1023
Plans for copper merger..... 1233
Plant, an electric (R)..... 392
Plant economy, transferring machinery to improve (E)..... 324
Plant life and auroras, Arctic..... 1024
Plant, story of an electric (E)..... 821
Plants, assisted (E)..... 525
Plants, assisted electric generating..... 534
Platinum situation 1042
Pole preservative experiments..... 548
Poles and railroad ties, preservation of telegraph and telephone..... 927
Poles, another enemy to wooden..... 508
Poles, cedar telephone and telegraph..... 544
Pole lines in New York city, joint..... 920
Poles, preservation of..... 167
Poles, yellow pine for (E)..... 3
Police of Dundee, Scotland, to use electric lamps 735
Popularizing the "electric home" (E)..... 1173
Porto Bello wireless station..... 544
Porto Rico, electrical development in..... 118

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Portraits:
Colegrove, George B. 734
Cutting, E. M. 734
Dodd, Philip Stephens. 226
Esterline, J. W. 654
Galloway, John R. 113
Gleed, C. S. 1013
Hobson, Samuel A. 656
Howlett, C. A. S. 583
Kreider, C. R. 113
Leslie, Frederick 373
McDaniel, Charles W. 361
McGilvray, C. F. 348
Manson, Daniel E. 137
Marshall, A. C. 383
Morton, W. H. 113, 192
Murray, Thomas E. 465
Peck, Edward Folger 137
Ray, William D. 450
Rothery, J. C. 152
Sanborn, G. M. 113, 192
Sweet, A. J. 1014
Westinghouse, George 1175
Postal Company's inspection tour. 841
Postal Company temporarily discontinues use of Rowland printing telegraph machines 831
Potential transformers and the magnetizing current, regulation of, by M. G. Lloyd and P. G. Agnew*. 242
Power and lighting rates, school-house (E) 869
Power at Hale's Bar (E). 47
Power business, getting, by John A. Cleveland 492
Power business, government goes into electric 798
Power company files mortgage. 899
Power company, new Niagara. 735
Power, cost of 798
Power, cost of in 3,000-kilowatt turbine plant (E) 621
Power, costs in 2-turbine stations, comparative (E) 773
Power, effect of electric on Transvaal gold and coal mines. 737
Power for industrial purposes, electric (E) 573
Power from coke-oven gas, cheap electric. 1188
Power from Enfield Rapids, electric (E)... 868
Powerhouse for Capitol buildings, new (*) 536
Power in Central West, hydroelectric (E).. 915
Power in Massachusetts, Connecticut River (E) 232
Power in New England mills, electric. 147
Power in Scotch shipyard, electric. 998
Power load (E). 188
Power, may use barge canal reservoirs for 958
Power plan, Ontario government finances.. 117
Power plant of Victoria Falls and Transvaal Power Company, by Dr. Alfred Gradenwitz * 1180
Power sites withdrawn. 210, 977
Power station for Naples, large electric (R) 304
Power station, heat losses in a. 1243
Power station in Europe, largest. 533
Power used in the remanufacture of lumber, with special reference to central-station energy for that purpose, by C. H. Scott. 414, 484
Preservation of poles. 167
Preservation of telegraph and telephone poles and railroad ties. 927
Preservative experiments, pole. 548
Press rates, cut cable. 19
Pretoria Power Company. 431
Primary cell, new. 691
Printing-press data for electric-motor salesmen and engineers, by S. H. Sharpsteen 298
Profit-sharing plan submitted to employes of Commonwealth Edison Company. 71
Progress in Europe, electrical. 635
Propulsion of ships, electric. 1048
Propulsion of ships, electric, by H. J. Oram 1141
Propulsion of steamships (E). 1117
"Prosperity" proof 23
Protection demanded for linemen. 535
Protection of telephone installation against the disturbing influences of high-tension alternating-circuits (R). 29
Public Service Boards' decision reversed... 147
Public Service Commission appropriation, New York 1118
Public Service Commission, engineering department promotions 306
Public Service Commission, New York State 96
Public Service Commission to advertise for subway bids 114
Public Service Commission to exhibit. 432
Public Service Commission, transportation engineer for New York. 256
Public Service Corporation of New Jersey files mortgage 698
Public service investigation. 429
Public Service Telephone Company. 121
Publicity for Cuba, department of. 117
Public utility corporations to pay enormous sums to City of Chicago. 169
Pumping, electric, how not to do it. 486
Pumping, New Zealand natives try electric 384
Pumping plant at Gatun, Isthmus of Panama, electric 244
Pumping plants, increase in electric. 300
Pumping system in New York, high-pressure. 642
Pumping, Toronto to try electric on large scale. 208
Pumps for London docks, electric. 1143

Q

Quarry, electrically equipped stone*. 727
Quarry Street plant enlargements. 671
"Quartz" system of electric heating (R) *.. 214
Quebec-Jacques Cartier Electric Company, sale of 1234
Quebec's light, power and traction merger 117
Queensboro bridge franchise. 980
Queensboro bridge line. 941
Queensboro bridge, trolley service for. 675
Queens bridge, trolley line for new. 739
Questions and answers. 25, 115, 257, 344, 434, 550, 648, 800, 895, 999, 1151

R

Radioactivity apparatus for measuring by electroscope method (R) *. 170
Radiology and electricity, international congress of 1091
Radiotelegraphy, carborundum in (R). 73
Radium, Antarctic 5
Radium factory, new. 891
Radium in the United States, to discover.. 546
Radium, new process of extracting. 548
Radium, new supply of. 429
Radium $9,000,000 a pound. 12
Radium on free list. 79
Rail-brake, the Brown electromagnetic (R) 28
Railroad in Carlsbad, electric. 1046
Railroad in Switzerland, new electric, by C. L. Dumond*. 204
Railroad ties, preservative of telegraph and telephone poles and. 927
Railway, construction of street. 1047
Railway conventions, electric (E). 725
Railway decision in Texas. 978
Railway, electrically operated cog-wheel, Montreux-Glion, Switzerland, by Frank Koester* 1043
Railway for Swatow, China, electric. 1046
Railway laws, liberalizing street. 8
Railway legislation in Connecticut. 578
Railway legislation in Massachusetts, street 64
Railway mileage in 1908, electric. 985
Railway securities, may invest in electric.. 303
Railway situation in Massachusetts, interurban (E) 916
Railway substation, modern electric*. 1086
Railway supervision, street 283
Railway, work starts on new Westchester.. 168
Railways, depreciation of electric (E). 1
Railways, increase in accidents on Indiana electric 338
Railways, increased earnings of Wisconsin 1088
Railways must interchange, steam and electric 23
Railways, new laws for Wisconsin electric 5
Rates approved in Wisconsin, "readiness-to-serve" 918
Rate decisions and freight classification, an interesting 116
Rates for Boston street lamps (E). 411
Rates for electric current, cheap yearly. 1185
Rates, ready-to-serve and minimum-charge (E) 523
Readiness-to-serve charge, court upholds (E) 95
"Readiness-to-serve" rates approved in Wisconsin 918
Receiver, condenser telephone (R) *. 304
Receiver for Albany & Hudson Road. 671
Receiver for Norwich & Westerly. 675
Receivers' certificate rights upheld. 200
Receivers for electric road. 877
Record-breaking copper production 1243
Recorder for mine cages, electric. 730
Rectifier, vibrating alternating-current*. 891
Reduction gear, Melville and Macalpine*. 1130
Regulation of potential transformers and the magnetizing current, by M. G. Lloyd and P. G. Agnew*. 242
Rensselaer Polytechnic Institute, new laboratory for 22
Reparation in case of differential rates on freight classification 531
Reporting extraordinary, newspaper. 732
Resicza iron and steel works*. 1247
Residence illumination, lamps for. 246, 991
Resistance coils, inductance in. 985
Resuscitation after electrocution. 1024
Retail and bulk service, discriminates between 165
Rhodes scholarships 193
Richmond Light and Railroad Company. 673
Richmond railway organized. 193
Rifle, Prussian searchlight. 1091
Right-of-way problems, handling (E). 725
Rio de Janeiro, electrical development in... 789
Rio de Janeiro Tramway, Light and Power decision 635
Riveter, portable electro-hydraulic. 1145
Roads, Connecticut electric. 844
Roads, steam and electric. 872
Röchling-Rodenhauser and Kjellin electric furnaces * 6
Rockingham Power Company sale. 79
Rockingham Power Company sold. 168
Rock Island orders gasoline cars. 338
Roentgen-photography, new method of instantaneous 922
Rolling mill, electrically-driven converter blower in (R). 438
Rolling-mill motor equipment, remarkable 7,000-horsepower electric, by Frank C. Perkins * 1144
Rome Telephone Company sold. 159
Röntgen-ray tube. 338
Roosevelt irrigation project in Arizona, work on, by D. A. Willey*. 284
Rouge-Faget permutator, by F. C. Zanzig* 1078
Rowland printing telegraph machine, use of temporarily discontinued. 831
Royal Society of London. 208
Rubber companies consolidate. 953
Rubber market, firmer crude. 345
Rubber, price of. 486
Rubber, regenerated 106
Rubber tree in Chili, new. 760
Rules for service and meter wiring. 460
Rules, wireless standardization. 543
Russia, electric steel plant for. 995
Russia, electrical openings in. 1135
Russian capital, tramway electrification in 1003
Russian Empire, proposed wireless across.. 841
Ryan scintillator *. 793

S

Safeguards, electrical workers petition for. 338
Salem Electric Company sold. 953
Sales possibilities in India, electrical. 977
Salt River project*. 10
Sample exhibition in Germany, American permanent 433
San Francisco electrical exhibition. 978
Sanitary and safety appliances for mechanics, to lecture on. 642
Santos, Brazil, electrical projects in. 64
Saskatchewan government purchases Bell Telephone System 17, 117
Saving the city money. 1195
Scholarships, Rhodes 193
School-house lighting and power rates (E) 869
School of aeronautics. 535
Scintillator * 687
Scintillator, Ryan * 793
Scotland, new electrode factory for. 995
Scottish coal-field, electric supply system of, by A. H. Bridge*. 579
Searchlight rifle, Prussian. 1091
Searchlights for North Carolina, electric... 1207
Seattle Electric Company to issue $1,150,000 new common stock. 435
Seattle Section, American Institute of Electrical Engineers, joint meeting with Northwest Electric Light and Power Association 341, 547
Second Avenue Railroad. 154, 463, 671
Second Avenue Railroad to borrow $500,000 630
Second Avenue suit delayed. 553
Secondaries, grounding of. 987
Secrecy in wireless transmission. 106
Securities, year's issue of. 738
Sewage disposal, electrolytic. 154
Sheet-metal factory, bituminous producer in double role in. 541
Shipbuilding, Parsons turbine in. 432
Ship, electrically propelled. 1202
Ship, extended uses of electricity on board, by John McLaren. 594, 638, 737
Ship insurance, wireless telegraphy and.... 297
Ship, most powerful yet. 1084
Ships, electric-drive on (R). 393
Ships, electrical kitchen machinery on..... 997
Ships, electric-propulsion of. 1048
Ships, electric propulsion of, by H. J. Oram 1141
Ships, turbo-electric propulsion for. 997
Shipyard, electric power in Scotch. 998
Shock, dangers from electric. 598
Shore Line, 1,200-volt operation of. 1198
Side-door cars, subway. 244
Side-door subway trains. 342
Sierra & San Francisco Power Company.. 460
Sign, a mammoth electric*. 14
Sign, largest electric in the South. 207
Sign lighting, tungsten, by Henry F. Schroeder * 479
Sign of the times. 119
Sign rules, new electric. 992
Sign, 7,500 lights on one. 338
Sign, story of a slogan, backed by a central station * 237
Signal Service electrical assistant—United States Civil Service Commission. 342
Signs, Indiana's state attorney objects to electric 300
Silundum as a heating material (R). 439
Simplon Tunnel, new electric locomotives for, by C. L. Durand*. 938
Single-phase electric road in Norway. 941
Sleepers from Chicago to St. Louis, trolley line 698
Slide rule, engineering (R). 170
Slot machines, magneto detector for. 338
Smelting costs in Sweden, electric. 1084
Smelting, electric 654
Smelting in Sweden, electric. 1143
Smoke prevention in Hamburg, industrial, by John B. C. Kershaw*. 788
Smoke problem in Illinois. 988
Smoke question (E). 771
Smoke recorder 1192
Smoke, reducing in the "Black Country" in England 1071
Smoking cars abandoned. 873
Society for telephone men, secret. 543
Society of Operating Engineers, proposed 547
Society of Wireless Telegraph Engineers.. 250
Some features of telephone service (E).... 1221
Sons of Jove, annual meeting of. 823, 1071
South Africa, new electrical industry for.. 431
South Africa, new electrochemical development in 691
South African Institution of Electrical Engineers 416
South African mining, electricity in. 546
South, fuel and energy problem of. 207
Southern expansion 592
Southern Pacific electrification. 144, 197, 351
Southern Pacific, electrification on (E).... 142
Southern streams, storage on (E). 1068
Space between Chicago street cars to be enlarged 17
Spark test for steel. 831

Digitized by Google

Speed control of electric motors..... 1096
Speed control, three-phase motors with.... 1143
Speed indicator, vibrating*..... 985
Spirits? 257
Standard of light, the absolute, by Joseph H. Hart 595
Standard Oil in Columbia Gas and Electric 582
Standard time by telephone..... 951
Standardization in Canada, electrical..... 1050
Standardization of electrical equipment in mines 828
Standardization of machine-tool motors.... 1049
Staten Island subway plan.....431, 463
Station announcer, new automatic railroad. 1047
Station wiring and minor piping, improving (E) 275
Statistics, value of central-station (E).... 621
Staybolts and pipes of electrolytic copper claimed unreliable 545
Steam and electric roads..... 872
Steam and electric traction on same track 726
Steam heating, advantages to electric companies of central-station, by Charles R. Bishop 887
Steam heating in connection with central-stations 784
Steam heating, some remarks on district, by W. J. Kline..... 1133
Steamship propulsion (E)..... 1117
Steel industry in South Africa, electric.... 531
Steel plant for Russia, electric..... 995
Steel refining, recent progress in electric, by John B. C. Kershaw*..... 490
Steel, spark test for..... 831
Steinmetz and Edison*..... 677
Steinmetz lectures in Chicago, Dr..... 975
Stepney, London, England, new generating station at 937
Sterilization of drinking water in dwellings, electrical 591
Stevens Institute, lectures at..... 1118
St. Lawrence River, hydroelectric plant for 947
St. Louis lighting rates, reduction in..... 432
St. Louis, new downtown street-lighting system of, by John E. Tiedeman*..... 1136
Stoking, mechanical 308
Stone quarry, electrically equipped*..... 727
Storage, advantages of (E)..... 1171
Storage batteries, care of..... 1041
Storage batteries, dry..... 584
Storage batteries, lecture on..... 1185
Storage battery company, big..... 158
Storage battery in electric lighting plant.. 936
Storage battery, the ideal..... 384
Storage-battery locomotives in German and Austrian mines, novel*..... 536
Storage battery meeting in Chicago..... 634
Storage-battery omnibuses (R)..... 123
Storage on southern streams (E)..... 1068
Storage problems, some electrodynamos.... 1201
St. Paul company backs Minneapolis enterprise 337
St. Paul electrification plans..... 116
Street arc, tungsten lamp for (E)..... 971
Street lamps, candlepower of Boston (E)... 2
Street lamps, income from tungsten street (E) 668
Street lighting abroad, by H. Thurston Owens * 930
Street lighting as a comprehensive problem (E) 455
Street lighting in Newark, N. J., by H. Thurston Owens* 989
Street lighting, new methods and specifications for, by J. H. Perkins..... 643
Street-lighting projects, special..... 596
Street-lighting system of St. Louis, new downtown, by John E. Tiedeman*..... 1136
Street telephone boxes on poles..... 1081
Stresses, determining by electricity..... 798
Student exchange, Anglo-America..... 159
Sturtevant Company, B. F., reorganized... 345
Substation, modern electric-railway*..... 1086
Subway bids, Public Service Commission to advertise for 114
Subway bids, request for..... 17
Subway, bonds authorized for Brooklyn.... 940
Subway, Chicago's proposed.....15, 463
Subway, Cincinnati proposes to build municipal 1097
Subway construction urged..... 300
Subway contract signed, Brooklyn..... 923
Subway, Croker to finance..... 209
Subway extension approved..... 978
Subway extension, McAdoo..... 14
Subway finance plan, new..... 297
Subway for Buenos Aires..... 825
Subway for mail, electric..... 71
Subway, moving platform..... 60
Subway permit amended..... 553
Subway plans modified, Lexington avenue. 121
Subway plan, Staten Island.....431, 463
Subway plans, New Haven's..... 247
Subway platform, to lengthen..... 783
Subway profits, New York..... 1087
Subway project, another New York..... 24
Subway project criticized, Cleveland's..... 633
Subway proposals, changes its..... 699
Subway route for New York City, another. 676
Subway side-door cars..... 244
Subway situation, New York..... 591
Subway system, Amsterdam Corporation's plan for freight..... 244
Subway system, London's..... 336
Subway system, may enlarge..... 431
Subway to carry packages, plan new..... 873
Subway tracks, for extra..... 60
Subways to cost $100,000,000..... 18
Suez conduit companies..... 5
Suit brought against Economy power dam, another 1184
Suit, infringement of patent..... 400
Suits, would drop telephone..... 735
Supervision, street railway..... 283
Supply men, among the contractors and electrical (E).....525, 549, 701, 899
Survey ship "Carnegie" has sailed..... 433
Suspension for high-tension electric conductors, safety* 891
Susquehanna Electric Power Company..... 384
Swatow, China, to have electric railway... 1046
Sweden, electric smelting in.....1143, 1084
Switchboard for group electric drive*..... 593
Switch boxes, explosions in..... 637
Switch for street lighting, remote-control (R) * 214
Switzerland, new electric railroad in, by C. L. Durand *..... 204
Synchronizing device for closed-circuit motors * 924
System of accounting for small central stations 1234
System of Michigan Power Company*..... 1235

T

Tariff and its relation to electrical industry 145
Tariff bill signed, Payne..... 287
Tariff changes on electrical goods..... 239
Tariff on carbons..... 256
Tarrytown, White Plains and Mamaroneck 828, 940
Tax franchises, cannot 121
Taxes in Ohio, higher telephone, telegraph and express 481
Taxes on electric lamps, German..... 430
Technical high schools, instructors in Chicago. 460
Technical Publicity Association.....827, 1022
Telechronometer 1085
Telecontrol, wireless 210
Telefunken system, new 337
Telefunken system of wireless telegraphy. 117
Telegraph and telephone business..... 380
Telegraph and telephone lines, vacuum lighting arrester for 1135
Telegraph and telephone mileage..... 757
Telegraph and telephone stations in Korea 469, 695
Telegraph and telephone systems as affcted by alternating-current lines 780
Telegraph circuit, longest..... 459
Telegraph messages in 1907..... 691
Telegraph rates advanced, cipher..... 380
Telegraph service, faster 384
Telegraph system in Australia, Wheatstone 699
Telegraphs, North Pole discovery helps.... 694
Telegraphs, ocean cables and commercial.. 950
Telegraphy at Panama..... 886
Telegraphy in Brazil..... 676
Telephone and telegraph business..... 380
Telephone and telegraph companies, proposed alliance of..... 8
Telephone and telegraph lines, vacuum lightning arrester for..... 1135
Telephone and telegraph mileage..... 756
Telephone and telegraph stations in Korea 469, 695
Telephone and telegraph systems as affected by alternating-current lines..... 780
Telephone boxes on poles, street..... 1081
Telephone business 951
Telephone cable, great..... 244
Telephone case, Wisconsin Supreme Court decides exceptional 828
Telephone companies' capitalization..... 209
Telephone companies must report earnings, Michigan 1003
Telephone companies plan merger, independent 259
Telephone companies prosper, Iowa..... 1034
Telephone company chartered, new $50,000,000 872
Telephone company, $5,000,000..... 435
Telephone company wins..... 250
Telephone competition ended..... 853
Telephone concession canceled..... 591
Telephone currents, measurement of by the Arno galvanometer (R)*..... 171
Telephone deal completed, Ohio..... 872
Telephone development in Great Britain, restricted 841
Telephone development, long-distance..... 12
Telephone exchange at Ashtabula, Ohio, automanual* 1092
Telephone, fighting forest fires with aid of 489
Telephone, fishing by..... 586
Telephone in Europe 695
Telephone inquiry in New York..... 1119
Telephone installation, new ruling on..... 1095
Telephone installations, protection of against the disturbing influences of high-tension alternating currents (R).. 29
Telephone, international long-distance..... 195
Telephone in theatrical management (E). 93
Telephone line in South America, new..... 1085
Telephone lines, extending into sparsely settled territory (E)..... 324
Telephone list, classified..... 582
Telephone merger enjoined, Iowa..... 753
Telephone merger, important 1127
Telephone mergers, Missouri attacks Bell.. 1071
Telephone merger, projected big..... 119
Telephone merger rumored, large..... 837
Telephone newspaper, new..... 837
Telephone openings in West Indies..... 417
Telephone opportunities in Latin America. 896
Telephone privileges, abuse of (E)..... 189
Telephone problems, discuss..... 337
Telephone progress, President Vail on..... 951
Telephone rates, British..... 210
Telephone receiver, condenser (R)*..... 304
Telephone service, Iowa court on..... 159
Telephone service, money value of one day's (E) 1021
Telephone service, Venezuela 799
Telephone situation, independent..... 925
Telephone slot, new penny for..... 337
Telephone, standard time by..... 951
Telephone stock, exchanging..... 543
Telephone suits in court..... 197
Telephone suits, would drop..... 735
Telephone system purchased by Swedish telegraph board, long-distance..... 1155
Telephone system, Saskatchewan government purchases Bell.....17, 117
Telephone toll service, popularizing (E)... 457
Telephone train dispatching.....430, 433, 695, 699, 949
Telephone train dispatching, Atchison, Topeka & Santa Fe extends..... 653
Telephone transmitter, new long-distance. 1118
Telephone work at Illinois National Guard encampment, no field..... 193
Telephones for dispatching..... 337
Telephones in Brazil 429
Telephones in Canada 950
Telephones in Cuba..... 673
Telephones in the South, farmers'..... 543
Telephones open up national forests..... 67
Telephoning across the ocean..... 380
Telephoning en tour 1119
Telephony in Europe, long-distance..... 1023
Telephony, wireless, still experimental..... 23
Temperature in magnetism, low..... 550
Temperature regulation of electric furnaces, automatic (R) 392
Tension of electrolytic metallic films..... 944
Terminology, National Electric Light Association to investigate..... 1070
Texas railway decision 978
Textile factories, electrical operation of.... 340
Textile mills, electric drive for (E)..... 325
Textile mills, electric drive in..... 1050
Theatrical management, telephone in (E).. 93
Third Avenue claims..... 71
Third Avenue Company's application denied 703
Third Avenue foreclosure sale..... 929
Third Avenue Railroad..... 18
Third Avenue Railroad, another plan for.. 1185
Third Avenue reorganization plans.....9, 16
Third Avenue reorganization rejected by Public Service Commission..... 636
Third Avenue sale October 27..... 251
Third Avenue Railway sale put off..... 671
Thief trap, live-wire..... 338
Third-rail zone, extends..... 738
Three-phase traction systems, by Frank Koester 1087
Timber supply of the United States..... 468
Tinning, electrolytic (R) 122
Titanium arc, by William S. Weedon*..... 1035
Titanium, production of..... 1037
Toledo electrical show.....975, 1179
Toronto to try electric pumping on big scale 208
Trackless-trolley car around London, first* 842
Trackless-trolley system proposed for Leeds, England 739
Trackless trolleys, a field for (E)..... 368
Trackless trolleys in Europe..... 341
Trackless trolleys in New York?..... 343
Traction action upheld..... 256
Traction company to issue bonds..... 739
Traction lines, central bureau for..... 1046
Traction situation in Detroit..... 918
Traction, steam and electric on same tracks 726
Traction, steam versus electric..... 19
Traction systems, three-phase, by Frank Koester 1087
Trade journal enterprise..... 535
Trade marks, domestic and foreign registration of, by C. D. and W. R. Davis.. 925
Trade with Latin-American republics, to increase 560
Traffic on New York city subway and "L" systems increases 13
Train dispatching by telephone.....695, 699, 949
Train dispatching by telephone extended by Atchison, Topeka & Santa Fe..... 653
Train lighting, electricity versus gas for... 1246
Train-lighting system, European electric.. 1076
Trains, wireless on 633
Tramway, successful British municipal.... 633
Tramway, underground 703
Transfer abuse, reducing electric-railway (E) 325
Transferring machinery to improve plant economy (E) 324
Transformer for 500,000 volts..... 1026
Transformer furnace, new electric*..... 689
Transformer oil, dehydration of..... 1026
Transmission, effect of electrical..... 533
Transmission line, a 500,000-volt..... 1243
Transmissions, notes on long-distance..... 1089
Transmitter, new long-distance telephone.. 1118
Transmitting messages, new method of.... 543
Transmitting pictures across Atlantic..... 1071
Transportation engineer for New York Public Service Commission..... 256
Transportation problem in New York city.. 634
Transvaal gold and coal mines, effect of electric power on..... 737
Trolley earnings in Iowa..... 14
Trolley freight in Pennsylvania..... 469
Trolley-line construction, catenary, by George W. Cravens*..... 626
Trolley line sleepers from Chicago to St. Louis 698

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Trolley lines unite, Maryland 1198
Trolley rate, enjoins two-cent 1124
Trolley service for Queensboro bridge 675
Trolley systems, Montevideo's 389
Trolleys, London County Council 339
Trollhoetta falls power station 533
Trust, Pinchot still suspects 674
Tube, Erie tests Hudson 171
Tube expansion, McAdoo 584
Tube, Röntgen-ray 338
Tubes through, two more Pennsylvania 623
Tungsten as a valve electrode 732
Tungsten development in Nevada 22
Tungsten economy, concrete case of, by W. R. Bonham 597
Tungsten lamp for street arc (E) 971
Tungsten lighting in Mishawapa, Ind.* 236
Tungsten mines, outlook in 256
Tungsten sign lighting, by Henry F. Schroeder* 479
Tungsten street lamps, income from (E) .. 668
Tuning for wireless telegraphy, acoustic method of* 333
Tunnel contract signed, Boston 691
Tunnel opening, to celebrate 114
Tunnel, Pennsylvania Railroad completes Bergen Hill 114
Tunnel service, Hudson 256
Tunnel system extended, electric 496
Tunnels inspected, Pennsylvania 1046
Turbine equipment, London railways to replace four-year-old 1091
Turbine, future of gas 1042
Turbine, future of gas 1042
Turbine plant, cost of power in 3,000-kilowatt (E) 621
Turbine, reversible 1085
Turbine stations, comparative power costs in two (E) 773
Turbines for American battleships 732
Turbines, low-pressure 201
Turbo-electric plant, English wind 1145
Turbo-electric propulsion for ships 997
Turkey, electricity for (E) 572
Turpentine, electric distillation of 1142
Twelve-hundred-volt operation of Shore Line 1198
Twenty-Third Street Railway Company 338
Two-cent trolley rate, enjoins 1124
Two thousand seven hundred fifty-volt direct current system, by A. H. Barringer* 1240

U

Ultra-violet rays, germicide properties of .. 1025
Underground circuit construction, methods and costs of, by Clarence Mayer* 1121
Underground, putting electric wires 732
Underground tramway 703
Underwriters' National Electric Association, committees of 79
Union Railway Company 253
United Power and Transportation affairs .. 941
United Railway's Investment's recently organized companies 385
United Railways, suit against 469
United Railways, to control 202
United States Civil Service Commission—Assistant inspector of electric-light plants 250
United States Civil Service Commission—Engineer and draftsman 1025
United States Civil Service Commission—Junior electrical engineer, Geological Survey 904
United States Civil Service Commission—Signal Service electrical assistant 342
University of Minnesota, non-resident lectures at 13
Unloader, motor-driven cement* 894
Unwired houses, getting after, by Charles A. Parker 1146
Uruguay, electrical developments in 922

V

Vacuum-cleaner development, unique 998
Vacuum cleaners on trains 342
Vacuum of incandescent lamps, determining degree of 1140
Vail on American and Western Union combination, President 1022
Value, gaining (E) 413
Value, gaing (E) 413
Value, right to franchise (E) 772
Value wire lines, to 1192
Venezuelan telephone service 799
Vibration in motor traction* 631
Victoria, Australia, electrical development in 928
Victoria Falls and Transvaal Power Company, plant of, by Dr. Alfred Grademvitz* 1180
Voltage losses, chart for calculation of, by H. P. Liversidge* 194
Voltmeters for indicating tension at distant end of feeders, compound* 1124

W

Warehouse for Chicago, machinery exhibition 655
Washington, Baltimore & Annapolis Electric Railway receivership 877
Washington, new Congressional heating, lighting and power plant at, by George H. Draper* 1125
Waterhammer and steam explosions 1090
Waterpower, Boston & Maine to use 300
Waterpower development at Kilbourn, Wis. (E) 369
Waterpower dispute, Austro-German 1049
Waterpower in Europe 1189
Waterpower in Iceland 1091
Waterpower in India, development of 590
Waterpower plants, improving old (E) 46
Waterpower problem, the (E) 1219
Waterpower resources and railway electrification 698
Waterpower rights attached 437
Waterpower rights, important decision relating to 739
Waterpower sites, to lease 1158
Waterpower, western permits for 923
Waterpowers, American 591
Water softening by electricity 124
Watt-hour meter manufacture, details of, by Joseph B. Baker* 278, 326, 386, 426, 458, 526
Wave-detectors based on thermo-electric element, a class of electric (R) 258
Wave-length experiments, recent 922
Wavemeter, portable (R)* 438
Waves and their analysis by a simple method, distorted, by Henry Hermann* 97
Waves, measurement of distance by electric and sound 950
Waves, neon and electric 1095
Wax sheets for condenser di-electrics, pure 127
Weather signals, international congress adopts system of uniform 9
Weighing machine, electric 114
Westchester and Portchester roads to unite 1227
Westchester road, work starts on new 168
Westchester Traction Company sale 703
Western Electric reports better business than ever 345
Western Electric's business 64
Western Electric's half year 126
Western Electric's position 582
Western Society of Engineers 433
Western Society of Engineers—Electrical Section, joint meetings with Chicago Section, American Institute of Electrical Engineers 622, 823, 975, 1174
Western Union-American Telephone 435
Western Union-American Telephone combination, President Vail on 1022
Western Union, control of secured by American Telephone and Telegraph Company 978
Western Union, denies control of 1174
Western Union directors, new 1174
Western Union's business 209
West Indies, telephone openings in 417
Westinghouse business, continued improvement of 124
Westinghouse business increasing 1005
Westinghouse company 400
Westinghouse company's dividends 678
Westinghouse Electric and General Electric companies' patent agreement 678
Westinghouse Electric Company 631, 635, 852
Westinghouse, Mr., president of American Society of Mechanical Engineers* 1175
Weston normal cell, cadmium amalgams and 1085
West Penn Railways Company's sign 119
Wetterhorn cable road of the Grindelwald Glacier, Switzerland, by Frank Koester* 61
Wheatstone telegraph system in Australia 699
Wheels ordered, 7,000 steel 1046
Wind-turbine exhibit, novel 193
Wind turbo-electric plant, English 1145
Wire lines, to value 1192
Wire used for telephone and telegraph communication, miles of 710
Wireless across the Russian empire, proposed 841
Wireless apparatus in India 825
Wireless communication is easier over water than over land, reason why 544
Wireless, fleet to test 5
Wireless for ships, underwriters favor 950
Wireless in Argentine 460, 694
Wireless in Australia 1158
Wireless in China 544
Wireless in German army 950
Wireless, Japanese study 949
Wireless joins England and Germany 1174
Wireless law, for international 119
Wireless manufacturer, opportunity for 951
Wireless, multiplex 1050
Wireless on steamship Caronia 1135
Wireless on trains 633
Wireless operation in Alaska 951
Wireless opportunity 1084
Wireless, Paris-New York by 384
Wireless plant, Eiffel tower* 542
Wireless record, long-distance 1198
Wireless service extended 300
Wireless sets, to test improved 435
Wireless ship law 15
Wireless standardization rules 543
Wireless station at Glace Bay destroyed by fire 553
Wireless station at Porto Bello 544
Wireless station, Bolt Head* 692
Wireless station, British government takes over Lloyds and Marconi 694
Wireless station on private estate, Government 159
Wireless stations for Panama 1095
Wireless system, Bellini and Tosi directional; the new experiments, by A. De Courcy* 838
Wireless talk with Honolulu 783
Wireless telecontrol 210
Wireless telegraphy, accoustic method of tuning for* 333
Wireless telegraphy and ship insurance ... 297
Wireless telegraphy, commercial development of—New York Electrical Society. 16
Wireless telegraphy, high-speed 949
Wireless telegraphy, Marconi's work is rewarded by Nobel prize 1118
Wireless telegraphy, Telefunken system of 117
Wireless telephony still experimental 23
Wireless tests, government 203
Wireless tests, navy 951
Wireless, 3,000-mile 430
Wireless transmission, secrecy in 106
Wireless with balloon, try 9
Wireless work, new detector for 476
Wires over railroads to be improved 1198
Wires under ground, putting electric 732
Wiring and minor piping, improving station (E) 275
Wiring, poor municipal 988
Wiring, rules for service and meter 460
Wiring rules, New York interior 1132
Wiring specifications, architects', by S. Deutsch 834
Wisconsin electric railways, new laws for .. 5
Wisconsin railways, increased earnings of .. 1088
Wisconsin, "readiness-to-serve" rates approved in 918
Wisconsin Supreme Court decides exceptional telephone case 828
Wood preservatives (R) 122
Wood-pulp grinders, direct electrical operation of large* 846
Wood waste, ethyl alcohol from, by George W. Cravens* 425
Worcester appeal (E) 571
Worcester appeal, decision of (E) 972
Worcester Electric Light Company, fight for control of 671
Workers petition for safeguards, electrical 338

X

X-ray and diphtheria toxin 1024
X-ray as leprosy cure 380
X-ray work, new instrument for (R) 78
X-rays in dentistry 637

Y

Yacht Carnegie, magnetic-survey* 196
Year's issue of securities 738
Yellow pine for poles (E) 3
Yerkes' estate receivership 437

Z

Zurich hydroelectric plant 483

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CONTENTS.

EDITORIAL:
Depreciation of Electric Railways ... 1
Transfer of Heat ... 2
Candlepower of Boston Street Lamps ... 2
Yellow Pine for Poles ... 3
Convention of the A. I. E. E. ... 3
American Institute of Electrical Engineers' Convention ... 4
Chicago's Latest "Bomb" Outrage ... 4
Fleet to Test Wireless ... 5
Pennsylvania Electric Association ... 5
New Laws for Wisconsin Electric Railways ... 5
The Kjellin and Röchling-Rodenhauser Electric Furnaces ... 6
Proposed Alliance of Telephone and Telegraph Companies ... 8
Electrical Fire Hazards ... 9
International Congress Adopts System of Uniform Weather Signals ... 9
The Salt River Reclamation Project ... 10
Radium $9,000,000 a Pound ... 12
Can a Display Room Be Conducted on a Profitable Basis? ... 12
Cornell University Commencement ... 13
Non-Resident Lectures at the University of Minnesota ... 13
A Mammoth Electric Sign ... 14
Trolley Earnings in Iowa ... 14
National Electrical Contractors' Association's Convention ... 14
Novel Methods of Advertising in Small Towns ... 15
The Advantages to Be Derived from Uniform Commercial Department Forms and Methods ... 15
Chicago's Proposed Subway ... 15
The Commercial Development of Wireless Telegraphy ... 16
McCall Ferry Power Company's Reorganization Plans ... 17
Annual Meeting of the American Railway Master Mechanics' Association ... 18
Laclede Gas Deal Terms ... 18
The World's Cable Systems ... 19
Canadian Electrical Association's Convention ... 20
Brooklyn Company Section of the National Electric Light Association ... 22
Chicago Electric Club ... 22
Magnetic Testing at the Bureau of Standards ... 23
Electric and Steam Railways Must Interchange ... 23
BOOK REVIEWS ... 24
Annual Meeting of the Master Car Builders' Association ... 24
QUESTIONS AND ANSWERS ... 25
FINANCIAL REPORTS OF ELECTRICAL COMPANIES ... 26
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE ... 28
INDUSTRIAL SECTION:
Two New Hydraulic Jacks ... 30
A. S. A. Lamp Cord Adjuster ... 30
Telephone Receivers for Wireless Transmission ... 30
Big Submarine Telephone Cable Consignment ... 31
A Simple Method of Comparing Intensity of Illumination ... 31
Westinghouse Type GA Condenser-Lead Circuit-Breaker ... 32
A New Dial Decade Testing Set ... 33
Electrical Manufacturers at the Exhibit of the Railway Supply Manufacturers' Association at Atlantic City ... 33
The "Compensarc" for Motographic Machines ... 34
CURRENT ELECTRICAL NEWS ... 35
RECORD OF ELECTRICAL PATENTS ... 42

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DEPRECIATION OF ELECTRIC RAILWAYS.

In a recent case that involved the valuation of a large electric-railway system before the Railroad Commission of Wisconsin, an engineer who appeared as a witness for the railway company gave the following for the life and annual percentage of depreciation of electric railways.

For the purpose of classification the electric plant and equipment were divided into ten items, and a life in years and a corresponding rate of depreciation was assigned to each.

On land no depreciation was assigned. Buildings were divided into two classes, namely, those containing the power plant and all others. For the power plant buildings the assigned life was twenty-five years and the annual depreciation was taken at four per cent of their reproductive cost. All other buildings connected with the railway had their life taken at fifty years, with annual depreciation at two per cent on their cost of reproduction.

For the entire power plant equipment, including both the steam and the electric generating plant, the composite life was fixed at twelve-and-one-half years, with the corresponding rate of eight per cent on their new cost at this time as the measure of its annual depreciation.

The track and track structures, the electric distributing system, the cars and their equipments, the tools and machinery necessary to operate the plant, and the office furniture were also assigned lives of twelve-and-one-half years, with the eight per cent rate of depreciation annually on their reproductive cost.

Paving was given a life of ten years, with ten per cent annual depreciation, and so also were the horses, wagons and miscellaneous articles used in the business, but no sum was provided for the depreciation of the paving.

For the entire plant, exclusive of the land, including all the equipment and articles named above, the conclusion of the witness was that the annual depreciation amounted to 7.67 per cent on the reproductive cost.

The percentages given above were intended by the witness to cover all sorts of depreciation, including obsolescence and inadequacy, as well as physical wear and decay, but he expressed some doubt as to whether these figures would ultimately prove large enough for all of these elements.

It is to be noted that the so-called sinking-fund method of computing depreciation is not involved in the figures given above, but that the percentage of annual depreciation is found for each class of items by the division of its years of life into

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100 per cent, just as the amount in dollars of annual depreciation is found by the division of the years of life into the cost of reproduction.

In other words, the figure of 7.67 per cent for the composite depreciation of the plant means that in thirteen years the sum necessary to offset depreciation must equal the present reproductive cost.

On this basis, it appeared that 24.23 per cent of the annual gross earnings of the electric railway property were necessary to make good its loss through depreciation. Without attempting to pass on the above figures, they are offered as an interesting opinion on an important subject.

THE TRANSFER OF HEAT.

One of the classical papers read at the recent meeting of the American Railway Master Mechanics' Association at Atlantic City, N. J., was entitled "Heat Transfer," by Professor Charles E. Lucke, of Columbia University. While Professor Lucke's paper was intended mainly to be considered with regard to firing locomotive boilers, his deductions and conclusions apply with equal force to stationary steam boilers, and the hope that he holds out for increased efficiency of heat transfer in locomotive operation would be of equal advantage in steam stations; in fact in its last refinement it is possible that the question of raising the efficiency of heat transfer will concern immediately the large steam stations rather than portable units, for, as President Vaughan pointed out in his opening address, master mechanics must watch the young and powerful rival, the electric locomotive, for it is giving the steam locomotive a close race. In the event of the supremacy of the electric locomotive Professor Lucke's conclusions would have to do essentially with the stationary steam station.

The paper under consideration reviewed the great variation in the value of the coefficient of heat transfer, which, strange to say, is found to have a range of from less than 2 to nearly 1,000. There is no way of applying heat easily to a working fluid except by internal combustion, and in the great mass of real, every-day cases the heat must be applied through plates or tubes or through metal containers. In order to complete a cycle, as a consequence of which heat is transformed into work, there is necessary not only the heat addition period but also a heat abstraction period, for without it the cycle cannot be completed; that is to say, the transformer cannot be returned to its original condition. What seems to be a transfer law of great importance is often stated in connection with such cases as these, as follows: The heat which will pass from a region of high temperature to a region of low temperature is directly proportional to the difference between those temperatures, to the amount of surface through which it may pass, and to the time available. This seems almost axiomatic, and so the coefficient of heat transfer would appear to be a proper measure of the phenomenon, and we find that the British thermal unit per square foot per hour per degree difference of temperature is a basis coefficient in each published work on the subject. As was stated above, this coefficient varies from 1.8 in refrigerating rooms with still air when either ammonia or brine is in the pipes, up to 1,000 in some forms of feed-water heaters and condensers. It is found that the value of the coefficient is increased by vigorous circulation of either the gas or fluid involved, and in fact there are many ulterior conditions which have a decided effect upon the value of this coefficient.

In order to test out the factors affecting the value of the coefficient of heat transfer a number of experiments were conducted at Columbia University with the idea in mind of probably establishing a law of relation between the coefficient and the velocity of the liquid or gas involved. Professor Lucke's conclusions are: (1) That laws of heat transfer applying to the whole subject do not exist; (2) that there is a possibility of enormous improvement in the transfer rate of apparatus involving gases. To his mind there is the possibility of raising the heat transfer coefficient of a steam boiler from its low value of 3 or thereabouts to at least 100. Should such a series of tests be successful, and there is every promise that they may easily be, boilers with perhaps 100 times the present capacity might be developed with the same heating surface.

CANDLEPOWER OF BOSTON STREET LAMPS.

Prior to the date when the recent contract was signed for street lighting in Boston a number of tests of the proposed lamps were made with portable photometers along the streets, and it is now possible to present some of the results.

Boston streets have been lighted for a number of years with direct-current enclosed arc lamps operated with about 6.6 amperes and 500 watts each, and during the past year the Edison Company has supplied about 3,200 of these lamps.

Though these direct-current enclosed arcs have given Boston the reputation of being one of the best-lighted cities in the country, it was felt that an even better lamp was desirable under the new contract, especially as the gas company proposed to show what could be done with high-pressure gas lamps. It was accordingly arranged to displace much the greater number of the enclosed arcs with 6.6-ampere, 500-watt magnetite arc lamps, and to locate several 6.6-ampere, 500-watt flaming-arc lamps at important points, notably in Copley Square. Some of the magnetite arc lamps were given a trial on Commonwealth Avenue, and in an adjoining block a number of the Graetzin inverted double-mantle gas lamps were located by the gas company. Many details concerning the above lamps were noted in editorials of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of May 15 and 22 last.

Tests on the flaming-arc lamps, the magnetite arcs, the enclosed arcs, and on the Graetzin inverted gas lamps were made on several nights with a portable photometer so as to obtain the candlepowers of these several lamps under the conditions of actual service. In the case of each electric lamp the photometer was placed so as to avoid interference with the light by the side rods of the carbon holder, and to measure the candlepower at an angle of twenty-five degrees below the horizontal.

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On the evening of April 27 and May 3, 1909, the candlepowers of each of the three flaming-arc lamps at Copley Square were found to give an average of 2,515 and 2,966 candlepower, respectively.

Four of the old 500-watt, direct-current, enclosed arc lamps in certain locations near Copley Square were tested on April 27 and found to give 260, 419, 601 and 712 candlepower, respectively, the average for the four being thus 495 candlepower. On the lamp of the last-named type at the corner of Clarendon and Newbury streets a test with the arc on the side of the carbons away from the photometer gave 200 candlepower; a test with the arc on the side of the carbons nearest to the photometer gave 880 candlepower, and midway between these two positions the candlepower was 371, so that the average of the three tests was 484 candlepower. These three tests on the same lamp show how uncertain the results obtained by an observation in only one direction may be as to the candlepower of an arc.

On April 29, 1909, ten magnetite arc lamps on Commonwealth Avenue, of the 6.6-ampere, 500-watt type, were tested, and the candlepowers of these ten lamps varied from 906 for the lowest to 1,400 for the highest, with an average for the ten of 1,150 candlepower. From these figures it appears that the candlepower of the magnetite lamps is more than double that of the direct-current enclosed arcs of the same wattage that are to be displaced at the angle of twenty-five degrees below the horizontal.

Eight of the Graetzin double-mantle inverted gas lamps on Commonwealth Avenue were tested on the evening of the third of May, and the candlepowers were found to vary from 88.8 at the lowest to 142.6 at the highest, the average for the eight being 112.2 candlepower. These gas lamps were operated at the ordinary pressure in the mains on Commonwealth Avenue and were supposed to be adjusted for a consumption of seven cubic feet per hour each, but as it is not understood that each lamp was provided with a pressure regulator, and as the pressure in the gas mains at Boston is known to be subject to large variations, the actual consumption at each gas lamp is somewhat uncertain. If the consumption was seven cubic feet per hour at each lamp, the average candlepower of 112 amounts to sixteen candles per cubic foot per hour.

A single-mantle inverted Graetzin burner that appeared to be of similar type to the double-mantle burners on Commonwealth Avenue was tried on a test meter and found to consume 3.2 cubic feet of gas per hour at a pressure of nineteen-tenths inches of water, corresponding to 6.4 cubic feet for a double burner of this pressure, but in some of the gas mains at Boston the pressure runs up to about twice the figure just stated, and this increase of pressure of course increases the consumption of an unregulated burner.

While the Graetzin burners have entirely failed in their competition with electric arcs for street lighting in Boston, they and other incandescent gas lamps are still being considered in competition with tungsten lamps for many miles of the city's streets.

YELLOW PINE FOR POLES.

In line with the notable work which the Forest Survey of the United States Government has been performing in recent years concerning the conservation of the timber supplies and experimentation looking to increasing the life of the materials already in use, is the work which has been under way for some time in processing yellow pine. The western red cedar is largely used on the Pacific Coast for poles, but in certain interior parts of California the wood is expensive, owing to the high cost of rail shipments from the mountains added to the cost of water transportation from the Puget Sound region to San Francisco. In the San Joaquin Valley the native yellow pine obtained from the surrounding mountains has been used to a limited extent for poles. This tree has a number of qualities which make it desirable pole timber, but it is not durable and decays at the butt in a few years when set without being given a preservative treatment.

An experimental plant operated near Fresno, Cal., by the Forest Survey has recently completed a series of tests, treating about 600 poles. It was found that the western yellow pine ranks among the woods which are most easily impregnated with preservatives, and that when thoroughly seasoned a penetration of from two to three inches was obtained by immersing the butts of the poles in a tank of hot creosote for a period of one hour, followed by five minutes' immersion in cold creosote. The government experts are of the opinion that since the treatments can be conducted with comparatively simple and inexpensive apparatus it seems certain that the pine pole with creosoted butt will replace the cedar pole in many localities when its advantages are more commonly recognized.

CONVENTION OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

In another part of this issue will be found a preliminary report of the first two days' proceedings of the annual convention of the American Institute of Electrical Engineers which at this writing is being held at Frontenac, N. Y. The arrangement of the programme this year has been quite effective in grouping topics of similar character. The early reports of the convention's progress indicate that its programme is being carried out with a fairly good division of time among the very numerous papers so that none of the topics is likely to be crowded at the close of the convention for lack of time. Where such a large number of papers is presented before a body for consideration in three-and-one-half days, it must follow that but comparatively little time can be devoted to any one topic, and therefore it is imperative that each paper be considered in as thorough and yet condensed a manner as possible. The topics that are being discussed show clearly the problems with which electrical engineers are at the present time chiefly contending. Among these more important problems may be mentioned the variable-speed induction motor, rolling-mill motors, testing of transformer steel and long-distance transmission lines. Each of these topics has been treated with more than one paper.

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CONVENTION OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

(*Special Dispatch to the* ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.)

Frontenac, N. Y., June 30.—Attended by every desirable element in the form of summer splendor, perfect weather, most delightful surroundings and comfortable appointments, the twenty-sixth annual convention of the American Institute of Electrical Engineers was opened here auspiciously on Monday morning, June 28, at the Hotel Frontenac, in the midst of the famous Thousand Islands.

About 250 members and guests were registered when the first session was called at 10 a. m. by President Louis A. Ferguson. The first number on the programme was the reading of the president's address. Mr. Ferguson took for his subject "The Centralization of Power Supply." He pointed out the marked tendency today toward the consolidation of large interests. The economy secured through combination results in material benefits to the whole people. As an outcome of the centralization of power development, investors are now looking with great favor upon electrical securities. The naturally monopolistic character of public utilities is being recognized and legal ways are being made for monopoly privileges under proper regulation. The opportunities for engineers were never greater than now for conferring upon the people the benefits and advantages of electricity obtained through centralization.

President-Elect Lewis B. Stillwell was then introduced. On assuming the chair he made a brief address. In perfect accord with the schedule for the morning session, the following papers were then read: "The Convection of Heat from Small Copper Wires," by A. E. Kennelly, C. A. Wright, and J. S. Van Bylevelt; "An Alternator for 100,000 Cycles," by E. F. W. Alexanderson; "A Method of Testing Transformer Core Losses Giving Sine-Wave Results on Commercial Circuits," by L. W. Chubb; and "Testing of Transformer Steel," by M. G. Lloyd and J. V. S. Fisher. Spirited discussions followed the reading of these papers.

The Monday afternoon session was called at 2:30 o'clock. The following papers were read and discussed: "A Sketch of the Theory of the Adjustable-Speed, Single-Phase, Shunt, Induction Motor," by F. Creedy; "The Repulsion Motor with Variable-Speed, Shunt Characteristics," by E. F. W. Alexanderson; "The Reduction in Capacity of Polyphase Motors Due to Unbalancing in Voltage," by S. B. Charters, Jr., and W. A. Hillebrand; "The Current Locus of the Single-Phase Induction Motor," by A. S. Langsdorf; and "Multispeed Induction Motors," by H. G. Reist and H. Maxwell. In the absence of its author, A. Miller Gray, the paper on "The Heating of Induction Motors" was temporarily passed over.

The third session of the convention assembled yesterday (Tuesday) at 10 a. m. At this session there were taken up the papers on "Output and Regulation in Long-Distance Lines" and "Calculation of the High-Tension Line," by Percy H. Thomas; "Even Harmonics in Alternating-Current Circuits," by J. B. Taylor; and "The Resistance and Reactance of Armored Cables," by J. B. Whitehead. Brilliant discussions followed the reading of the two papers by Mr. Thomas. The reading of the paper announced for Mr. Fisher was deferred till the evening session.

At the fourth regular session, that of Tuesday evening, the following papers were read: "Losses, Induced Volts and Amperes in Armor and Lead Cover of Cables," by H. W. Fisher; "Corona Phenomena in Air and Oil and Their Relation to Transformer Design," by W. S. Moody and G. Faccioli; "Surges on Cable Systems with Aluminum-Cell Protection," by E. E. F. Creighton and S. D. Sprong; and "Split-Pole Converters and Storage-Battery Regulation," by J. L. Woodbridge.

At 6 o'clock Tuesday, there was given a dinner by the sections committee, consisting of Paul Spencer, chairman; H. R. King, Paul M. Lincoln, H. H. Norris and D. B. Rushmore, to the officers and delegates from the various sections and branches of the Institute. Following the dinner a number of rousing addresses were delivered and there was a general discussion of the work of the sections and branches in broadening the influence of the Institute. In every way this proved a most enjoyable meeting.

In the way of pure entertainment, the arrangements have been planned excellently. On Monday evening there was a reception at the Hotel Frontenac, followed by a dance and the serving of light refreshments. On Tuesday morning quite a large party of ladies and gentlemen took a boat ride on the New Island Wanderer. On Tuesday afternoon there were played the first round in the handicap golf tournament and also a ladies' putting contest. In the latter the first prize, a solid silver card case, was won by Mrs. Louis A. Ferguson; the second prize, a gold enamel belt buckle, went to Miss Alice A. Reed; three ladies, Mrs. F. A. Donohoe, Mrs. W. I. Schlichter, and Mrs. H. G. Reist, tied for the third prize, a topaz hat pin; when played off this prize was won by Mrs. Donohoe. Each lady entered in this contest received a solid silver lead pencil. Last evening a ladies' bridge-whist tournament was held. In this the first prize, a pearl brooch pin, was won by Mrs. J. M. Wakeman; the second prize, a pair of gold enamel bar pins, was won by Miss Alice A. Reed. In the qualifying round of the men's golf tournament Frank A. Donohoe made the highest gross score, winning thereby a handsome mahogany humidor; E. P. Cox made the best net score and won a solid silver safety-razor set.

A full report, giving all the convention proceedings in detail, will be given in these columns next week. A. A. G.

Chicago's Latest Bomb Outrage.

Late last Sunday night a tremendous explosion in the very heart of Chicago's business district announced to the community that another bomb outrage had been perpetrated.

Fourteen or fifteen persons were injured, one very seriously, and damage to the extent of over $100,000 was done to property. The point of the attack seems to have been the Chicago Telephone Company's Central Exchange in the Chicago Title and Trust Building. The bomb was exploded in the alley back of it. While the chief damage was to the telephone company's cables, cable racks and distributing frames, there was general havoc to the glass windows within a block of the explosion. In the Title and Trust Building over 700 windows were broken. It is the second direct attack on this company's premises. The police, so far, have not succeeded in bringing the guilt directly home in any of the thirty-one cases, and the citizens of Chicago are now very much aroused. It is said on the one hand that the last outrage is the result of labor troubles; on the other hand it is claimed that it is the result of jealousies and bitter war between racing gamblers.

It is significant that some weeks ago, on personal instructions from the Mayor of Chicago, the headquarters of the racing pools were raided by the assistant chief of police, and ten telephones, with a regular private switchboard, confiscated. It is not said that the telephone company

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informed on the gambling telephone exchange, nor is it said that the small strike between that company and certain of its electrical workers is particularly bitter. The popular opinion is that the outrages have been the result of a gamblers' war. Up to the time of going to press a reward of $5,500 has been offered for the arrest and conviction of the terrorists. The City of Chicago has voted $3,000 and the Chicago Telephone Company has appropriated $2,500.

The police, as a result of the last explosion, are making strenuous efforts, and one or two important arrests have been made which may or may not furnish a clew to the real ringleaders. Meantime, accident, plate-glass, and, in fact, all insurance companies, are considering the revision of their rates. The extent of the havoc wrought by the last bomb attack has produced a crisis concerning the character of the city's police service. It is considered a very serious condition of affairs on all sides.

Sues Conduit Companies.

Declaring that the city has been defrauded out of $4,348,686 by means of fraudulent accounts and reports, Corporation Counsel Francis K. Pendleton has begun an action in the Supreme Court against the Consolidated Telegraph and Electrical Subway Company and the Empire City Subway Company, of New York city, to compel them to render a detailed accounting, showing the cost of the electrical subway, for which the city paid $12,388,519.

Under the laws of 1884 the city entered into a contract with the companies to construct conduits for the purpose of abolishing overhead wires, and it was especially provided that all electric wires were to run through these subways. By the terms of this contract the subway companies were to be allowed a profit of ten per cent on all moneys expended in the construction work. On the completion of the subways the two companies were to operate them and receive ten per cent of the profits, by way of rentals and other income, the city to receive the balance.

Recently the Consolidated and Empire companies entered a claim against the city for $8,000,000, which they alleged represented their total loss in operating the subways since 1899, when they were completed. This caused the comptroller and corporation counsel to begin an investigation. They found, according to the papers on file, that instead of constructing the subways as provided they had sublet the work to various contractors, and had charged to the city additional percentages of profit which the people had paid.

Fleet to Test Wireless.

Wireless telegraphy will play an important part in the war game of the Atlantic fleet during the summer maneuvers off the New England coast this month.

Admiral Schroeder's flagship Connecticut has been equipped with a set of high-powered wireless telegraph apparatus and the scout cruisers Chester and Birmingham, when they reach the United States from Liberia, also will be equipped with similar instruments. The scout cruisers, which for the first time will participate in the war exercises, will figure in some of the important problems to be worked out by Admiral Schroeder, and the wireless telegraph will come into play in these evolutions.

While the battleship fleet is at sea practicing this summer the experiments will be made with it in long-distance wireless telegraphy. At Brant Rock, Mass., a high-powered station has been erected and at this point Lieutenant-Commander Cleland Davis and Lieutenant George Sweet, experts of the navy in wireless telegraphy, will watch the work between that station and the vessels of the Atlantic fleet carrying the high-powered instruments. Not until the conclusion of these experiments will the Navy Department award the contract for the erection of the station in or near Washington which will be required to send messages 3,000 miles.

Owing to what he considers an exorbitant price, Secretary of the Navy Meyer has cut out the stipulation in the contract requiring an adjunct wireless telephone apparatus which the Department's specifications required should be able to transmit and receive to and from a distance of a hundred miles. The price asked for one of the instruments was $10,000.

Pennsylvania Electric Association.

The annual convention of the Pennsylvania Electric Association will be held at Eagles Mere, Pa., on September 8, 9, and 10. Various committees are working to make this convention successful, enjoyable and profitable, and every indication points to a large attendance. The officers are: President, L. H. Conkling, Scranton; vice-president, E. F. McCabe, Lewistown; secretary and treasurer, E. L. Smith, Towanda. Executive committee, A. R. Granger, Chester; R. S. Orr, Pittsburg; J. H. Perkins, Wilkesbarre; K. P. Fichthorn, Reading.

Metropolitan Plan Soon to Be Announced.

It is reported that the plan of reorganization of the New York city Metropolitan system has been practically agreed upon and that all details will be arranged in the next few weeks, so that the plan can be made public. It is rumored that an assessment of $20 or $25 a share will be levied on the stock, but that bonds or preferred stock will be given therefor. It is also said that the Interborough-Metropolitan Company is prepared to pay any assessment that may be levied to protect its holdings. The plan will be underwritten.

New Laws for Wisconsin Electric Railways.

Three important bills affecting interurban electric-railway service have been passed by the Wisconsin Legislature. The bills are:

1. Providing all electric cars weighing 40,000 pounds or over must be equipped with air brakes. This will affect practically all passenger coaches used in interurban service.

2. Requiring all interurban cars to be heated between October 15 and April 15.

3. Requiring interurban companies to maintain stations in all cities and villages which they reach, whether they be terminal or way stations.

Antarctic Radium.

Advices brought to Victoria, B. C., by the steamship Makura are to the effect that Lieutenant Shackleton's expedition has left Sydney for the purpose of searching for islands believed to exist in the Antarctic. Man has never set foot on Emerald, Nimrod or Doherty islands, which Capt. J. H. Davis, now commander of the Nimrod, is to seek. Professor David, who accompanied the late Shackleton expedition, reports that analysis of the specimens shows the existence of radium in the Antarctic.

Chair of Aviation.

The University of Paris has announced two donations in the interests of aviation.

The first is $100,000 with an annual subvention of $3,000 from Henri Deutsche de la Meurthe for the foundation of a department of technical aeronautics, including studies and researches for the perfection of aerial apparatus of whatever form. The second is $140,000 from Basil Zakaroff, a Greek resident of Paris, for the foundation of a Chair of Aviation.

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The Kjellin and Röchling-Rodenhauser Electric Furnaces.

The use of electric furnaces in the iron and steel industry is rapidly increasing. Much study has been made of their application to electric smelting as well as electric refining in the manufacture of the highest grades of iron and steel. Among the electric furnaces that have met with exceptional success in this line are the Kjellin induction furnace and its modified form known as the Röchling-Rodenhauser electric furnace. It will be the aim of this paper to describe the construction and operations of these furnaces and to give some of the results that have been achieved by their use. The data for this description have been obtained chiefly from a paper on this subject read by Dr.

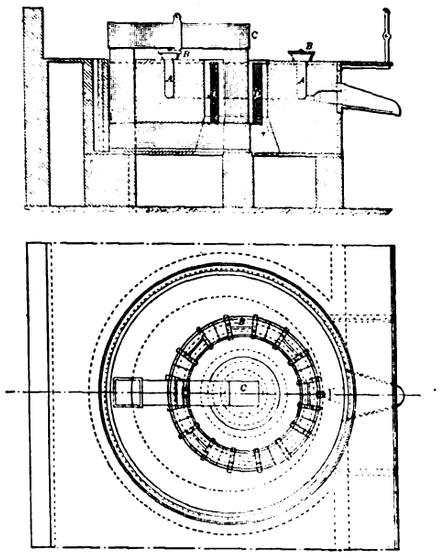

FIG. 1.—SECTIONAL ELEVATION AND PLAN OF KJELLIN INDUCTION FURNACE.

F. A. Kjellin before the recent meeting of the American Electrochemical Society at Niagara Falls, Ont. The illustrations have been loaned by the American Electric Furnace Company.

Dr. Kjellin developed this type of furnace in 1899 and 1900. He had been asked to design an electric furnace for the production of the highest class of tool steel by the general manager of the old iron works at Gysinge, Sweden. On March 18, 1900, the first steel ingot was cast from this furnace. With a consumption of fifty-eight kilowatts from 1,300 to 1,500 pounds of steel ingots were produced each twenty-four hours, the charges being about 220 pounds each. As soon as waterpower was available at Gysinge, about two years later, a larger furnace was built which had an output of about four tons each twenty-four hours with a power consumption of 225 electric horsepower. In this larger furnace the lining was of magnesite instead of silica bricks. This reduced the high percentage of silicon in the steel that had formerly been taken out from the lining and the life of the lining was increased from one week to about twelve weeks.

From a study of the operations of these furnaces a number of German iron-makers became much interested in this matter, and in order to adapt it for their methods the modified form of the Kjellin furnace was devised by them. This later furnace is known as the Röchling-Rodenhauser furnace.

The principle of the Kjellin furnace is shown quite well by the diagrams of Fig. 1. The furnace is practically a transformer in which a bath of molten metal forms the secondary circuit. The transformer core C is built up on laminated sheet iron. About one leg of the core is mounted a primary coil D, which consists of a number of turns of insulated wire or tubing. Surrounding this coil so as to protect it from the heat and also to form a hearth for the furnace is a body of refractory materials. In this, and concentric with the primary coil, is a ring-shaped crucible A, which when filled with molten metal forms the secondary circuit of the transformer. This crucible is provided with covers B and a tap shown in the upper diagram of Fig. 1.

When the primary coil D is energized it induces the secondary current in the molten metal ring. From this fact this type of furnace is called an induction furnace. As in any transformer, the ratio between the primary and the secondary electromotive-forces is fixed by a ratio of the number of primary turns to the number of secondary turns. Since in this case there is but one secondary turn, this ratio is evidently the same as the number of primary turns. Therefore the ratio of the current is also practically the inverse ratio of the potentials; thus in a small furnace of this type a current of 280 amperes at 500 volts supplied to the primary induces a current of 20,000 amperes at seven volts in the molten bath.

In operation the induction furnace is peculiar because it is not possible to fill the crucible with broken pieces of pig iron or scrap and to melt this down. Instead an iron ring is placed in the crucible and melted down to form the bath, or the crucible is filled with molten metal taken from another source. In continuous operation it is the custom to leave a sufficient amount of metal in the crucible to establish a molten bath.

The product from this electric furnace can be controlled in its composition to a nicety. As a result the steel product is of the highest grade. Sample bars have been twisted cold to a much greater degree than has been possible with the best crucible steel. It has been found that molten Thomas-Bessemer steel poured into the Kjellin furnace and left there for some time has improved remarkably in quality. This is explained by the fact that the higher heat of the induction furnace expels the gases dissolved in the steel and also facilitates the removal of the combined oxygen. It has been possible to work this furnace with cold pig iron and pure iron-ore briquettes instead of using pure scrap.

The Kjellin induction furnace has been found to possess a marked advantage in the production of the highest class of steel from pure raw materials and it can compete both technically and economically

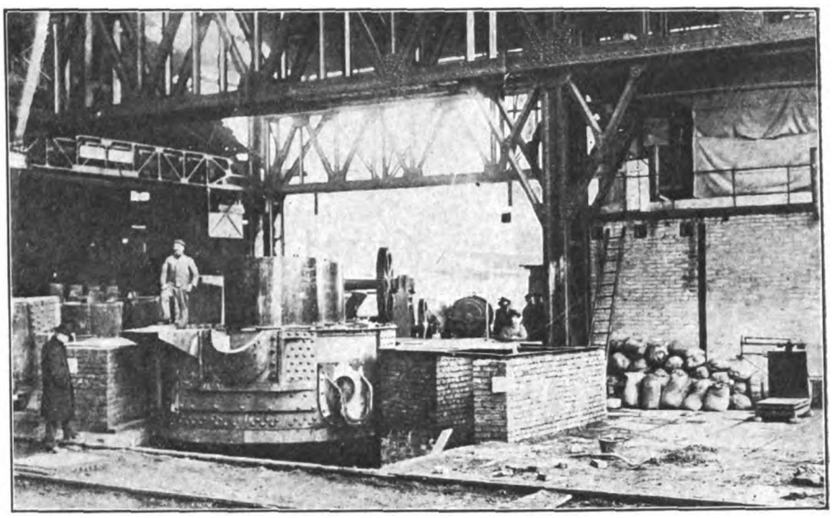

FIG. 2.—EIGHT-AND-ONE-HALF-TON KJELLIN FURNACE AT VÖLKLINGEN.

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with the older methods, especially with the crucible process. The steel product is of a better quality than that formerly produced from the same raw material. The alternating current has a sort of stirring effect upon the steel so that the molten charge of the furnace becomes thoroughly mixed. When the current is applied marked movements on the surface of the molten steel are noticeable. Since the

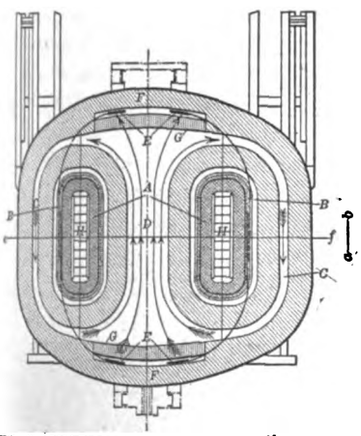

FIG. 3.—SECTIONAL PLAN OF RÖCHLING-RODENHAUSER FURNACE.

bath has a uniform cross-section throughout, the heat created by the current produces a uniform temperature in the whole bath: this removes the risk of overheating the steel in one part of the furnace and of having it too cold in another. There have been installed of the original Kjellin type fourteen electric furnaces whose charge varies from 220 to 18,700 pounds, and that have a combined charge capacity of nearly 32,000 pounds. In Fig. 2 is shown

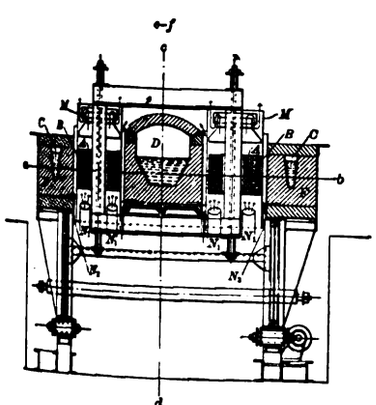

FIG. 4.—SECTIONAL ELEVATION, RÖCHLING-RODENHAUSER FURNACE.

a general view of the Kjellin furnace at Völklingen having a capacity of 8.5 tons.

The Röchling-Rodenhauser furnace is also of the induction type. A good idea of its general construction is obtained from Figs. 3, 4 and 5, which represent a single-phase furnace of this type. In these figures H-H represents the iron core of the transformer. Each leg of this core is surrounded by a primary coil A. About each of the primary circuits is a closed secondary circuit C which is formed of a channel of molten metal. These channels are joined together, forming a central hearth D. This construction gives the molten metal a section similar to the figure eight. As an auxiliary to the currents in the secondaries C there is provided about each primary coil an extra secondary coil B. The terminals of these coils B are connected to plates E which are set in the lining of the furnace. These plates are covered with electrically-conducting refractory material G that serves

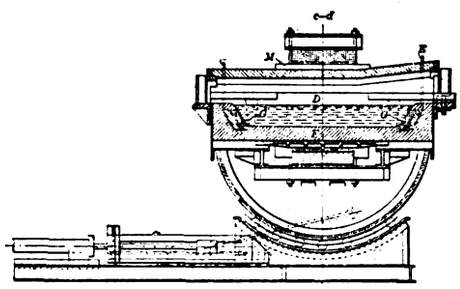

FIG. 5.—SECTIONAL ELEVATION OF RÖCHLING-RODENHAUSER FURNACE.

to protect the plates and also to distribute the current from them. In Fig. 3 the paths taken by the currents are clearly indicated by arrows. This shows that in the central hearth D there is the combined effect of the currents induced in the channels C and also those forming the portions of the secondary circuits B between the terminals E. The effect of this increased current is that the power-factor of the furnace is materially raised; thus the introduction of these secondaries raises this factor from 0.5 to 0.823. This is caused largely by the fact that the magnetic leakage field surrounding the primary coil is now used for inducing currents for the extra secondary.

The Röchling-Rodenhauser furnace was designed for the purpose of using it for the refining of fluid Bessemer steel obtained from the converters so as to produce a higher quality of rails than had been possible before and for the production of high-class steel in general. The method of operating the furnace is as follows:

After tapping, fluid steel from the converters is poured into the furnace and suitable fluxes added. During the action a dephosphorizing slag is formed which is drawn off by tilting the furnace. In making rails the phosphorus percentage is reduced sufficiently in one operation, but in making the highest class steel the operation is repeated. After removing the phosphorus the carbon percentage is adjusted by adding the proper amount of pure carbon to the bath, and after this a new basic slag is formed to remove the sulphur.

The first furnace of this type was one of 3.5 tons capacity. The results from it were so satisfactory that a number of orders for steel rails were secured from the Prussian Government Railway System. In order to adapt these furnaces better to the three-phase current that was

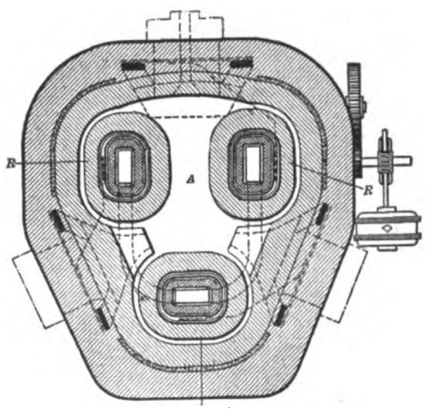

FIG. 6.—PLAN OF RÖCHLING-RODENHAUSER THREE-PHASE FURNACE.

available and also in order to raise the power-factor further, three-phase furnaces of this type were constructed. The general designs of these three-phase furnaces are shown by Figs. 6, 7 and 8. Fig. 9 shows a three-phase furnace having a capacity of 1.5 tons that is being tapped. The construction of these furnaces is similar to that of the single-phase type, except that the central hearth is in common to all of the secondary circuits and is

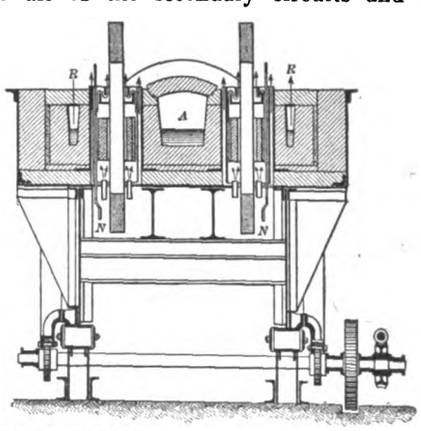

FIG. 7.—SECTIONAL ELEVATION OF RÖCHLING-RODENHAUSER THREE-PHASE FURNACE.

therefore traversed by a multiplicity of currents.

The output of various sizes of these furnaces varies from 9,000 to 65,000 pounds per twenty-four hours with cold charge and from 35,000 to 246,000 pounds in hot charging. The average time is three-and-one-half hours for a cold charge and one hour and twenty minutes for a hot charge. Basic Bes-

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semer steel charged into a furnace can be finished for rails with a power consumption of 100 to 125 kilowatt-hours per ton, or to the highest quality of steel with 300 kilowatt-hours per ton. A detailed table of costs for a seven-ton three-phase Röchling-Rodenhauser furnace on the assumption that power costs 0.58 cent per kilo-

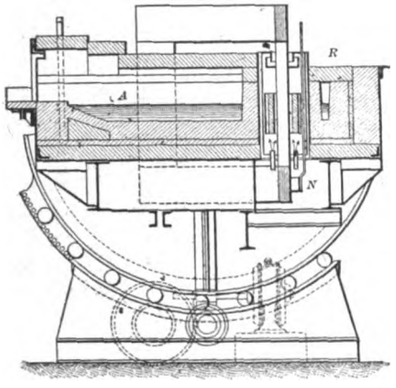

FIG. 8.—SECTIONAL ELEVATION OF RÖCHLING-RODENHAUSER THREE-PHASE FURNACE.

watt-hour shows that the total cost of electrically refined Thomas steel for use in steel rails is $18.67 per ton, or for the production of soft boiler-plate steel is $19.78 per ton. These costs include all the original materials, power, wages, linings, as well as fixed charges on the plant. A 3.5-ton furnace at Völklingen has produced more than 5,000 tons of steel rails per year, and an eight-ton furnace at the same plant has averaged about 600 tons of steel for rails per week, the lining averaging two weeks. The specifications for these rails were very rigid and the product has more than met requirements.

Argentine International Exhibition.

An extension of time is announced for applicants for space at the Argentine International Exhibition, already announced in these columns as lasting from May to November, 1910. Delegates abroad may ask for space up to August 10 next, or up to September 10 when the application is made in Buenos Aires.

Liberalizing Street-Railway Laws.

Governor Draper, of Massachusetts, has signed an amendment to the street-railway laws which authorizes street railways, with the approval of the railroad commissioners, to issue new securities for the purpose of providing working capital. The new law authorizes issues up to five per cent of their stock in new stock of working capital, or to issue such amount of bonds as shall not impair the security of bonds outstanding at the time application is made.

Proposed Alliance of Telephone and Telegraph Companies.

Although interests identified with the American Telephone and Telegraph Company have denied the report that the company had secured control of the Western Union Telegraph Company, the rumor that a deal had been consummated between the two companies has been persistently exploited, and it is stated that when the Western Union dividend was cut some time ago heavy buying by the American Telephone and Telegraph Company was what saved the stock from making a considerable decline.

If this should be carried out, it would be one of the most important moves ever made in the telephone and telegraph industry, as it would probably mean eventually the alliance of the American Tele-

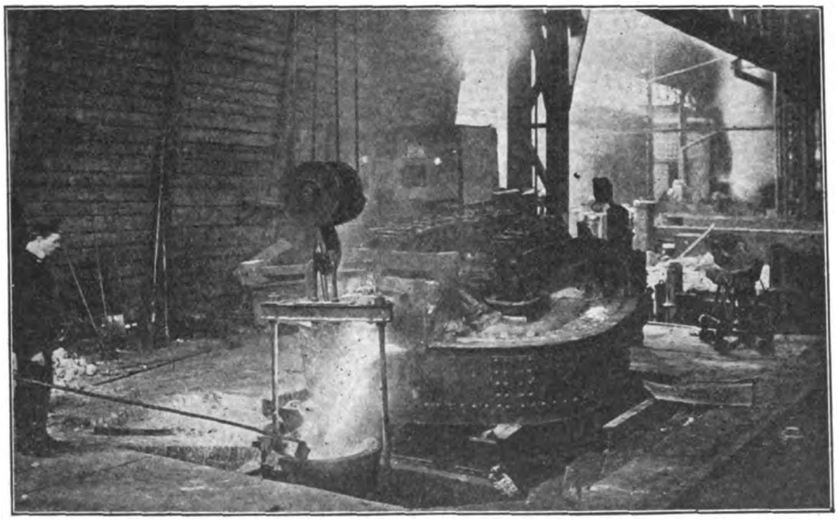

FIG. 9.—TAPPING A ONE-AND-ONE-HALF-TON THREE-PHASE FURNACE AT VÖLKLINGEN.

phone and Telegraph Company and both the Western Union and Postal Telegraph companies. The Mackay Companies, which owns the Postal Telegraph Company, is reputed to be the largest stockholder in the American Telephone and Telegraph Company and its licensee companies.

The American Telephone and Telegraph Company is primarily a holding company, holding stocks in associated operating and manufacturing companies. As an operating company it owns and operates the long-distance lines connecting all the systems of the associated operating companies with each other. According to the annual report for the year ended December 31, 1908, there were outstanding, in the hands of the public, at the close of the year 1,584,766 shares of capital stock. The balance sheet shows assets as follows:

Stock of associated companies, $235,729,305.60; bonds and other obligations of associated companies, $73,289,388.92; The capital stock outstanding is, $180,587,000; the surplus is, $16,225,917.64; depreciation reserve is figured at $21,884,159.53; the net revenue for 1908 was $18,121,707.26; out of which a dividend of eight per cent was paid, amounting to $12,459,156.

The officers of the American Telephone and Telegraph Company are as follows:

President, Theodore N. Vail.

Vice-presidents, Edward J. Hall, Bernard E. Summy, Charles P. Ware, and H. B. Thayer.

Treasurer, William R. Driver.

Secretary, Charles Eustis Hubbard.

The directors are: Charles W. Amory, Thomas B. Bailey, George F. Baker, Francis Blake, Harry H. Brigham, Alexander Cochrane, T. Jefferson Coolidge, Jr., W. Murray Crane, George L. Green, Henry S. Howe, Charles Eustis Hubbard, William Lowell Putnam, Thomas Sanders, Sylvanus L. Schoonmaker, Nathaniel Thayer, Theodore N. Vail, John I. Waterbury and Moses Williams.

The outstanding capital stock of the Western Union Telegraph Company, as given in the annual report for the year ended June 30, 1908, to the meeting of the stockholders on October 14, was $99,817,100, of which $30,131.50 belongs to and is in the treasury of the company.

The bonded debt at the close of the year was $38,645,000, divided as follows: Funding and real estate mortgage bonds due May 1, 1950, four-and-one-half per cent, $20,000,000; collateral trust bonds, due January 1, 1938, five per cent, $8,645,000; convertible, redeemable bonds,

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due November 1, 1936, four per cent, $10,000,000.

The company operates 208,477 miles of poles and cables and 1,360,000 miles of wire.

The officers of the Western Union Telegraph Company are as follows:

President and general manager, Robert C. Clowry.

Vice-presidents, George J. Gould, J. B. Van Every, and Thomas F. Clark.

Secretary, A. R. Brewer.

Treasurer, M. T. Wilbur.

Auditor, J. B. Van Every.

General attorney, George H. Fearons.

The board of directors is as follows: Thomas T. Eckert, chairman; John T. Terry, Henry Walters, J. J. Slocum, George J. Gould, Samuel Sloan, Edwin Gould, Robert C. Clowry, Frank J. Gould, J. Pierpont Morgan, Charles Lanier, Chauncey M. Depew, Henry M. Flagler, John Jacob Astor, J. B. Van Every, Jacob H. Schiff, James Stillman, Thomas F. Clark, William L. Bull, James H. Hyde, Morris K. Jesup, E. H. Harriman, Howard Gould, H. C. Fahnestock, Thomas H. Hubbard, all of New York; Oliver Ames, Boston; C. Sidney Shepard, New Haven, Conn.; John J. Mitchell, Chicago; H. A. Bishop, Bridgeport, Conn.

Third Avenue Reorganization Plans.

A plan for the reorganization of the Third Avenue Railroad system, New York city, has been submitted informally to the Public Service Commission and is now under consideration. It has been prepared by the committee of bondholders of which J. N. Wallace is chairman.

Inasmuch as approval by the Commission must be secured before any plan can be declared operative, this tentative scheme was submitted to the commissioners so as to get its views on the subject before going further with the project.

It is understood that the plan involves a rather heavy assessment on the stockholders and provides for the exchange of the present outstanding bonds on a basis of part bonds and part stock in the reorganized concern. Just what the proportion will be has not been revealed. Neither has the amount of the proposed assessment on the stock, though it is believed that that will be at least twenty-five per cent.

That the Third Avenue may take over the Fifty-ninth Street Crosstown line is a possibility, but there have been no negotiations with that object in view between the owners of the two systems.

Electrical Fire Hazards.

Dealing with the electrical fire hazard, Adjuster L. S. Hayes, of Bellows Falls, Vt., reports:

"The frequency with which the obscure origin of fires is attributed to electricity, whether correctly or incorrectly, makes any definite knowledge of such ignition, or of the hazards of electricity, of interest. A few weeks ago I adjusted a small loss in a physician's office, which clearly showed its origin to have been in the coil of a small X-ray machine. The machine was of the type known as a Campbell High-Frequency Coil, 110 v., amp. 4, cycle 60, No. 353, made by the Campbell Electrical Company, of Lynn, Mass.

"The machine was set upon a narrow shelf in front of a bookcase, which had glass doors, and was connected with the city lighting company's wires by a flexible cord about four feet in length, leading from a small switch on the side of the room to the binding posts of the machine. The fire was discovered at 6:30 a. m. by a passerby. The inmates of the building were aroused and it was easily extinguished. It had communicated from the machine to the woodwork of the bookcase and cracked the glass of its doors. The gutta-percha barrel of the coil was burned off and the wires inside were melted; the binding posts burned from the wooden base and a few inches of the flexible cord destroyed. The office had been closed about twelve hours earlier, just previous to which the machine had been in use. The doctor was sure he threw the switch off between the binding posts and the coil, and thought he turned the switch at the other end of the cord when he finished using it.

"Feeling the importance of the incident, I arranged to have the machine shipped to the manufacturers just as it was found, and have followed the case by correspondence, and by two personal interviews, with the Campbell Electrical Company. They state that they 'have about 800 of these coils in use, some of them having been in use for over six years, and this is the first case of a fire that we have ever had reported. The coil had a transformer of the ordinary type, operated by a high-frequency coil through a spark gap. Evidently the doctor failed to open the switch when he left the machine, and the indications show that it caused combustion in the insulating material of the transformer. The same thing could happen to an electric vibrator, an electric fan, or almost any electrical device. It is evident that in order to prevent a repetition of this occurrence it will be best for us to equip each coil with a pilot lamp, which will remain lighted so long as the current is entering the coil. This we shall make immediate provision for, and all machines shipped after this date will be so equipped and every coil returned to us for repairs will be so equipped.'

"I do not understand that these coils, as manufactured by this firm, ever have been approved by the New England Insurance Exchange, or any other underwriting organization."

International Congress Adopts System of Uniform Weather Signals.

The American and European delegates to the commission appointed by the international meteorological committee in Paris in 1907 to consider the adoption of an international system of maritime weather signals, which is now in session in London, Eng., have adopted a uniform system by unanimous vote. The new code will necessitate changes in the existing American and European methods in signaling weather conditions, and as the United States Weather Bureau has authorized a change of signals without reference to the congress, it is expected that this international code will be adopted first at the stations on the American coast. The other nations agree to make the change as soon as the necessary legislation is passed. The commission is now considering the best means of obtaining weather reports from sea by means of wireless telegraphy from liners and warships. It may be noted in this connection that the United States Weather Bureau has for some time been urging upon navigators the expediency of transmitting, by wireless, particulars of the weather conditions at sea. While this idea has already been exploited to some extent, no concerted action on the point has yet been taken.

Try Wireless with Balloon.

The Gross airship conducted a series of experiments on June 4 over Berlin with wireless telegraphy. The apparatus was recently installed on the airship and the trials lasted for some hours while the craft maneuvered over the roofs of the city. An attempt was made to put the instruments in tune with those at the wireless land stations. The army officers who controlled the airship declined to make any statement as to the results.

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THE SALT RIVER PROJECT.

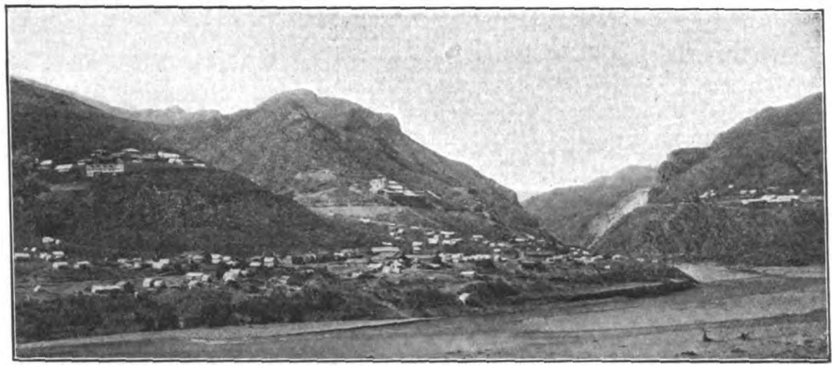
FURTHER DATA AND ILLUSTRATIONS ON THIS IMPORTANT RECLAMATION SCHEME.

In a recent issue[1] of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN a description was published of the great extent of what is known as the Roosevelt irrigation project which, when completed, will furnish irrigation to no less than 270,000 acres of arid land in the Southwest. One of the largest dams in the world is being erected across the Salt River, and this will create a reservoir holding sufficient water to flood 1,300,000 acres to a depth of one foot.

In connection with this project electricity plays a most important part, for as stated in the previous article, one of the first works undertaken in connection with the building of the dam was the construction of a power canal having a sufficient head of water to furnish a maximum electrical horsepower of 4,000 when all of the generators are installed. As soon as the canal was completed a power station was constructed supplying 1,500 horsepower for aerial transmission lines for carrying material, also for lighting the site of the dam and for operating machinery, including a large cement mill turning out 10,000 barrels of this material each month.

Owing to the isolation of the Roosevelt work from the nearest fuel supply and also from railroad facilities, electricity has been depended upon almost entirely for power. In addition, however, to the use of the current described, it is also being employed to a considerable extent for operating an elaborate pumping system, by which water is obtained from underground wells to irrigate an extensive farming district. In addition to the supply obtained from the wells, pumps are also used for obtaining water from several of the rivers in Arizona, the current being transmitted from the site of the Roosevelt dam.

[1] Vol. 53, No. 9, pp. 316.

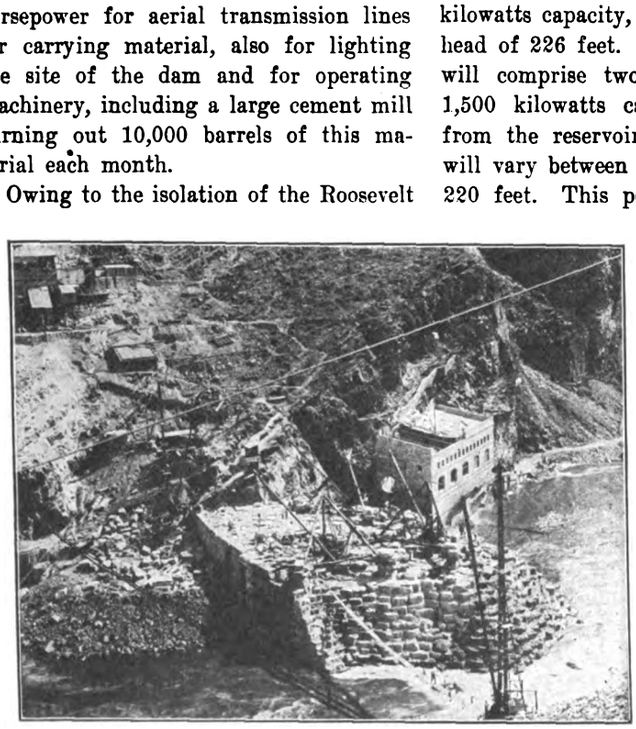


ROOSEVELT, ARIZONA.
In the foreground, Roosevelt and Salt River. In the background, left to right, U. S. R. S. headquarters, cement mill, dam site, and J. M. O'Rourke & Company's camp.

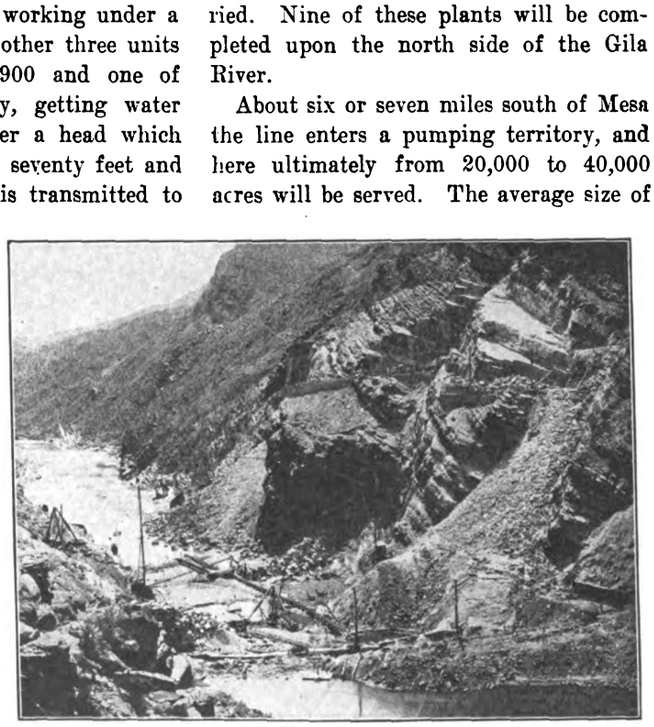
The electrical installation includes a series of vertical units, General Electric generators, and S. Morgan Smith waterwheels. Three of these units are 900 kilowatts capacity, each working under a head of 226 feet. The other three units will comprise two of 900 and one of 1,500 kilowatts capacity, getting water from the reservoir under a head which will vary between about seventy feet and 220 feet. This power is transmitted to the valley below over a steel-tower transmission line carrying six wires of stranded hard-drawn copper. Where the line enters the irrigated district the wires are carried on tripartite poles of varying height, depending on the location and the size of the line and character of the country through which it passes. At a point about a mile east of Mesa a switching station is installed from which a line leads south into the pumping territory, continuing still further down into the Sacaton Indian Reservation, where about a thousand horsepower in all will be used for pumping for the Indians. The wells have been drilled and the preliminary work is now going on for the canal system into which the water will be pumped and through which water diverted from the river during flood times will be carried. Nine of these plants will be completed upon the north side of the Gila River.

About six or seven miles south of Mesa the line enters a pumping territory, and here ultimately from 20,000 to 40,000 acres will be served. The average size of the pumping units will be about fifty horsepower, varying somewhat with the location. The units will consist of a vertical-shaft centrifugal pump, direct-connected to an induction motor operating at about 220 volts, twenty-five-cycle.

The main transmission line carries 45,000 volts, and the main distributing lines



VIEW OF ROOSEVELT DAM POWER HOUSE AND TRANSMISSION LINES ACROSS THE RIVER.



SALT RIVER GORGE, SHOWING THE IMMENSE HEIGHT AND THE DAM FOUNDATION WORK.

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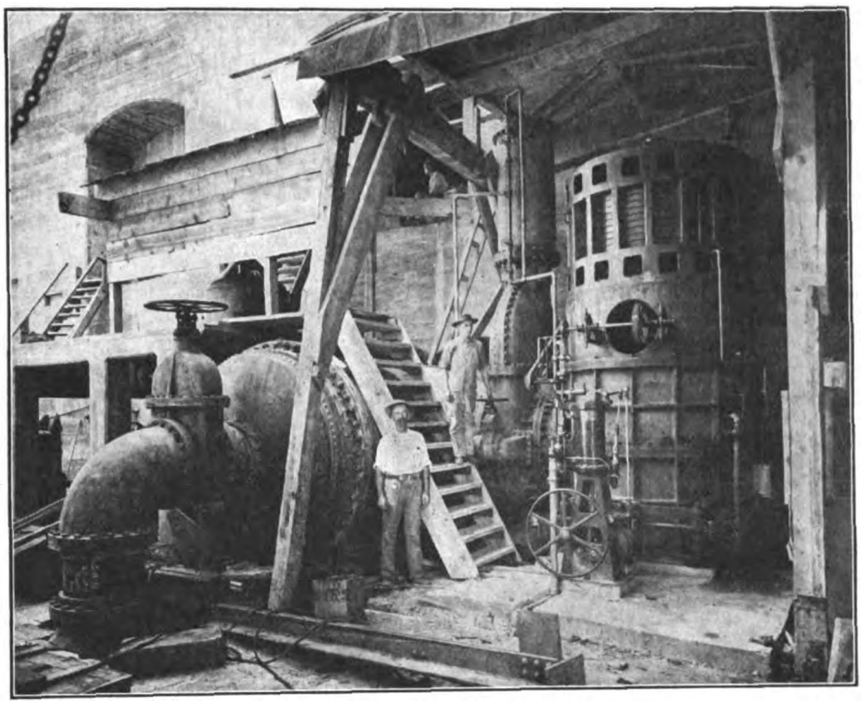
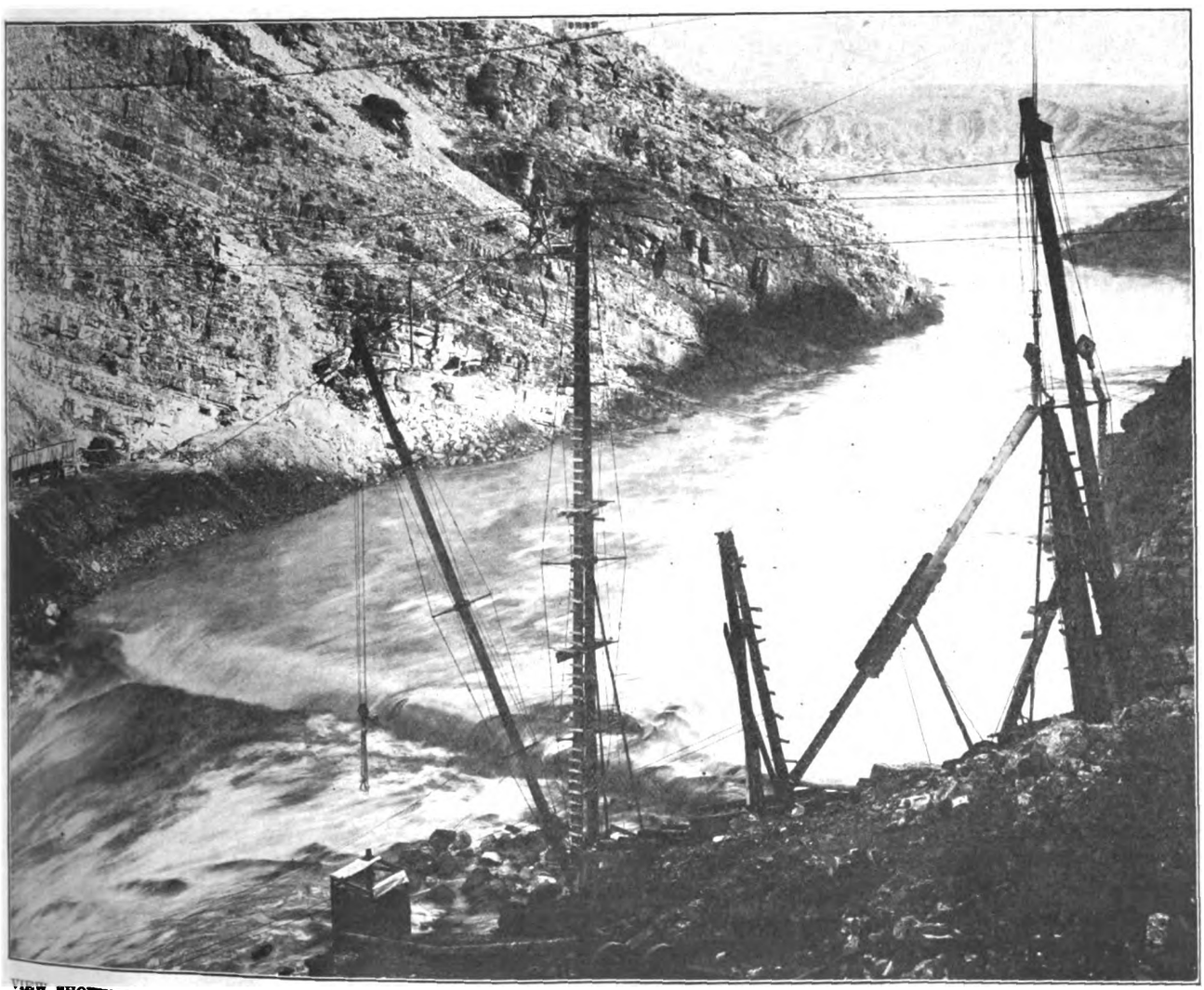
operate under 10,000 volts. The line previously described running south to the Sacaton Indian Reservation is a 45,000-volt line. There is a substation some eight miles south of Mesa in which the transformers change this voltage from 45,000 to 10,000. The main transmission line continues through Mesa on west, crossing the river near Tempe, and terminates at the present time in Phœnix, where power is furnished to the Pacific Gas and Electric Company at one-and-one-half cents per kilowatt-hour. This company had a contract with the original canal company controlling the canal system on the north side of the river, and the present contract was substituted for the old one.

About 500 horsepower is being used to operate the cement mill at Roosevelt, about 100 horsepower to operate the sand plant, which furnishes sand to the contractor, and he is using in the neighborhood of 400 to 600 horsepower. Various small users, such as running shops, ice plants, etc., aggregate possibly 100 horsepower more. The engineers will ultimately use in the valley for pumping between 3,000 and 6,000 horsepower, depending upon the supply of underground



ELECTRIC GENERATOR BY WHICH POWER OBTAINED FROM THE RIVER FURNISHES CURRENT FOR CONSTRUCTING THE CONTROLLING WORKS.



VIEW SHOWING THE PIT FILLED WITH WATER AND THE MAIN CHANNEL OF SALT RIVER PASSING OVER THE MASONRY, ALSO DERRICKS PLACED ON THE BANKS DURING THE FLOOD.

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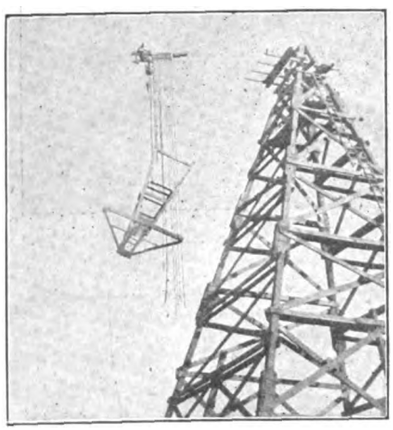
water they finally develop and how deep they have to go for it. At different points on the river between the Roosevelt storage dam and Granite Reef diversion dam are sites for a number of power plants, which will ultimately be built. Further along, on the canal system, there are a number of locations where from 300 to 5,000 horsepower can be developed.

These statistics indicate to what extent the electric current is being employed at present and is to be further employed in the future; also the variety of purposes for which it is absolutely necessary. It is doubtful if anywhere in the United States electricity is serving a greater diversity of activities than in connection



TRAMWAY USED FOR CARRYING PIECES OF MACHINERY ACROSS THE RIVER.

with the Arizona project. The installations were planned and are being carried out by the United States Bureau of Reclamation according to the plans of Louis C. Hill, supervising engineer.

Radium $9,000,000 a Pound.

According to the Cleveland *Plain Dealer,* the British Radium Institute, which was founded recently by the generosity of Lord Iveagh and Sir Ernest Cassel, has given an order for seven-and-one-half grammes of radium, which will cost $150,000—equivalent to something more than $9,000,000 a pound. This is the largest order ever given. The radium will come from a mine in Cornwall.

Long-Distance Telephone Development.

A new microphone, the invention of Messrs. Egner and Holmström, two Swedish engineers, is reported to have greatly increased the range of long-distance telephony. According to a (London) *Standard* correspondent, conversation has been carried on with the aid of this new invention between Stockholm and Berlin as easily as on local calls.

"Can a Display Room Be Conducted Upon a Profitable Basis?"

Frank B. Rae, Jr., as editor, and the following assistant editors: H. K. Mohe, E. W. Lloyd, John G. Learned, George Williams and H. N. McConnell, presented this paper at the National Electric Light Association's recent convention, but the conclusions drawn were all in favor of the display room. Mr. Rae gave personal observations on the salesrooms at Chicago, Philadelphia and Rochester. The first of these cities has what is, without doubt, the most beautiful sales floor in America. Tiffany's, the world-famous jewel house, cannot boast anything more perfect. The location is one of the highest-priced corners in the city, the investment in furnishings and stock is very great, the employes are well paid. Yet this room, established less than six months, is today practically self-supporting. This company's small salesroom, an office approximately twenty feet square, located near the contract department—sells, roughly, $10,000 worth of merchandise a year. Philadelphia likewise boasts a salesroom most excellently equipped, located at a prominent shopping corner, and manned by an adequate and well-paid staff. Mr. Rae also referred to the successful efforts made along these lines by the North Shore Electric Company of Chicago. The theory of the salesroom, he observed, is generally approved, but realization of results is by no means the same thing as approval of an idea. To obtain success the following general points should be kept in mind: (1) Central location in the best shopping district. The greater part of the salesroom's custom comes from women of refinement. Go where such women are; do not expect them to come to you. (2) Attractive stock of high-class portables, and the like, is necessary. The first principle of merchandising is to attract and please. (3) Well-defined departments are essential. Keep the various classes of goods separated and show only one of each. Keep the mechanical devices in the background, but convenient when wanted. (4) Equipment must be first-class and equal to that of the best retail store in your community. Inferior and makeshift fittings mar the majority of display rooms. (5) Make good window displays. Study the windows of other stores and apply their principles. Remember that you are conducting an educational exhibit as well as a salesroom. (6) Keep interest up; not only public interest, but your own and that of your employes. There should be "something doing" every day in the salesroom. Study department-store methods here. (7) Cleanliness is imperative. A jeweler's stock should not be more spick-and-span. Keep the vacuum cleaner and the dust rag always at work. (8) Keep honest records. The books of the salesroom should be as straight as those of a retail merchant. Charge to it exactly what it costs—no more, no less. Such records will interest local merchants and contractors some day. (9) Advertise the salesroom. Make it the center for all electrical wants. Study the advertisements of other merchants and use their methods.

Railroad Electrification.

According to the *Wall Street Journal,* there has already been expended, or plans have been accepted for the expenditure of $60,000,000 in electrification work in and about New York city. This big total is contributed by four railroads, the Pennsylvania, New York Central, New Haven and Long Island. The detailed figures follow:

Railroad.	System.	Amount.
Pennsylvania		$20,000,000
New Haven	Overhead trolley	18,000,000
Long Island	Third rail	11,000,000
New York Central	Third rail	11,000,000
Total		$60,000,000

The Long Island electrification includes 105 miles in actual operation and ninety-five miles which will be completed during this year and next. The Pennsylvania's electrification is mostly terminal work in connection with the opening of its Thirty-third Street terminal. The New York Central's electrification covers about 120 miles of single track or thirty miles of four-track road from the Grand Central Station to Yonkers through the Park Avenue tunnel. This electrification will, within the next year, be pushed on toward Croton on the main line and on the Harlem division from Wakefield to White Plains.

The New Haven expenditure includes $5,000,000 spent on the electrification of eighty-eight miles of single track, or twenty-two miles of four-track main line from Woodlawn to Stamford, and the estimated cost of building 160 miles of electric single track on the new line from Harlem River to New Rochelle.

Massachusetts After Western Union.

Attorney-General Malone, of Massachusetts, is preparing to take action against the Western Union Telegraph Company on charges made by the Highway Commission that the company has failed to furnish returns of its business, in accordance with the laws of the state.

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Cornell University—Commencement and Announcements.

The forty-first annual commencement was held on Thursday, June 17. In the absence of President Schurman, degrees were conferred by Prof. T. F. Crane, who retires this year from the headship of the department of romance languages. More than 225 men received the degree of mechanical engineer, including about seventy-five who have specialized in electrical engineering.

Two years ago the electrical course was improved by the addition of a junior laboratory course. The present class is the first to graduate with this complete course; namely, eight hours of required electrical work in the junior year and twenty hours in the senior year.

The benefit of the junior introductory courses in preparing seniors to attack electrical problems has been clearly shown this year. The senior problems form the main portion of the course. They consist in the prediction of the performance of electric circuits and machines when the dimensions of the various parts and the properties of the materials are given. The courses are not intended to fit students directly for practical work, but rather to show the application of electrical principles to particular fields.

The appointment of a permanent head for the department permits a rearrangement of the details. Beginning next fall there will be three main divisions of the department, each under the charge of a professor or assistant professor. The divisions are: (1) Introductory (junior) courses; (2) advanced laboratory courses; (3) advanced theoretical courses. In the junior year the same range will be covered as heretofore, but in somewhat different order. No change will be made in the required senior courses next year. The elective courses will be adapted to the needs of mechanical and electrical engineers who wish to carry their studies farther than the regular course permits. In addition to those already mentioned there will be illuminating engineering, applications of electrical machinery, and current electrical topics.

Conductivity of Fire Streams.

Experiments recently made by the Pennsylvania Railroad Company showed that there is no danger from electric shock, even from a high-voltage line, to the operator of a fire stream when the nozzle is held at a distance of upward of three feet from the wire.

Non-Resident Lectures at the University of Minnesota.

Several interesting non-resident lectures have recently been given at the University of Minnesota, Minneapolis, Minn.

R. W. Clark, of the Minneapolis General Electric Company, in an interesting and instructive talk on "Home Lighting," pointed out that for domestic lighting a well-diffused light is most effective, and this may be of much less brilliancy than that required for commercial purposes. Switches should be arranged so that a person moving about the house may progressively light the way ahead without difficulty. In conclusion, Mr. Clark called attention to the convenience afforded by a baseboard receptacle for the connection of table lamps, fans, cooking utensils, flatirons, vacuum cleaners, and other electric utilities.

A. C. Pratt, of the Missouri River Power Company, Helena, Mont., gave a lecture on "Hydroelectric Plants." A practical point in transmission is to have the transformers for the receiving end of the line wound for a pressure about fifteen per cent lower than that at the power house, thus keeping nearly all of the transformer winding in service, giving minimum iron and copper losses, and most efficient operation. The most desirable kind of load in mining districts is given by motors for pumping and crushing. The hoists give a rapidly varying load, similar to that of a street railway. Some hoists in the mine at Butte run up to 3,000 horsepower, lifting cars weighing six to twelve tons, at a speed as high as 2,500 feet per minute. At the Canyon Ferry plant, there are about six to eight short-circuits a year, caused by lightning. The trouble from lightning always originated on the plains and never in the canyons, the topmost wire being the one that usually suffered. About seventy per cent of the line troubles come from outside interference.

G. A. Anderegg, of the Western Electric Company, lectured on "The Telephone and Train Dispatching" before the engineering students and a number of railway men. The telephone has already proved successful as a substitute for the telegraph in the handling of railway trains. The objection to verbal orders has been overcome by the use of suitable record blanks and by the repetition of orders. The recent efforts of telephone engineers have been given to the perfecting of the signaling devices in order that the train dispatcher may call any station desired without disturbing others, and also be sure that the person answering is the one called. He described the various synchronizing systems and the step-by-step systems. He also described the new system recently developed by his own company, and which is believed to obviate the difficulties met with in some other systems.

Increased Traffic on New York City Subway and "L" Systems.

The New York Public Service Commission has made public the result of reports of ticket sales on the subway and elevated lines of New York city for the years 1907 and 1908, which show a remarkable increase in passenger traffic in Greater New York. The total sales on the subway and elevated systems amounted to the immense total of 494,846,348 during the past year.

The ticket sales in the subway grew from 182,559,990 in the year 1907 to 220,991,212 in the year 1908. The elevated-railroad system, however, showed a falling off, the figures for 1908 being 273,855,136, against 289,799,576 for 1907, a decrease of 15,944,440. This was due partly to the loss of passengers to the subway system, as well as to the falling off in travel due to the depression following the financial panic of October, 1907. As the subway gained 38,431,222, however, the elevated's loss was more than compensated, and the total traffic of both subway and elevated showed a gratifying net increase for the year of 12,486,782 passengers.

Some interesting sidelights on the situation are shown by a glance at the tables giving the ticket sales for each station. For instance, in 1907, the Brooklyn Bridge station of the subway sold 23,175,615 tickets, while in 1908, the sales at the same station fell off to 16,909,244. The explanation of this drop is the opening of the tube to Brooklyn, which made a difference of more than 6,000,000 tickets at the Brooklyn Bridge station. In both years, however, the heaviest sales of tickets in the subway were scored at this station.

The total sales for 1907 and 1908 on the subway and elevated systems were as follows:

	1907.	1908.
Subway	182,559,990	220,991,217
Elevated—		
Second Avenue line	42,643,033	39,286,507
Third Avenue line	129,519,023	122,085,633
Sixth Avenue line	85,234,445	82,945,171
Ninth Avenue line	32,403,075	29,537,820
Grand total elevated	289,799,576	273,855,138
Subway and elevated systems	472,359,566	494,846,348

The sale of tickets by the McAdoo line is not given.

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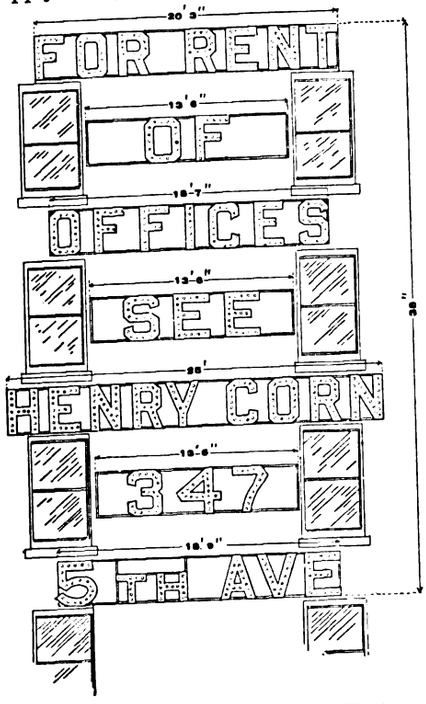
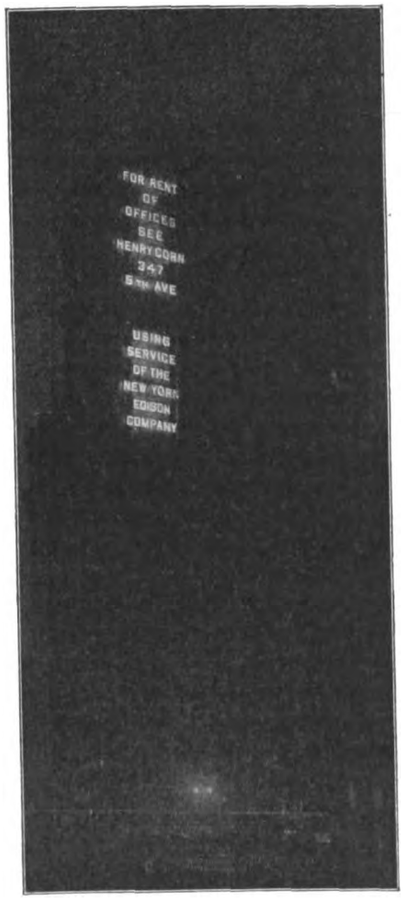
A Mammoth Electric Sign.

One of the largest electric advertising signs in the world has recently been erected on the premises of Henry Corn, at the northeast corner of Fifth Avenue and Forty-second Street, New York city. The over-all dimensions of the sign are: Height, ninety feet; length, twenty-five feet. The height of the letters is three feet. There are no less than 1,211 eight-candlepower lamps in the sign, thus giving a total illumination of nearly 10,000 candlepower.

The sign was designed by Benjamin Wall, of the New York Edison Company, and was built by the Metropolitan Erecting Company. The service wiring was installed by the Electric Construction and Supply Company.





MAMMOTH ELECTRIC SIGN, FIFTH AVENUE AND FORTY-SECOND STREET, NEW YORK CITY.

The Toledo Convention of the National Electrical Contractors' Association.

The ninth annual convention of the National Electrical Contractors' Association will be held at Toledo, Ohio, July 21, 22, and 23. There will be a series of business meetings and several open sessions, to which everyone interested in the electrical industry is invited.

The registration bureau will open at 5 p. m., July 20. On July 21 there will be an open meeting in the Chamber of Commerce rooms at 10 o'clock in the morning, with a business meeting at 2 p. m.

On July 22 an open meeting will be held in the Chamber of Commerce rooms at 10 a. m. There will be a trolley ride for the ladies at 10:30 a. m. and a business meeting at 2 p. m., the men's banquet in the Boody House banquet hall and the ladies' banquet in the Boody House parlor at 8 p. m.

On July 23 all serious matters will be laid aside and there will be an all-day outing at Sugar Island, leaving at 9 a. m. and returning, leaving the island at 5:30 p. m.

At the open session it is expected that W. H. Blood, president of the National Conference on National Wiring Rules, will address the members. Addresses are also expected from George C. Nimmons, architect, Chicago, C. L. Elliot, New York, and James R. Strong, for the National association, in addition to several other speakers.

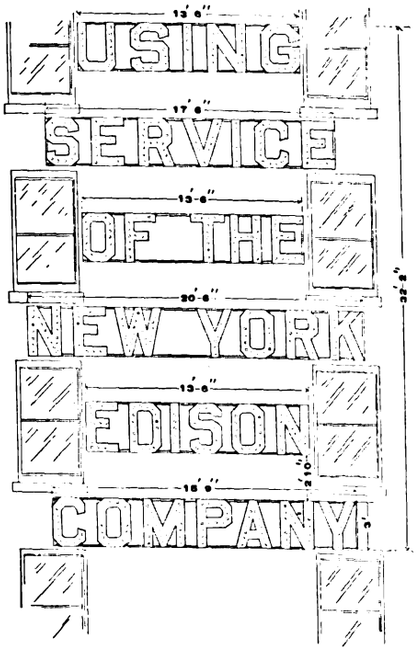
McAdoo Subway Extension.

Mayor McClellan has signed the franchise providing for the extension of the McAdoo subway from Sixth Avenue and Thirty-third Street to the Grand Central Station, New York city, thus removing every legal obstacle so far as the local administration is concerned. The only remaining step is the obtaining of consent of property owners to permit the starting of construction work.

Trolley Earnings in Iowa.

Net earnings of $84,036.93 over and above all expenses is the showing of the Fort Dodge, Des Moines & Southern interurban road during its first year of regular business. This is the electric road between Fort Dodge and Des Moines, with street-car service at Fort Dodge and at Ames. Its first annual report was filed recently with the state executive council at Des Moines.

The total gross earnings were $295,631.69, of which more than three-fourths was received from passengers. Gross passenger earnings were $225,747.17, freight earnings, $46,590.60, and express earnings, $3,089.01. Total operating expenses were $211,594.76, or $3,769 a mile, as compared with gross earnings of $5,266.91 a mile. The net earnings were $84,036.93 for the 56.13 miles, or $1,498.18 a mile.



The Interurban Railway Company has also filed its report for 1908. It shows a decrease of $8,772.66 in gross earnings and a reduction of $10,200 in operating expenses, leaving a net earning slightly larger than that of last year. Comparative figures for the years 1907 and 1908 are as follows:

	1907.	1908.
Gross earnings	$220,099.55	$211,326.79
Per mile	3,408.70	3,272.83
Operating expenses	149,708.24	139,608.88
Per mile	2,318.54	2,162.13
Net earnings	70,391.31	71,717.91
Per mile	1,090.16	1,110.70
Taxes paid	4,823.40	6,817.84

Gross earnings from passenger business totaled $131,719.95 and from freight business $55,415.69. The figures are not reported by lines, only the totals for the system being given.

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Novel Methods of Advertising in Small Towns.

Alex. J. Campbell pointed out in this paper, which was read by him at the recent convention of the National Electric Light Association, that there are two important requirements in advertising: (1) You must attract someone's attention and (2) you must convert that someone into a customer. Many methods of advertising have been employed for increasing the central-station business. In the preparation of this paper fourteen companies had contributed their ideas and experiences. Quite a number of novel methods of advertising are being made use of successfully. In newspaper advertising, for instance, scare headlines can be used to attract attention. For example, "Burglars Foiled," in large letters can be followed by a statement that a porch light left burning all night keeps burglars away from the home. Striking headlines can be made to refer to customers of the lighting company, always with a moral at the end of the tale. Under the heading, "Live Men," a list of wide-awake business men of the town who are using electric service can be made an effective advertisement. These efforts, however, must not be spasmodic. Persistent advertising is essential. A quite successful plan, which is somewhat indirect, is for the company to take a prominent part in pushing the development of its city, frequently by means of ideas and suggestions for accomplishing this without even mentioning electricity. Demonstrations are more or less useful if employed with judgment and at the right time. The giving of invitations to a select few has proven successful. Along with its possibilities novel advertising also has its dangers. Usually novel forms of advertising are short-lived. They may attract attention for a day but do not hammer home the vital facts, nor are they able, as a rule, to embody the logic that carries conviction or the persuasion that creates a customer.

The Advantages to Be Derived from Uniform Commercial Department Forms and Methods.

Clare N. Stannard, editor of a paper with the above title, read at the National Electric Light Association's convention, was aided by the following assistant editors: Henry J. Gille, A. V. Wainwright, Douglass Burnett, E. N. Writington, C. Willing Hare, E. J. Allegaert and W. A. Henderson. It advocated fullest co-operation between all members of the Association in comparing the systems employed in various companies, their manner of approaching the public, the style of advertisements, the number of solicitors employed, follow-up methods, and the like. Uniformity in the use of the best was likewise strongly advocated.

The example of members of railway associations and insurance companies should be followed. The legal and medical professions all have their uniform forms and contracts, why not the members of the National Electric Light Association? The satisfaction of the general public and increased efficiency of employes would be secured by such uniformity. Contracts should be terse, complete and pointed, and, above all else, to the point. Canvas books should reflect thoroughness and exactness; some day the rate controversy might result in uniform and standard methods of calculation at any rate. The problem of keeping prospects classified and in following them up at the proper time should be simplified. Attention was directed to the advantages of uniform methods in interior lighting, electrical display advertising and the use of electric power.

The paper in a strong, clear way then took up the importance of popularizing the business by securing publicity through press agents and high-class newspaper advertising. An organized electrical show to be held periodically at central points throughout the country was suggested, and the creation of a Board of National Electric Light Association Commercial Engineers was advocated.

Wireless Ship Law.

Senator Frye, of Maine, chairman of the Committee on Commerce, has introduced a bill providing that all ocean-going steamships carrying more than fifty passengers shall carry efficient wireless apparatus. Steamships which make trips of less than 200 miles from starting point to destination are exempted from the operation of the proposed bill. A fine of $2,000 is provided for all violations of the measure, which is to take effect one year after the date of its passage. The penalty clause of the bill contains this proviso:

"That it shall constitute a good defense to a prosecution under this act for the defendant to show that the corporations supplying efficient apparatus for radio-communication have entered into a combination for the purpose of maintaining or enhancing the rental or price of such apparatus."

Chicago's Proposed Subway.

The first supplement to the subway report prepared by City Engineer John Ericson, of Chicago, and his assistants on the construction of a comprehensive system of underground tunnels to take care of Chicago street-railway traffic has been made public. Instead of $50,000,000, as first intimated, the cost of the entire subway system is placed at $112,000,000. Exclusive of the galleries for taking care of public utilities, the cost is estimated at $95,500,000.

This subway system, according to Mr. Ericson, will take care of Chicago's traffic problem for the next fifty years. Its total capacity for passengers, both on the elevated and surface lines, will be 1,013,920 an hour.

Four tentative plans are set forth in the supplemental report, each divided into sections. The suggestion is made that work be started on the first section and that after this is completed the city continue with the next section according to convenience, and so on, until the entire system is built. The fourth set of plans provides for an entirely through-route system.

The entire plan is a series of loops within an outer belt. Milton J. Foreman, chairman of the Chicago City Council's transportation committee, will have copies of the new report prepared at once for distribution.

The plans were prepared by R. C. St. John, assistant to Mr. Ericson. He has gone fully into the question of traffic congestion, rapid transit, elimination of noise and how the subways will affect real estate values.

Mr. St. John holds that both the elevated and surface car lines have reached their maximum capacity, by reason of street congestion. In the elevated cars he has found that 48,371 persons are compelled to stand every twenty-four hours, because of overcrowding. In the same time 88,490 passengers have to stand in street cars.

The proposed subways will eliminate the elevated loop and take care of the elevated as well as the surface lines.

Electric Capstans in Dockyards.

The Devonport (England) Dockyard authorities have replaced the hydraulic bollards, which were used for warping the ships into position, by electric capstans. The motors are of sixty-five horsepower, capable of sustaining a load of sixty-five long tons.

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THE COMMERCIAL DEVELOPMENT OF WIRELESS TELEGRAPHY.

ADDRESS AT MEETING OF THE NEW YORK ELECTRICAL SOCIETY, JUNE 15.

The New York Electrical Society brought its successful 1909 season to a close on the evening of Wednesday, June 16. The members met in the Sun-Parlor of the Waldorf-Astoria. The secretary's report showed that during the year the society had elected ninety-two members. There were seven deaths, twenty-five resignations, and 102 names were dropped for non-payment of dues. The year closed with a net membership of 835. The election of officers resulted as follows:

President—Theodore Beran.

Vice-Presidents — John Bottomley, Frederick A. Scheffler, Charles H. Hadlock.

Secretary—George H. Guy.

Treasurer—Henry A. Sinclair.

After the election of officers, Cloyd Marshall gave an informal address on "The Commercial Development of Wireless Telegraphy," and the station of the United Wireless Telegraph Company on the roof of the hotel was thrown open for inspection.

Mr. Marshall went over some of the early history of wireless telegraphy and gave a brief explanation of the characteristics of spark and arc methods of operations. He described in some detail the method of producing undamped oscillations and explained the features of this method which made it valuable in commercial operation. He recited the specification which the Federal Government had given out for its 3,000-mile wireless-telegraph station. Concerning the practical operation of wireless apparatus, he stated that the Signal Corps of the United States Army had various stations at the principal seaboard fortifications and along the Yukon River in Alaska and in the Philippine Islands. The Bureau of Equipment of the Navy Department operates stations in the navy yards and principal strategic points along the Atlantic and Gulf coasts, the Canal Zone, in the West Indies, along the Pacific Coast, in Alaska, Hawaii, Guam, and Manila; fifty-six government shore stations in all. These stations are used for government service and for the relief of vessels in distress, but not for regular commercial service.

The United Wireless Telegraph Company now maintains twenty-seven shore stations on the Atlantic seaboard, extending from the New England coast along the Gulf of Mexico and in the West Indies; twenty-six stations on the Pacific Coast from San Diego, Cal., up into Alaska, and seven on the Great Lakes.

The Lighthouse Board maintains wireless stations on three of the lightships. The Treasury Department maintains stations on seventeen revenue cutters, the army on six of its cableships and transports, and the navy on the principal armored vessels; one hundred government marine equipments in all.

The United Wireless Telegraph Company now operates 163 stations on shipboard. The latest list of the wireless-telegraph stations of the world, compiled by the Bureau of Equipment of the Navy Department, gives a total of 782 shore and floating stations.

The United Wireless Telegraph Company is manufacturing, installing, leasing, and selling, said Mr. Marshall, more than one complete wireless-telegraph station each working day.

The importance of the wireless for ship and shore communication, for Weather Bureau and Hydrographic Office service, in all branches of the military and naval service, and for commercial service, on land, were pointed out. Mr. Marshall also emphasized the opinion that the future held forth a promise that with the knowledge to be gained from aerial navigation and the study of earth and air currents, a great many of the present difficulties would be swept away and even greater strides made than was possible in the remarkable development of the last few years.

Third Avenue Reorganization Plan.

The reorganization plan of the Third Avenue Railroad, New York city, prepared by the bondholders' committee, was officially filed with the Public Service Commission on June 25, with a petition that a hearing be held on the matter. The commission will take up the matter at once.

The total amount of securities of the old company, stock, bonds and notes, is stated at $98,570,908, and the new securities to be issued under the reorganization plan amount to a total of about $92,000,000.

An assessment of $25 per share on the stock is provided for. Stockholders will receive 125 per cent of their present holdings in stock of the new company.

The present Third Avenue Consolidated four per cent bonds will receive eight per cent in refunding bonds of the new company for the unpaid interest and on account of the principal, twenty per cent in refunding bonds of the new company, and eighty per cent in adjustment bonds of the new company.

The syndicate will receive $5,000,000 of new bonds, $1,000,000 adjustment bonds, $20,000,000 of stock, which stock it will offer to the shareholders upon payment by them of $25 per share, and in addition provide the committee with sufficient cash to pay the reorganization expenses and other cash requirements, making a total of $7,500,000.

The properties covered by the Third Avenue consolidated mortgage are to be purchased by the committee at a foreclosure sale (unless they should hereafter decide to proceed without foreclosure sale) and the new company is to be organized under the laws of the state of New York by which the securities herein provided for shall be issued when approved by the Public Service Commission. Application has already been made to the commission for its approval.

Securities of the new company are to be $40,000,000 first refunding mortgage fifty-year four per cent gold bonds, bearing interest from July 1, 1909; $32,000,000 cumulative five per cent adjustment mortgage gold bonds carrying interest from July 1, 1909; $20,000,000 stock.

Hudson Tunnel Opening.

William G. McAdoo, president of the Hudson & Manhattan Railroad Company, announces that the downtown tunnels extending from the Hudson Terminal Buildings, New York, to the Pennsylvania Railroad station, Jersey City, will be opened for operation on Monday, July 19, at 3 p. m.

The first official train, carrying the company's guests, will leave the Hudson Terminal Buildings some time in the morning of that day. Arriving at the Pennsylvania Railroad station, the party will become the guests of Jersey City, and will participate in the exercises arranged by the authorities.

The entire tunnel system, from the Hudson Terminal Buildings to the Pennsylvania, Erie, and Lackawanna Railroad stations, will be completed and ready for operation on July 19, but failure on the part of the car builders to deliver sufficient equipment makes it possible to operate then only that portion of the line from the Hudson Terminal Buildings to the Pennsylvania Railroad station.

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McCall Ferry Power Company's Reorganization Plans.

A plan for the reorganization of the McCall Ferry Power Company, in the underwriting of which prominent Wall Street houses are interested, is being opposed by some of the bondholders of the company, who feel that the interest of the holders of the company's securities is inadequately safeguarded in the scheme of reorganization, which has been worked out by the committee, of which William M. Barnum is chairman, and the other members of which are A. C Bedford, S. Reading Bertron, Charles A. Coffin and Gardiner M. Lane.

The committee's plan in brief was to form a new company, to be known as the Southern Pennsylvania Power Company, which was to have an authorized issue of $12,500,000 five per cent bonds and $8,500,000 stock. There are $8,325,000 of bonds of the old company outstanding and to these the committee proposed to give forty per cent in new bonds and sixty per cent in new stock, while the new money was to be raised by the sale of $4,250,000 new bonds at 90, with a bonus of $3,500,000 stock. The stock, moreover, was to be trusteed until November, 1912, two of the three voting trustees to be named by those who put up the new money.

Among the points on which the dissenting bondholders criticize the plan, is that to let the old bondholders out even, who took their bonds originally at 90, it is necessary for the new common stock to sell at par. In that event those who put up the $3,825,000 of new money would realize, besides any profit on the bonds themselves, a profit of $3,500,000 on the stock before the old investors in the undertaking could as much as get back their principal. The dissenting bondholders, who are understood to command very strong financial support, believe that it is possible to form a syndicate to take a small issue of first mortgage bonds on the property, just enough in fact properly to complete the work, if the old bondholders will accept par in new preferred stock with a division of the new common stock between the present bondholders and the syndicate which would take the new bonds, the old security holders to have the right to subscribe to the new bonds, a right not offered them under the plan put out by the committee.

The McCall Ferry Power Company was engaged in the construction of a 100,000-horsepower plan on the Susquehanna River when the financial troubles of 1907 put an end to the work after nearly $8,000,000 had been spent on the property. The company had a contract to supply electric power to Baltimore, but it was not able to fill this contract. McCall Ferry, on the Susquehanna River, is within forty miles of Baltimore and about sixty miles of Philadelphia, and when completed will be in a position to supply power to both those cities as well as to many other manufacturing centers.

Space Between Chicago Street Cars to Be Enlarged.

As the result of a unanimous decision reached on June 29 by the Board of Supervising Engineers, Chicago Traction, the standard distance between track centers that had formerly been adopted as nine feet, eight-and-one-half inches was increased to ten feet, two inches. The width of all new cars to be built hereafter for the street-car systems under the control of the Board will also be reduced from nine feet to eight feet, six inches. By these changes the clearance between passing cars will be increased from eight-and-one-half inches to twenty inches on all lines to be rehabilitated hereafter. Considerable public agitation has been aroused in the last few months due to a series of fatal accidents to persons getting between the cars, and it was therefore thought advisable to make the clearance as large as the street conditions permit. The extreme width of the trackwork is limited on many lines by the width of bridges, clearance between elevated-railway columns, and minimum allowable space for vehicles standing alongside the curb line. This action does not affect those lines which have recently been rehabilitated in a thorough manner and at great cost, but it is contemplated to rebuild the wide cars to the narrower width as opportunity is afforded, thus giving at least six inches more clearance due to this feature alone. All new track construction and rehabilitation will be to the increased distance between centers.

Saskatchewan Government Purchases Bell Telephone System.

Consul-General John Edward Jones, of Winnipeg, reports that the Canadian province of Saskatchewan has followed the action of the province of Manitoba and purchased for $367,500 the Bell telephone system in the province. According to statements made by the provincial authorities, a number of important extensions will be made throughout the province.

Request for Subway Bids.

The letter of Chairman Willcox of the New York Public Service Commission to the New York City Board of Estimate and Apportionment urging that body to invite bids for the construction of additional subways in Greater New York says that the commission holds that the Lexington Avenue route, with its connections, should be the first line to be built in Manhattan and the Bronx, although other longitudinal lines will be necessary in the near future. This Lexington Avenue system is to extend from the Battery to Pelham Bay Park and Woodlawn in the Bronx, with an important crosstown connection at Canal Street.

The commission says that it was found necessary to modify original plans for the Lexington Avenue route to increase its capacity and efficiency. This change will allow double-decking between Houston Street and the Harlem River, a change not only reducing by one-half the portion of the street necessary for the subway, but providing a great increase in the capacity of the subway and reducing the cost of its construction.

"The situation has greatly changed," says the commission, "and the time has now arrived when further steps toward construction by preparation of contracts and proposals for bids should be taken. The commission has received formal and informal communications from several parties desiring to bid for construction, equipment and operation of rapid transit lines, and it believes that satisfactory bids will be obtained.

"In offering the various routes the invitations should be broad enough to permit bids on as many bases as possible in order that contracts may be awarded on the best terms."

The Public Service Commission promises that as soon as it is notified of the Board of Estimate's wishes the work of preparing contracts will be at once undertaken.

New York City Meter Report for May.

During May the New York Public Service Commission tested 27,651 gas and eighty-seven electric meters.

Of the gas meters, 53.8 per cent were within two per cent of correct, 36.2 per cent were two per cent or more fast, and ten per cent were two per cent or more slow; and of the electric meters, 85.1 per cent were within four per cent of correct; 11.5 per cent were four per cent or more slow, and 3.4 per cent were four per cent or more fast.

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Annual Meeting of the American Railway Master Mechanics' Association.

The annual meeting of the American Railway Master Mechanics' Association was held at Atlantic City, N. J., June 16, 17, and 18. Reports were presented on mechanical stokers, revision of standards, and motor cars, and technical papers taking up the details of locomotive construction, locomotive performance and materials of construction were presented. In his presidential address, H. H. Vaughan reviewed the history of the Master Mechanics' Association, which was organized in 1868. Referring to the electric locomotive, he said that the master mechanics were face to face with several changes in the development of their motive power. The steam locomotive that has been supreme for so many years is finding its superiority questioned by the electric locomotive. The articulated locomotive has increased the field of the steam locomotive and enabled it to compete on more favorable terms with its younger and more powerful rival. The master mechanic should be informed of every development in this line, the results and experiences that are being obtained, and the reduction in the cost of transportation that is being realized. They should know more of electric operation, so that as motive-power officers they may be well informed as to its advantages and disadvantages, and be in a position to assist in deciding on the proper system to employ.

The report of the committee on motor cars divided these into three general classes: One, steam motor cars; two, internal-combustion motor cars; three, electric cars in combination with storage batteries or with one of the above primary movers. The report deals almost entirely with internal-combustion motor cars, but a circular of inquiry has been prepared to be sent out next year in which the electric car and the gasoline-electric car will receive special attention.

Officers for the ensuing year were elected as follows:

President, G. W. Wildin, New York, New Haven & Hartford.

First vice-president, C. E. Fuller, Union Pacific.

Second vice-president, H. T. Bentley, Chicago & Northwestern.

Third vice-president, D. F. Crawford, Pennsylvania Lines.

Treasurer, Angus Sinclair, *Railway and Locomotive Engineering.*

Members of the executive committee: C. A. Seley, Chicago, Rock Island & Pacific (two years); D. R. MacBain, New York Central & Hudson River (two years); F. W. Whyte, New York Central & Hudson River (one year).

Laclede Gas Deal Terms.

Details regarding the acquisition of the Laclede Gas Company by a syndicate headed by William Salomon & Company have been published. The syndicate, it is stated, obtained from the North American Company 74,000 shares of the company's stock out of 85,000 common shares outstanding for a price said to be about $7,215,000, which is about $280,000 more than the bid of the American Light and Traction Company. The purchasing syndicate is composed of William Salomon & Company and St. Louis interests, including G. H. Walker & Company, Adolphus Busch, A. A. Busch, W. K. Bixby, and C. H. Hittig.

Payment is to be made in cash and short-term notes, the proceeds of which will be devoted by the North American Company to the development of its other holdings.

The purchasing syndicate, it is said, owns 240,000 acres in Caddo Parish, Louisiana, and has a franchise to supply New Orleans with natural gas.

It is estimated that if the management so chooses it can connect this territory up with St. Louis at a cost estimated to be about $8,000,000.

New Haven Electrification.

Contracts for the work of electrification of the New Haven road from Stamford to New Haven have been given out, except for concrete piers between Stamford and Glenbrook. A mile of track is to be electrified for experimental purposes, chiefly for the application of electricity to the hauling of freight cars.

Interborough Wins Franchise Case.

The Court of Appeals at Albany, N. Y., has sustained the contention of the Interborough Rapid Transit Company that by virtue of its leasing the subway system in New York city it is exempt from assessment on its special franchise.

The State Tax Commission placed the value of the company's special franchise in Manhattan at $16,000,000 for 1905, and, after a hearing, reduced it to $9,000,000.

The lower courts canceled the assessment on the company's claim, and the Court of Appeals has affirmed the decision with costs.

Subways to Cost $100,000,000.

W. R. Willcox, chairman of the New York State Public Service Commission, has received from the Bradley-Gaffney-Steers Company, a series of plans and offers to construct and operate subways in various parts of New York city and Queens County, the contract costs to be over $100,000,000.

When completed, it will make a complete circuit of subways, all operated on a one-fare system, issuing transfers to and from all points. The corporation offers to build one part providing the city constructs the other, but in the event of the city's refusal, A. J. Bahn, representing the Bradley-Gaffney-Steers Company, says the company will build all if necessary. The plans run in sections:

First—A double-track subway from the Battery through Vesey Street to Broadway, then with a four-track, double-deck system, northerly along Broadway to Tenth Street, through private property to Irving Place, then north along Lexington Avenue, under the Harlem River to Mott Avenue at its juncture with One-hundred-and-forty-ninth Street, following the lines of the Broadway-Lexington Avenue subway as first planned and approved by the Commission.

Second—To run a branch along Fulton Street double-track from Ashland Street to Lafayette Avenue, then to Broadway (Williamsburg), east on Williamsburg Bridge.

Together with other plans the cost will reach $80,000,000. The part they ask the city to build would be the connecting links to the other subways, the city's cost to reach $20,000,000.

The Commission will advertise for bids for construction and operation of all or part of proposed plans, and the Bradley-Gaffney-Steers Company announces that it will be active bidders for all or part of plans submitted by it.

A. J. Baldwin, in an interview after the project was made public, said he was not in position to make public the principal backers, but they had the money and everything had been carefully planned.

Third Avenue Railroad.

Justice Ford, of the New York Supreme Court, has dismissed the complaint of the Public Service Commission against Frederick W. Whitridge, receiver of the Third Avenue Railroad Company, for the collection of a penalty for not having filed the company's report within the time specified.

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The World's Cable Systems.

During the past ten years the submarine-cable lines of the world have increased by 594 cables of a length of 163,921 kilometres. The entire cable property of governments and private concerns at the end of March, 1908, according to the *Elektrotechnische Zeitschrift,* was: 1,651 government cables, of a length of 84,155 kilometres, and 402 private cables, of a length of 380,697 kilometres; that is, a total of 2,053 cables, with a length of 464,852 kilometres, of an estimated value of one-and-one-fourth billion marks ($297,500,000). The accompanying table

	1898			1908		
Country.	Owned by Governments.	Owned by Private Companies.	Total.	Owned by Governments.	Owned by Private Companies.	Total.
England (including Pacific Cable Board)..	8,900	199,847	208,747	23,219	230,679	253,898
North America (including Philippines)....	.....	50,545	50,545	7,320	85,498	92,818
France	10,781	15,376	26,157	20,702	22,413	43,115
Germany	4,127	2,059	6,186	5,866	24,301	30,167
Denmark	436	12,952	13,388	569	17,202	17,771
Netherlands	1,768	.....	1,768	5,721	.....	5,721
Japan	2,797	.....	2,797	8,084	.....	8,084
Spain	3,237	.....	3,237	3,565	.....	3,565
Italy	1,968	.....	1,968	1,989	.....	1,989
Various countries.....	3,111	122	3,233	7,120	604	7,724
Total for the world.....	37,125	280,901	318,026	84,155	380,697	464,852

shows the distribution of the cables among the various nations and the increase during the past ten years, the length of the cables being indicated in kilometres (one kilometre equals 0.62 mile).

Cut Cable Press Rates.

The committee appointed by the Imperial Press Conference, held at London, to deal with the question of cable rates, reported on June 25 that the Pacific Cable Board had signified its willingness to reduce the charges on press messages by one-half. The board understood also that the government of New Zealand was prepared to make an equal reduction on the land rate and there is reason to believe that Australia will follow suit.

Resolutions were adopted demanding that the Imperial Government increase the means and reduce the cost of cable communication with all parts of the empire, and urging upon the various governments of the empire the desirability of establishing a chain of wireless telegraph stations with the double purpose of cheapening communication and safeguarding the mercantile marine.

William Marconi, who was present, said that if considerable press work were forthcoming his company would give a press rate of two pence a word between Canada and England. It was possible to transmit twenty-five words a minute across the Atlantic, and he hoped soon to be able to send fifty. He said that soon it might be possible to communicate wirelessly for 6,000 miles instead of 3,000 as now.

German Electrical Enterprise in China.

Consul Wilbur T. Gracey, of Tsingtau, transmits the following report (*Daily Consular Report 3515*) on the installation of numerous electric-light plants in Chinese cities:

"A certain German firm in China has had considerable success during the past few months in securing contracts for the erection of electric-lighting plants in several cities of the Far East. This firm, whose headquarters are in Berlin, I understand, has a branch house in Shanghai, and others in Tsingtau, Hankow, Tientsin, and the other large ports of the Far East. A full supply of electric-lighting supplies, sample plants, etc., is kept at each branch house, so that intending purchasers are able to see the entire plant in working condition. This undoubtedly is the best way to secure orders for this class of goods, and the success of the method of pushing trade by personal representatives and goods on the spot is shown by this company's recent success.

"An electric-light plant installed in Kirin recently was put up and successfully started by this German firm. The plant consists of two boilers by Borsig, Tegel, Berlin, supplying steam at 150 pounds pressure to two high-speed compound engines built by W. H. Allen, Son and Company, Ltd., Bedford, England. The engines are coupled direct to 165-kilowatt alternators supplying three-phase current at 5,000 volts, with a periodicity of fifty, which is transformed down to 220 volts for consumers, the alternators having been manufactured by the German firm mentioned. The exciting dynamos are mounted on an extension of the crankshaft.

"In February the same company also inaugurated the electric light at Soochow, a city of 40,000 inhabitants, and this station is now regularly supplying current to consumers. In this plant there are three Krupp Lancashire boilers seven feet three inches in diameter by thirty-one feet long, with dished ends and corrugated flues, supplying steam at 150 pounds to two open-type Schickau engines running at a speed of 250 revolutions per minute. These engines have fourteen-inch and twenty-three-inch cylinders, with a stroke of fourteeen inches, and are arranged with a jet condenser and air pump worked from the low-pressure crosshead. The engines are coupled direct to German 175-kilowatt alternators, generating three-phase current at 2,200 volts, the area of distribution being less than in Kirin. Current is transformed down for consumers to 220 volts. The number of lamps is increasing daily.

"The same German company has also secured the contract for lighting Mukden, Manchuria, a city of 180,000 people, and the initial installation will consist of one 250-brake-horsepower Belliss engine and one 350-kilowatt dynamo."

Steam Versus Electric Traction.

At a recent lecture at the Royal Institution in London, Prof. W. E. Dalby compared steam and electric traction for main lines. The latter scored on the question of speed and pulling power, inasmuch as the tractive force was only limited by the number of axles on which motors could be equipped. The only drawback was the expense. If a speed of about fifty-five miles an hour was high enough, the steam locomotive was, as far as knowledge had gone at present, the most economical apparatus that could be used for comparatively long-distance working. But if a speed of 100 miles an hour was considered necessary, then recourse must be had to electric traction, though the passengers must be prepared to pay from two to three times the fares charged on the steam roads.

Illinois Central May Lower Rates.

The Illinois Central is compiling statistics regarding the amount of suburban traffic and the average fare paid with the view of rearranging, reducing and standardizing its suburban rates in connection with the proposed electrification of its suburban service. There is a possibility that even though electricity should not be installed, the company may decide to make a five-cent fare to Woodlawn and Hyde Park and any other points where there is competition from surface lines.

The reduction of suburban fares to the five-cent basis by the Southern Pacific out of San Francisco in connection with the ferry established the lowest suburban fare and built up the biggest suburban service of any road and made the department one of the most remunerative of the entire passenger service.

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Canadian Electrical Association.

The nineteenth annual convention of the Canadian Electrical Association, of which a skeleton report was made in these columns last week, will be recorded as one of the most successful meetings the association has yet held. About 175 delegates were in attendance. The convention was held at the Chateau Frontenac, Quebec, Can., on June 16, 17, and 18. The Wednesday morning session was opened by an address of welcome from Sir George Garneau, Mayor of Quebec, following which President W. N. Ryerson presented his annual address.

PRESIDENT'S ADDRESS.

President Ryerson, after heartily welcoming the members to the convention, said, in part:

"During the past year committees have been appointed to investigate the following subjects: Grounding of transformer secondaries; meter inspection; central-station statistics; theft of electricity.

"The Board of Railway Commissioners for Canada recently drafted new rules governing wires crossing railways. These were submitted to a number of the power companies and to the Canadian Electrical Association with a view to receiving suggestions as to desired amendments. I therefore appointed a committee consisting of A. L. Mudge, Toronto; R. G. Black, Toronto; R. M. Wilson, Montreal; V. G. Converse, Niagara Falls; A. A. Dion, Ottawa; Julian C. Smith, Shawinigan Falls, Que., and P. S. Coate, Chatham, to revise the rules. A special meeting of the managing committee was held in Toronto on April 7, 1909, to receive the report of this committee, at which the secretary was instructed to recommend, on behalf of the association, certain changes in the rules as submitted by the railway commissioners. I am pleased to say that the revised set of rules has been forwarded to the association for approval and should probably be discussed at this convention.

"The proposed rules of the Board of Railway Commissioners are all matters of deep interest to members of this association and it is hoped that the reports to be presented by the committees will be full and complete and will call forth good discussion."

In conclusion the president mentioned, in passing, the depression in the electrical trade during the past year, and discussed the recent developments at Niagara.

REPORTS.

Next in order came the reading of the secretary-treasurer's report by T. S. Young.

The report of the committee on meter inspection was next presented by the chairman, A. A. Dion, of Ottawa. This committee's report was very favorable. During the year the committee waited upon the Dominion Government with a view to obtaining a reduction in the rates charged for the verification of electric-light meters. They had succeeded in having the registration fees, of from $10 to $25 for each operating company, completely abolished, and had obtained a reduction in the verification of both electric-light and gas meters aggregating $10,000 a year, with a promise of further reductions at an early date.

R. S. Kelsch's committee on the grounding of transformers recommended the grounding of all secondaries carrying a pressure of 150 volts or less, but above 150 it was recommended to be left optional. In the discussion ensuing the importance of making good grounds to water pipes (where possible) was emphasized. It was brought out that grounds should be tested when made and also from year to year as they deteriorate. Resistance tests were recommended.

Where grounds are used it was recommended to educate the public to the fact that the system is grounded. Mr. Barton, of Quebec, stated that the necessity of grounding the secondaries showed a weakness in the present distribution system. The grounding, he said, brought in a risk that was wrong. The danger lay in the transformer and should be taken care of at that point.

SYNCHRONOUS MOTORS.

A paper entitled "Synchronous Motors Used for Power Factor Correction," by B. T. McCormick, of the firm of Allis-Chalmers-Bullock, Limited, was read in the absence of the author by Percy Cole. The author, after a preliminary explanation of the terms "power factor" and "wattless factor," demonstrated by means of a diagram the components of lagging kilovolt-amperes at various power-factors, with a constant value of true kilowatts (= 100 in the case chosen). It was shown that the leading current required for power-factor correction becomes relatively much greater as the corrected power-factor approaches unity. Thus it is not consistent with economy in first cost to install a motor large enough to correct completely the power-factor of a system. The percentage increase of kilovolt-ampere capacity over that required for power-factor correction with various values of mechanical load was next considered by means of curves and a worked-out numerical example. A graphical solution of the problem and a general discussion on designing of synchronous motors concluded the paper. A discussion followed.

Mr. Black, of Toronto, commented on the prevalence of low power-factor in synchronous motor units. The time to make provision for special apparatus for correction would be when making the contract with the manufacturer.

Mr. Ryerson pointed out that the prevalence of low power-factor was often due to the salesman selling too large a motor, which had to be operated underloaded, with a poor power-factor resulting. He recommended operating companies allowing a power-factor of ninety per cent without increasing the rates, but below ninety per cent a penalty should be inflicted, especially where one's transmission lines were nearly loaded.

POWER RATES FOR CENTRAL STATIONS.

In the afternoon session a paper entitled "Power Rates for Central Stations" was read for L. W. Pratt, of the Hamilton Electric Light and Power Company, by A. L. Mudge, of Toronto.

The paper was arranged under two heads: (1) Flat Rates, for which, owing to the fact that no two customers use power in the same way, it is not possible to outline an exact universal schedule of charges for power in large quantities. (2) Meter Rates. The meter system is by far the most equitable method (when properly worked out) of selling or buying power. It lends itself when combined with a sliding scale of discounts or table of fixed charges to every variety of power service. Instructive tables giving scales of prices, discounts, etc., under various conditions, with a discussion of the points involved, concluded the paper.

S. E. Doane, of the National Electric Lamp Association, Cleveland, Ohio, read a paper entitled "The Conservation of Our Natural Resources Through the Use of High-Efficiency Lamps."

A discussion on the two preceding papers followed.

A. L. Mudge, of Toronto, pointed out that amusement parks with a load on for only a few hundred hours in the year would ask for a low rate for a large load. It was not a desirable load at a low rate. There should be a "readiness-to-serve charge," unless the kilowatt rate is placed very high. A number of others quoted

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their successful experience with the readiness-to-serve and an additional kilowatt-hour charge.

THE SONS OF JOVE.

E. D. Strickland, the national organizer of the Sons of Jove, was introduced to the convention and made an eloquent appeal for the association's support of that rejuvenated order.

The next paper read was "The Small Central Station and Its Practical Management," by R. J. Smith, of the Canadian Electric Water Power Company, of Perth, Ont.

R. F. Pack's paper, "Accounting for Electrical Companies," was then read and discussed, which concluded the first day's session.

ELECTROLYTIC LIGHTNING ARRESTERS.

The convention resumed at 9:30 a. m., Thursday, and the paper on "Electrolytic Lightning Arresters," by Professor Herdt and Mr. Dalemont, of McGill University, was read. Two types of arresters were described in full, the liquid electrode arrester and the aluminum cell arrester. The first consists of two metallic electrodes, either dipping in an electrolyte of high conductivity placed in an earthenware vessel or with a small air gap between the electrolyte and the electrodes. In one type, that without an air gap between electrodes and electrolyte, the cell is placed in series with air-gap arresters. In another, with an air gap between electrodes and electrolyte, no air-gap arresters are required in series, since, after breaking through the gap, the current in passing throws the electrolyte away. In the aluminum cell arrester, aluminum disks, in the form of cups covered with a thin film of oxide, are placed one on top of the other, built up in the form of a column, and are separated by insulating disks or washers. These cups are filled with an electrolyte. The whole combination is placed in earthenware jars. A number of such arresters can be placed in series in case of high line voltages. The critical voltage per disk varies from 380 to 400, depending on the voltage used when the plate formation was made.

A discussion followed.

Mr. Ryerson, formerly with the Ontario Power Company, stated that this company was the first to receive these aluminum arresters and use them on their 12,000 and 60,000-volt circuits. They were placed on a truss beside a pole with a horn gap in series. They do not require any attention to keep them in good condition. In some cases the plates and pans had flashed over, but this had been overcome by the use of oil surrounding the plates.

Mr. Lambe, of the Canadian General Electric Company, Toronto, pointed out that the secret of this arrester was the film on the aluminum plates, which seemed to have infinite resistance to 400 volts per pair of plates, but with a rush of current it opened like the safety valve of a boiler, taking off the charge brought in by lightning or direct stroke. It could take care of direct stroke and static charges in all cases. The present designs were just large enough to look after half an hour's discharge. Beyond that the heating becomes excessive. He pointed out that heavy iron tanks were also used in the work, which have the advantage of being almost indestructible, and all the live parts could be placed in the vessel, which could then be thoroughly grounded. Freezing, while not hurting the arrester, reduces its capacity tremendously.

CHOICE OF TYPE IN TRANSFORMERS.

The next item was the paper, "Considerations Affecting the Choice of Type in Transformers," by G. Percy Cole, of the firm of Allis-Chalmers-Bullock, Limited, Montreal. Mr. Cole discussed the advantages and disadvantages of the "shell type" and the "core type" of transformers. As far as weights of active materials and efficiencies are concerned, there is very little to choose between the two types. Broadly considered, the main advantage of the core type lies in the fact that the top yoke may be made removable and the individual coils easily taken out for repairs, although the time is not yet ripe to relegate the shell type to the background in view of the satisfactory work that this type is still doing every day on our high-tension systems.

The committee under the chairmanship of W. A. Bucke, Toronto, brought in an interesting report on power-plant statistics covering some fifty operating companies in Canada.

Questions and answers and discussion on business-getting proved interesting. It was suggested that the employment of ladies would facilitate the work accomplished in introducing sadirons and small domestic wares to the central-station's customers.

On Friday morning "Questions and Answers" and "Topical Discussion on the Use of Pole Transformers" brought out much interesting discussion.

William P. Flint read a paper on "Gas Engines and Plants." This paper was illustrated with slides of different gas engines and producers and a number of comparative charts.

A paper by E. P. Heaton, of the insurance department, Canadian Manufacturers' Association, entitled "Insurers and Insured, Illusions and Delusions," wound up the morning's proceedings.

ENTERTAINMENTS.

All through the convention the delegates were admirably entertained by the Quebec members of the Association. E. A. Evans, general manager of the Quebec Railway Light and Power Company, was chairman of the local committee. Special provision was made for the entertainment of the ladies.

On Wednesday evening special cars were provided by the Quebec Railway, Light and Power Company and a trip was made around the city. On Thursday afternoon the delegates were royally entertained on board the Royal Mail steamship Empress of Britain. After witnessing the different drills and inspecting the ship, refreshments were served.

On Thursday evening a trip was made to Montmorency Falls, about eight miles from the city, and the annual dinner of the association took place at the Kent House. About 150 members and their friends sat down. The visit to the Rustic Theatre was declared off, owing to the inclemency of the weather, and an impromptu programme of songs was provided by the guests.

On Friday afternoon a trip was made on the Dominion Government ice-breaker Montcalm, and the steamship Campana was visited. This latter vessel lies upon a rock fifteen miles below Quebec and has been abandoned to the underwriters.

A special band concert was provided by one of the regimental bands for Friday night and took place on the famous Dufferin Terrace beside the Chateau Frontenac.

During the convention the ladies made several trips—one to St. Anne de Beaupre, where the famous shrine is erected; a trip on the Levis County Railway, and an automobile ride. Laval University was opened to delegates on Thursday.

Metropolitan Application Denied.

Judge Lacombe, in the United States Circuit Court, on June 22, denied the application of the Guaranty Trust Company, of New York city, for an allowance of an appeal to the United States Supreme Court from the decree of foreclosure and sale of the Metropolitan Street Railway made on March 18, last.

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Brooklyn Company Section of the National Electric Light Association.

The first annual convention of the Brooklyn Company Section (Edison Illuminating Company) of the National Electric Light Association took place at the Oriental Hotel, Manhattan Beach, Long Island, June 23, 1909.

This was an event of unusual significance, because it was the first convention so far held by any company branch. The idea was to spread the information and the inspiration secured by a fortunate few who were able to attend the recent Atlantic City convention of the National Association among the 250 other employes who are members of this company branch.

G. L. Knight, chairman, presided over the convention, which was attended by nearly 300 members and guests. Among these guests were W. C. L. Eglin, president of the National Association, P. H. Bartlett, president of the Philadelphia Section, Frank W. Smith and T. I. Jones of the United Company of New York and Arthur Williams, past-president of the National Association, and Messrs. Thomas and Kirkpatrick of the Queens County Light and Power Company.

The first business was the presentation of an original paper on "Subway Construction," by J. J. Leddy of the distribution department of the Brooklyn company. Then followed abstracts of various papers presented at the national convention, with original comments thereupon by various members of the section. Two papers or more were assigned to each speaker.

The presentation of these papers was made in a remarkably clear and capable manner by the following-named: G. L. Knight, P. D. Sharkey, F. H. Harrison, J. J. Leddy, E. W. Babcock, C. A. Graves, J. F. Becker, M. S. Seelman, Jr., and J. L. Wiltse. The commercial papers seemed to arouse more interest than the technical ones.

There was an especially interesting and vigorous discussion on the "Relation of Electric Vehicles to Central Stations," a paper delivered by J. T. Hutchings, of Rochester, at the national convention and reviewed by Mr. Graves. It was this paper that stimulated the Brooklyn Company to new and energetic effort toward placing a larger amount of this desirable type of business on its system, and Mr. Becker made the announcement that more business of this kind had been secured during the past week than in the entire previous year. W. W. Freeman, vice-president of the company, also spoke on this subject, indicating to those present the possibility of helping the work along in this direction.

"The Development of Revenue from Existing Customers" and "Methods of Introducing Tungsten Lamps, and Their Effect on Central-Station Income," were other subjects that aroused a more than ordinary degree of interest, though every paper was discussed, and a number of ideas of real value presented to the convention by different employes. Among those who took part in the discussions were Messrs. Becker, Wiltse, Thurling, Leitner, F. W. Smith, Sharkey, Ashe, Shrugue, G. E. Brown, Babcock, Cohen, Seelman, Jones, Reid, Wegner, Disque, Wells, Walton, Yeager, Leddy, Stephens, Graves, Gillman, Wood, Morris, and Wessel.

Dinner was served at 6 o'clock in the Oriental, and an evening session followed. During this session a strikingly original and scholarly address was delivered by Caryl D. Haskins, of the General Electric Company. Mr. Haskins' address was reminiscent, contemplative of present conditions, and prophetic as to the future. He indicated the remarkable progress that has been made in the electric-lighting industry in the last twenty years, and prophesied a still more brilliant future.

The convention adjourned after electing the following officers and committees for the ensuing year: Chairman, J. F. Becker; vice-chairman, F. W. Harrison; secretary, E. A. Baily; treasurer, F. C. Hill. Executive committee: W. Wickert, G. L. Knight, J. W. Lafferty, F. W. Leitner, F. J. McCormack, E. J. Magrath, A. G. Paulsen, F. E. Richards, A. W. Welch, H. P. Wood, W. F. Wells, and W. W. Freeman. Question Box committee: H. P. Wood, G. E. Brown and P. D. Sharkey. Editorial committee: E. W. Babcock, J. J. Carboy, F. E. Richards, M. J. Shrugue, and C. E. White. Committee on meetings and papers: F. W. Morris, H. P. Pope, and J. L. Wiltse.

Tungsten Development in Nevada.

It is announced that a tungsten refinery will shortly be built on the Melvin group of tungsten claims at Round Mountain, Nevada. The only mill at present refining tungsten ores in this country is situated at Boulder, Colo. Other mills for treating tungsten ores will, if present plans materialize, be built at Murray, Ida., and at Deer Park, Wash.

New Laboratory for Rennselaer Polytechnic.

The Rensselaer Polytechnic Institute, at Troy, N. Y., celebrated the eighty-fifth year of its existence on June 15 by the opening of one of the most modern and best-equipped mechanical and electrical engineering laboratories. It is a memorial to the late Russell Sage, and the building and its contents cost over $400,000.

The president of the institute read the letter from Mrs. Sage in which she presented $1,000,000 to the institute, and the resolutions of the faculty and trustees relating to the schools of mechanical and electrical engineering. Robert W. DeForest, of New York, in behalf of Mrs. Sage, Jesse M. Smith, president of the American Society of Mechanical Engineers, and Louis B. Stillwell, president-elect of the American Institute of Electrical Engineers, spoke.

Chicago Electric Club.

At the midday meeting and luncheon of the Chicago Electric Club, held on Wednesday, June 23, E. W. Lloyd, contract agent of the Commonwealth Edison Company, reviewed the papers read before the Atlantic City convention of the National Electric Light Association.

The entertainment committee announced that the picnic would be held at Michigan City, Ind., on Saturday, July 17. Boats will leave Chicago at 10 a. m. There will be running and swimming races, a ball game, and other athletic events.

On Monday evening, June 28, the members of the club were specially invited to attend the concert of Ferullo's Band at the Coliseum Garden. A special feature of the programme was the Italian ballet.

Fewer Accidents on New York Roads.

There were fewer accidents on the railroads and street railroads of Greater New York during May, 1909, than in the same month of 1908, according to the report of the Public Service Commission. The total number of accidents show a falling off of 640, the total number of personal injuries being 402, and the total number of serious injuries, thirty-nine.

Following is the recapitulation of the report for the month of May, 1909, as compared with 1908:

	1909.	1908.
Total accidents	5,152	4,512
Total injuries to persons	3,382	2,980
Serious injuries	210	171
Killed	31	32

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Magnetic Testing at the Bureau of Standards.

The Bureau of Standards, Department of Commerce and Labor, Washington, D. C., has enlarged its facilities for conducting investigations and tests of magnetic material and instruments. The Bureau has just issued Circular No. 17, which describes the character of the work in this line that the Bureau is now adapted to conduct.

Permeability and hysteresis tests are made by the ballistic method on magnetic materials in the form of round or rectangular bars, and sheets. For these tests two specimens of each sample, at least twenty-five centimetres long, should be furnished. The permissible cross-section is determined by the dimensions of the holes of the coils and yokes used. The apparatus on hand at present will receive round rods of the following diameters: Three-eighths inch, one centimetre, and one-half inch. Rectangular bars may be of any section which will pass through a hole 1.27 centimetres in diameter. Sheet metal five centimetres wide, or under, may be used. For these measurements two rods or strips of the material to be tested have their ends joined by two soft-iron yokes, so as to form the four sides of a rectangle. Each bar is surrounded by a magnetizing and a test coil. The change in the magnetic flux embraced by the test coil when the magnetizing current is altered is measured ballistically.

Tests of non-magnetic materials, such as are used for chronometers and other instruments, and feebly magnetic materials will be made. Investigations on magnetic properties at high and low temperatures can also be made. Bismuth spirals, for measurement of magnetic fields, will be calibrated. The Bureau is prepared to calibrate permeameters and other apparatus used in magnetic measurements and to make investigations on the magnetic properties of materials. A limited number of bars of carefully aged iron and steel have been prepared and will be supplied to testing laboratories and manufacturers as standards, at little more than the amount of the fee for testing.

Wattmeter tests for energy losses due to alternating magnetization are carried out upon sheet iron and steel, such as is used in the cores of transformers. A special apparatus has been designed for this purpose. This serves to determine the losses due to hysteresis and eddy currents. A curve showing the relation between the flux density in the test specimen and the wattless component of magnetizing current can also be furnished when desired. Tests to determine the aging quality of this material are also carried on. Not less than five pounds should be submitted. The losses are measured at sixty cycles and 10,000 gausses, unless otherwise specified, and the results are accurate to one per cent.

Transformers are tested for core loss under normal working conditions; and by the measurements of resistance and impedance in addition the efficiencies and regulation can be computed. For tests of instrument transformers, including measurements of ratio, phase angles, regulation, etc., the Bureau has prepared special Circular No. 20, which describes this feature of the work in detail. These circulars and other information in relation to any of this magnetic work may be obtained by simply addressing the Bureau of Standards, Washington, D. C.

Electric and Steam Railways Must Interchange.

The Indiana Railroad Commission has made an important decision relative to the interchange of passenger traffic between steam and interurban lines. At a recent hearing on a petition filed with the Commission by the citizens of Garrett, Ind., in which it was sought to compel the Vandalia Railroad Company to stop all its passenger trains at the intersection of the company's road with the line of the Toledo & Chicago Traction Company at the southern border of the city in order to allow an exchange of passengers, the Vandalia resisted the petition, but the Commission ruled that the evidence showed that it was practicable for the Vandalia to stop its passenger trains at the junction with the electric line and entered an order that, beginning July 1, the Vandalia shall stop its trains at the crossing for the purpose of allowing an interchange of passengers for a period of sixty days. If after sixty days the Vandalia company can show to the satisfaction of the Commission that the convenience of the traveling public does not demand the stopping of its trains at this point, the order will be vacated, otherwise it will remain in force for two years.

The order of the Commission has aroused considerable interest among steam-road managers, who say there is no necessity for the attempt to make such exchange general. There is a possibility of litigation over the question.

English Patent-Law Decision.

In dismissing two applications for the revocation of letters patent in England because the patented articles were not manufactured in that country as required by the recent notorious patent law, the Comptroller-General of Patents said that as a general rule a patentee ought not to be called upon to manufacture any mechanism or machine which he had not specifically described and claimed in his specification, especially when such mechanism or machine was the subject of prior patents, and was only claimed in combination, if at all, in the patent under consideration.

A "Prosperity" Proof.

According to Prof. G. D. Shepardson, dean of the electrical department of the University of Minnesota, the demand for electrical engineers is greater than the supply. All of the graduates of the electrical engineering college of the University of Minnesota have secured positions, and several jobs are going begging. The professor declares this to be a proof of prosperity, as last year, on account of the financial flurry, few of the graduates were able to find work.

The Illuminating Engineering Society of Great Britain.

The executive committee which was appointed at the inaugural dinner of the Illuminating Engineering Society of Great Britain, held in London, on February 9, has reported and the constitution and by-laws have been ratified. It has been decided to proceed actively with the building up of the organization, and a membership campaign has been initiated. The honorary secretary is L. Gaster, 32 Victoria Street, London, S. W.

Wireless Telephony Still Experimental.

In view of the recent claims made for some of the present systems of wireless telephony, it is interesting to note Prof. J. A. Fleming's conclusions on the subject. In a lecture last month at the Royal Institution in London, this eminent British electrical authority unequivocally declared that while the experimental results so far obtained in wireless telephony were extremely interesting, they had not yet passed into the stage of practical application, differing in this respect from Marconi's simple but certain system of wireless telegraphy. The professor, however, anticipated with confidence much improvement in future developments.

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BOOK REVIEWS.

High-Tension Underground Electric Cables. By Henry Floy. New York, N. Y.: Electrical Publishing Company. Cloth, 136 pages (5¼ by 7½ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $2.

This book brings together a great deal of information which has been widely scattered, and places in the hands of engineers a compendium that should prove of value to all those interested in the subject of high-tension underground electric cables. As the author states in his opening chapter, "Knowledge or lack of knowledge of this subject on the part of the engineer in charge may determine whether an alternating or a direct current system, or high or low voltage shall be selected for a given installation, with a consequent large or small expenditure in transformer plant, elaborate switchboard, enlarged buildings, or unnecessarily heavy insulation. Lack of general information regarding recent improvements made both in the manufacture of cables and in the solution of the peculiar troubles likely to arise in the operation of high-tension cables probably accounts in a large measure for their comparatively limited use." Chapter two takes up cable records, giving the gist of considerable operating data and tabulating existing high-tension cable installations, giving the approximate miles, working voltage, condition of the neutral, size of conductor, thickness of lead sheath, character of insulation, and thickness of insulation. Chapter three deals with the advantages of underground cables. Chapter four on cable insulation takes up an interesting dissertation on dielectric stresses and a study of graded insulation. Chapter five deals with metal in cables, taking up the relative values of copper, aluminum, tin and lead. Chapter six deals with heating of cables, chapter seven with electrical formulas, chapter eight with testing of cables and chapter nine with costs. The language is extremely simple and the exemplification carried out in a lucid and consistent manner. While the author is warmly in favor of the underground system, both for reliability and ultimate low cost, the expressions are far from argumentative and the treatment gains strength by its apparent fairness.

Questions and Answers About Electrical Apparatus. By W. B. Clayton and J. W. Craig. West Lynn, Mass.: Clayton and Craig. Leather, 176 pages (4½ by 6¾ inches), 95 illustrations. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.

The second edition of this book is practically a new work in comparison with the earlier edition. The size of the volume has been reduced to more convenient dimensions and the binding changed to flexible leather, both features resulting in a handy pocket reference book. Coincident with these external changes there has been a complete revision and material increase of the contents. The subject-matter of the chapters is now as follows: Direct-current motors; induction motors; constant-potential transformers; constant-current transformers; mercury-arc rectifiers; incandescent lamps; arc lamps; meters and instruments; steam turbo-generators. The chapters on incandescent lamps and turbo-generators are entirely new. A valuable addition has been the inclusion of more than one manufacturer's apparatus in the description of typical equipments. While no attempt has been made at systematic or exhaustive treatment, it will be found that the questions discussed relate to the most frequently recurring queries about the apparatus considered. Thus the book has considerable value in making clear many interesting features, particularly of a useful and practical nature, which come up in the operation and testing of electrical apparatus.

Another New York Subway Project.

William J. Wilgus, president of the Amsterdam Corporation, called on Chairman Willcox, of the New York Public Service Commission on June 11 with a plan for the Inter-Terminal Belt Line, which the company proposes to construct and operate in New York city. Mr. Wilgus was accompanied by Edward M. Shepard, counsel for the company, and Henry J. Pierce, Jr., one of the engineers. The company wishes to build a line which will be a combination elevated and subway line, along the water front on both the North and East rivers and to run across town at Sixtieth Street. It is also planned to have a double-deck subway connecting with both the Grand Central Station and the Pennsylvania Terminal at Thirty-fourth Street. The road is designed to carry freight and passengers. Its cost is estimated at $100,000,000.

This plan is separate and distinct from the plan submitted by the same company for a freight subway which is designed to be extended through all the important business districts downtown with tunnels connecting with the New York Central, the Pennsylvania, and the New Haven railroads, the estimated cost being about $300,000,000.

Annual Meeting of the Master Car Builders' Association.

The annual meeting of the Master Car Builders' Association was held at Atlantic City, N. J., June 21, 22, and 23. An important report was presented on "The Revision of Standards and Recommended Practice." There were also topical discussions on wheel defects, application of suitable lugs to steel or steel end-frame cars for jacking up car bodies, and reports on train brakes, signal equipment, brake-shoe tests, and air-brake hose. Other reports and papers were entitled "Tests of M. C. B. Coupler," "Revision of Rules for Loading Long Materials," "Rules of Interchange," "Cast-Iron Wheels," "Splicing Sills," "Tank Cars," "Safety Appliances," "Side Bearings and Center Plates," "Freight-Car Trucks," "Painting Steel Cars," "Side and End-Door Fixtures," "Train-Pipe Connections for Steam Heat," "Classes of Cars," "Salt-Water Drippings from Refrigerator Cars," "Revision of Constitution and By-Laws," "Wheel-Mounting Pressures for Various Sizes of Cast-Iron and Steel Wheels," and "Cleaning Triple Valves and Brake Cylinders of Freight Cars to Meet Interstate Commerce Commission Requirements."

The election of officers resulted as follows: President, F. H. Clark, of the Chicago, Burlington & Quincy Railroad; first vice-president, T. H. Curtis, of the Louisville & Nashville; second vice-president, L. G. Parish, of the Lake Shore & Michigan Southern; third vice-president, A. Stewart, of the Southern Railway; and treasurer, J. Kirby, of Adrian, Mich.

Edison Baseball Game at New York.

The first baseball game of the series arranged between teams representing the New York and the Brooklyn Edison companies was played on the afternoon of June 19th before 1,000 enthusiastic spectators at Visitation Oval, Lorraine and Henry streets, New York city. The Brooklyn team won a brilliant victory, the score being seven to two.

Philadelphia Rapid Transit.

City Solicitor Gendell, of Philadelphia, has petitioned the Supreme Court for leave to file a bill in equity between the city and the Philadelphia Rapid Transit Company, in the matter of strip tickets. This action is in response to a recent resolution by the City Councils, calling upon him to test the right of the company to do away with the strip tickets.

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QUESTIONS AND ANSWERS.

STARTING SYNCHRONOUS MOTORS.—I would like to ask one additional point in regard to starting a synchronous motor, beyond what you imparted in the issue of June 5. It is this: In starting the motor with the field switch open, in what way does one tell when the motor is in synchronism, and when should one close the field switch? Is there any danger in closing this switch at the wrong period? —J. M. W., Portsmouth, Va.

The field switch should be closed when the motor has almost reached synchronism. There is no great harm in closing it a little ahead of time, except that it will give the motor a sudden spurt of speed, and therefore an increased rush of current. However, in order to know when synchronism has been attained, the most perfect means is by aid of a synchroscope, which is a switchboard instrument that enables one to tell exactly when two alternating-current machines are in perfect synchronism. Such an instrument was described in these columns in the issue of March 20, 1909, page 524. To avoid the expense of putting in these instruments, a method of synchronizing with lamps is commonly used. This was described in the issue of January 2, 1909, on page 31. However, it is unnecessary when closing the switch to have absolute synchronism, and it is possible to judge the approximate time by the hum of the motor, since when the motor attains what is known to be its highest speed it has reached synchronism.

AUTOMOBILE IGNITION.—I have a magneto for ignition purposes on my gasoline car, and find that I cannot run regularly below about twelve miles per hour, nor can I start the machine with the magneto. With the dry cells that I have for reserve I can start all right and also run at as low as seven or eight miles per hour. A friend of mine suggests that the magneto is not working correctly, but while going at moderate or high speeds it runs excellently. Why does it not run at low speed?—J. Z., Chicago.

The electromotive-force that a magneto generates varies practically directly with its speed. To produce an effective spark at the spark plug requires a certain minimum voltage applied to the sparking circuit. In order to produce this voltage in the sparking circuit, the magneto must run at least at a speed great enough to generate the required electromotive-force. With the dry cells a practically constant electromotive-force is supplied to the circuit; therefore, they will operate the machine regardless of speed, or, if anything, better at low speed than at high speed. Special spark plugs are now made for use with magnetos. These have a smaller gap between electrodes than those for battery ignition. By using one of these plugs a smaller voltage is needed than with the plug now in service; therefore the magneto will supply sufficient voltage at a much lower speed, probably even at starting.

RESISTANCE FOR SPARK-COIL CIRCUIT. —How many feet and what size of German-silver resistance wire shall I use to reduce a 110-volt alternating current to about ten volts and three amperes, or even less? I want to use the current on a one-half inch spark coil for experimenting.—O. E. W., Oak Park, Ill.

In order to carry as much as three amperes through a German-silver resistance coil it will be necessary to have a wire probably as large as No. 14. It will require about 500 feet of this size of thirty per cent alloy German silver. The resistance should best be wound non-inductively; that is, the wire should first be doubled, and the winding should begin at the middle point. If the resistance or impedance of the spark coil were known it might be possible to use a smaller amount of this wire. For experimental purposes it would be just as well, perhaps, to use incandescent lamps instead of a resistance coil. In this case six to eight sixteen-candlepower lamps might be connected in parallel and the set placed in series with the coil. By unscrewing some of the lamps the number that are placed in circuit can be varied, and in this way the spark length can be adjusted.

WATERPOWER.—(1) How is the available horsepower of a stream calculated? (2) What type of waterwheel is considered the best in small sizes? (3) What is the approximate cost of a waterwheel suitable to drive a fifty-kilowatt generator?—C. M., Berne, Ind.

(1) The calculation of the horsepower available from a stream is a difficult matter unless extensive data of the variation of flow for a long period are available. For this purpose it is customary to consult whatever records there may exist upon the maximum and minimum flow of the stream during what is known to have been the greatest flood and the driest season for many years. In the absence of such data, it is necessary to make a careful study of the average rainfall and the extent and character of the drainage area tributary to the stream. For small streams it is common to measure the actual flow a number of times by means of a weir. For making such measurements considerable care is necessary in order to get reliable results. The formula made use of in making the calculations of the available power is as follows, the power P being given in horsepower and assumed to be eighty per cent of the theoretical yield:

$$P = \frac{H F}{660},$$

in which H is the effective head in feet and F the average flow in cubic feet per minute. (2) Without a knowledge of the exact conditions of the proposed development, it is difficult to say what type of waterwheel would be best. The old types of overshot, breast, and undershot waterwheels are now practically out of date, and it is almost the universal custom to make use of a hydraulic turbine if the head is not in excess of about 200 feet. For greater heads, a form of impulse wheel, such as the Pelton wheel, is generally used. (3) Without knowing the type of waterwheel that is to be used an exact estimate of its cost cannot be given. Assuming that a pressure turbine for a head of some forty feet is used to drive the fifty-kilowatt generator, and assuming a generator efficiency of eighty-five per cent and an overload capacity of thirty-three per cent, the approximate cost of a 110-horsepower turbine would be $700.

HOUSE BELLS FOR ALTERNATING-CURRENT CIRCUITS.—In a large apartment building, for which I am the engineer, we have a great deal of trouble with the bells getting out of order. Usually it is on account of the batteries not working right. Could we not connect the bell circuits to the lighting circuit? We have alternating current for lights and motor pumps.—W. A. N., New York N. Y.

The trouble with the batteries now in may be that they are not large or numerous enough to provide the current required. For a large installation like this, however, the operation of the bells from the lighting circuit is frequently desirable. The bells cannot be connected direct to this circuit though, and they will all have to be changed to alternating-current bells. Polarized bells are necessary, such as are used on telephone circuits. Connection direct to the 110-volt circuit would cause the push-buttons to be burned on acount of arcing. Therefore, what is known as a bell-ringing transformer must be used to lower the voltage for the bell circuit. This has its primary coil connected to the lighting circuit and its secondary coil to the bell circuit in place of the batteries. The current taken by the transformer is very small. The installation of this system in a new building is more justified than a change in an existing building from direct to alternating-current bells.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

FONDA, JOHNSTOWN & GLOVERSVILLE.

The report of the Fonda, Johnstown & Gloversville Railroad Company for the month of May and eleven months ended May 31 compares as follows:

	1909.	1908.
May gross	$ 71,396	$ 61,326
Expenses	32,091	30,675
May net	$ 39,305	$ 30,651
Eleven months gross	704,134	713,853
Expenses	324,904	350,549
Eleven months net	$379,230	$363,304

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of May and eight months ended May 31 compares as follows:

	1909.	1908.
May gross	$ 329,339	$ 313,679
Expenses	184,147	169,723
May net	$ 145,192	$ 143,956
Charges	42,891	46,462
May surplus	$ 102,301	$ 97,493
Eight months gross	2,437,056	2,341,552
Expenses	1,524,083	1,485,623
Eight months net	$ 912,973	$ 855,928
Charges	261,757	270,571
Eight months surplus	$ 651,216	$ 585,357

CUMBERLAND TELEPHONE AND TELEGRAPH.

The report of the Cumberland Telephone and Telegraph Company for the month of May and five months ended May 31 compares as follows:

	1909.	1908.
May gross	$ 524,954	$ 503,358
Expenses	297,454	292,790
May net	$ 227,500	$ 210,568
Charges	41,110	36,107
May surplus	$ 186,390	$ 174,461
Five months gross	2,643,848	2,552,614
Expenses	1,514,125	1,489,999
Five months net	$1,129,723	$1,062,615
Charges	214,282	187,635
Five months surplus	$ 915,441	$ 874,980

LONDON UNDERGROUND.

The Underground Electric Railways of London report gross earnings for the week ended June 5 and for twenty-two weeks ended June 5, 1909, compared as follows:

	1909.	1908.
Bakerloo	£ 3,400	£ 2,910
Piccadilly	5,745	5,305
Hampstead	4,520	3,320
District	10,246	9,128
Tramways	9,655	7,843
Total	£ 33,656	£ 28,506
Twenty-two weeks:		
Bakerloo	£ 73,600	£ 67,075
Piccadilly	127,295	119,135
Hampstead	85,545	70,680
District	215,693	195,996
Tramways	125,698	131,247
Total	£627,831	£584,133

HUDSON & MANHATTAN.

The report of the Hudson & Manhattan Railroad Company for the quarter ended March 31, 1909, as filed with the New York Public Service Commission, is as follows:

Operating revenue	$202,466
Operating expenses	123,012
Net operating revenue	$ 79,454
Other income	174,021
Gross income	$253,475
Deduction	6,924
Surplus	$246,550

The reports of the Hudson & Manhattan Railroad Company for the quarters ended September 30, 1908, and December 31, 1908, as filed with the New York Public Service Commission, are as follows:

	Quarter Ended Sept. 30.	Dec. 31.
Gross operating revenues	$121,373	$189,729
Operating expenses	127,898	136,589
Net operating revenues	*$ 6,525	$ 53,140
Other income	142,419	149,806
Gross income	$135,894	$202,946
Deduction	833	9,552
Surplus	$135,061	$193,394

*Deficit.

CONSOLIDATED COMPANY, OF BALTIMORE.

The Consolidated Gas, Electric Light and Power Company, of Baltimore, has sold to Drexel & Company, of Philadelphia, and E. H. Rollins & Sons, of Boston, $3,584,500 general mortgage four-and-one-half per cent bonds of the Consolidated Gas Company, making $6,553,500 of the authorized issue of $15,000,000 outstanding.

SAO PAULO TRAMWAY.

The Sao Paulo Tramway, Light and Power Company has issued its report, for the year ended December 31, 1908, which compares as follows:

	1908.	1907.
Gross earnings	$2,287,411	$2,111,523
Operat. and maint. exp.	783,051	715.650
Net earnings	$1,504,360	$1,395,873
Charges	365,468	359,422
Surplus earnings	$1,138,892	$1,036,451
Dividends	836,538	691,476
Contingent accounts	300,000	100,000
Balance, surplus	$ 2,354	244,975
Balance, last year	656,898	.....
Total surplus	$ 659,252	.....

President Mackenzie says in part:

"The company's plant has throughout been maintained in excellent condition, and in addition the sum of $92,065, which has been charged to the contingent account referred to in last year's report, was expended for renewals and replacements. To meet expenditures of this nature, and to provide for the reconstruction of tracks, which will become necessary in connection with the general plans of the city in the way of widening streets, reducing grades, etc., the directors have thought it well to set aside $300,000 from the earnings of the year, as a definite provision for renewals, and this sum has been transferred to the contingent account opened for this purpose; $17,968 of the expenditures above mentioned has been already charged against this appropriation.

"The expenditure on capital account during the year amounted to $1,017,147. Improvements were made to the hydraulic plant at Parnahyba, an extension being made to the power house for the accommodation of units, 6, 7, and 8, and the foundation of the seventh unit, now being installed, was completed.

"The rolling stock was increased by twenty-five passenger cars and a number of passenger and freight rail cars were constructed, all of which were built in the shops of the company.

"Additions were made to the main substation in the city of Sao Paulo, and subsidiary transformer stations were erected and equipped. The light and power feeders, as well as the underground work of the system, were increased to meet the demands upon the service, and expenditure was also made on various other branches of the company's property.

"To meet the above capital expenditure the directors during the year disposed of $1,200,000 of the capital stock of the company. The premium on these shares, after deducting exchange charges, etc., amounted to $161,562, which has been transferred to the credit of reserve fund."

BUTTE ELECTRIC AND POWER.

The $1,650,000 first mortgage five per cent bonds of the Butte Electric and Power Company, recently purchased by Lee, Higginson & Company, of New York city, have all been sold.

METROPOLITAN STREET RAILWAY.

The committee of holders of the four per cent refunding mortgage bonds of the Metropolitan Street Railway Company has issued a statement saying that under existing conditions the company is not able to earn the interest charges on either the four or the five per cent bonds. In the course of its circular the committee says: "Careful and laborious examination, practical tests, tabulations and study have resulted in demonstrating conclusively that, separately operated under existing conditions, not one of the leased lines produces an income sufficient to pay its operating expenses and taxes and yield a return equal to the amount specified in the lease thereof." In most instances, it continues, "the contribution of the leased lines to the combined gross earnings of the system as a whole is greatly less than the cost of operating

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and maintaining its property, and a readjustment of relations with the leased lines is essential to a proper and stable solution of the problem." The circular says: "During the last fifteen years the fare per passenger carried has been reduced from five cents to an average of practically three cents, namely, nearly forty per cent, while in less than ten years the burden of taxation has been increased fully 100 per cent." The committee concludes that the enforced transfers should be abolished and the franchise taxes reduced, or else any reorganization will be merely a temporary makeshift. The committee, however, believes that only as a last resort should the properties pledged be sold separately to satisfy the bondholders.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

The American Telephone and Telegraph Company reports for May and five months ended May 31, 1909, as follows:

May:	1909.	1908.
Dividends	$ 901,133	$ 634,964
Int. and other revenue	886,991	840,144
Tel. traffic, net	370,048	264,724
Real estate	8,584	11,742
Other sources	230,520	55,951
Total earnings	$ 2,397,259	$ 1,807,528
Expenses	213,176	151,066
Net	$ 2,184,083	$ 1,656,461
Deduct interest	546,667	647,501
Balance	$ 1,637,415	$ 1,008,960
Five months:		
Dividends	$ 7,123,915	$ 6,443,344
Interest and other revenue	4,253,942	4,136,437
Tel. traffic, net	1,744,707	1,519,627
Real estate	41,089	42,579
Other sources	719,668	301,362
Total earnings	$13,883,323	$12,443,351
Expenses	960,222	870,178
Net	$12,923.100	$11,573,172
Deduct interest	3,360,351	3,224,136
Balance	$ 9,562,749	$ 8,349,036
Dividends paid	3,333,067	3,050,560
Balance	$ 6,229,682	$ 5,298,476

Figures for 1908 include a proportionate part of the extraordinary provision for depreciation for the year 1908. Equivalent or greater provision is being made for each month of 1909.

GENERAL ELECTRIC.

The General Electric Company has issued a statement of its financial condition as of March 31, 1909, to the state of Massachusetts, which compares as follows:

ASSETS.

	1909.	1908.
Real estate	$ 85,127	$ 541,900
Machinery	13,985,978	13,045,475
Merchandise	20,341,659	20,749,588
Cash and debts rec.	39,229,981	43,815,580
Patent rights	1	1
Miscellaneous	25,469,759	20,756,743
Total	$99,112,505	$98,909,287

LIABILITIES.

Capital stock	$65,178,800	$65,169,000
Accounts payable	2,997,793	2,702,740
Funded debt	14,963,000	14,975,000
Profit and loss	15,972,912	16,062,547
Total	$99,112,505	$98,909,287

CHICAGO RAILWAYS.

The Chicago Railways Company has issued a statement of income for April, 1909, and for the period from February 1 to March 31, as follows:

EARNINGS.

	April.	February 1 to March 31.	Total to Date.
Passengers	$975,440	$1,813,856	$2,789,296
Other income	21,908	42,792	64,700
	$997,348	$1,856,648	$2,853,996

EXPENSES.

Mt. way and struc.	$ 40,702	$ 86,890	$ 127,592
Maint. of equip.	59,794	123,792	183,586
Oper. power plants	103,837	217,314	321,151
Operating cars	303,929	610,748	914,677
General expenses	116,871	206,166	323,037
Ex. ac. in real est.	5,946	8,368	14,315
Taxes (estimated)	34,178	61,880	96,058
	$665,258	$1,315,158	$ 980,416
Balance (actual)	332,090	541,490	873,580
*Balance	299,204	556.994	856,198
Ded. int. 5% on val.	171,522	328,841	500,363
Net income	$127,682	$ 228,153	$ 355,835
City of Chicago 55%	70,225	125,484	195,709
Chicago Rys.Co.45%	57,457	102,669	160,126

*Based on seventy per cent for operation.

DETROIT EDISON.

The Detroit Edison Company consolidated income account for the year ended December 31, 1908, as reported to the New York Stock Exchange, shows as follows:

Gross from operation	$1,788,812
Expenses and taxes	1,106,081
Net earnings	$ 682,731
Interest charges, etc	501,322
Surplus	$ 181,409
Other charges	34,709
Net surplus	$ 146,700
Previous surplus	75,366
Transferred from sinking fund reserve	2,146
Profit and loss surplus Dec. 31, 1908	$ 224,212

The Detroit Edison Company in its application to list on the New York Stock Exchange $7,979,000 five per cent first-mortgage thirty-year gold bonds, $5,000,000 capital stock already issued and $1,000,000 stock to be issued in exchange for convertible bonds, says that the capital stock is distributed among about 200 holders and that there is no controlling interest, syndicate or otherwise, therein.

That very close relations exist, however, between this company and the North American Company is shown by the fact that several officers are identical in both companies.

MEXICAN TELEGRAPH.

The Mexican Telegraph Company's report of estimated earnings for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Traffic receipts	$ 165,000	$ 168,500
Expenses	41,000	35,000
Net	$ 124,000	$ 133,500
Other income	21,000	28,000
Total income	$ 145,000	$ 161,500
To Mexican government	7,500	8,000
Balance	$ 137,500	$ 153,500
Dividends	89,720	71,752
Surplus	$ 47,780	$ 81,748
Previous surplus	2,091,611	2,482,012
Total	$2,139,391	$2,563,760

CENTRAL & SOUTH AMERICAN TELEGRAPH.

The Central & South American Telegraph Company's estimated report of earnings for the quarter ended June 30, 1909, compares with last year's report as follows:

	1909.	1908.
Gross	$ 365,000	$ 408,000
Expenses	163,000	162,000
Net	$ 202,000	$ 246,000
Other income	2,500	5,500
Total income	$ 204,500	$ 251,500
Dividends	143,565	143,565
Surplus	$ 60,935	$ 107,935
Previous surplus	1,495,492	1,172,712
Total surplus	$1,556,427	$1,280,647

NORTHERN OHIO TRACTION AND LIGHT.

The report of the Northern Ohio Traction and Light Company for the month of May and five months ended May 31 compares with last year's report as follows:

	1909.	1908.
May gross	$188,749	$158,409
Expenses	103,832	94,878
May net	$ 84,917	$ 63,531
Charges	43,809	44,154
May surplus	$ 41,107	$ 19,377
Five months gross	775,738	664,298
Expenses	445,389	419,761
Five months net	$330,349	$244,537
Charges	219,074	217,043
Five months surplus	$111,275	$ 27,494

TOLEDO RAILWAYS AND LIGHT.

The report of the Toledo Railways and Light Company for the month of May and five months ended May 31 compares with the corresponding report of last year as follows:

	1909.	1908.
May gross	$ 212,835	$ 198,973
Expenses	126,611	109,444
May net	$ 86,224	$ 89,529
Other income	320	81
Total income	$ 86,544	$ 89,610
Charges and taxes	70,871	71,719
May surplus	$ 15,673	$ 17,891
Five months gross	1,085,332	1,028,607
Expenses	621,109	574,930
Five months net	$ 464,223	$ 453,677
Other income	908	2,774
Total income	$ 465,131	$ 456,451
Charges and taxes	354,651	348,374
Five months surplus	$ 110,480	$ 108,077

BOSTON SUBURBAN ELECTRIC.

The combined earnings of the subsidiary companies of the Boston Suburban Electric Companies, comprising the Newton, Newton & Boston, Lexington & Boston, and Middlesex & Boston Street Railways, and excluding the Norumbega Park and the Waltham Gas Company, for May and eight months, are as follows:

	1909.	1908.
May gross earnings	$ 74,569	$ 76,082
Expenses	50,550	54,413
Net earnings	24,018	21,669
Interest	13,520	13,270
Surplus for dividends	10,497	8,390
Eight months' gross earnings	499,855	494,664
Expenses	396,259	420,789
Net earnings	103,595	73,875
Interest	107,403	106,018
Surplus for dividends	*3,807	*32,143

*Deficit.

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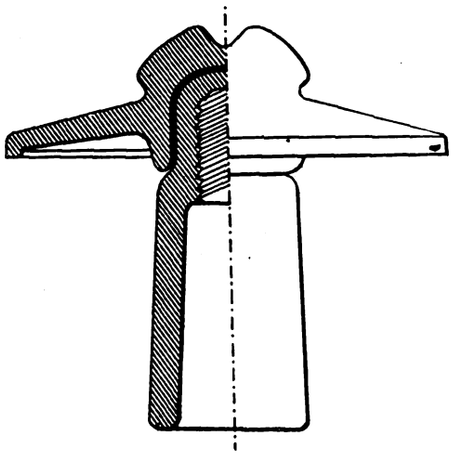
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

INSULATORS ON LINES NEAR THE SEA.

The efficacy of insulators depends not only on their form and the material of which they are manufactured but also on the condition of their surface; and humidity, dust and smoke are detrimental to their good working. In the vicinity of the sea the salt contributes to the formation of a thick conducting layer on their surfaces, which after a while entirely destroys the insulation of the line. This phenomenon has been investigated by G. Anfossi on the Acquedotto de Ferrari Galliera line of Genoa, which transmits three-phase current under a tension of 25,000 volts to a distance of fifteen kilo-



HIGH-VOLTAGE INSULATOR.

metres. The observations demonstrated absolutely that the incrustation forms to a harmful extent only on those parts of the insulator that are protected from the wind and atmospheric action. Thus it was found that the crust of dust and salt forms most easily on the surfaces best protected from the rain, which under ordinary conditions should constitute the most efficient parts of the insulator. The usual forms are therefore not suitable for localities subject to deposits of salt, and the author has designed a new type of insulator intended to overcome this difficulty on the basis of his experiences. It comprises a large upper, almost flat bell, under which a harmful crust cannot form. Below this bell the insulator must have a shape which leaves it freely exposed to the action of the wind in order to prevent the progress of the incrustation. The lower portion therefore consists of a simple smooth or undulated sleeve, or even superposed bells, but there must be no cavities in which dust can locate. The accompanying illustration shows one of these types of insulator. The diameter of the bell is 220 millimetres; the total height of the insulator is 200 millimetres. In the laboratory they withstood a pressure of 75,000 volts when dry and 30,000 volts in a heavy rain. These insulators have been in use on the line referred to for over eighteen months with perfect success. Of course they may also be employed to advantage on lines that are not near the sea.—*Translated and abstracted from La Revue Electrique (Paris), May 30.*

AN INTERESTING GAS-DRIVEN GENERATOR SET.

The well-known firm of Mather and Platt, Manchester, England, has recently designed and built a gas-engine generator set for the East Indian Railway Company, which includes many new features. The gas engines will utilize the waste gases from the railway company's coking ovens at their Giridih Collieries. The two engines run at 167 revolutions per minute, each coupled directly to a three-phase alternator wound for 2,300 volts, fifty cycles. Each alternator has a normal output of 200 kilovolt-amperes on a power-factor of 0.75, but the sets are also capable of twenty per cent overload for two hours. The engines are of the Körting double-acting two-cycle pattern, with Mather and Platt's improvements. They are intended to run in parallel, and are particularly suitable for this, as owing to an impulse being produced at every stroke the turning is extremely regular, and the cyclic irregularity does not exceed one in 300. Each engine has two cylinders, side by side, with cranks at right angles; thus four impulses will be given to the shaft per revolution. The construction is remarkably simple, and as the flywheel is placed between the cylinders, with the field magnets of the alternator mounted on the flywheel rim, the whole arrangement is compact, well balanced, and easily accessible. Duplicate sparking plugs and ignition gear are provided for each end of the cylinders. The alternators are coil-wound, and the exciters are driven by Morse chains. To start the engines, compressed air will be used, with a compressor of special type, driven by coke-oven gas. This compressor has two cylinders—one for gas and the other for air—and delivers the air to reservoirs at a pressure of 150 pounds per square inch. The order was obtained in direct competition with both English and foreign firms.—*Extracted from Electrical Engineering (London), June 10.*

THE BRAUN ELECTROMAGNETIC RAIL-BRAKE.

This brake serves for increasing the adhesive power of the cars to the rails, thus reducing the distance for which the brakes have to be applied. While normally the adhesion of a car amounts to from one-seventh to one-tenth of the pressure resting on the wheels, it is increased twofold by using the electromagnetic rail-brake in conjunction with the ordinary brake applied to the wheels. This rail-brake, which is manufactured by Adolf Braun, of Friedenau, near Berlin, consists of a two-pole magnet, the pole-shoes of which are flat, parallel irons extending in the direction of the rails. The space between the flat irons is equal to about one-fifth of the width of the rail head. At an induction of 17,500 centimetre-gramme-second units between brake-shoe and rail-head, which is easily reached, and which corresponds to a pressure of 12.5 kilogrammes per square centimetre, a brake pressure of fifty kilogrammes per one metre of rail will be obtained. By lengthening the brake-shoes any required braking power may be produced. The Braun rail-brake is manufactured in three sizes: For six tons brake pressure at 120 centimetres length, for four tons at eighty centimetres, and for 2.5 tons at fifty centimetres. The total weight of the brake amounts to three per cent of the brake pressure exerted. The medium-size brake consists of two double magnets capable of a pressure of 4,000 kilogrammes each. The magnet windings, which are made on forms, are protected by steel casings. This brake is particularly suitable for mountain railroads, and for street railways it has been developed into a combined rail and wheel brake. In

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the latter case a lever transmits the pull of the rail-brake to the brake-shoes acting on the wheels.—*Translated and abstracted from Zeitschrift des Oesterreichischen Ingenieur und Architekten Vereines (Vienna), June 4.*

PROTECTION OF TELEPHONE INSTALLATIONS AGAINST THE DISTURBING INFLUENCES OF HIGH-TENSION ALTERNATING CIRCUITS.

Various methods have been proposed and tested for reducing the disturbances that occur in telephone installations, when the telephone circuit is exposed to the electrostatic or electrodynamic influence of high-tension alternating-current lines. Nearly all of them attempt to solve the problem by a suitable arrangement of the line wires, but the results have not been entirely satisfactory in all cases. Martin Hoechstaedter proposes the employment of a protective circuit at each installation for eliminating those disturbances that have not been prevented by the use of known methods of building the line itself, so that it will be as free of disturbances as possible. The simplest way of preventing the electromotive-force still present from sending a current through the telephone without noticeably weakening the telephone currents is undoubtedly the insertion of a condenser of suitable capacity in the telephone circuit. An idea of the size of condenser required may be gained from the following rough calculation: The disturbing frequency is assumed to be fifty per second and the average sound vibration 1,000 per second; it is also assumed that for fifty periods an alternating-current resistance of 60,000 ohms is sufficient to render the disturbance harmless. As a condenser of one microfarad has an apparent resistance of 3,000 ohms for a current of fifty periods, a condenser of 0.05 microfarad proves to be necessary. For 1,000 periods this condenser has a resistance of approximately 2,000 ohms. At the beginning of the experiments it was feared that the employment of such small capacities might have an injurious effect on the clearness of speech, but experience showed that the insertion of condensers of 0.05 and even 0.03 microfarad in an ordinary circuit with a good granular microphone rendered the speech decidedly more distinct. It was found that the microphones could be operated with double the tension at which cracking ordinarily occurred. The method was practically tested with good results along a 10,000-volt polyphase transmission line thirty kilometres long. The condenser was supplemented by a choking coil of suitable size in parallel with the telephone receiver.—*Translated and abstracted from Elektrotechnische Zeitschrift (Berlin), June 3.*

ELECTRIC MINE HOISTING.

In the further development of the Denaby Main Colliery, in Yorkshire, England, electricity is playing an important part. The hoisting machine, which will lift 140 tons per hour, is operated by an electric motor designed for a peak load of 700 horsepower and a mean load of 340 horsepower at 392 revolutions per minute. Three-phase current at 3,000 volts and forty cycles a second is used. The speed can be regulated for inspection purposes by means of the controller which controls the motor under normal conditions. The brake gear is operated by compressed air from a motor-driven air-compressor, which is automatically controlled by the variation of the air pressure. Among the safety devices is a solenoid in the main motor circuit, which trips the emergency brake when the current fails. Other safety devices trip this brake when the attendant fails to cut off the current in approaching the top, when the motors reverse, and when the air pressure in the compressor falls below a certain point. When the brake is tripped a triple pole switch in the stator circuit is automatically opened. The whole of this plant stands on a concrete bed of thirty feet by twenty-eight feet, with a headroom of but nine feet, on the 1,380-foot level. The shaft is fourteen feet in diameter and extends to a further depth of 780 feet. The bedplate weighs twelve tons and was constructed in sections for being brought down the mine.—*Abstracted from The British Trade Review, June 1.*

ELECTRICAL CONDUCTIVITY OF PURE HEXANE.

Some interesting particulars are adduced in a recent paper by G. Jaffe in the *Annalen der Physik* on the electrical conductivity of pure hexane. The pure hexane can be obtained from the better electrically conducting impure material by electrolysis and by repeated distillation. The resulting product has a practically constant conductivity about twelve times that of air under the same conditions. The pure hydrocarbon has, however, only one-third of this conductivity when the measuring vessel is sheathed with lead so as to cut off external radiations, and even this is influenced by the material of the containing vessel, aluminum, for instance, giving very low values. Other remarkable properties are that the current is practically constant at varying temperatures and that an increase of potential from 200 to 2,000 volts produces no increase in the current, which reaches a saturation value analogous to that of a gas, although at a much lower voltage.—*Abstracted from Nature (London), June 3.*

MERCURY MOTOR-METERS.

No meter has been brought out for continuous-current supply to equal the mercury motor-meter in simplicity and accuracy. It, no doubt, has faults and failings which worry the supply engineers, but still it has held its own against all others; its manufacture is a large business, and must be carried on upon a factory system with perfect organization and special plant to make it a paying business at current prices. The makers may, therefore, be credited with having reduced its construction to the simplest and cheapest design. George Hookham's name will always be associated with this class of meter, as will that of Ferranti. The original meters of these two inventors represent the two classes of mercury motor-meters, into which they may be divided. The Hookham meter, broadly considered, is a motor-generator, a magneto-motor driving a generator with a short-circuited armature. The original Ferranti meter belongs to another class, wherein there is no magnetic brake; it is not a motor-generator, but simply a series motor, working against the fluid friction of the mercury. In the new Ferranti Company's meter (Hamilton's patent) we have the idea of employing one disk to act as motor and brake between two or more separate poles. As made, there is one pair of poles for driving and one pair for braking. As a matter of fact, both act as brakes, and so it is, in this case also, difficult to account for the compensating effect of the series coils. To the writer (Rankin Kennedy) it seems that a separate brake is desirable, as it gives the power of easy compensation and adjustment of speeds without electrical shunts. A portion of the current is sometimes shunted past the mercury bath in order to adjust the speed. This is not a safe practice, as any change in the mercury bath or the contacts immediately alters the rate of the meter. The subject is one worth consideration and discussion.—*Abstracted from The Electrical Review (London), June 18.*

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Two New Hydraulic Jacks.

Anyone who has much heavy lifting to do appreciates that there are pleasanter tasks than carrying around a jack from one place to another, especially when it weighs more than a hundred pounds. It means rather a heavy load if carried by hand, and if the jack is loaded and reloaded onto a truck with each using, this involves considerable work too.

The new Watson-Stillman shop jack, shown in Fig. 1, renders unnecessary much of this labor. This jack, made in eleven sizes, of from twenty to fifty tons capacity, and lifts of twelve and eighteen inches, fills all the ordinary requirements of lifting heavy machinery and for general shopwork. The wheels on the base and the handle on the cylinder facilitate moving the jack quickly from one place to another without the exertion of a great deal of energy. The wheels touch the floor only when the jack is tilted, so they are never in the way during the lifting operation. If it is desired to use the jack at an angle, it can be tilted in the opposite direction to the wheels, and when it is laid flat upon the side, the ram will push out its entire lifting length. An independent steel claw (not shown in the illustration) can be used when desired for lifting from near the ground. This is more convenient than a permanently attached claw, as the independent part is easily applied when a low lift is required, and its removal at other times allows the jack to be made of considerably lighter weight. The weight, however, is comparatively small, because the whole jack is made of steel, and the parts under greatest strain, such as the ram and cylinder, are machined from a solid bar of high-carbon steel.

FIG. 1.—SHOP JACK.

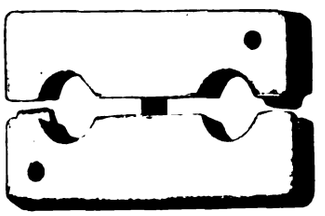
It is sometimes inconvenient to work the lever of a jack of the internal-pump type because of the lack of room, or insufficient footing. To meet these conditions, the Watson-Stillman Company has put upon the market the independent-pump hydraulic jack shown in Fig. 2, which is furnished in fifty-three sizes, of from two to 1,200 tons capacity. The various sizes of the jack proper have maximum ram movements of from four to eight inches. The pump is connected to the jack by means of flexible copper tubing, which may be of any length suitable to the work in question. The jack may be operated up to a pressure of 450 pounds per square inch on the ram by means of the hand lever shown on the pump, and further worked to full capacity by means of the extension lever. The gauge may read in pounds per square inch, or in tons load upon the jack, or both. This is not furnished when the jack is to be used for ordinary lifting, but is necessary in testing. When equipped with the gauge, the jack may be used between two fixed platens for making compression tests, testing the tightness of force, fits, etc.

FIG. 2.—INDEPENDENT-PUMP JACK.

Both of the above jacks are made by the Watson-Stillman Company, of New York, and are able to stand a considerable overload without danger of injury to the operator or jack.

The A. S. A. Lamp Cord Adjuster.

The accompanying illustration shows a new lamp-cord adjuster which has been placed on the market by the A. S. A. Manufacturing Company, Westfield, N. J. This adjuster is made of hard white porcelain and is entirely free from burrs or rough edges. It is not necessary to remove the socket to attach the adjuster, as the two portions are held together by a spring. Alinement is effected by means of an offset fitting into a groove on opposite sides of each of the halves of the adjuster. In attaching to the lamp cord all that is necessary is to draw the two halves apart, give them a slight turn, insert the cord and spring the halves back into position. There is a small hole in either end of the adjuster to enable it to be suspended from the ceiling or any other place.



THE A. S. A. LAMP CORD ADJUSTER.

Telephone Receivers for Wireless Transmission.

In designing telephone receivers for wireless work, many points must be attended to in order to attain the desired degree of sensitiveness. Contrary to general belief, high resistance of the coils does not necessarily mean great sensitiveness; rather, the coils must be wound so as to give the greatest number of turns with the least resistance, so that for maximum efficiency there must be the greatest possible number of turns of wire nearest the cores for a given resistance.

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Other points which also greatly affect the sensitiveness are the amount of iron in the cores, the quality of this iron, the thickness and diameter of the diaphragm and the quality of the iron from which this is made, and the strength of the permanent magnets. The magnets must be designed with due regard to the cores and diaphragms with which they are to be used. All the parts mentioned must, moreover, be mounted on a substance entirely unaffected by heat or moisture, in order to secure permanence of adjustment.

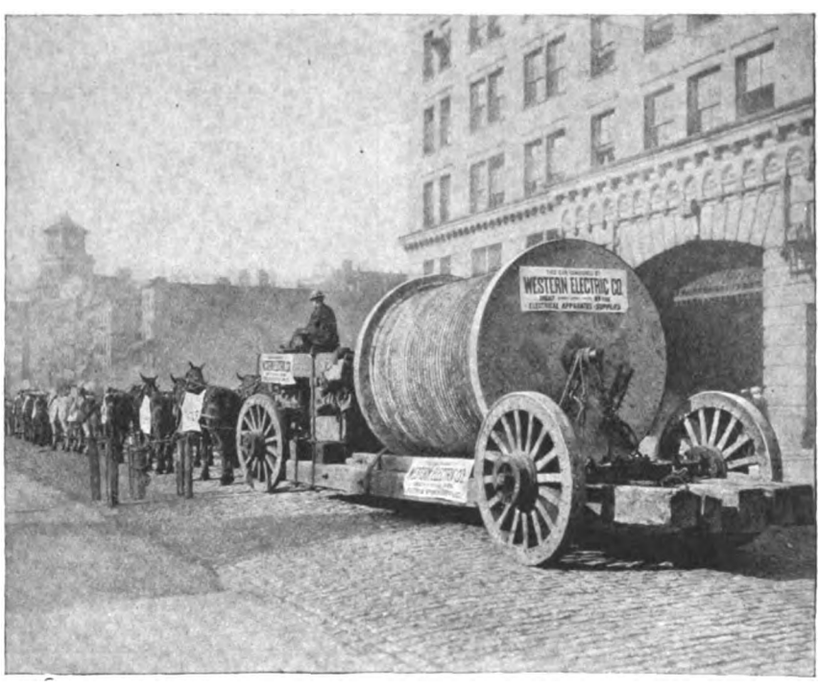
The wireless operator's head receiver, illustrated herewith, which is made by the Holtzer-Cabot Electric Company, of Brookline, Mass., has been designed to give the maximum degree of comfort with which such instruments can be worn, besides keeping all the above points carefully in view. The spools and magnets are mounted in a metal cup which supports the diaphragm, and the windings are all of silk-covered copper wire. These magnets are made of special quality steel and of such a strength as to give the best results with the diaphragms used. Adjustment is made permanent by grinding the cores to an exact proper height, and the metal cup referred to above is enclosed in a hard-rubber shell. The receivers are mounted on an adjustable leather-covered head-band on which there is nothing to work loose or to catch the hair. The large detachable pneumatic rubber cushions which are provided with each set not only shut out interfering outside noises, but also materially increase the comfort of wearing.

These sets may be wound to resistances up to 4,000 ohms. A six-foot two-conductor green silk tinsel cord is supplied with each set.

WIRELESS TELEPHONE RECEIVER.

A Big Submarine Telephone Cable Consignment.

On June 8 last the Western Electric Company shipped the first sections of submarine telephone cable designed to connect San Francisco with Oakland, by way of Goat Island, beneath the waters of San Francisco Bay. The cable was two-and-seven-eighths inches in diameter, containing sixty-nine pairs of telephone wire, twenty-six pairs of No. 13 Brown & Sharpe gauge, and forty-three pairs of No. 19 Brown & Sharpe gauge. On the big reel the first section, 4,250 feet in length, weighed twenty-six-and-one-half tons.



FIVE-TON TRUCK, CONVEYING HUGE CONSIGNMENT OF CABLE.

The truck on which this cable was hauled weighed about five tons, and sixteen horses dragged the heavy load. The wagon was built very low, with a clearance of only eight inches between its lowest part and the ground. Guiding eight teams of horses through the streets of New York and around the narrow corners is an unusual sight as well as a difficult task, and many stared at the cavalcade as it made its way along Bethune Street from West Street to Eighth Avenue, thence up to Twenty-seventh street and west to the river, where the freight dock of the Lehigh Valley Railroad is located.

The second consignment, of 4,250 feet, left the Western Electric Company's factory in the same manner two days later.

The first two sections of this cable, 8,500 feet altogether in length, are to extend from San Francisco to Goat Island. When the other two sections of 7,800 feet arrive, they are to be stretched from the island to Oakland Mole. On Goat Island connection with the land cable is to be made. The entire 16,300 feet of cable is one of the largest orders for paper-insulated submarine telephone cable ever placed. The cable is consigned to the Pacific Telephone and Telegraph Company.

A Simple Method of Comparing Intensity of Illumination.

The increasing use of high-efficiency tungsten lamps in connection with reflectors or shades has created a demand for some simple method by which the intensity of light derived from two sources can readily be compared.

The average photometric measurement method is not well adapted for use by a layman who does not care to know, as a rule, the intensity of a source of light or an illumination in terms of a standard, but simply desires a visual comparison which will indicate which source gives the brighter light without knowing just how much brighter one source is than the other.

A simple practical method of comparing the intensity of illumination has been worked out in the fixture studios of the Central Electric Company, Chicago, Ill., and a short description of the method may be of interest to the central-station solicitors and others called upon to dem-

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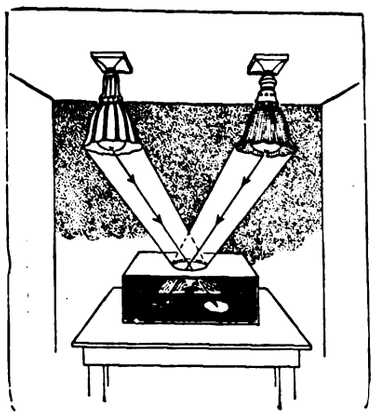
onstrate lighting effects to the ordinary consumer.

The method is simply one of comparison, the two sources to be compared being located approximately as shown in the illustration, in which the intensity of the light reflected from one source is being compared with the intensity of the light reflected from another source.

The usual practice is to mount two sockets and shade holders approximately four feet apart on the ceiling of the fixture or display room and equip each holder with the desired shade, care being taken to have the sockets connected to the same source of supply in order to operate the lamps under the proper voltage conditions. Care should also be taken to select lamps having approximately the same watt consumption in order to secure a fair comparison.

The measuring or comparing device is placed on a table, and consists of a rectangular box provided with a round hole in the top, this hole being so located that



DEVICE FOR COMPARING INTENSITY OF ILLUMINATION.

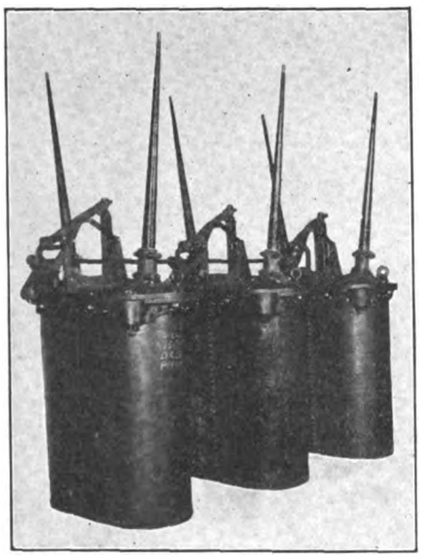
a ray of light emitted from either of the lamps will throw a light spot on the horizontal shelf, on which is placed a piece of white paper. As will be seen from the illustration, one side of the box is left open, so that an observer can readily see the interior.

With two sources of light located as shown in the diagram, two light spots are thrown on the white paper, and it is an easy matter to select the brighter spot. It should be remembered that the light rays cross; that is, the light from the left lamp is thrown to the right-hand side of the measuring device.

Westinghouse Type GA Condenser-Lead Circuit-Breaker.

The recent revival of several large power developments which had been held up for financial reasons, and the rapid extension of existing systems, have led the Westinghouse Electric and Manufacturing Company to develop and place on the market a heavy capacity oil circuit-breaker.

This new type GA breaker consists of single-pole units, each enclosed in its individual boiler-steel tank with separate operating mechanism, leads, etc. All the operating parts are mounted on the cast-iron top and are operative on the top so that the mechanism may be lined up before it is dropped into the oil tank. Eye bolts are provided for handling this top as a unit. Since the connection between poles is simply a piece of three-fourth-inch gas pipe, the poles may be spaced any convenient distance apart. The pipe is used as a pull rod, being in tension only. It is impossible for the different



WESTINGHOUSE TYPE GA CONDENSER-LEAD CIRCUIT-BREAKER.

poles to stick, due to improper alinement, as they may be placed several inches out of line without making the angle of pull sufficient to jam the mechanism.

The breaker is made for four voltages —44,000, 66,000, 88,000 and 110,000 volts. It may be either hand or solenoid operated and of any number of poles. The automatic circuit-breaker is furnished either for use with series transformers or with a self-contained series trip. Time-limit features may be incorporated if desired.

The breaking capacity is practically unlimited, the heavy boiler-steel tanks and cast-iron top giving great strength against internal pressures. The total travel of the moving contacts is large, there being two breaks in series at each pole. Each break takes place in a separate compartment, separated from the other pole by double barriers of insulating material. The break is between brass and copper, materials which have been found to give the best protection against burning. Each moving contact piece has its own heavy steel spring to take up any wear due to arcing and slides across the stationary piece with a rubbing motion, keeping the contacts bright. The insulation features of this breaker are probably superior to those of any device of its character ever designed. While this is in a great measure due to the condenser type of lead, as will be explained, in any type of apparatus the insulation is dependent on the number of paths to ground, or, in other words, the number of insulation points. It will be noted that in this form of circuit-breaker there are only three such points, namely, the two leads and the wooden rod. The rod, being of moderate cross-section, can be easily and thoroughly dried and impregnated and is well immersed in oil at all times, so that its factor of safety is large.

The condenser type of lead marks probably the greatest advance in high-tension work that has been made for some time. The problem of carrying a high-tension conductor through a grounded surface has been one of the limiting factors in developing higher voltages. Due to the fact that it was impossible to maintain the same stresses in all layers of insulating material, on account of the unequal distribution of potential in them, excessive amounts of insulation were required to secure safety. It was even found necessary to remove all grounded material from the neighborhood of the conductor, and various further makeshifts have been used, such as oil-filled terminals, double or triple porcelains and excessive amounts of varnished cloth or paper. In the Westinghouse type G breaker, which is regarded as the standard for 66,000-volt transmissions, providing the protection for both the Niagara and Southern Power Company lines, heavy soapstone tops, varnished cambric leads, and expensive and cumbersome porcelains were required. The contrast in the type GA breaker is surprising. A moderate-sized lead made up of alternate layers of tinfoil and insulation is fastened solidly into cast-iron flanges, and at voltages far in excess of that required to break down former constructions these leads show no static discharge or other evidences of strain.

The development of this condenser lead has been carefully worked out, expensive machinery for producing it having been installed, and every point in connection

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with its manufacture is thoroughly covered by patents.

That this breaker is appreciated is shown by the fact that the Westinghouse company has supplied, or has orders for at the present time, over 200 single-pole units for 44,000, 66,000 and 110,000-volt lines, and has other large orders in immediate prospect.

High-tension operators and engineers appreciate fully the simplicity, rugged construction and large factors of safety of this device.

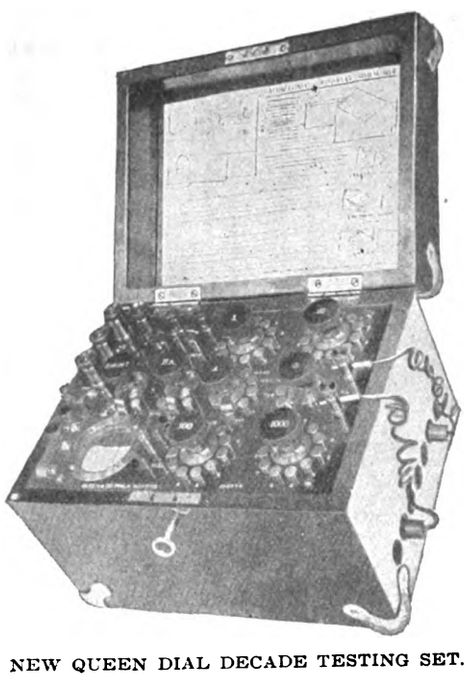
A New Dial Decade Testing Set.

The illustration herewith shows a new type of portable testing set. This set is very small and compact, measuring but nine-and-one-fourth inches long by seven inches wide by seven-and-one-half inches deep and weighing about eleven pounds. It is equipped with a new form of rheostat, consisting of four complete dials of ten coils each, of the capacity of units, tens, hundreds, and thousands, and so arranged that the revolving laminated brush may be changed from the highest to the lowest coils without revolving backward over the intermediate contacts, thereby saving considerable time in the manipulation. The bridge arm "A" has coils of 10, 100, 1,000 and 10,000 ohms and also a block "infinity" or no resistances. The "B" arm has coils of 10, 100, 1,000, and 10,000 and also a zero block, which short-circuits "B" side when its switch is on zero. It will thus be seen that a very wide range is allowed.

The type of brush designed for this set is of the tripod form, with two legs of the tripod resting on the central contact ring, thus doing away with the annoying and variable stud contact as usually made in switch-type sets. The third leg rests on the block, as indicated by the position of the brush. It will be noticed by this arrangement that no flexible lead or variable stud can enter into the resistances of the rheostat or bridge. Each of the necessary switches and binding posts are plainly marked and are conveniently arranged that the operator may quickly make Wheatstone bridge, Murray and Varley loop tests for insulation measurements, and numerous other tests.

The scale on the galvanometer is calibrated uniformly, making the readings for insulation uniform throughout the entire range of the scale. The resistance coils are wound with manganin wire, of zero temperature coefficient, properly shellaced and baked, and the resistance, therefore, requires no correction over very wide ranges of temperature. The galvanometer is of the D'Arsonval type, with a long, narrow coil, securing thereby a high sensibility with dead-beat action.

The magnets for these galvanometers are made of the finest grade of magnet steel, carefully aged and tested, and are permanent and uniform. A specially arranged Ayrton shunt allows the galvanometer a very wide range of application, making it possible to allow full current to go through the galvanometer or one-tenth or one-one-hundredth part of the same. An outside galvanometer may be used when an instrument of very high sensibility, higher than that furnished in the set, is desired.



NEW QUEEN DIAL DECADE TESTING SET.

Keys are in series with both battery and galvanometer circuits and are so arranged that they can be kept locked down when it is desired to make permanent contact by means of a thumb-nut at the back of the strap, or both keys may be depressed with the same finger, when necessary. Provision is made by means of binding posts so that the set may be used with an outside battery of higher electromotive-force than that furnished with the set, when stronger battery power is needed.

The battery consists of six special dry cells mounted in the base. The terminals of these batteries extend through the side of the case, but the ends of the tips are below the outer edge of the case, so that they cannot become short-circuited. For the renewal of the batteries it is only necessary to remove four small screws from the base of the case. These open the cell compartment, and the battery can be renewed without soldering or rewiring any connections. This cell compartment is made entirely separate from the rest of the case and securely sealed, there being no danger, when changing the battery, of getting any dust or dirt into the interior of the set, or around the galvanometer or resistance coils.

The card of direction in the lid describes the connections of the set and also the diagram of the wiring as used in the different tests, together with printed descriptions and formulas. The case is of polished mahogany, highly finished, with nickel-plated corner straps, thus protecting the case from injury.

This set is being placed upon the market under the name of the Queen Dial Decade Set by Queen and Company, of Philadelphia, Pa.

Electrical Manufacturers at the Exhibit of the Railway Supply Manufacturers' Association at Atlantic City.

In connection with the conventions of the Master Mechanics' Association, which was held at Atlantic City, N. J., June 16, 17, and 18, and the Master Car Builders' Association, June 21, 22 and 23, the Railway Supply Manufacturers' Association made an extensive exhibit. Among the electrical manufacturers participating in this exhibition were the following:

Adams & Westlake Company, Chicago, the Adlake-Newbold axle electric car-lighting system, and electric and gas fixtures.

American Blower Company, Detroit, Mich., motor-driven blowers for forges and furnaces, and mechanical draft apparatus.

Carborundum Company, Niagara Falls, N. Y., carborundum wheels, sharpening stones and abrasive material.

Consolidated Car Heating Company, Albany, N. Y., heating and signaling systems.

Consolidated Railway Lighting and Equipment Company, New York, N. Y., standard electric train-lighting equipments.

Cooper Hewitt Electric Company, New York, N. Y., Cooper Hewitt lamps for shop and train lighting.

Dearborn Drug and Chemical Works, Chicago, method of scientific treatment of boiler feed water.

Joseph Dixon Crucible Company, Jersey City, N. J., Dixon crucible graphite paint for steel cars, and Dixon lubricating material.

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Duntley Manufacturing Company, Chicago, vacuum cleaners.

Electric Storage Battery Company, Philadelphia, Pa., storage batteries for car lighting, signal, vehicle and ignition service.

General Compressed Air and Vacuum Machinery Company, St. Louis, Mo., Thurman portable electric vacuum cleaner.

General Electric Company, Schenectady, N. Y., gasoline-electric car and reception booth.

Gold Car Heating and Lighting Company, New York, N. Y., car heating and lighting equipment.

H. W. Johns-Manville Company, New York, N. Y., asbestos packing, roofing, pipe-covering cement, Vulcabeston and magnesia products.

Kerite Insulated Wire and Cable Company, New York, N. Y., samples of underground and submarine cables, railway wire and Kerite tape.

Safety Car Heating and Lighting Company, New York, N. Y., axle-driven electric-lighting equipment and lighting fixtures.

Watson Insulated Wire Company, New York, N. Y., insulated wire.

Westinghouse Automatic Air Brake and Steel Coupler Company, St. Louis, Mo., automatic air brakes and steel couplers.

Westinghouse Air Brake Company, Pittsburg, Pa., triple-valve test rack and operative centrifugal dirt collector, air compressors, pumps, hose couplers and auxiliaries.

Westinghouse Machine Company, Pittsburg, Pa., turbine train-lighting set and electric storage batteries for railway use.

Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., turbine train lighting sets, motors, arc lamps, incandescent lamps, blowers, ventilating fans, and measuring instruments.

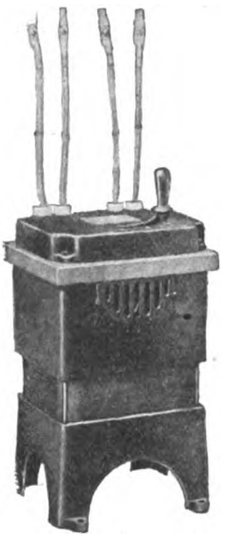
Yale & Towne Manufacturing Company, New York, N. Y., electric hoists, triplex chain blocks, I-beam trolleys, padlocks, door jacks and kindred hardware.

The "Compensarc" for Motographic Machines.

The need of some kind of a device for controlling arc lamps on moving-picture machines is obvious when it is known that moving-picture machine arc lamps operate at approximately thirty-five volts at the arc, while the voltage obtainable from practically all commercial lighting circuits is either 110 volts or 220 volts. Some electrical device must of necessity, therefore, be used between the line and the lamp to take care of the difference in voltage. Formerly iron-wire or grid resistance rheostats were used. Their use, however, resulted in a waste of all that energy supplied from the line over and above that actually required by the lamp. Progressive managers are now using "Compensarcs" instead of rheostats, and thus save all that amount originally wasted.

The Compensarc, therefore, must of necessity be invaluable to all moving-picture theatres operating their arc lamps from alternating-current circuits. The Compensarc cannot be used on direct-current circuits. It is in reality a special type of adjustable auto-transformer.

The great saving in power resulting



THE "COMPENSARC."

from the use of the Compensarc, with the superior quality of light in color, intensity and stability, makes it a prime favorite with all moving-picture men who have tried it.

The Compensarc, illustrated herewith, is known as type A, form 4, and is rated at two kilowatts for 110 volts, or two-and-one-half kilowatts for 220 volts, and wound for either sixty cycles or 133 cycles, as may be desired.

The general appearance of the Compensarc is clearly shown in the illustration. The core is made of the highest grade sheet-steel laminations, similar to standard transformer construction. The outer surface of the core is fully exposed to the air. The coils are mounted within the core and are completely protected and thoroughly insulated. Core and coils are given vacuum treatment, making them completely waterproof.

The assembled core and coils are supported by a cast-iron base having four legs, which hold the Compensarc at a convenient height from the floor. The case is also of cast-iron and rests on the top of the core. It is liberally ventilated and encloses the ends of the coils and protects the connections on the inside. A slate top supports the switch blade and clips. The slate top, case and base are securely held together by four long, heavy bolts, one passing through each corner of the slate top, case and base outside the core.

A horizontal, three-step, continuous-circuit switch is mounted on the slate top, providing three adjustments for intensity of light. Each adjustment is so designed that it maintains approximately the same voltage at the arc while passing from one step to the next, without at any time opening the circuit. There is no waiting for the arc to settle and become steady before the intensity of the light can be determined. The Compensarc increases or decreases the intensity of light without a flicker.

A cast-iron cover over the slate top completely encloses the switch blade and contacts, making it impossible for accidental short-circuits to occur, and also removes all danger to the operator. The terminals to the line and lamp are brought out through porcelain insulators in the cover.

The Compensarc has a neat and symmetrical appearance, and is extremely simple to operate—one hand on the switch handle controls everything.

The Compensarc is approved by the fire underwriters. There is positively no fire risk, as there is no noticeable rise in temperature, even after several pictures have been run through the machine.

The Compensarc is very substantially made and maintains its usefulness indefinitely. It cannot be short-circuited. Even when the switch blade is at an intermediate point, and thus bridging two adjacent contacts, it will not burn out. The adjustments possible with the Compensarc are very essential to successful moving-picture work and the fact that the Compensarc provides these adjustments without breaking the circuit and putting out the light makes it all the more desirable.

The Fort Wayne Electric Works, Fort Wayne, Ind., which manufactures the Compensarc, claims a saving of two-thirds on lighting bills for moving-picture arc lamps by its use.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JUNE 19.—For quite a number of years past the electrical industry in Great Britain has been suffering from the great unwillingness of capitalists to invest money in undertakings at home, whereas the obtaining of capital for foreign and colonial electrical enterprises has been a comparatively easy matter. There are a number of opinions as to the real causes of this state of affairs, the remedy for which has been variously put at tariff reform, the reform of Parliamentary procedure in the promotion of bills, and the stringent revision of the powers now possessed by local authorities. With regard to the difficulty in finding capital for launching new electric-lighting and tramway enterprises probably the latter is the most vital factor, for the veto possessed by local authorities has been used somewhat mercilessly in many cases. But whatever the actual cause may be in every individual case, the fact remains that the city people are decidedly reluctant to take up electrical enterprises at home. A determined effort is now to be made with the view of altering this unsatisfactory state of affairs and an influential meeting is being arranged to be held in the city, probably presided over by a member of the royal family, with the object of interesting the "city" in the possibilities and merits of home enterprises. In order to do this, of course, some relaxation of the present parliamentary restrictions upon private promoters will have to be sought, and it is conceivable that a deputation will eventually wait upon the government to this end. Following this meeting, it is also probable that an electrical industrial association will be formed whose objects will be to endeavor to bring about a relief of the unhappy condition of the industry generally which has now existed for several years.

The committee of representatives of London electricity supply undertakings, both company and municipal, has now been finally agreed upon, and a set of preliminary rules will be drawn up with a view to arriving at a working basis for linking up all the undertakings for the purposes of mutual supply. In this way it is hoped to shut down a number of very uneconomical stations which it has hitherto been necessary to work in consequence of the policy of dividing London up among so many supply authorities.

The working expenses upon the Griffiths-Bedell surface-contact system at Lincoln for the past financial year show a better result than the average of seventy-five municipal systems working upon the overhead system, viz., 5.60d per car mile against 6.37d per car mile.

Since the Home Office some years ago deemed it wise to appoint an electrical inspector of factories, in consequence of the increasing use of electric power in industrial works, the annual reports dealing with the year's work have always been both practical and interesting. The report for 1908 has just been issued, and shows that there were only twelve fatal accidents entirely due to the electrical apparatus installed, while there were also only two fatal accidents in generating stations on works. Portable apparatus, as usual, is the cause of the majority of the accidents, and electrical manufacturers are urged to give greater attention to this. In this connection the electrical inspector makes the suggestion that the wires of a plug should be connected to the plug in such a way that they do not pass through the hands of the person holding it. No less than fifteen accidents have been reported as having occurred when placing the plug of a connector into the socket. Electrical manufacturers should be grateful to the electrical inspector of factories for the hints he gives on the most suitable forms of design for various classes of apparatus. This year he gives good advice on how to deal with unprotected cables on motors and calls attention to some excellent methods of dealing with these in order to eliminate the danger which necessarily arises through the liability of the wires being trodden on, etc. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, JUNE 18.—A hydraulic plant of some size has been erected not long since in the region of Verona, Italy, by one of the leading firms, the Canale Milani Company. The canal was built originally for irrigation purposes, but it possesses a fall of thirty-two feet. A considerable amount of power is secured by the present plant which is installed by the Westinghouse Company for the electrical outfit, while an Italian firm, Riva, Monneret and Company, supplied the turbines. The units in the plant are of 15,000-kilowatt size and are three-phase alternators working at 180 revolutions per minute, and supplying 3,300 volts. A bank of transformers raises the voltage to 40,000 for the pole line, the transformers being of the water-cooled oil type. Not far from the principal station has been erected a steam plant which serves as a standby to the former, and it contains Westinghouse alternator groups of 2,300 kilowatts. There is a second hydraulic plant in project which will work in parallel with the present one.

An experimental overhead structure for testing purposes has been erected by the Allgemeine firm of Berlin in order to find out the data as regards elevated electric roads. It is located at Oranienburg, and consists of a closed circuit formed by two straight portions 830 feet long, closed by two semicircular parts. Several kinds of overhead structure are used to form the circuit. Upon the elevated line there are made tests of an electric locomotive built by the firm, and the locomotive takes a train of 380 tons around the track, making over 500 rounds a day in general, and the tests are carried out for twenty hours. Current is secured over a power line from the Brandenburg station. The locomotive gives 1,050 horsepower, but this can be raised to 1,400 horsepower by adding a fourth motor. It is operated on 6,000 volts and 25 cycles.

At Bucharest, Roumania, there is a project on foot for building a new system of tramway lines. The Municipal Council will be represented for one-third in a syndicate which is to be formed for the purpose. The project includes a light and power plant which will be erected near the city. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, JUNE 26.—The civic power committee of Hamilton, Ont., has instructed the mayor of the city to apply to the hydro-electric commission for terms for 1,000 horsepower for civic purposes.

It is stated that the wireless telegraph apparatus, at the silver mines of Gowganda, Ont., is almost ready for business, and commercial messages will soon be sent over the tops of the forests to Elk City, Haileybury, and thence over the wire to the outside world. The connecting of Gowganda by wireless is one of the most fascinating features of silverland.

A large power development company on the Gatineau River, near Ottawa, is contemplating the erection of a transmission line to Brockville, Ont., taking in the intermediate points along the route. The company will be able to furnish the city of Brockville with 20,000 horsepower. The plant will have a capacity of 50,000 horsepower.

Fears that the Mexican Power Company might stop the dividend, in view of the break in the Mexican dam, have been dispelled for the time being, as it is announced that the regular one per cent quarterly payment has been declared on the common stock, payable on July 15.

The reorganization of the board of directors of the Quebec Railway means that steps will be taken for the consolidation of all the electric and power companies of the city of Quebec and district, and that important extensions will be made to the company's system, the intention being to continue the Quebec & Charlevoix road, which forms part of the system, to Murray Bay. The new company will, it is understood, be capitalized at $8,000,000.

In regard to cheaper cable service, Sir Sandford Fleming, of Ottawa, who is one of the greatest authorities on such matters, says that while he believes there will be no immediate result from the present agitation, there should be a cheaper rate between Canada and Great Britain. About one-fifth of the present rate, he declares, would be quite sufficient. Cable companies were laying new cables out of their revenues at the present time. In reply to a query, Sir Sandford said that he did not think that the Marconi system would ever take the place of the cable, although it will tend to decrease the cable rate. In a couple of years the rate between Canada and Great Britain, and all the colonies, will be much cheaper.

The following statement is appended to the May report of the Sao Paulo Company, Brazil: "The company has recently reduced its rates for electric light and power, and has also reduced the tramway rates by abolishing double fares on all lines on which two fares were charged, so that, at the present time, the entire system is operated under one fare. These changes in rates naturally affect the income slightly, but it is expected that very soon the effect of these reduced rates will materially increase it." W.

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IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

NEW CALIFORNIA LIGHT AND POWER COMPANY INCORPORATED—Articles of incorporation have been filed for a $30,000,000 gas and electric company, designed to control all the gas and lighting plants in southern California. W. B. Cline, of the Los Angeles Gas and Electric Company, is president of the new concern.

POWER FOR NORTH CAROLINA TOWNS—The Burgrahaw Traction Company, capitalized at $3,100,000, which is connecting the three milling towns of Burlington, Graham and Haw River, N. C., with an interurban electric line, has begun work on a power plant on the Haw River. The development is capable of furnishing 20,000 horsepower, but the full capacity will not be sought in the first construction. The company will also furnish electricity for domestic and municipal lighting in the towns named.

PROPOSED PENNSYLVANIA TELEPHONE COMPANY—On July 7 application will be made at Harrisburg, Pa., for a charter for the National Telephone and Telegraph Company. Keystone Telephone Company interests will be strongly represented in the new company, which, at a cost of $1,000,000, will construct a long-distance telephone line from Philadelphia to the Ohio line. Similar companies will be organized in other states to carry the independent long-distance line west to St. Louis, where it will connect with the independent system of that city.

WESTCHESTER LIGHTING COMPANY—The New York Public Service Commission, Second District, has given its consent to the Westchester Lighting Company to purchase all the $804,000 capital stock of the Northern Westchester Lighting Company, and all the $500,000 common stock of the Peekskill Lighting and Railroad Company, for $505,000, and $75,000 of its six per cent cumulative preferred stock, at $75,000; also $90,000 of the first consolidated mortgage bonds of the Northern Westchester Lighting Company, at $81,000. The commission states that, in its opinion, the turning of the control of these companies over to the Westchester Lighting Company will result in superior facilities. The Westchester Lighting Company is authorized to issue $580,000 five per cent first collateral trust bonds, to mature in ten years from date. The proceeds are to be used for acquiring the stocks authorized to be transferred to it by the Northern Westchester Lighting Company and the Peekskill Lighting and Railroad Company.

LIGHTING AND POWER.

(Special Correspondence.)

MONETT, ARK.—The Monett Lumber Company will install an electric-light plant.

ROUND-UP, MONT.—James U. Gridley is seeking an electric-light plant franchise here.

CARTHAGE, S. D.—H. B. Potter has applied for a twenty-year franchise for an electric-light plant.

MINNEAPOLIS, MINN.—The Pike Electrical Company has increased its capital from $50,000 to $100,000. C.

EL PASO, TEX.—An addition is to be made to the power plant of the municipal electric-lighting plant.

TEMPLE, TEX.—The Temple Electric Light Company has been incorporated with a capital stock of $5,000.

CENTRAL CITY, NEB.—This city is to vote on the proposition to establish a municipal electric-light plant.

MONTPELIER, IND.—The B. W. Smith Company has incorporated to manufacture and deal in electrical supplies. S.

CALVERT, TEX.—The Calvert Water, Ice and Electric Light Company will erect an addition to its plant, to cost $40,000.

MOUND CITY, MO.—The Mound City Electric Light and Ice Company has been incorporated with a capital stock of $25,000.

QUINCY, ILL.—The Illinois Soldiers' and Sailors' Home of this city is in the market for a complete electric-lighting plant.

MILTON, ORE.—Bonds to the amount of $15,000 have been issued in this city for improving the municipal light and power plant.

SAN JOSE, CAL.—The board of supervisors of this county will on July 12 open bids for an electric conduit system applied for by the Los Gatos Ice, Gas & Electric Company of Los Gatos, Cal.

SAN FRANCISCO, CAL.—The Mountain Water Power Company has been incorporated here with a capital stock of $1,000,000 by J. T. Stanton, W. H. Barrows, J. C. Irvine, W. P. Barry and W. H. Phelps.

WINCHESTER, VA.—The Virginia Woolen Company has begun the construction of an addition reported recently. The company will install woolen machinery and electric motors of fifty horsepower at a cost of $8,000.

PORTALES, N. M.—Citizens of this town have been working assiduously to obtain a governmental power plant of $300,000 value, in or near Portales, the power from this to be conducted to individual pumps for general irrigation.

SAN FRANCISCO, CAL.—The directors of the Mojave Water and Power Company of San Francisco have called a stockholders' meeting for August 11 to take action on a proposition to create a bonded indebtedness of $15,000,000.

TACOMA, WASH.—It is reported here that C. A. Stone, of the Stone-Webster Company, is investigating the Lake Tapp region with a view to putting in a power plant near Sumner, Wash., with approximately 100,000 horsepower capacity.

NEVADA CITY, CAL.—Civil Engineer Edward C. Uren of this city and a corps of assistants are now in the field of the Middle Yuba River, below Graniteville, making the survey for the proposed electric plant to be installed by Dr. A. G. Wickell. U.

SANTA PAULA, CAL.—The Board of Trustees of this city has passed a resolution authorizing the president and secretary to sign a contract with the Ventura County Power Company for a new tungsten lighting system to be installed immediately.

TRENTON, N. J.—The Eastern Light and Fuel Company, of Camden, N. J., has been incorporated to generate electricity for light, heat and power; capital, $200,000. Incorporators: W. B. MacDonald, Camden; W. E. Stokes, B. L. Van Schaick, Philadelphia.

TOLEDO, OHIO—The electric lighting plant at West Liberty, Ohio, has been sold to Arthur Hartzler of Bellefontaine, who, it is said, will operate it under private ownership in the future. It is understood that the consideration paid was $10,000. H.

PROSSER, WASH.—Manager Harry Benson, of the Prosser Power Company, announces that a stone power house will be erected by the company at once at the Prosser Falls of the Yakima River. In this two units of 500 horsepower will be installed.

NEW YORK, N. Y.—Secretary of Commerce and Labor Nagel made an inspection trip recently to the immigration station of Ellis Island, when he discussed with the commissioner plans for the erection of a new $80,000 electric lighting plant at the station.

MASON CITY, IOWA—A scheme for harnessing the waterpower of Lime River, at Portland, and the Shell Rock, at Nora Springs, to furnish power for the production of electricity in the operation of an interurban line between this city and Rockford, Ia., is being considered. Both local and foreign capital is interested.

LOS ANGELES, CAL.—The Los Angeles Aqueduct Commission has asked for an appropriation to cover preliminary expenses in the erection of hydroelectric power plants along the Owen's River Aqueduct now under construction. The expenses specified include the drawing of plans and the inspection of modern plants and machinery.

BANGOR, ME.—The Bridgewater Electric Company has been organized at Bridgewater, for the purpose of maintaining an electric-light plant in the town of Bridgewater, Me., with $10,000 capital stock. Officers: President, James H. Farley, of Bridgewater; treasurer, Judson C. Burt, of Bridgewater. Certificate filed June 4, 1909.

AINSWORTH, NEB.—The Ainsworth Light and Power Company has just been formed. It is already at work on the installation of a plant for furnishing light and power. A dam is to be built at Plum Creek, fourteen miles from town, and something over 400 horsepower will be developed. The capital stock of the company is $60,000.

OAKLAND, CAL.—The Oakland Light & Power Company, recently incorporated here with a capital stock of $1,250,000, began work on June 14 on its power plant at the corner of First and Alice streets. The new plant is to be equipped with machinery to develop 25,000 horsepower and is planned to be ready by January 1, 1910.

MONTPELIER, VT.—The Vermont Lighting and Power Company is erecting a 500-horsepower Corliss engine at the Viles plant, which will be connected with a 350-kilowatt Westinghouse generator. During the low water last year, the company was 400 horsepower short in furnishing power, and this auxiliary will care for the additional load.

DENVER, COLO.—A syndicate composed of the holders of the $900,000 worth of bonds of the Lacombe Electric Company, headed by Emerson McMillan, who resigned as chairman of the board of the Denver Gas and Electric Company a short time ago, is being organized to look after the interests of the holders of these bonds. A protective committee has been formed and is now seeking to get in touch with these security holders. Emerson McMillan is apparently entirely out of the Denver company and it is claimed that he has sold all of his holdings. It was

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denied, however, that there had been any break between the Doherty and the McMillan interests and that his retirement was because he could not be with both companies in the fight which may develop over the Lacombe bonds.

WALLA WALLA, WASH.—Plans for a new $100,000 power plant and substation, and for a $30,000 office building and depot, were announced to-day by officers of the Northwest Corporation, the holding company for the local electric company, and the Walla Walla Valley Traction Company. Work on these buildings is to commence immediately.

GREENVILLE, S. C.—Arrangements are being made, it is understood, by the management of the Monaghan Mills, for the driving of the plant by electricity, although the change will not be made for some time. The large Cooper-Corliss cross-compound engine now in operation at the plant will be used for emergencies after the installation of electricity.

DENTON, MD.—The managers of the new electric-light plant here, Henry C. Hawkins, formerly with the Consolidated Gas and Electric Company, of Baltimore, is now wiring dwelling and business places in town and installing street lights. Electricity will take the place of acetylene gas in Denton streets and the thoroughfares will be lighted all night every night in the year.

LITTLE ROCK, ARK.—The Garland Power and Development Company, with offices at Hot Springs, has filed articles of incorporation with the secretary of state. The capital stock is $1,500,000. The company has been formed for the purpose of building a dam across the Ouichita River in order to generate waterpower to be supplied to Pulaski, Saline, Garland and Hot Springs counties.

SAVANNAH, GA.—The increased demands for a greater output by the Savannah Electric Company, of this city, in the lighting line has forced the company to arrange for doubling the capacity of its present plant. A new turbine from the Allis-Chalmers Company has been ordered, while other new machinery will be installed, beginning July 1. Many extensions have already been made this year.

FULTON, N. Y.—The Oswego County Light and Power Company has been authorized by the Second District Public Service Commission to increase its capital from $100,000 to $1,000,000 and to issue a mortgage on its properties not exceeding $4,000,000, to secure a bond issue of that amount. The company will develop Salmon River Falls, near Pulaski, and furnish electricity for Syracuse and other points.

MINNEAPOLIS, MINN.—Commencing July 1, the Minneapolis General Electric Company announces reductions in its rates of seventeen per cent on residence lighting; ten to seventeen per cent on commercial lighting and fifty per cent on minimum power rates, to those of its customers who are not in arrears. The company makes the reductions in order to induce the Council to repeal the ordinances of 1907, which declared the five franchises of the company void, and also to induce those customers who have refused to pay their bills in the last two years, except at the rates fixed by the 1907 ordinances and which rates the company declines to accept, to pay up. C.

BIRMINGHAM, ALA.—The Chattanooga and Tennessee River Power Company, the corporation that is building the 50,000-horsepower electric plant at Hale's Bar, where the great lock and dam is being erected under the auspices of the United States government, has filed an application for an increase of its capital, by charter amendment, from $3,500,000 to $5,000,000. Because of the need of more capital to complete the plans of the company this action was determined on at a meeting of the stockholders and directors a month ago. The board of directors signed the application for amendment. They are R. H. Williams, James C. Brady, A. E. Brady, C. E. James and George D. Lancaster.

INDIANAPOLIS, IND.—A score or more of locomotive engineers gave the Indiana Railroad Commission their unqualified indorsement of the twenty-candlepower oil lamp now in use, and condemned strongly the use of electric headlights on locomotives, at the second conference held before the Commission, June 11. The engineers who had had experience with high-power locomotive headlights stated that the intense rays of light blinded them to an extent that they were unable to read signals either approaching or riding behind the electric lights; that their use endangered the lives of employes and of the traveling public. Tests will be made by the Commission and another conference held June 29. S.

LEWISTON, ME.—The Union Water Power Company has secured control of the waterpower privileges of the International Paper Company on the Androscoggin River for a distance of six miles, between what is known as the Babbitt and Googin dam and the Turner Center bridge. Between these two points, which are from five to eleven miles above this city, there is a fall of forty-four feet and it is capable of developing over 10,000 horsepower. The company will build a concrete dam and an electrical power station and will transmit the power to Lewiston for the mills, which are largely increasing their capacity, and for another new mill to be built here. This development will about double the available power for the cotton mills of this city.

PHILADELPHIA, PA.—The properties and franchises of the Philadelphia, Bristol & Trenton Street Railway Company, a subsidiary of the Interstate Railways Company, will be sold at public sale within the next thirty days, the upset price being $200,000 under a decree of foreclosure entered by Judge Stout at Doylestown, Pa. The property has not earned the interest on its $650,000 first-mortgage five per cent bonds for years, and the Interstate management decided last fall that this property was a drag on the holding company, so defaulted the interest due September 1, 1908, on the bonds. It has outstanding $1,000,000 stock, a majority of which is owned by the United Power and Transportation Company.

DENVER, COLO.—Negotiations conducted for several months are understood to have culminated in a contract with the Colorado Central Power Company to furnish for the famous Georgetown loop of the Colorado & Southern. It is the initial undertaking for the electrification of steam roads in Colorado, and is to be followed, it is stated, with arrangements for converting other lines of the Colorado & Southern into electric roads. The Georgetown loop has for years been a popular one-day excursion ride out of Denver. Its sharp curves and stiff grades have made operation difficult, and yet gained fame for the line. It is one of the few narrow-gauge roads still upon the railroad map over which many specials are run.

BOISE, IDAHO—L. W. Glass, who is in charge as superintendent of the Shoshone Falls power plant and also of all electrical installation and operation for the Kuhns, who recently spent a short time in Boise, is authority for the statement that an additional unit of 1,800 horsepower is to be installed at the falls. The present production is 850 horsepower. Ground is now being cleared and a camp established at Little Salmon Falls, where a plant is to be established by the Kuhns to generate 30,000 horsepower. This power will be used in the construction work on dams and canals for the various undertakings of the Pittsburg men on the Carey tract segregations and will be sold at the various towns on the tract.

DOTHAN, ALA.—D. G. Zeigler & Company, of Jacksonville, Columbia, S. C., and Atlanta, propose to develop 4,300 horsepower at the Abbey Creek in Henry County, twenty-two miles from here, and furnish power for Dothan, Headland, Abbeville, Eufaula and all other towns within a radius of sixty miles. They have secured the site for their power plant, and if the right kind of a deal is made with the city, they are prepared to go to work immediately. The firm of D. G. Zeigler & Co. now have fourteen different contracts of this kind under way, and are big contractors in this line of work. The present jobs represent the expenditure of something like $20,000,000, scattered over South Carolina, Georgia, Florida and Alabama.

BIRMINGHAM, ALA.—Two new power and mill concerns are to operate in this state. The Abbeville Power and Manufacturing Company, of Abbeville, has been incorporated with a capitalization of $500,000. Its purpose is the development of a waterpower plant with electrical transmission for a cotton mill which is to be established. J. L. Pollard and C. J. Owens are the principal promoters. The other enterprise will be incorporated as the Geneva Power and Manufacturing Company, also with a $500,000 capitalization. It will be a hydroelectric plant to operate a cotton mill planned by the concern and to furnish power to others. D. O. Vaughan, D. G. McInnis, D. H. Morris and A. M. McKinnon are the projectors.

SPOKANE, WASH.—The Northern Idaho and Montana Power Company, which recently took over the electric light and power plants and sites at Sandpoint and on Moyle River, formerly controlled by J. L. Drumheller of Spokane, has purchased the entire plant and business, including local telephone and water service, from the Kalispell Water and Electric Company at Kalispell, Mont., on which they have held an option for sixty days. The purchasing company is a big concern with capital stock of $10,000,000 and does business in several states. It recently purchased the Big Fork power plant of the Flathead Valley Water Power Company and the deal just consummated places that plant and the local light and telephone plant under one management.

CHARLOTTE, N. C.—Dr. W. G. Wylie, of New York, president of the Southern Power Company, of Charlotte, the largest electro-hydraulic development company in the South, states that according to the estimates of engineers the new development of the Wateree River, near Camden, S. C., will furnish 100,000 horsepower, much more than had been expected by the first estimate. The preliminary surveys are being completed and the actual structural work will begin as soon as possible. When the Wateree development is completed the Southern Power Company will establish an office at Columbia for the South Carolina district, which will have at its disposal more than 100,000 horsepower, the office at Charlotte then to control a somewhat smaller amount.

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ELECTRIC RAILWAYS.

(Special Correspondence.)

NIAGARA FALLS, ONT.—The Niagara, St. Catharines & Toronto Railway has at last completed negotiations whereby the line will be extended from Welland to Port Colborne, eight miles. This will put the latter port, which is on Lake Erie, in direct trolley communication with this city. The work will be completed by August. The company last year extended the line from Thorold to Welland, but no further work was done and since then arrangements have been under way whereby the shore of Lake Erie might be tapped via Port Colborne.

MILLVILLE, N. J.—Capitalists are considering plans to build an electric railroad by a short route to Port Norris. The survey has been made and the work will start at once. The route will be from Millville due south to Haleyville, where it will connect with the West Jersey & Seashore Railroad direct to Port Norris and Bivalve. The line will carry both passengers and freight, and will be several miles the shortest possible route between the great oyster centers and Camden. To complete this work it will be necessary to lay less than seven miles of track.

GOSHEN, N. Y.—Although the Rockland Railroad Company's lines of electric railway exist only on paper as yet, the company is desirous of extending its proposed system from these six miles originally contemplated, and has applied to the Public Service Commission for permission to make extensions from Sparkill to State Line, Nyack, New City, Congers, West Haverstraw, Haverstraw, Stony Point, Suffern, Nanuet and Pearl River. The increased mileage by reason of these additions to the road would be thirty-four miles and the estimated total cost $2,982,000.

OLYMPIA, WASH.—Walter Christian, of Tacoma, attorney for the Harriman roads, has filed with the secretary of state articles of incorporation of the Peola & Snake River Railroad & Navigation Company, with $400,000 capital, headquarters at Tacoma, and Ed. M. Lakin, W. H. Carey and J. F. Murphy, of Tacoma, as incorporators. The announced purposes are to build and operate a railroad from the junction of Dead Man's Hollow and the Snake River, in Garfield County, thence easterly along the valley to its head, and thence southerly to Peola, Garfield County.

WORCESTER, MASS.—Agreements have been executed whereby the Worcester & Blackstone Valley Street Railway Company purchases the franchise and property of the Uxbridge & Blackstone Valley Street Railway Company. The Worcester & Southbridge Street Railway Company agrees to purchase the Hartford & Worcester Street Railway Company. These consolidations of four lines under two heads which are closely related are subject to approval by the Railroad Commission. The merger would connect the pieces of two continuous lines south and southeast from Worcester.

RUSHVILLE, IND.—Rushville is to have another traction line. The project is being pushed by a New York bonding house and has been considered by them for over three years. It has planned to run the tracks with a northern terminus at Shirley, parallel with the Big Four Railroad to Knightstown, thence in a southeastern direction, and take in the Soldiers' and Sailors' Orphans' Home, and back southwest to Carthage. Then it will be run alongside the Big Four to this city, Rushville being the southern terminus for a time, until an extension is made on south to Andersonville and Brookville.

CLAREMORE, OKLA.—The mayor ordered all business houses to close one day last week until a bonus of $25,000 was raised for the Cherokee Belt and Interurban Railroad, and as a result the bonus was practically raised in a few hours. This is a proposed road extending from Pryor Creek on the M., K. & T. Railroad on the east to the town of Skiatook on the Midland Valley Railroad on the west, being about forty-three miles in length and connecting five trunk line railroads—the M., K. & T. at Pryor Creek, the Missouri Pacific and Frisco at this place, the Santa Fe at Collinsville and Midland Valley at Skiatook.

VANCOUVER, B. C.—An enterprise originated by local capitalists who have secured the financial support of the Earl of Aberdeen, viceroy of Ireland, and owner of the famous Coldstream ranch near Vernon, is to be started shortly. It is the construction of 100 miles of electric railway, tapping the principal fruit-growing centers on both sides of the Okanaqan Lake. The new company was incorporated by special act at the last session of the provincial Legislature. The proposed line is expected to greatly aid the rapid collection of fruit at Vernon, where it is intended to make a large fruit exchange.

ALBANY, N. Y.—The Public Service Commission has authorized the Rockland Railroad Company to construct and operate its line in Rockland County and to exercise franchises in the villages of Piermont, Grand-View-on-Hudson, Nyack, South Nyack, Haverstraw, West Haverstraw, Spring Valley and Suffern, and in the towns of Clarkstown, Stony Point, Orangetown and Ramapo. A franchise has also been received from the County Board of Supervisors. The permission given will enable the company to construct trolley lines throughout the greater part of Rockland County. There are no trolley lines in that county at present.

BELLINGHAM, WASH.—It is stated here that the Canadian Pacific Railway plans to build a line from its main road in British Columbia, over the Cascade Mountains, down the Skagit Valley to Anacortes and ultimately to Seattle. The big power plant being built by the Skagit Power and Development Company on the Skagit River, the proposed line of the Anacortes, Sedro-Woolley & Eastern and the line of the Puget Sound & Baker River Railway, which will be converted into an electric road, are all properties of the Canadian Pacific.

ALLENTOWN, PA.—At a special meeting the stockholders of the Lehigh Valley Transit Company have voted to spend practically $1,000,000 for improvements to the system, largely for a belt line in Allentown. The increase of indebtedness was from $7,600,000 to $9,000,000. Favorable action was taken on the proposition, and President R. P. Stevens will now be in a position to bring the Transit system to a higher state of efficiency than ever before. About $500,000 will go to pay outstanding notes, while the rest is to be expended in improvements, including the Allentown extensions, track repairs, higher power and new rolling stock.

SEATTLE, WASH.—Stockholders and bondholders of the Alaska Central Railway Company, represented by the Bellaire and Frost factions, have settled their differences. R. D. Miller, of Spokane, has been elected president, with other officers and directors as follows: Vice-president, G. R. Sanborn; secretary-treasurer, James H. Haight; directors, former United States Senator George Turner, R. E. W. Strickland, L. Roy Slater and G. W. Dickenson. The new officers will endeavor to pay a bonded indebtedness of $3,000,000 and repair the line, extending it twenty miles to Turnagain Arm. The line is completed from Seward to mile fifty-six.

TAUNTON, MASS.—The railroad commission is considering the advisability of authorizing the issue of new bonds for extensions and improvements by the Boston & Northern and the Old Colony Street Railway companies, both roads having submitted statements as to their plans. The Old Colony would issue $275,000 in bonds, to be spent for new equipment, duplicate transmission line between Brockton and Fall River, underground conduits for feed wires in Brockton, a telephone line between Taunton and Fall River, and a new power station and paint shop in Fall River. The Boston & Northern wants to issue bonds to the value of $536,000.

HARTFORD, CONN.—The Legislature has taken action on several trolley charter propositions. In the House the charter of the Danbury & Bethel Street Railway Company was amended in regard to extensions desired by the company, and the New London & East Lyme Street Railway Company's charter was amended so as to permit this company to build westerly from Niantic through East Lyme and Old Lyme to the Connecticut River. In the Senate the charter of the Meriden, Middletown & Guilford Company, which has not yet built, was extended for two years, from July 1, instead of to November 1, 1910, as has been the rule of the joint committee on railroads this session.

JERSEY CITY, N. J.—The Public Service Corporation of New Jersey has purchased the Apgar homestead in Jersey City. It is generally believed that the land, for which the Public Service Corporation paid $31,000, will be used for the purpose of erecting a depot near the station that will be constructed in Hudson City when the Hudson & Manhattan Railroad Company has completed the tunnel from the Pennsylvania Railroad depot at Newark. The Pennsylvania Railroad has authorized the tunnel company to construct a tunnel underneath its tracks through Railroad avenue to Summit avenue, from which point the electric trains when in operation will use the present tracks to the new Harrison terminal.

WATERTOWN, WIS.—The new electric line of the Milwaukee & Western Electric Railway Company between Milwaukee and Beaver Dam now seems an assured fact. The construction of the line will begin this fall. This was announced at the annual meeting of the stockholders, held recently in Milwaukee. The contract for the work was awarded to the Chapman Construction Company, of Chicago. Officers have been elected as follows: Valentine Zimmermann, Milwaukee, president; Alvin P. Kletsch, Milwaukee, first vice-president; Richard Roll, Hustisford, second vice-president; J. W. Barber, Milwaukee, secretary; W. E. Elliot, Milwaukee, general manager, and H. L. Janzer, Milwaukee, treasurer.

TACOMA, WASH.—The $5,000,000 mortgage given by the Pacific Traction Company, recently filed, means the beginning of work on the part of a street-car line to carry out plans outlined several years ago, when the company obtained franchises here. The first work will be double-tracking of the present line to the baseball park. This will be followed by other lines over streets where the company has franchises. It is the announced purpose to get down on Pacific Avenue and out that way to South Tacoma, making two lines of its own to the south end of the city. Other lines will go to Point Defiance and Bismarck. The Pacific Traction Company will also build an interurban line from South Tacoma to Olympia and Grays Harbor.

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TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

MILFORD, IOWA—The Midland Telephone Company has increased its capital stock to $50,000. C.

LA WARD, TEX.—The Bay Telephone Company has been incorporated with a capital of $1,200.

CORNING, IOWA—The Middle Valley Mutual Telephone Company will rebuild its entire line.

GRINNELL, IOWA—The Interior Telephone Company will expend $20,000 to $30,000 in improvements.

MARFA, TEX.—The Marfa Power Company has been succeeded by the Marfa Telephone Company.

FLORENCE, OKLA.—The Boone Telephone Company has been incorporated by C. E. McIntosh and others.

TERRY, MONT.—The Co-operative Telephone Company has been organized, with a capital stock of $40,000.

COLUMBUS, OHIO—The Flushing Telephone Company has increased its capital stock from $50,000 to $75,000.

WAVERLY, S. D.—The Waverly Farmers' Telephone Company has been incorporated with a capital stock of $25,000.

BRITT, IOWA—The Hancock County Telephone Company will purchase the Western Electric Line and will extend it to Crystal Lake.

BAKERSFIELD, CAL.—The Kern Mutual Telephone Company has been awarded a franchise along certain public highways in this county.

ELY, NEV.—At a meeting of the directors of the White Pine Telephone Company last week it was decided to reconstruct the line from Ely to the mines.

NEW BEDFORD, MASS.—At a recent meeting of the directors of the Automatic Telephone Company, in this city, it was voted to increase the dividend on the common stock to seven per cent.

COLUMBUS, GA.—The City Council has approved the purchase of the local Automatic Telephone Company by the Southern Bell Telephone Company, and the consequent merger of the two systems.

OROVILLE, CAL.—The Pacific States Telephone Company has announced plans for expending $10,500 on its telephone system in this city. A new long-distance line will be also built between Marysville and this city.

HARRISBURG, PA.—A charter has been issued here for the West Shore Telephone Company to run lines from Lemoyne, Cumberland County, to Camp Hill and Carlisle, New Cumberland and York, Enola and New Bloomfield and this city.

TOPEKA, KAN.—The Independent Telephone Company announces the completion of its copper toll lines to Wichita, Hutchinson, Newton, Kingman and territory. The service to these cities will be the very best and gives connections with thousands of telephones not reached heretofore.

SAN FRANCISCO, CAL.—Under the direction of Master Electrician George Hanscom, the Navy Department this week began the reconstruction of the wireless plant on the Farallon Islands. A number of new instruments will be installed, increasing greatly the efficiency of the plant.

FORT WAYNE, IND.—The Citizens' Home Telephone Company has entered upon the work of constructing a new circuit toll line connecting a number of independent systems in Indiana and Ohio. When completed the toll-line service will be accessible to a large number of telephone patrons. S.

OAKLAND, CAL.—The Home Telephone Company announces that six miles of cable, weighing 600,000 pounds and costing $30,000, to be used in connecting Oakland with San Francisco, has been turned over to the telephone company by the Oakland manufacturers. Preparations are now being made for laying the cable.

BEATRICE, NEB.—The Lincoln Telegraph and Telephone Company will expend $50,000 within the next sixty days in improving and extending the lines of the New Home Telephone Company, which it recently purchased. A preliminary survey of the proposed improvements has been made in southern Gage County.

HARRISBURG, ILL.—Chas. V. Parker, secretary and treasurer of the Saline County Telephone Company, has returned from Murphysboro, where, at a meeting of the officials of the several principal telephone companies operating throughout the large territory extending from Harrisburg south, and practically trunking the cities and towns of the down-state, a merger was completed last week. The Murphysboro Telephone Company acquires the management and control of the whole. By vote of the stockholders the capital stock of the home company was increased from $10,000 to $50,000, in order that the merger could be perfected. The companies that figure in the merger are Carterville Herrin Telephone Company, Saline County Telephone Company, Ava and Southern Illinois Telephone Company and Johnston City Telephone Company.

DALLAS, TEX.—Formal statement has been made that the Independent Telephone Company of Dallas has let the contract for a new system capable of accommodating 35,000 subscribers, and that the cost is to be $1,200,000. A site for the exchange has been purchased and conduits have been laid on the principal streets.

INDIANAPOLIS, IND.—The Indiana State Tax Board has decreased the value of the Central Union Telephone Company's property in the state $600,000 and increased the value of the Indianapolis Telephone Company and the New Long-Distance Telephone Companies in the aggregate $120,000. The decrease is due to the surrender of a number of fields to the independents. S.

FRANKFORT, KY.—The Home Telephone Company has purchased a franchise from the city to conduct a telephone exchange in this city in conformity with the ordinance recently passed by the Council regulating telephones and fixing the maximum price at $2.50 for business houses and $1.50 for residences. The franchise was purchased by Attorney Guy Bridge for the Home Company.

INDIANAPOLIS, IND.—The New Long-Distance Telephone Company is installing an additional toll circuit on its poles between this city and Terre Haute. When completed Terre Haute will have superior toll-line facilities with Indianapolis and the Eastern points. This company connects with the Citizens' Telephone Company of Terre Haute, which is connected with a score of rural lines in Vigo and adjoining counties whose patrons enjoy the toll-line service which this outlet affords. S.

BREMERTON, WASH.—The Pacific Telephone Company is about to lay a new submarine telephone cable between Alki Point and Restoration Point, connecting Seattle with Bremerton and other points on the west side of Puget Sound. The old cable across the sound has been damaged. Two reels, each containing 8,250 feet of ten-pair steel-armored submarine cable, are to be used. Each reel weighs sixteen tons and is fifteen feet in width and ten feet in height.

TOLEDO, OHIO—The Toledo Home Telephone Company is about to construct its first branch exchange on the west side at a cost of $40,000, work to begin in the near future. It will be equipped with an automatic switchboard with a capacity of 1,000 telephones, and will be the first automatic switchboard in this territory. In addition to deciding on this the directors at their meeting held this week declared the usual quarterly dividend of 1½ per cent, payable to stockholders of record on July 20. The company reports 600 additional subscribers during the months of May and June. H.

BRAZIL, IND.—A deal that has been on for some time has been closed by which the Citizens' Telephone Company, of this city, has purchased the property of the Central Union Telephone Company for the sum of $52,000. For a time both lines will be operated independently, but as soon as it is possible to make the change both lines will be merged into one exchange, which means that the large number of citizens now having both phones can have their Bell phone taken out. The purchase includes all of the telephones of the county, but the Central Union retains its long-distance service and wires.

OKLAHOMA CITY, OKLA.—Unable to handle the outside telephone business of Oklahoma City with only one system over the main line of the M., K. & T. Railroad, which does not pass through this city, H. C. Wilson, of New Yrok, general superintendent of the American Telephone and Telegraph Company, has completed negotiations for construction of another circuit over the Santa Fe line from Dennison or Gainesville, Tex., to Newton, Kan., via Oklahoma City. The coming of the packing plant to the city had much to do with the final decision, which means the expenditure of nearly a half million dollars in the state of Oklahoma alone.

PITTSBURG, PA.—Pennsylvania, West Virginia and New England capital is behind the National Telephone Corporation, of Pittsburg, chartered in Charleston, W. Va., capitalization $15,000,000, which will work in harmony with a similar syndicate in the West, headed by St. Louis men, in pushing a network of long-distance independent telephone lines across the Continent. The new corporation is designed to handle the entire long-distance service of the independent lines east of Chicago. West of Chicago the toll lines will connect with those of the western syndicate, which has control of the extreme northern field, including Michigan and Wisconsin. At the head of the new company chartered at Charleston is John A. Howard, of Wheeling, who was elected president of the Pittsburg and Allegheny Telephone Company at the reorganization this week.

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ELECTRICAL SECURITIES.

For some time past trading on the stock exchange has been confined mainly to professionals, but strength has again been shown, even with perfunctory transactions. United States Steel has been leading the industrials in a slight advance, which has been partly shared by railway stocks. Steel common is now at about its record price. Expenditures by railways and industrial corporations alike are encouraging. If the public was in the market there would probably be a big rally.

Dividends have been declared upon the following electrical securities:

Bell Telephone Company of Missouri; the regular quarterly dividend of two per cent, payable July 1.

Boston Suburban Electric Company; regular quarterly dividend of seventy-five cents on the preferred stock, payable July 15 to stock of record June 30.

Central District and Printing Telegraph Company; a regular quarterly dividend of two per cent, payable July 31 to stock of record June 24.

Central and South American Telegraph Company; the regular quarterly dividend of one-and-one-half per cent, payable July 9 to stock of record June 30.

Consolidated Traction Company of New Jersey; a regular semiannual dividend of two per cent, payable July 15 as registered on June 30.

Knoxville Railway and Light Company; a regular quarterly dividend of one-and-one-half per cent upon the preferred stock, payable June 30; books closed June 22, 1909; also the regular quarterly dividend of one per cent on the common stock, payable June 30, 1909; books closed June 22. In addition the company has declared a special dividend of one per cent on the common stock, payable June 30; books closed June 22.

Little Rock Railway and Lighting Company; the regular semiannual dividend of two-and-one-half per cent, an extra dividend of one-and-one-half per cent on the common stock and the regular semiannual dividend of three per cent on the preferred stock, both payable June 30.

Massachusetts Lighting Companies; the regular quarterly dividend of one-and-one-half per cent and one-fourth of one per cent extra, the same as six months ago, payable July 15.

Mexican Telegraph Company; the regular quarterly dividend of two-and-one-half per cent, payable July 15 to stock of record June 30.

New York & New Jersey Telephone Company; the regular quarterly dividend of one-and-three-fourths per cent, payable July 15 to stock of record July 6.

Seattle Electric Company; a dividend of $3 per share on the common stock, payable July 15 to stock of record July 6.

United Railways Company of St. Louis; a regular quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable July 10.

NEW YORK.	June 28.	June 21.
Allis-Chalmers common	14¼	15¼
Allis-Chalmers preferred	51¼	51⅞
Amalgamated Copper	81⅜	78⅜
American Tel. & Cable	80*	80*
American Tel. & Tel.	141⅝	140⅛
Brooklyn Rapid Transit	79½	77¼
General Electric	161	160
Interborough-Metropolitan common	17¼	15⅜
Interborough-Metropolitan preferred	51⅜	44⅛
Kings County Electric	130	129
Mackay Companies (Postal Telegraph and Cables) common	80	79½
Mackay Companies (Postal Telegraph and Cables) preferred	73⅞	74
Manhattan Elevated	142½	143
Metropolitan Street Railway	23	27
New York & New Jersey Telephone	133	129
U. S. Steel common	66⅜	64¼
U. S. Steel preferred	123⅜	121
Western Union	72	72⅝
Westinghouse common	85	83
Westinghouse preferred	123*	122*

*Last price quoted.

BOSTON.	June 28.	June 21.
American Tel. & Tel.	141⅝	140¾
Edison Elec. Illuminating	248	249
General Electric	161	160
Massachusetts Electric common	12	12
Massachusetts Electric preferred	68½	67½
New England Telephone	132	132
Western Tel. & Tel. common	9¾	10
Western Tel. & Tel. preferred	86	87

PHILADELPHIA.	June 28.	June 21
American Railways	45¾	45¾
Electric Company of America	12¾	12¾
Electric Storage Battery common	52½	53½
Electric Storage Battery preferred	52½	53½
Philadelphia Electric	11⅞	11¾
Philadelphia Rapid Transit	28¼	28⅜
Philadelphia Traction	91	91
Union Traction	52	52

CHICAGO.	June 28.	June 21
Chicago Railways, Series 2	37½	36½
Chicago Subway	24	24¼
Chicago Telephone	134	132½
Commonwealth Edison	120	118
Metropolitan Elevated common	17½	19
Metropolitan Elevated preferred	50	54
National Carbon common	92	93
National Carbon preferred	117	118

NEW PUBLICATIONS.

UNIVERSITY OF ILLINOIS BULLETIN—The University of Illinois Engineering Experiment Station has issued Bulletin No. 30, which deals with the rate of formation of carbon monoxide in gas producers, and which was prepared by J. K. Clement with the assistance of L. H. Adams. The mathematical appendix was added by Prof. C. N. Haskins.

REPORT OF THE COMMISSIONER OF EDUCATION, 1908—The second volume of the annual report of the Commissioner of Education has been published by the Government Printing Office, Washington, D. C. This report is for the year ended June 30, 1908. Among interesting topics on which the second volume treats, aside from complete statistics of common and secondary schools, are reports on the work conducted by the various universities, colleges, technological and professional schools throughout the country. Among other chapters are some devoted to manual and industrial training, commercial and business schools.

PERSONAL MENTION.

WILLIAM BARCLAY PARSONS returned from Europe last week on the Kaiser Wilhelm II.

LOUIS A. LURRENNE, traffic manager of the French Cable Company, left on the La Lorraine last week for a three months' vacation in Europe.

GEORGE WESTINGHOUSE, president of the Westinghouse Electric and Manufacturing Company, has been in Pittsburg the last week making an inspection of the properties.

WILLIAM M. SMITH, formerly treasurer of the Chicago Insulated Wire and Manufacturing Company, has resigned his position with that concern to become associated with the American Insulated Wire and Cable Company, also of Chicago, Ill.

THEODORE N. VAIL, president of the American Telephone and Telegraph Company, who has returned from a trip West and Southwest, says: "There certainly is no cause for any business depression. As it looks to me the confidence necessary to a very prosperous era is rapidly returning."

ARTHUR N. DUTTON has resigned as superintendent of transportation of the Brooklyn Rapid Transit Company to become the vice-president and general manager of the Peerless Motor Car Company of New York. Mr. Dutton had no street railway experience when he entered the employ of the Brooklyn Rapid Transit Company six years ago. He is a native of Milwaukee, and only thirty-six years old.

BENJAMIN WALL has taken a position with Betts & Betts, Incorporated, electrical advertisers, New York city, as manager of the central-station department. The new position will keep Mr. Wall in close touch with the interests with which he has been long identified. Mr. Wall has recently been associated with the New York Edison Company, and before that with the Metropolitan Engineering Company, Brooklyn, N. Y.

W. A. REICHERT, for the past three years advertising manager for the Fort Wayne Electric Works, Fort Wayne, Ind., has resigned to accept a similar position with the Power and Illuminating Engineering Company, of Alliance, Ohio. This company is a commercial organization co-operating with central stations to increase the day load on their plants. Mr. Reichert's ability in this line is well known and with his aid the day-load boosters will undoubtedly achieve much deserving success.

HERBERT ALDEN SEYMOUR, editor of the *Electric City Magazine*, a publication which has labored more earnestly and successfully than any other in the single purpose of drawing the attention of the electrical world and the general public to the advantages of central-station power from its particular point of view, is to be congratulated on the snappy and appropriate—beautiful, too—front cover page for the July issue of his journal. Mr. Seymour has conducted the *Electric City Magazine* for six years—ever since it started—and makes it brighter every month. "Ad astera" is clearly his motto, and he not only reaches to them but gives them brilliancy by bringing them nearer to earth.

OBITUARY.

W. W. DUDLEY, former president of the National Fire Protection Association, died on June 9, last, at Chicago. The National Fire Protection Association has distributed an "In Memoriam" card announcing this to its members and others interested.

C. C. REYNOLDS, general manager of the Terre Haute, Indianapolis & Eastern Traction Company, died on June 26 at his home in Indianapolis, death following a stroke of paralysis. Mr. Reynolds was at one time superintendent of the Chicago & Erie division of the Erie Railroad.

ALBERT P. WATSON, who drove the first bolt in the ironclad Monitor, and for some years was on the editorial staff of the *Scientific American*, died on June 22 at his home in Elizabeth, N J. Mr. Watson founded the *Mechanical Engineer* in 1881, and continued its publication for sixteen years. He was

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for many years a member of the Marine Engineers' and Naval Architects' Association, and was a vice-president of the National Association of Marine Engineers.

SARAH J. SARGENT, the elderly sister of W. D. Sargent, vice-president of the New York & New Jersey Telephone Company, died on Saturday, June 26, at Mr. Sargent's home in Brooklyn, N. Y. The funeral services were held at 820 Union Street, Brooklyn, on the afternoon of June 29, and interment after cremation was made at Greensburg, Pa.

WALTER SCOTT HUGHES, a captain in the United States Navy, who retired from the service in July, 1905, died recently at Santa Cruz, Cal. He was fifty-seven years old. He was born in Marshalltown, Iowa, and was graduated from Annapolis in 1875. Captain Hughes wrote extensively about technical naval affairs, his most familiar work being "Electricity and Warfare."

PATRICK H. DOLAN, superintendent and a director of the Pittsfield (Mass.) Street Railway Company, died on June 25, at his home after a brief illness. With his brother, Peter C. Dolan, he owned a controlling interest in the company. The brothers, before they went to Pittsfield fifty years ago, controlled the street-railway system in New Britain, Conn. Mr. Dolan was fifty-one years of age and a native of Ireland.

ORRIN S. WOOD, one of the first builders of telegraph lines in this country, died on June 22, at his home in Turner, N. Y. He was ninety-one years old. Mr. Wood was born in Sherburne, N. Y., and became a telegraph operator in Washington in 1844. He studied telegraphy under S. F. B. Morse, and in 1845 superintended the construction of the first telegraph line between New York and Philadelphia. He opened the first telegraph office in New York city, and in the following year built a line between Albany and Buffalo. Later he became superintendent of the Montreal Telegraph Company until 1866, when he reconstructed the telegraph system northwest of Chicago. On its completion the system was sold to Jay Gould and became included in the Western Union lines. Mr. Wood retired from active business thirty-five years ago.

PROPOSALS.

ELECTRICAL SUPPLIES, BROOKLYN NAVY YARD—The Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., will receive bids until July 13 for the supply at the Brooklyn Navy Yard of 5,000 feet of lamp cord, 2,000 feet of duplex rubber-covered wire, and miscellaneous electrical supplies. Applications should be made to the Bureau for Schedule No. 1395.

POST OFFICE, BELLEVILLE, ILL.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., July 29, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Belleville, Ill., in accordance with drawings and specifications, copies of which may be had from the custodian of site at Belleville, Ill., or at the Supervising Architect's office.

POST OFFICE, HUDSON, N. Y.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., July 28, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Hudson, N. Y., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Hudson, N. Y., or at the Supervising Architect's office.

POST OFFICE AND COURT HOUSE, COUNCIL BLUFFS, IOWA—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., August 3, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension to the United States Post Office and Court House at Council Bluffs, Iowa, in accordance with drawings and specification, copies of which may be obtained from the custodian at Council Bluffs, Iowa, or at the Supervising Architect's office.

INDUSTRIAL ITEMS.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, has issued Bulletin 361, containing an illustrated article, entitled "Induction Motors in a Piano Factory," reprinted from the *Electrical Record*, December, 1908. The applications of the induction motors herein described are both typical and suggestive.

THE TUNGSTOLIER COMPANY, Cleveland, Ohio, is distributing a souvenir booklet, entitled "The Luminaries," which was specially prepared for the recent Atlantic City convention of the National Electric Light Association. This contains four art designs, emblematic of the stars, moon, sun, and the "Tungstolier," respectively.

THE WALLACE-BARNES COMPANY, Bristol, Conn., has issued Catalogue No. 5, dealing especially with all kinds of springs. This catalogue differs from the preceding one in that it includes a description of many forms of hardened and tempered washers, of which the company has recently been making a specialty, and of screw-machine products.

THE WESTERN ELECTRIC COMPANY, of Chicago and New York, has prepared a timely souvenir post card on which is shown a manifestation of the comfort obtained by the use of its electric fans in this torrid season. It also invites recipients of this card to ask for its fan motor catalogue and to request a quotation on any type of fan desired.

THE WESCO SUPPLY COMPANY, St. Louis, Mo., is distributing a series of illustrated bulletins describing Wesco transformers, alternating-current generators, induction motors, bipolar generators and motors, multipolar belted generators and motors, switchboard instruments, direct-current and alternating-current switchboards, and direct-current motors. A copy of any of these bulletins, or of the entire set, can be obtained on request.

THE NATIONAL AIR FILTER COMPANY, Chicago, Ill., manufacturing the Shaffner ozonizer, which is making such a stir among medical and electrical authorities, has been fortunate in securing, this week, Arthur D. Lord for its general manager. Mr. Lord was formerly connected with the well-known advertising firm of Lord & Thomas, of Chicago, and brings with him a reputation for straightforward and businesslike capacity which augurs well for the prosperity of the new ozonizer concern.

ADOLPHUS BUSCH, South Side Bank Building, St. Louis, Mo., announces that he has purchased the patents, patent rights, good-will, and all unencumbered physical assets of the American Diesel Engine Company, and that it is his intention to organize and finance a company in St. Louis, in the near future. In the meantime the business will be conducted in the name of "Adolphus Busch, Purchaser of American Diesel Engine Company," and will be managed by experts at the location named above.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, of St. Louis, Mo., has just published Bulletin No. 3216, devoted to bipolar ventilated motors for direct current. These machines are designed for an output of one-half horsepower and for speeds of 1,200 or 1,800 revolutions per minute. Compound motors of this type are carried in stock. Shunt wound and series motors, while not regularly carried in stock, are readily furnished to special order. These motors are wound for either 110 or 220 volts. They can also be provided with adjustable belt tighteners.

THE PACKARD ELECTRIC COMPANY, St. Catharines, Ont., has issued Bulletin 103 on large transformers for electric smelting. The 800-kilowatt transformer, for instance, is designed for primary voltages of 12,000, 11,700, 11,400, 11,100, and secondary voltages of fifty-five, sixty and sixty-five volts. Its height to the top of the leads is nearly seven feet. Among the plants for which the Packard company has supplied large installations of transformers for electric furnace service are those of Electro Metals, Limited, Welland, Ont., and the American Cyanamid Company, Niagara Falls, Ont.

THE CENTURY ELECTRIC COMPANY, of St. Louis, Mo., has published Bulletin No. 12, relating to single-phase, self-starting motors. In this bulletin there is given not only a detailed description of the motors but also a clear statement of their advantages, a complete listing of all sizes built, and nearly fifty excellent illustrations of these motors as equipped for a large number of special applications. The Century motors start as repulsion motors and when up to speed automatically become induction motors. They are arranged for operation on either 110 or 220 volt circuits, and are built for any specified frequency between twenty-five and 140 cycles.

THE AMERICAN CROSS-ARM COMPANY, of Chicago, Ill., has issued an interesting little folder on fir cross-arms. In it are clearly stated the advantages of fir for cross-arm material, among which are its great strength, freedom from knots, straightness in grain, the fact that it requires no preservative treatment, nor painting, and also its relatively light weight. In manufacturing its cross-arms the company has made use of expensive automatic machinery which insures that its material is cut to exact dimensions and turned out in as perfect condition as possible. Fir cross-arms are now used exclusively by the Bell telephone companies and the Postal Telegraph Company.

THE MACHEN & MAYER ELECTRIC MANUFACTURING COMPANY, of Philadelphia, Pa., announces that it has removed from its former location at Twelfth and Buttonwood streets to Seventeenth and Vine streets, where with greater quarters and more adequate facilities it will be better able to take care of its rapidly increasing business. The company began operations during October, 1907, and, notwithstanding the financial depression, its business has steadily grown until now it has been compelled to seek larger quarters. Among the products manufactured by the company are the well-known "M & M" specialties in the line of flush push-button switches, plugs and receptacles, pendent switches, wall cases, panel boards and cabinets. As before, M. B. Austin & Company will remain the distributers for the Chicago territory.

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RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) June 22, 1909.

925,452. BATTERY HOLDER. Seth A. Brown, Buffalo, N. Y. Filed January 6, 1908. A plate of insulating material is adapted to be attached to a wall or support and has an upturned pin at its upper part and a shorter pin at its lower part, both pins having means for attaching electric wires thereto.

925,495. REGULATING STEP SWITCH. Benjamin McInnerney, Council Bluffs, Iowa. Filed June 28, 1907. A series of unequally disposed switches within the range of the field of a magnetic circuit are adapted to be successively operated by the variation of the intensity of magnetic field which is caused by a movable member actuated by the circuit.

925,499. DYNAMO-ELECTRIC MACHINERY. Charles A. Parsons and Alexander H. Law, Newcastle-upon-Tyne, England; said Law assignor to said Parsons. Filed October 8, 1906. Means for regulating the voltage as the load increases comprise field magnets, magnetic material bridging the poles of these field magnets, a winding on this magnetic material, and means supplying alternating current to the winding.

925,539. FUSE PLUG. August Weber, Jr., Schenectady, N. Y. Filed January 16, 1909. Has means provided for ventilation.

925,549. TROLLEY HOLDING AND RETRIEVING DEVICE. John W. Woodward, Rochester, N. Y. Filed June 13, 1908. A latch device is mounted on a supporting frame and held by gravity in engagement with a slidably mounted pin attached to a helical extension ring connected with the trolley pole for holding the same in erect position, and means connected with the device and pole are provided for releasing the device as the trolley pole ascends to a certain point for removing the tension of the spring to permit the pole to lower by gravity.

925,551. RHEOSTAT. William G. Abbott, Jr., Schenectady, N. Y., assignor to General Electric Company. Filed July 3, 1907. In combination with a hollow resistance rod are controlling means comprising a revoluble ring surrounding the rod, and a number of laminated brushes mounted therein and extending radially into engagement with the rod.

925,573. TELEPHONE-EXCHANGE SYSTEM. William A. Fricke, Chicago, Ill., assignor to Monarch Telephone Manufacturing Company. Filed April 11, 1908. Describes the details of an interior telephone system.

925,575. AUTOMATIC FIRE ALARM. Hermann Furlani, Pirano, Austria-Hungary. Filed December 30, 1908. Comprises a conductive tube with insulated electric terminals projecting into each end of it, and movable conductive material normally maintained out of contact with these terminals by separated fusible masses disposed at opposite ends of the tube and fusible at different temperatures, and an invertible back plate upon which the tube is mounted.

925,594. FAULT LOCATOR FOR ELECTRIC CABLES. Walter O. Pennell and Henry L. Hoffmann, Kansas City, Mo. Filed May 8, 1908. The method of locating a fault in an electric cable conductor consists in causing a varying current to flow through the conductor by way of the fault, causing the current to induce a current in the circuit of a detecting instrument, and rendering the circuit of the instrument neutral with respect to the varying current flowing in the sheath of the cable.

925,599. ELECTROPLATING APPARATUS. John B. Russ, Shelton, and Charles H. Poland, Bridgeport, Conn., assignors to the Robert N. Bassett Company, Shelton, Conn. Filed August 19, 1908. Has a drum mounted to rotate around the cathode member.

925,606. MEANS FOR AND METHOD OF DETERMINING POTENTIAL GRADIENTS. William Stanley, Great Barrington, Mass., assignor to General Electric Company. Filed May 13, 1905. Renewed May 5, 1909. The rotor has an induced winding and the stator has a symmetrically constructed winding dissymmetrically located relatively to the rotor windings and connected to the brushes.

925,607. SYSTEM FOR GENERATING ALTERNATING CURRENTS. William Stanley, Great Barrington, Mass., assignor to General Electric Company. Filed May 13, 1905. Renewed May 5, 1909. The potential gradient of a separately-engaged exciter is complimentary to the normal potential gradient of the alternator.

925,609. MICROPHONE. Harve R. Stuart, Wheeling, W. Va. Filed March 21, 1908. Has coils for receiving the voice currents and varying the flux entering the armatures in such a way as to cause the microphone electrodes to move simultaneously in opposite directions.

925,611. BLOCK-SIGNAL SYSTEM. Robert W. Taynton, Tacoma, Wash. Filed October 19, 1908. Describes the details of an electric block-signal system.

925,612. REFINING OF STEEL IN ELECTRIC FURNACES. Otto Thallner, Bismarckhütte, Germany, assignor to the Firm of Bismarckhütte, Germany. Filed June 17, 1908. Describes the process for refining steel, comprising the steps of refining the steel to high extent in a basic-lined electric furnace and then treating the same in an acid-lined electric furnace.

925,620. VAPOR-ELECTRIC APPARATUS. Chattin Bradway, Schenectady, N. Y., assignor to General Electric Company. Filed April 4, 1904. An exhausted chamber has electrodes therein, one at least of which is vaporizable, and an auxiliary starting circuit includes an arc-producing device which is located within the chamber and operates by expansion when heated with current.

925,622. ELECTRIC RAILWAY SIGNAL SYSTEM. Charles M. Cleavland, Wausau, Wis. Filed June 4, 1908. Comprises a conducting rail having its continuity broken, inclined guides or tracks approaching the brake in the conductor and flanking the conductor, a collecting shoe adapted to the rail and including an inclosing casing adapted to engage the guides or tracks, and means for carrying the collecting devices out of contact with the rail before the shoe is elevated above the same.

925,626. APPARATUS FOR RECOVERING METALS FROM ORES AND OTHER SUBSTANCES. Léon Dion, New York, N. Y., assignor to the Americus Electro-Hermatic Company, New York, N. Y. Filed March 4, 1904. In combination with a chamber adapted to receive the fumes, gases or vapors arising from the fusion of metal, or metals, are groups of electrodes between each of which groups these fumes, gases or vapors are caused to pass, arranged within such chamber with each of these groups constructed of material active upon a different and particular metal. Means are provided for supplying a current of electricity of a different strength to each of these groups, also a vessel into which the residue of the fumes, gases or vapors is finally delivered.

925,642. FIRING MECHANISM FOR GUNS. Abner Y. Leech, Jr., Washington, D. C., assignor to United States Ordnance Company. Filed December 24, 1907. The breechblock is revoluble eccentrically to the bore of the gun and has a combined electric and percussion firing mechanism.

925,653. MOTOR-CONTROLLING MECHANISM. Luther Roberson, Sharpsburg, Ky. Filed January 26, 1909. The movement of a truck carrying the motor-driven device to or from the motor operates a lever which applies or disengages a band brake for the motor.

925,666. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE. William Stanley, Great Barrington, Mass., assignor to General Electric Company. Filed May 13, 1905. Renewed May 5, 1909. The rotor windings and stator windings are connected together and connected in multiple arc to a common work circuit, the windings being each traversed by exciting and work currents, and means are provided for causing the work currents to vary automatically the magnetization of the machine so as to produce a rising potential upon an increase in the load of unity power-factor.

925,673. ELECTRICALLY-CONTROLLED VALVE-OPERATING MECHANISM. Henry W. Zook, Easton, Pa., assignor to Ingersoll-Rand Company. Filed December 17, 1907. The operating mechanism includes a toggle lever and an electromagnet of the solenoid type having its core provided with a cam block arranged to control the movement of the toggle lever and thereby the valve.

925,708. APPARATUS FOR VENTILATING AND COOLING STORAGE-BATTERY SYSTEMS. Simon Lake, Bridgeport, Conn. Filed October 31, 1908. A fan operates in a casing connected to one end of an air duct arranged in the storage-battery compartment.

925,732. ELECTRICAL SWITCHBOARD FOR THEATRES. Charles T. Waddell, Birmingham, Ala. Filed February 21, 1906. A lighting system for theatre stages comprises a border light having vari-colored electric lamps in separate circuits, two independent multi-point switches and circuit connections controlled thereby, each adapted to control the distribution of current to the several circuits, and two independently-operative dimming devices which control the voltage of the current distributed by the switches to the circuits.

925,737. TELEGRAPH KEY. Laban Wilson, Sidney, W. Va. Filed March 11, 1908. Has a main lever, a secondary lever,

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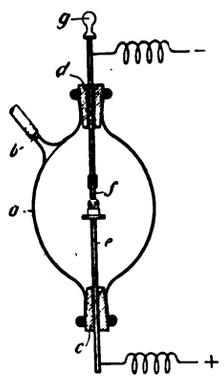
a crosspiece on the secondary lever, a yoke having members straddling the first lever, means for adjustably connecting the yoke with the crosspiece, and a stationary contact arranged in co-operative relation with the aforesaid members.

925,742. ELECTROMAGNETIC IGNITER. Charles S. Beardsley, Cleveland, Ohio. Filed August 7, 1908. In combination with an electromagnet and its armature are a vibrating contact arm and its stationary contact. The former is actuated by the armature, a permanent magnet normally opposes the electromagnet, and a separate armature therefor is normally retracted to maintain the contact in closed relation.

925,756. TELEPHONY. George C. Cummings, Western Springs, Ill. Filed July 20, 1908. Describes a system of telephony.

925,775. APPLIANCE FOR USE WITH TELEPHONE TRANSMITTERS. Edward F. Hutton, New York, and George A. Ellis, Jr., Bay Shore, N. Y., assignors to the Miniature Telephone Booth Company. Filed June 20, 1908. A telephone box or casing has means for detachably securing a portable telephone set therein, and a door secured thereto has a facial opening in it having substantially the contour of the lower portion of a person's face.



925,798.—APPARATUS FOR PRODUCING HOMOGENEOUS DUCTILE BODIES OF A HIGHLY REFRACTORY NATURE.

925,776. ELECTRIC-CURRENT REGULATOR. Herman A. Keip, Rochester, N. Y., assignor to Electro Surgical Instrument Company. Filed October 1, 1908. A cylindrical coil has one side flattened and is provided with two longitudinal series of contacts at the edges of the flattened portion, and a contact movable longitudinally of the coil is provided with two contact points to co-operate with the two longitudinal series of contacts on the coil.

925,790. INCANDESCENT LAMP. Charles C. Woodworth, Portland, Ore. Filed July 1, 1908. Has a resistance mounted in its base and an electromagnet in series with the lamp terminals and in shunt with the filament, an armature co-operating with the magnets and arranged to connect the resistance in series with the lamp terminals and in shunt with the magnet and filament, means for locking the armature in its attracted position, and magnetically operated means for releasing the armature.

925,798. APPARATUS FOR PRODUCING HOMOGENEOUS DUCTILE BODIES FROM METALS OF A HIGHLY-REFRACTORY NATURE. Werner von Bolton, Charlottenburg, Germany, assignor to Siemens & Halske, Aktiengesellschaft, Berlin, Germany. Filed September 29, 1905. A device for fusing highly refractory metal consists of an exhausted air chamber and a pair of electrodes of highly refractory conducing material located therein, one of these electrodes being provided with means for supporting a powder of the metal to be acted upon and the other with means for adjusting it relatively to the first electrode.

925,806. APPLIANCE FOR USE WITH TELEPHONE TRANSMITTERS. Orrin H. Goodrich, Castleton Corners, N. Y., assignor to the Miniature Telephone Booth Company. Filed September 14, 1908. An inclosing casing or box for a portable telephone transmitter is provided with a circuit-changing lever, and a circuit-changing arm exterior to the box and attached to a shaft journaled in one side of the box is adapted to support the receiver. Mechanical connections inside the box are adapted to actuate the circuit-changing lever.

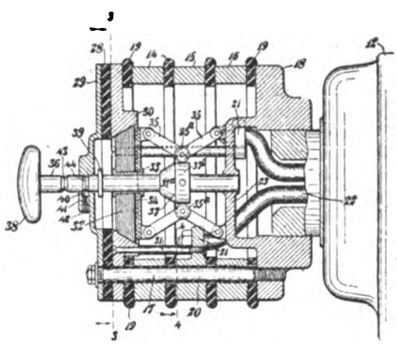
925,808. LIGHTING ATTACHMENT FOR GASEOUS-FUEL BURNERS. Charles E. Heft, Portland, Ore., assignor of one-half to Lettie B. Markham, Grand Rapids, Mich. Filed June 5, 1908. An electric contact is carried by a crankshaft and a second contact is pivotally supported in the path of movement of the first contact.

925,823. SHIELD FOR CIRCUIT-WIRE CONNECTIONS. Thomas E. Murray, New York, N. Y. Filed September 2, 1908. Comprises a block with lugs on it having openings and circuit conductors entering the openings in the block, a detachable tubular shield inclosing the conductors and surrounding the block openings, and a locking rod passing through the openings in the lugs and an arm on the shield.

925,830. MULTIPLE-CLUSTER-LAMP RECEPTACLE. Frank S. Ober, New York, N. Y. Filed February 26, 1909. Has an insulating base and two metallic plates supported respectively on the upper and lower faces of the base, the upper plate being formed with integral curved corrugated extremities constituting threaded shells and the other having center contacts.

925,838. CIRCUIT-BREAKING DEVICE. Edward L. Rancourt, Waterville, Me. Filed November 11, 1908. Describes the details of a spark timer for internal-combustion engines.

925,884. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE. Bernard Elshoff, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed November 30, 1906. Has means for short-circuiting the collector rings comprising contacts fixed relative to the rings and conductively related thereto, and an axially movable contact is adapted to engage these relatively fixed contacts; also means for shifting the axially movable contact which comprise a toggle mechanism connected thereto and located within the rings, and a manually movable device in operative relation to the toggle mechanism.



925,884.—ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE.

925,887. AIR DRIER FOR STATIC ELECTRIC MACHINES. Mont R. Farrar, Greensboro, N. C. Filed June 29, 1908. Consists of a non-conducting outer shell having a removable door, a refrigerant receptacle contained therein, means for forcing a fluid medium through the shell, and a duct at each end of the shell communicating with a compartment whose air is to be dried.

925,902. ELECTRIC KILN. John L. Harper and William J. Larkworthy, Niagara Falls, N. Y.; said Larkworthy assignor to said Harper. Filed October 7, 1907. Renewed May 18, 1909. Consists of a tunnel divided into a longitudinal series of chambers, with means for electrically heating an intermediate chamber, and two trains or trucks movable in opposite directions through the tunnel, each chamber receiving two trucks and permitting the unrestricted flow of heat between the contents of the trucks.

925,925. TELEGRAPH TRANSMITTER. Charles W. Leiser, Salt Lake City, Utah. Filed January 29, 1909. A spring is provided for biasing an oscillatory armature arranged with its axis between the windings of an electromagnet. The armature is arranged to operate a circuit-closing device, and means are provided for preventing rebounding of the armature from a stop.

925,951. MAGNET. Hermann Ruthardt, Stuttgart, Germany. Filed April 3, 1908. A C-shaped disk or plate adapted to form an element of a field magnet has a circular armature gap in the field between its poles, the disk gradually increasing in width toward the gap on both sides of the same from a part intermediate to the ends.

925,956. DOOR OPENING AND CLOSING MECHANISM. Frank Scott, Orbisonia, Pa., assignor of one-half to James B. Shively, Shippensburg, Pa. Filed April 29, 1908. Is operated by an electric motor.

925,976. HIGH-SPEED DYNAMO-ELECTRIC MACHINE. Alfred H. Wouters, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed November 3, 1906. Has means whereby the removal of the

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main field coil can be effected without disturbing the auxiliary field coils and without changing the position of the field yoke or any part of it.

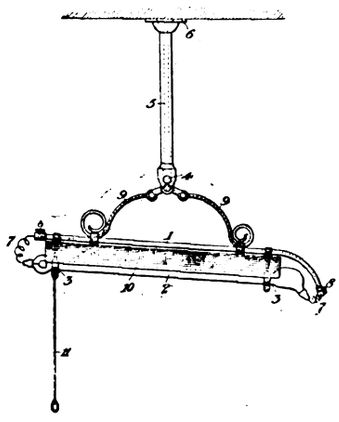
925,991. VENTILATING MEANS FOR LAMINATED CORES. Arthur J. Brown, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Filed October 19, 1905. A spacer for laminas of dynamo-electric machines comprises a member U-shaped in cross-section and having a laterally-extending holding wing or projection in the plane of the base of the U.

925,994. OIL-SWITCH. Herbert W. Cheney, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Filed August 30, 1905. Includes an oil tank having a cover, a pair of contacts therein, contact rods (on which the contacts are supported), extending out of the tank through the cover and supported thereon, means for connecting the contact rods to the main line leads, and means for rocking the rods to swing the contacts into and out of engagement.

925,995. CONTROLLER. Herbert W. Cheney, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed January 8, 1908. A brush-carrying arm is movable relatively to the contacts about a pivot fixed in relation thereto, and a spring is movable about the same pivot into and out of engagement with the brush.

926,001. SWITCH. Gerald W. Hart, Hartford, Conn., assignor to the Hart Manufacturing Company. Filed October 15, 1908. Describes the details of a push-button switch.

926,020. TROLLEY ATTACHMENT. Frank V. Polakoskey, Peekskill, N. Y., assignor of one-third to P. W. O'Brien and one-third to Thomas McPhillips, Peekskill, N. Y. Filed June 23, 1908. In addition to the trolley wheel proper are grooved pulleys adapted to embrace the line wire.



926,057.—ADJUSTABLE SUPPORT FOR VAPOR LAMPS.

926,022. ELECTRIC BLOCK RAILWAY SIGNAL. Emory B. Samuels, Deatsville, Ky. Filed October 22, 1907. Describes the details of an electric block-signal system.

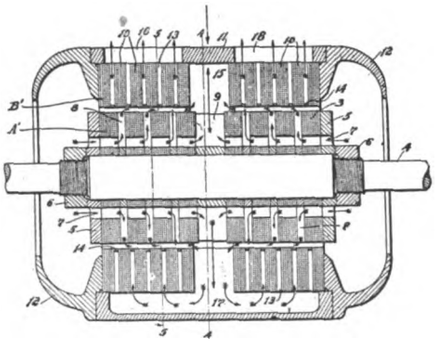
926,026. INDICATOR. Harry H. Shults, Cherry Creek, N. Y. Filed August 24, 1908. Electrically-controlled means limit the rotating movement of the shaft.

926,057. ADJUSTABLE SUPPORT FOR VAPOR LAMPS. Stanwood E. Flichtner, Englewood, N. J., assignor to Cooper Hewitt Electric Company. Original application filed July 28, 1904. Divided and this application filed January 9, 1905. The support comprises a depending hollow arm, a pair of hollow curved arms hinged to this, a hollow supporting rod with which these curved arms are connected, circuit wires leading to the electrodes of the lamp through the hollow parts or devices, and connectors secured to the ends of the hollow supporting rod.

926,066. MULTIPLE-CONTACT TIMER. Edwin S. Lincoln, Brookline, Mass., assignor to Electric Goods Manufacturing Company, Boston, Mass. Filed May 5, 1908. Describes the details of an electrical timer for the ignition system of multi-cylindered internal-combustion engines.

926,069. PROCESS OF TREATING METALLIC FILAMENTS FOR ELECTRIC INCANDESCENT LAMPS. Wilhelm Majert, Berlin, Germany. Filed July 10, 1908. Describes a process of cleaning metallic filaments for electric incandescent lamps and giving them a more compact structure, which consists in very highly heating the filaments twice in succession by the electric current, the first time when they are in a neutral atmosphere, and the second time when they are in a practically evacuated space.

926,082. SUPPLEMENTAL LIGHT FOR LAMPS. Edward E. Taylor and David H. Elkins, Amesbury, Mass., assignors to William Gray and Lambert Hollander, Amesbury, Mass. Filed January 16, 1909. A pivotally-supported electric lamp can be moved into position adjacent to an acetylene gas burner when the latter is not in use.



926,086.—DYNAMO-ELECTRIC MACHINE.

926,086. DYNAMO-ELECTRIC MACHINE. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed August 21, 1905. The stator is provided with circumferential ventilating passageways all communicating with a chamber, and means are located at the middle of the rotor for forcing air into the chamber and thence through the circumferential passageways of the stator to cool the latter.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired June 28, 1909:

477,635. ELECTRICAL KEYBOARD. William E. Blodgett, Faribault, Minn.

477,645. BATTERY. William A. Childs, Englewood, N. J.

477,652. WRITING-TELEGRAPH SYSTEM. Harry Etheridge, Pittsburg, Pa.

477,665. INDIVIDUALIZING CUT-OUT PRINTING-TELEGRAPHS. Samuel R. Linville, Philadelphia, Pa.

477,708. ELECTRIC-CURRENT REGULATOR. Charles D. Sigsbee, United States Navy, and Thomas S. Hayward and Frank S. Anderson, Easton, Md.

477,729. DYNAMO-ELECTRIC MACHINE. James J. Wood, Fort Wayne, Ind.

477,735. PROCESS OF MAKING WHITE PIGMENTS. John Blair, Spokane, Wash.

477,835. PHONOPORIC TELEGRAPHY. Charles Langdon-Davies, London, England.

477,853. ELECTRIC TELEMETER. Cornelius T. Barrett, Brooklyn, N. Y.

477,866. TELEPHONY. Robert Hope-Jones, Birkenhead, England.

477,869. ELECTRIC SWITCH. Herbert M. Pilkington and Roger S. White, Brooklyn, N. Y.

477,870. ANTI-INDUCTIVE DEVICE FOR TELEPHONES. Simon Pollak, Prague, Austria-Hungary.

477,879. ELECTRIC-CURRENT TRANSFORMER. Norman T. Wilcox, Meriden, Conn.

477,897 and 477,898. ELECTRIC LOCK. William H. Hollar, Elizabeth, N. J.

477,914. SECONDARY BATTERY. William L. Silvey, Lima, Ohio.

477,931. TELEPHONE TABLET. Joseph S. Gold, Columbus, Ohio.

477,951. COMPOSITE ELECTRIC CONDUCTOR. Charles A. Mezger, Brooklyn, N. Y.

477,984. ELECTRIC LAMP OR CONDUCTOR SUPPORT. Charles Bell, Stroudsburg, Pa.

477,986. ELECTRICAL STOP-MOTION FOR KNITTING MACHINES. Albin Beyer, Brooklyn, N. Y.

478,018. ELECTRODE FOR SECONDARY BATTERIES. Harry G. Osburn, Chicago, Ill.

478,026. CONDUIT FOR ELECTRIC RAILWAYS. Carl T. H. Schwieger, Berlin, Germany.

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CONTENTS.

EDITORIAL:
The Convention of the American Institute of Electrical Engineers. 45
Improving Old Waterpower Plants. 46
The Power at Hale's Bar. 47
American Institute of Electrical Engineers' Convention—Complete Report of the Proceedings. 48
For Extra Subway Tracks. 60
Moving Platform Subway. 60
More Electrification. 60
Lighting Plant for Pennsylvania Terminals and Tunnels. 60
The Wetterhorn Cable Road of the Grindelwald Glacier, Switzerland. 61
Electrical Exports for May. 64
The New Point of View. 64
Chicago Electric Club. 65
Navy Department Supplies. 65
Technical Book Publishing Consolidation. 65
Electrical Notes from Great Britain. 66
High-Speed Conduit Construction. 68
Electric Locomotive Headlights. 69
Ohio Electric Light Association. 70
National Electrical Contractors' Association. 70
"Exide" Meeting at Dayton, Ohio. 70
Commonwealth Edison Company Submits Profit-Sharing Plan to Employes. 71
American Society of Engineering Contractors. 71
General Electric Increases Plant. 71
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE. 72
INDUSTRIAL SECTION:
New Overload Inverse-Time-Limit Relay. 74
The Paragon Ground Cone. 75
New Cut-Outs for Arc-Lighting Service. 76
A Simple Low-Tension Magneto. 76
Recent Installations of Electric Mining Machinery. 76
Electric Drive in Patternmaking. 77
An Improved Metal-Clip Wood Cut-Out Box. 78
Car Lighting with Opalux Reflectors. 78
Electric Vehicle Reorganization. 78
Committees of the Underwriters' National Electric Association. 79
Convention of the American Street and Interurban Railway Association 79
Rockingham Power Company Sale. 79
CURRENT ELECTRICAL NEWS. 80
DIRECTORY OF ELECTRICAL AND ALLIED ENGINEERING AND SCIENTIFIC SOCIETIES. 87
RECORD OF ELECTRICAL PATENTS. 89

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THE CONVENTION OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

One of the pleasantest and most profitable conventions of the year is that of the American Institute of Electrical Engineers. Relieved almost entirely of everything except the straightforward presentation of technical papers and with interest heightened by a frank spirit of cordiality and freemasonry, those participating look forward to and make ready for a thorough good time. The convention just held at Frontenac, N. Y., in the Thousand Islands, will be remembered as one of the best of a number of exceptionally valuable and interesting meetings. The selection of this famous summer resort as the place of meeting was indeed fortunate, and the weather conditions were such as to elicit the extreme of commendation.

The programme for the technical sessions called for the presentation of thirty-seven papers, and these were grouped so that the attention could be concentrated upon certain subjects and the discussions, if necessary, become extremely general. The programme was so arranged that there was ample time between sessions for recreation, and the boating, fishing, golf, tennis and baseball gave everyone an opportunity to indulge in his favorite pastime. President Ferguson is to be congratulated upon the excellent arrangements which his committees carried through and for his earnest effort and complete success in keeping the meeting up to its schedule and clearing away the large number of papers presented.

Notwithstanding the length of the technical programme and the wide variety of subjects covered, there was missing from the list a number of subjects, the absence of which was remarked upon. This lack takes on peculiar significance in view of the meeting of the sections committee and delegates from the university branches and local sections during the convention. As was pointed out by President Ferguson in his address at Atlantic City last year, there is urgent need for the Institute to encourage the formation of local sections and superintend the holding of joint meetings with other engineering bodies in the various large cities. It is also necessary, in the opinion of many members of the Institute, that action be taken very soon looking to the amalgamation of interests of all electrical engineers, no matter along what lines their studies and work may take them. By some it is considered that the establishment of technical sections will counteract the tendency toward the formation of organizations devoted to some particular branch of

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electrical work. The American Institute of Electrical Engineers is the parent body to which all electrical engineers should subscribe, and it should be a matter of engineering recognition and engineering pride which should constrain every engineer to participate in its membership. Those who are gifted by intelligence, natural talents and personality to become leaders in their respective sections should bend every effort to inculcating the high aims of the Institute in the minds of young engineers and swell the membership with desirable accessions through the work of the local sections.

It would be impossible to make any extended analysis of the attention devoted to each of the papers, and it will suffice to say that the discussion was complete and the printed transactions will form a valuable addition to the literature of each subject. Discussion of the two papers by Percy A. Thomas, dealing with output and regulation in long-distance lines, and with calculation of the high-tension line, was particularly brilliant, and, as was pointed out by several of those present, these data will become classical in the study of these phenomena.

The last session was marked by several particularly happy incidents. In the desire of President Ferguson to group the educational papers together, the paper by Professor C. A. Adams was held over until just before adjournment. The spirit in which Professor Adams made his presentation at the end of the session elicited the hearty commendation of those present and brought out a splendid tribute from Dr. Steinmetz, who hailed Professor Adams as "the leading designing engineer of our American universities." This session also brought forth a stirring appeal from Dr. Steinmetz devoted to the broadening and improvement of entrance requirements for young men taking up the study of electrical engineering. As a fitting climax to so special an occasion the Board of Managers presented retiring President Ferguson with a gold medal, as a token of their appreciation of the work which he had conducted and of the indelible impress which his personality had made so consistently throughout his administration. The presentation of this medal brought every man to his feet with a generous and genuine outburst of applause, and after a few remarks by the recipient the convention closed under the most happy circumstances.

IMPROVING OLD WATERPOWER PLANTS.

One of the most noticeable characteristics of the average hydroelectric power plant is the permanence of the station design. The majority of steam-generating stations may be remodeled by merely tearing out old equipment and making a place for new machinery—at considerable cost, it is true, but without affecting conditions outside the station to any serious degree. In the hydraulic plant a radical change in the methods of equipment and generation is almost certain to require alterations in the forebay, penstocks, building, canal, and perhaps the dam construction. For this reason it is generally the case that when a hydroelectric station is first laid out the design remains substantially the same as long as the plant is capable of doing its work. The initial cost of the waterpower development is too great to permit anything but extensions to the plant along the original lines, or the impounding of additional reservoir capacity as the load grows.

In visiting stations of this kind in different parts of the country one is therefore bound to be impressed with the fixed character of the individual installations, and often a distinct feeling of disappointment strikes the engineer familiar with the most advanced work when he encounters plants in which all the canons of efficiency and progressive practice appear to be violated. Not seldom is there a mental reservation of sympathy for the operating superintendent or manager who has such an assortment of line shafts, belts, gears, cramped wheel pits, oddly mated generators and governors on his hands, all probably housed in a dingy old wooden frame structure, utterly unfit for the advanced requirements of the present-day station. The visiting engineer congratulates himself that the maintenance and handling of such a plant are not his to accomplish on a limited annual appropriation, and not infrequently goes away unconscious of the real economy of production which the station displays to its owners. For a man accustomed to the operating data of steam plants cannot easily appreciate the extremely favorable service conditions under which even an antiquated waterpower station usually runs in periods where the water supply is fairly dependable and in cases where the development cost was not excessive.

Efficiency in the use of water is clearly more desirable in a station where an opportunity for storage exists than in cases where the supply must be taken on the run, so to speak. What is more important is that the reliability of service shall be increased as the load connected with the plant grows, and that the labor costs in the established station shall be kept down. The trend of financially feasible improvements in these old stations is set toward the accomplishment of these results, where practice is enlightened. Among the betterments which may be considered are the more symmetrical organization of the mechanical and electrical equipment; the installation of a controlling switchboard or gallery at a strategic point; the standardization of mechanical parts and elimination of odd sizes in shafting, gears and belt drive; establishment of uniform methods of lubricating bearings; sectionalizing of the prime movers in groups; installing transparency signals at the various governors and wheel gates to co-ordinate the handling of units from the switchboard and centralize the responsibility for the service rendered; removal of partitions to allow for the installation of more complete crane facilities; labeling of the internal wiring; replacement of antiquated switching apparatus by modern equipment; sectionalization of busbars and establishment of more positive methods of routine operation and inspection. Sometimes the re-wiring of the station lighting circuits and the better selection of lamps for improved locations will raise the efficiency of the station service as a whole. Multiplication of forms in apparatus accomplishing a common purpose is un-

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desirable, and sometimes a slightly larger investment in the capacity of initial equipment will enable operation to be carried on with fewer spare parts and an increase of interchangeability that may be worth hundreds of dollars in an emergency. It is a revelation how cost of generation and reliability of service can be kept on a proper basis in some of these long-used stations, where conditions have been overcome along the lines above suggested.

THE POWER AT HALE'S BAR.

At Chattanooga the Tennessee River turns from its course down the Appalachian Valley and winds its way for nearly forty miles between the Cumberland Mountains, that rise 1,000 to 1,500 feet above its surface.

In this "Mountain Section" the Tennessee falls thirty-four feet along several series of rapids, at times of low water, and forty-seven feet when the river is in flood. The increase of fall in high water results from the narrow channel, often no more than 1,000 feet wide between the mountains, which sets back the river to a point above Chattanooga as the volume of discharge increases, and has a velocity of as much as fifteen feet per second at some points.

During the period since 1830 the National Government has made minor improvements in the channel along the "Mountain Section" of the Tennessee, and is said to have spent some $150,000 for this purpose.

Finally, in 1900, the government engineers reported on a system of slack-water navigation for this Mountain Section, and it was proposed to construct a dam at the "Skillet" that would set back the water to Chattanooga, and would give a channel five feet deep at low water. At the dam there was to be a single lock for the transfer of boats over the fall of about twenty-five feet, and the estimated cost of the dam and lock was $1,000,000.

Acts of Congress, in 1904 and 1905, authorized the Secretary of War to contract with persons who might wish to build the desired lock and dam, and accept the resulting water power as their compensation, and a corporation was organized for this purpose and has nearly completed the work, including a hydroelectric plant of about 50,000 horsepower. It was found that the location of the dam at Hale's Bar, thirty-three miles down stream from Chattanooga, would give a natural fall five feet greater than that at the "Skillet," which is only sixteen miles below the city, and that the loss of head at times of high water would be less at the lower point.

Hale's Bar was accordingly selected for the site of the dam, lock and electric plant, and in this way a normal water head of 36.5 feet was secured, with a storage area extending thirty-three miles up river to Chattanooga. The dam is of cyclopean rubble masonry, 1,200 feet long and about forty-two to sixty-two feet above the bedrock of the river.

Adjoining one end of the dam and in line with it is the concrete power and transformer house, some 300 feet long, and then comes an earth embankment with concrete corewall that runs some 700 feet to the bluff. The other end of the dam is the site of the lock, through which boats with an aggregate length of 300 feet, drawing six feet of water and fifty-nine feet wide, may pass at one time.

In the power house the design calls for fourteen vertical electric generators with a total capacity of about 50,000 horsepower, each generator being mounted at the top of a shaft that carries three turbine wheels. When there is a normal flow of water in the river only two wheels per generator will be used, but when the river is in flood water will be admitted to the third wheel so as to deliver a constant power with the reduced head.

With its total drainage area of 43,897 square miles, and a discharge of 11,000 cubic feet per second as a minimum at Paducah, Ky., where it joins the Ohio, the Tennessee must be classed with the great rivers of the United States. The Ohio is generally regarded as one of our great rivers, but it does not surpass the Tennessee in either high or low water discharge at Paducah.

At Chattanooga the drainage area of the Tennessee River is 21,418 square miles, and this city is 452 miles from the mouth of the river on the Ohio. Hale's Bar, thirty-three miles below Chattanooga, of course, has a little greater drainage area and discharge than that city.

At times of low water, the head of 36.5 feet maintained by the dam can be increased to 39.5 feet by the use of flashboards. With this head of 39.5 feet and the ordinary minimum flow of 5,000 cubic feet of water per second in the river at Hale's Bar the gross water horsepower amounts to 22,407, from which all wheel, generator and transmission losses must, of course, be deducted to determine the power that may be delivered to consumers. No doubt the average flow of about 40,000 cubic feet of water per second in the river at Hale's Bar, and the storage area along thirty-three miles of its length to Chattanooga, warrant a power-house equipment for much more than the minimum flow of 5,000 cubic feet per second, and this is indicated by the installation of about 50,000 horsepower.

Probably the most unique and certainly one of the most valuable features of this notable development is its storage area along thirty-three miles or more of the river. Taking the length of storage at thirty-three miles and its average width as 1,000 feet, though it is probably more, gives a storage area of 174,240,000 square feet. For each foot of depth over this area that may be treated as storage without too great reduction of the operating head the stored water is 174,240,000 cubic feet, representing the minimum flow of 5,000 cubic feet per second in the river during 9.6 hours. At the minimum rate of discharge the entire night flow of the river may be stored and then used during the working hours of the following day with a reduction of a little more than one foot of the head on the turbine wheels.

The hydroelectric plant at Hale's Bar appears to be the largest in point of capacity of any in the Central West, and is perhaps larger than any such plant in the country, aside from those at Niagara Falls.

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American Institute of Electrical Engineers.

Twenty-sixth Annual Convention, Hotel Frontenac, Frontenac, N. Y., June 28 to July 1.

One of the most enthusiastic and altogether satisfactory conventions ever held by the American Institute of Engineers was that convened at the Frontenac Hotel, Frontenac, N. Y., June 28 to July 1. In point of attendance the convention was not quite so large as in some previous years, but whatever lack there was in numbers was made up in good-fellowship and fine spirit of cordiality, and in the excellent discussion which attended the technical sessions. The meetings and papers committee had made a careful grouping of the technical papers, and the earnest work of President Ferguson kept the meeting up to its schedule and brought about a very complete and satisfactory treatment of all the important presentations.

The convention committees set a mark for future conventions to aspire to in the thoroughness with which they had made their plans for the entertainment and edification of the visitors. The Thousand Islands, a famous resort at any time, were dressed in their best holiday attire and the weather was all that could be wished for. The golf tournaments, the special matches, the fishing and boating, tennis and baseball afforded recreation for those of widely varying inclination. It is easy to say that never before have the entertainment features been so thoroughly enjoyed as during the session just passed.

A number of those attending the convention had come down to Thousand Islands over Saturday and Sunday, and fully seventy-five per cent of those attending were ready for the first session, which was called to order on Monday morning shortly after ten o'clock.

President Ferguson took for the topic of his address the subject of "The Centralization of Power Supply." Mr. Ferguson said that the tendency today was toward the consolidation of large interests, that it was the age of consolidation, the economies secured through the aggregations of small units were being appreciated, and these combinations were resulting in material benefit to the whole people. In the electrical field, consolidation had been backward, but the awakening was now at hand; and the investor was looking upon electrical securities with greater favor, for these securities, now that centralization of power supply had become an economic entity, were being marketed more easily and upon better terms. Centralization of power supply means a better load factor and a better relation between fixed charges and operating costs; improvement of the load factor means greater earnings, and this can be accomplished most surely by combining all classes of service with the maximum loads coming at different periods. Centralization brings cleanliness and improves civic conditions. Chicago, because of its strategic position, is destined to become one of the world's greatest cities, and the possibility of its power development seems almost boundless. Centralization there is already well advanced. Industrial-power business has not been properly developed. By combining all of the electrical systems in cities within a radius of thirty or forty miles great economies could be effected. The naturally monopolistic character of electric companies is being recognized and monopoly privileges under proper regulation are being advocated, and the legal way is being made to establish the monopolies. Continuing, Mr. Ferguson said:

"It has seemed to me that a condition of such transcendent importance to the electrical profession should receive liberal attention and consideration from our Institute. We, as an organization, have a large part to play in the development of the art of electrical application as well as in electrical science. . . . The progressive work of the electrical engineer will determine with what success we can reach out into these larger fields. The mechanical engineer has given us a steam turbine of greatly improved economy; it is for us to improve still more the method of transmission and conversion and the application of electricity in the arts. It is for the commercial electrical engineer (which really includes nearly all of us) to educate the layman and particularly the power user to an appreciation of the superiority and desirability of electric service and to emphasize the material and ethical advantages to a community of centralized power production.

"It is for the technical electrical engineer to furnish him with the sinews of war, with the ammunition to conquer in the fields where waste, where useless dissipation of energy prevails. We should bend every effort to advance the cause of centralization with its resultant economic gains. Those connected with the manufacturing interests especially should not tolerate for an instant a selfish backward step within their fold.

"As we meet here in convention to gain a broader knowledge and to discuss our special problems let us think of those opportunities which our profession affords in this grand movement for world betterment, this guiding of the forces so that Nature's bounty to man will bring to him the highest and greatest good. The thought carries with it inspiration and enthusiasm and a determination to do our part, individually and collectively, in the successful upbuilding of an industry which means so much to the economic development of the country's resources."

At the close of his address Mr. Ferguson said that it gave him great pleasure to call upon the popular choice for president of the Institute, Lewis B. Stillwell, whose labors both for the Institute and in the profession were so well known that an introduction was unnecessary. He appointed C. W. Stone and Paul M. Lincoln escorts to bring Mr. Stillwell to the chair.

Mr. Stillwell said that the management of the Institute was wisely in the hands of a board of managers, whose terms of office were so arranged that continuity and coherence of efforts would be secured. The fact that the constitution had been amended no less than six times within the last twenty-six years indicated that the Institute was awake and progressive. Never before did the scientific man have so great an opportunity of impressing his usefulness upon the people at large, and no body of men had so great an opportunity of performing valuable service as the electrical engineers. There were many problems to be solved and the methods of procedure must be along scientific and engineering lines. Every effort should be made to bring the members of the Institute to a plane of culture and high standing such as has heretofore never been attained. Another matter which the members should give attention to was the the work of the committee on engineering education. Mr. Stillwell considered that we are handicapped by lack of breadth in our preliminary education. No small proportion of the time of the engineers responsible for constructive work is used up in making a proper presentation of his ideas to those who make the decisions as to whether the work shall be undertaken, and the young engineer, in addition to his technical training, should receive as much instruction as possible in the humanities and tributary sciences as will tend to make his lines of reasoning and forms of expression more comprehensive.

The first paper, entitled "The Convection of Heat from Small Copper Wires," by A. E. Kennelly, C. A. Wright and J. S. Van Bylevelt, was read by Dr. Kennelly.

The object of this paper is to describe a research made on the convective loss of heat from small copper wires, of less than 0.7 millimetre or 27.5 mils diameter, and to present some quantitative results arrived at from the observations. Convection was arbitrarily divided into two classes: (1) Free convection, when the wire is supported in free, still air; (2) forced convection, when the wire and the surrounding air are in relative motion one to the other. The experimental methods employed in this research were: (1) To vary the atmospheric pressure surrounding the test wire, under conditions of free convection, and to measure the change of electric power required to maintain the wire at constant temperature elevation; (2) to subject a wire to varying wind velocity, under conditions of forced convection, and to measure the change of electric power required to maintain the wire at constant temperature elevation. For the first, a short length of the copper wire under test was supported horizontally in an airtight tank and supplied with a steady current from a storage battery. By ad-

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justing the current strength, the wire was kept at constant resistance and, therefore, at constant temperature. The pressure of air in the tank was varied by means of an air pump. For the second test, in order to measure forced convection, the test wire was mounted between the prongs of a long fork, which was fastened at right angles to a shaft driven by a motor at a regulated speed. The test wire was thus forced to move transversely through the air at a known velocity. Electric connection was maintained with the moving wire through pairs of slip rings and brushes, one pair of slip rings carrying the testing current through the moving wire, while another pair served to maintain pressure connections with taps near the ends of the wire. The wire was maintained at a constant temperature by keeping its resistance constant. From the experiments the following summaries were deduced: (1) Free convection in a tank—At constant standard air pressure of one atmosphere, the linear convection was proportional to the temperature elevation of the wire, and was in the neighborhood of 6,000 abwatts (6×10^{-9} watt) per linear centimetre per degree centigrade, and, to a first approximation, independent of the size of the wire, although increasing slowly with the diameter. Under varying atmospheric pressure, the linear convection increased with the pressure, substantially according to an exponential law, the exponent being the same for the same wire at different temperature elevations, but with different wires increasing slowly with the diameter of the wire. The current strength required to maintain a wire at constant temperature under free convection in varying atmospheric pressure, followed an exponent of the pressure, the exponent being the same for different temperature elevations (up to 180 degrees centigrade) of the same wire, but increasing slowly with the diameter of the wire. (2) Forced convection—The linear convection was proportional to the temperature elevation of the wire at the same wind velocity. The linear convection, at any single wind velocity between 200 and 2,000 centimetres per second, increased with the size of wire and, as a first approximation, in direct proportion to the wire diameter. Under varying wind velocities, within the same range, the linear convection increased as the square root of the velocity. At lower velocities the linear convection was greater than this, owing apparently to the presence of free convection in air not moved by an external force. The linear convection from a wire under a wind velocity of 2,000 centimetres per second was nine times that of the wire when at rest.

The discussion was opened by Prof. V. Karapetoff, who said that Dr. Kennelly should receive all credit for his ingenious system of notation, which had been found to be of great value in technical work. He did not understand, however, the reason for using this notation in the present paper, as the measurements had been made with the standard units, and in this presentation had been converted to the absolute system rather to the confusion of the engineer. He also asked whether the use of the corrective term in measuring the power expended did not introduce considerable difficulties in plotting the results on logarithmic paper.

Dr. Charles P. Steinmetz said that with a little experience and by utilizing well-known mathematical laws, the annoying feature of the corrective factor could be eliminated and logarithmic paper could be used in plotting the results.

Charles F. Scott expressed the opinion that the use of this nomenclature complicated the understanding of this excellent paper. He also raised the question whether it could be stated that the velocity of the air passing the heated wire was ever at zero, and suggested that it be considered that there was always a relative velocity between the wire and the surrounding air. He suggested rotating the wire at a certain speed so that there would always be a basis of virtual velocity when the wire would always be surrounded by heated air at a certain velocity.

Paul M. Lincoln said that Dr. Kennelly had contributed a very valuable paper and that it answered one of the first questions that a designer had to reckon with concerning the rate of radiation of heat from a conductor and the law of the relations which were effected by forced ventilation.

Dr. Kennelly in replying to the discussion said that the paper was almost purely a physical one and that it was thought better and safer to keep to the absolute system. Mr. Scott's suggestion in regard to the virtual velocity of the air was pertinent, but the investigators did not feel they were justified in stating the virtual velocity of air moving about a still wire. Possibly this statement was correct, and he would like to see someone demonstrate it.

The paper entitled "An Alternator for 100,000 Cycles," by E. F. W. Alexanderson, was read by the author.

This paper describes an inductor alternator built for Professor Fessenden's wireless telegraphy work. The machine was the first high frequency generator to have a commercial rating as high as two kilowatts. Its speed is 20,000 revolutions per minute. Both the field and the armature are stationary. The latter has 600 slots with one conductor per slot. The rotating field mass is a disk with 300 projections on each side, one-eighth inch apart, thus corresponding to 600 poles in a machine of the ordinary alternate-pole type. The output varies largely with the air-gap clearance, which is adjustable from about 0.015 to 0.004 inch. The shaft is flexible; it has its largest diameter, one-and-one-fourth inches, at the center and at the ends the diameter is five-eighths inch. The machine is geared to its driver through a gear ratio of ten to one. The diameter of the disk is one foot and its peripheral speed is 700 miles per hour. It is designed to have uniform stresses in all its parts. To overcome air friction it was found necessary to have non-magnetic fillers between the projections on the disk; these gave it a smooth surface. The generator has four bearings. The middle ones have one-sixty-fourth inch clearance and are more for steadying the revolving shaft in starting; at full speed they are free from the shaft. The outer bearings carry the weight of the revolving parts and are lubricated by oil circulated by a pump. At the close of the paper the electrical characteristics of the machine are discussed and illustrated. The no-load voltage is 110 and the short-circuit current is twenty amperes. The maximum continuous output is thirty amperes at seventy volts. Under the author's directions a machine giving thirty-five kilowatts at 50,000 cycles is now being built.

J. C. Lincoln asked why the revolving portion was made so small. He suggested that if the diameter of the disk were increased it could withstand higher centrifugal strains and improve the mechanical features of the machine.

D. B. Rushmore said that the new construction was similar in many respects to the old inductor alternator, which more than held its own until lower frequencies were demanded in commercial machines. The characteristics of the newer machine were similar to the old inductor and the data realized could possibly be used to advantage in connection with the older form of construction. The subject of the critical speed involved also was of interest and was in line with modern work which indicated a tendency to use velocities limited only by the strength of material.

Replying to the discussion, Mr. Alexanderson said that the choice of the diameter of the revolving disk was purely a natural one in an experimental case. The machine now being built for an output of thirty-five kilowatts has a diameter of three feet in the rotating member. Replying to a question with regard to the effect of the alinement of the shaft he said that this had apparently nothing whatever to do with the speed. The point was also raised whether the chrome-nickel could withstand a tensile strain of 200,000 pounds per square inch. Mr. Alexanderson said that he had received assurances that the material could be depended upon and that it was expected that it would be cut and turned before it was hardened by a special oil hardening process.

The paper entitled "Method of Testing Transformer Core Losses Giving Sine-Wave Results on Commercial Circuits" was read by L. W. Chubb.

The author points out in this paper that the core loss in a transformer is not ordinarily the same that it would be with a sine-wave electromotive-force on account of the common variation of the wave shape from the ideal sine form. Since, for the sake of comparison, it is necessary to determine the core losses with sine-wave electromotive-forces, and since the equivalent conditions can be produced by a certain change of voltage, the author recommends the use of an instrument which will indicate exactly when the voltage of the circuit has been adjusted so that the core loss with the particular wave shape of that circuit is equivalent to what it would be with a pure sine wave. Although the standardization rules for a sine wave allow a deviation from the equivalent sine of ten per cent of the maximum ordinate, the use of such a nominal sine is not correct in core-loss determinations on account of the large percentage of error in the results that may result in comparison that would be obtained from an equivalent sine. The eddy-current loss component of the core loss depends upon the root-mean-square value of the induced voltage, while the hysteresis component depends upon the average values of this voltage. With the use of an ordinary voltmeter giving root-mean-square values the eddy-current losses will be correct, but the hysteresis loss and the sine value may be high or low, depending on the form factor of the voltage wave. If an average voltage rating

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were taken the hysteresis loss would be correct, but the eddy-current loss would be either high or low. In the instrument described, which is termed by the author an iron-loss voltmeter, the readings are such a function of the average and effective voltages, that when it reads a normal voltage in the transformer, the error in the eddy-current loss is equal and opposite to the error in the hysteresis loss, thus giving the correct total core loss. The instrument consists of a ring-shaped core of laminated steel about which is a winding which has a series coil of a wattmeter in its circuit. A shunt circuit connected to the same terminals contains the movable coil of the wattmeter movement, a compensating coil around the stationary series coil and a non-inductive resistance. The indications of the wattmeter correspond to the total input to the instrument, which is equivalent to the iron losses in the laminated ring and the copper losses in the instrument. The sum of these losses is dependent both upon the average value and the effective value of the terminal voltage. The instrument is calibrated so that its indications agree with the readings of a voltmeter on a circuit having a pure sine voltage wave. In using the instrument the voltage in the circuit is regulated by either resistance or inductance until the iron-loss voltmeter indicates the normal voltage of the circuit. At this point the core loss of the transformer is measured on a wattmeter. The accuracy of the instrument is in general within one per cent and in extreme cases within two per cent. The author also describes a method of correcting the form factor to eliminate even the smallest errors. The paper is concluded by giving some specimen test results in which the iron-loss voltmeter was used.

Prof. Frederick Bedell said that if the permanency and calibration of the instrument could be relied upon it would prove of great value.

Dr. Steinmetz said that the use of the instrument involved a definition of the form factor as the ratio of effective to mean value. This gives a value for the sine wave of 1.1. This was unfortunate, as the standard sine wave should have a value of unity. He would suggest, however, that the definition should be given as the ratio of the effective to the mean in the actual wave to the ratio of the effective to the mean in the pure sine wave.

M. G. Lloyd stated that the instrument should prove of great value to manufacturers who did not have laboratory facilities, as it would enable them to participate in bidding on contracts for supplies for the Navy Department, the specifications in many cases calling for the form of the wave form in certain lines of material. He questioned whether the instrument could be used to cover a variety of materials used in transformer construction, and he considered also the excessive weight of the instrument as a handicap, as it did not allow it to be classed as a portable machine.

Charles F. Scott said the machine was essentially a practical instrument; under fairly wide variations its readings were substantially correct. To get at the real value of the instrument one must consider the instruments and the series of checks it displaces. It has become of great value in factory testing.

Dr. Steinmetz explained a method whereby a sine wave might be secured, no matter how great the distortion in the main circuit. If in one leg of the circuit two large reactances were placed in series and a condenser put in shunt across the line, one terminal of the condenser being connected at a point between the two reactances, an ammeter placed across the line, one terminal being connected beyond the second reactance, would show but a small distortion. Taps taken off from a coil across the circuit, if the current flow in the tapped portion is small compared to the whole current flowing, would give a sine wave as desired.

The paper entitled, "Testing of Transformer Steel," by M. G. Lloyd and J. V. S. Fisher, was read by Dr. Lloyd.

At the beginning of this paper the authors discussed the conditions that should be realized in the measurement of the losses occurring in sheet iron and steel subject to alternating magnetization. A description of the method made use of by the Bureau of Standards, which is a modification of the Epstein method, is then given. In this modified method the sample to be tested is stamped into strips about ten by two inches. These are assembled into four bundles, the sheets of which are separated by strips of pressed board, and each bundle is inserted into a solenoid. The four corners are joined by special corner pieces so as to produce a substantially perfect, rectangular magnetic path. Each solenoid has two secondary windings above which are wound the primary exciting winding. This method is said to be the closest approach to the ideal conditions for testing such samples. The accuracy attained is within one per cent, and the material consumed is only about four pounds. The results of various numerous tests are given. These show a very wide range in the quality of transformer steel in general use, the quality not seeming to have any direct connection with the price. Among the samples tested were a number of foreign specimens of ordinary and of silicon steel for comparison with the American products. By making measurements at two frequencies, viz., thirty and sixty cycles, the eddy current and hysteresis losses were separated and a study made of the variation of each with flux density. The values of the hysteretic constant and the total loss in watts per pound at sixty cycles and 10,000 gausses were obtained and tabulated. The effects of artificial aging were shown to depend upon the flux density selected for test, the hysteresis increasing more for 5,000 than for 10,000 gausses. Therefore, it is recommended that such tests should be made at the particular density to be used in the transformer. In silicon steels the aging was found to be practically negligible.

L. T. Robinson asked whether the method proposed by Dr. Lloyd was a workshop proposition, and why was not the Epstein method satisfactory. Has the method suggested by Dr. Lloyd been demonstrated to be identical with results found with ballistic methods?

Professor Karapetoff said that the method described by Dr. Lloyd had some advantage, inasmuch as putting the strips on edge were concerned, but there was a disadvantage in using so many corner pieces. He suggested using longer strips and bending them, thus reducing the number of joints.

Andrew Pinkerton said that there was little use in making tests of sheets from small sections or strips.

Dr. Clayton L. Sharp said that Dr. Epstein had stated to him that tests made on small strips of iron had no value whatever as indicating the characteristics of larger pieces of material.

MONDAY AFTERNOON SESSION.

The Monday afternoon session was called to order at 2:15 with the closing of the discussion of the previous paper by Dr. Lloyd.

The paper entitled "A Sketch of the Theory of the Adjustable Speed, Single-Phase, Shunt Induction Motor" was read by F. Creedy.

The author at first describes the three fundamental ways in which speed variation in this type of motor is attained. All are modifications of the Atkinson commutator motor, in which the rotor has four brushes, or sets of brushes, one or both pairs of which may be short-circuited. These three methods are: (1) Variable voltage control; this is accomplished by feeding an extra voltage from the line, through a transformer preferably, to what may be regarded as the armature circuit of the motor's rotor. (2) Adjustable field excitation; this may be done by inserting an inductance or capacity in the rotor circuit at right angles to the one above; an inductance raises the speed and a capacity lowers it. (3) A modification of the previous method is to place a coil on the stator, with its axis parallel to the "field" axis and connected in series with the field brushes; this will weaken or strengthen the rotor ampere turns, depending on its connection. Other methods are combinations or modifications of these. In order to discuss the relative merits of the three leading methods, the theory of each is considered by aid of the circle diagram. This shows that the shunt motor excels both the regular single-phase and polyphase motors enormously in regard to overload capacity and power factor; in fact, it is closely analogous to the direct-current motor in that the output is not limited by the breakdown point, but by heating and sparking. The author suggests that a salient pole construction might be used. In general, the first method is suitable for increased speed only and is not adapted for speeds below synchronism. The second method gives conditions quite similar to those of the ordinary single-phase induction motor; it works best with the motor compensated; the use of capacity is not practicable, however. The third method is adapted to speed reductions only, and is limited practically to a twenty per cent reduction below synchronism. After discussing phase compensation and commutation, the paper concludes by giving some experimental results attained by the author, F. Punga and Dr. A. Fraenckel, with some motors of this general type.

The next paper, entitled "Repulsion Motor with Variable-Speed Shunt Characteristics," was read by E. F. W. Alexanderson.

The object of this paper was an investigation into the possibilities of an alternating-current motor with adjustable speed to replace the direct-current shunt motor, which is at present the only one on the market to fulfill this requirement. The author commenced by presenting a theory of the alternating-current machine in such a way as to indicate the possibilities of developing a motor with the required characteristics. He then proceeded to demonstrate cases of a shunt repulsion motor with speed regulation by armature control

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and by field control. The first is effected by introducing a voltage from the outside into either the circuit of the main brushes or the circuit of the exciting brushes. This voltage may be either positive or negative, and consequently the speed may be regulated below synchronous speed as well as above. In the second method, the short-circuit is maintained on the main brushes, while an external voltage is impressed upon the exciting brushes. In order to make the impressed voltage effective for speed variation, it should be in phase with the voltage of alternation and the voltage of rotation of the same circuit. The speed variation by armature control is particularly applicable to those cases in which the torque increases with the speed, and field control to those cases in which the torque decreases with the speed. With armature control a speed variation of three to one can be obtained; with field control, one-and-one-half to one. The author, in conclusion, stated as his impression that the single-phase shunt motor will be preferred on account of the greater simplicity of control.

Discussing Mr. Creedy's paper, Mr. Alexanderson explained various methods of affecting speed variations in single-phase motors. He said exceptions should be taken to Mr. Creedy's statement that the speed could not be conveniently lowered below synchronism. It would also be of interest to owners of single-phase motors to know that a complementary device would be available giving to constant-speed motors the adjustable shunt features.

The paper entitled "Reduction in Capacity of Polyphase Motors Due to Unbalancing in Voltage," by S. B. Charters, Jr., and W. A. Hillebrand, was read by Mr. Charters.

The authors of this paper have made a study of the effect upon the capacity of a polyphase motor of unbalance in the voltage and also of phase angle between the various phases of the motor. A series of tests was made in which voltage unbalance and phase displacement were separated in a number of cases and in others the effects were combined. The tests were made upon several two and three-phase induction motors of moderate size. In all cases it was found that a marked decrease in capacity resulted from either of these causes. In several instances the capacity was reduced to fifty per cent by a voltage unbalance of about twelve per cent between the phases. The influence of transformer regulation is to slightly mimimize the effect of the unbalancing. Some tests were also made with a synchronous motor. In this the results were similar to those given by the induction motors except that the combined effect of voltage and phase angle unbalance, instead of being greater than the sum of the effects, as was the case with the induction motor, was found to be somewhat less than this sum, due to a neutralizing tendency of these effects. The general conclusions reached by the author are: (1) Unbalancing of voltage and shift of phase tend to cause serious overheating in polyphase motors. (2) Where it is possible to separate the effects due to phase shift and voltage unbalance, the former is found to be of relatively more importance. (3) The reduction in capacity due to either phase shift or voltage unbalance varies with the cause approximately according to a straight-line law. (4) In the induction motor the existence of phase shift and voltage unbalance causes a worse performance than would be expected from either irregularity alone, whereas in the synchronous motor the reverse is true. (5) The performance of an induction motor supplied from an unbalanced circuit is materially affected by designs. (6) The commonly accepted statement that the torque of an induction motor varies with the square of the voltage should be changed to read "varies with the voltage," in order to make it more consistent with conditions found in ordinary operation.

A communication from R. E. Hellmund was read. Mr. Hellmund stated that it had been his experience that the interchange of heat between the various stator parts is comparatively good. The final temperature of iron and coils is as a rule pretty much alike, no matter how the losses are distributed between the iron and copper.. The only remedy that may be applied to unbalanced circuits in the motors is to improve the line construction.

A communication from I. E. Hanssen said that all conductors should be arranged so as to prevent the unbalancing of circuits. All conductors should be arranged as nearly symmetrical as possible and unbalanced transformer connections, such as open delta or two-phase-three-phase, should be avoided wherever possible.

J. B. Parker said that the commercial features involved in unbalance were important. Where long-distance power transmission is involved the danger of unbalance is great. Where central-station companies supply power and lighting circuits there is also considerable danger of unbalance. In many cases these companies penalize users for bringing about unbalanced conditions, and they are also giving some customers a better rate for using current so as to maintain a better load factor. He also said there was strong reason why a maximum-demand current meter rather than a maximum wattmeter should be used, as with the latter there was still opportunity for considerable unbalancing of circuits.

Dr. Steinmetz said that he did not agree with the statement given by the authors that the torque varied directly as the voltage. At constant voltage the torque varied directly with the load. In order to understand the situation correctly, it must be stated what torque is meant. One condition of torque is when the motor falls out of step and stands still, the other is the maximum torque when the motor will pull continuously with constant heating.

C. F. Scott said that the safe capacity of the motor does not always depend upon its heating, as its limit of safe operation may lie in some other direction. An unbalanced single-phase load is helped back to balance in some cases because other variations may compensate from one circuit to the other. The conclusions arrived at by the authors do not permit of indiscriminate application.

Mr. Charters stated that the torque in most cases will vary almost as a linear function. He also cited an instance of a three-phase plant in which some of the motors, when standing idle, would not start up because of the inability to effect proper regulation. When other motors were operating they would tend to compensate, and no difficulty would be encountered in starting the larger motors.

The paper entitled "The Current Locus of the Single-Phase Induction Motor" was read by A. S. Langsdorf.

The author commenced by deprecating the general use of Ferrari's expedient of resolving the impressed alternating magnetic field into forwardly and backwardly rotating components, in the theory of the single-phase induction motor. Within the last few years the tendency has been to go back to first principles, and several valuable contributions have appeared, notably those of Fynn and McAllister. The author's treatment is based largely on the theory advanced by Fynn in his several publications. The subject was taken up under three successive divisions: General principles and vector diagram; mathematical treatment; experimental results. From the considerations involved it appears that statements to the effect that the current locus is a curve of higher order are in error. The locus is a true circle in spite of the complicated nature of the equivalent circuit, and it may be readily determined for any given motor by two simple measurements—primary current and power-factor with the rotor open-circuited, and the impedance voltage and power-factor with the rotor blocked and short-circuited.

This paper was discussed briefly by Professor Karapetoff, who thought that the substitution of the commutator in this instance was not necessary.

The paper entitled "The Multi-Speed Induction Motor," by H. G. Reist and H. Maxwell, was read by Mr. Reist.

In multispeed induction motors the different synchronous speeds are produced by changing the number of poles in the magnetic circuit. Secondary resistance may be used to vary the speed below each of the synchronous speeds. A change in the number of poles may be produced in any one of the following ways: *a* By the use of single magnetic and electric circuits, changing the number of poles by regrouping the coils. *b* By the use of a single magnetic circuit and independent electric circuits. *c* By means of separate magnetic and electric circuits. The paper proceeded to discuss each of these methods in detail. As a suggestion in the selection of the best type of motors for various conditions, the following conclusions were appended, subject to broad interpretation according to modifying circumstances: (1) For two speeds ratio two to one, use motor type *a*. (2) For two speeds having ratios other than two to one, use motor type *b*, except when the winding and insulation require too much space. (3) For three speeds, two having ratios two to one, the other intermediate, use type *b* with one winding connected as in *a*. (4) For four speeds, one one-half the highest speed, and the lowest speed one-half of the next highest speed, use type *b* with each winding such as is used in type *a*. (5) For two or more speeds close together, use type *c* concatenated motors. (6) Use concatenated motors when polar windings on the rotor are necessary with more than two speeds, or if the two speeds differ from two to one. (7) Use concatenated motors for high-voltage machines except when type *a* can be used.

This paper was discussed at some length by H. C. Specht. Mr. Specht's conclusion was that with cascade motors practically any set of speeds may be obtained, but that this is not the case with

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the multi-speed motor. Even if the cost of cascade motors is higher, they can be recommended when simplicity and safety of control and operation are desired.

Dr. Steinmetz said that there was no gain with the cascade motor; rather there is a loss in having two structures instead of the single motor. For general stationary work the machine that changes the number of its poles is superior mechanically and electrically.

In closing the discussion Mr. Reist stated that the machine he described would cover any reasonable range of speeds.

The paper entitled "The Heating of Induction Motors," by A. Miller Gray, was passed over in the absence of the author.

TUESDAY MORNING'S SESSION.

The third session was called to order promptly at 10 o'clock Tuesday morning, and two papers were read by Percy H. Thomas. These were entitled respectively, "Output and Regulation in Long-Distance Lines" and "Calculation of the High-Tension Lines."

These papers provoked a brilliant discussion, which was opened by Thomas R. Rosebrugh and participated. in by Dr Kennelly, Professor Karapetoff, J. B. Taylor, D. C. Jackson, Dr. Steinmetz, P. M. Lincoln, R. D. Mershon, H. W. Fisher, J. B. Whitehead and Charles F. Scott.

The first paper treated of limitations of the power-transmission line as to distance, power and voltage, and its characteristics as to voltage variation, energy loss, and line output. The electrical action in the line was first discussed by reference to the "leading energy," or that flow of energy which is absorbed by the line capacity on rising voltage and is returned on falling voltage; and the "lagging energy," or that energy which is absorbed by the line inductance on rising current and returned on falling current. A table was given showing illustrative line adjustments with calculations, and among the several illustrative examples was the 700-mile transmission line of the Victoria Falls Power Company. The true energy loss in this line works out to 10.4 per cent, the drop in voltage 12.1 per cent, and the rise in voltage due to the effect of throwing off the load, twenty-two per cent, assuming that the synchronous machines at the load end supply no leading energy in the no-load condition or that they have dropped off the line. The power to be delivered at full load was assumed to be 40,000 kilowatts at 150,000 volts, and with a load power-factor of 0.85. The terminal apparatus for long-distance lines was fully considered, as much depends on the type and adjustment of this apparatus, generators, motors, and synchronous converters, in controlling the line voltage, energy loss and power-factor. In conclusion, some of the more important points were summarized as follows: To obtain the most economical transmission of power over a long-distance line, it is necessary to have balanced the leading and lagging energies of the line itself, and at the same time to have unity power-factor. To obtain satisfactory regulation, the leading current taken by the line at light loads should be fed mainly from the receiving end. Non-synchronous generators are suggested for the power house where it is desired to supply the leading energy for the line from the receiving end, which then becomes the controlling and operating point of the system. Constant voltage or suitable compounding should then be maintained at the receiving end and not at the generating end of the system, thus practically eliminating line voltage regulation as a disturbing factor.

The other paper discussed calculation of the high-tension line as relating to the important matters of regulation and energy line loss, and with special reference to the unusually long and high-power lines. For this purpose several new formulas suited for practical calculations are derived. There is derived a formula for calculating the true current, voltage, and power-factor at the generator end of a transmission line when the current, voltage and power-factor at the receiving end are known. For purposes of comparison an approximate formula is given, based on the much-used assumption that the line capacity is concentrated at the ends of the line. This is called the "split-capacity" formula in distinction from the "wave" formula, with the distributed capacity. The former is adapted to slide-rule work and the latter is exceptionally simple and can be used with a table of cosines and tangents.

Mr. Rosebrugh was of the opinion that the equations could be put in much simpler form, and Dr. Kennelly contended that the use of hyperbolic trigonometry was simpler and afforded a better opportunity for elucidating such complex mathematics as was involved in transmission-line calculations.

Professor Karapetoff said that the prophetic picture projected by Mr. Thomas was very important, as it would help greatly in preparing engineers for development work in the future. This paper, he said, would undoubtedly be considered a classic, and would be referred to by engineers in the days to come. It would be a matter of regret if the splendid works thus presented were not given expert mathematical revision to the end that some of the equations might be simplified and the method of procedure shortened.

Professor Jackson said that the tables available in hyperbolic trigonometry were not complete enough to be useful in computation, and Mr. Thomas was justified in sticking to circular functions. The paper was admirable in making such a good start toward a practical method of computation of power-transmission data.

The paper entitled "Even Harmonics in Alternating-Current Circuits" was read by J. B. Taylor.

The author commenced his paper by stating certain misconceptions concerning the omission of the second, fourth, sixth, etc., harmonics in the consideration of wave forms in alternating-current circuits. A number of oscillograph records showing current corresponding to simple sustained vowel sounds were given, demonstrating the even, as well as the odd, harmonics that telephone lines, transformers and receiving apparatus have to deal with. There is no difficulty in connecting standard generators in series or in parallel when the resulting wave form will have pronounced even harmonics. A typical example taken was a three-phase, high-tension transmission system with transformer neutrals grounded at both ends. Another was a single-phase railway with a ground at a substation and also at various cars along the line, while a neighboring direct-current traction system caused direct current to be shunted into the alternating-current system. An oscillogram showed a pronounced second harmonic in the transformer magnetizing current, due to direct current in the windings. The author proposed the use of counter-electromotive-force cells, similar to storage batteries, but with plates unformed, in order to check leakage direct currents, but he had not yet seen a case where the magnitude of these currents warranted such a proceeding.

This paper was discussed by Frederick Bedell, Professor Karapetoff, C. F. Scott and Dr. Steinmetz.

Professor Karapetoff said that the reason why even harmonics do not appear in commercial machines is because in nearly all cases they have been mutually canceled.

Dr. Steinmetz said that even harmonics were just as frequent as odd harmonics in the transient phenomena of electrical circuits; that there is no physical reason why even harmonics should not exist, particularly in the upper harmonics.

The paper entitled "The Resistance and Reactance of Armored Cables" was read by J. B. Whitehead.

In a recent single-phase railway installation it was deemed desirable to use armored cables in connection with a drawbridge. To ascertain whether the reactance and losses in the armor would be prohibitive, calculations and tests were made whose results are recorded in this paper. The tests were made with No. 0 B & S stranded single conductor, paper-insulated, lead-sheathed, jute-covered, iron-armored cables and similar cables that were copper-armored. The decrease in effective resistance and increase in effective reactance, with increasing separation, were noticeable at sixty cycles, but not important at twenty-five cycles. From these tests the following conclusions were drawn: (1) Theoretically the reactance of the usual type of single-conductor, iron-armored power cable may be from two to 4.5 times that of the unarmored cable, depending on the distance to the return conductor; the factor increases with decreasing distance. (2) In cables as manufactured the reactance is about seventy per cent of the maximum theoretical value. (3) The effective resistance as measured varies little with the distance to the return conductor and is about 1.6 and two times the dead resistance at twenty-five and sixty cycles, respectively, and a current density of one ampere per 1,000 circular mils. (4) The impedances for distances under twelve inches is about three times the dead resistance at sixty cycles and 1.7 to two times the dead resistance at twenty-five cycles. With the sheathing and armor grounded at both ends the impedance is somewhat lessened and is largely of the nature of resistance. (5) The impedance of a double-conductor, iron-armored cable, with conductors located 0.873 inch apart between centers, and at the current density given above, is about seven per cent greater at sixty cycles and three per cent greater at twenty-five cycles than the calculated value. The increase is in effective resistance due to eddy currents in the lead sheathing.

There was no discussion on this paper and, owing to the lateness of the hour, the paper entitled "Losses, Induced Volts and Amperes in Armor and Lead Cover of Cables," by H. W. Fisher, was passed until the evening session.

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MEETING OF THE SECTION DELEGATES.

On Tuesday evening, prior to the regular session, there was a rousing meeting of the officers of the Institute and delegates from the geographical sections and university branches. About fifty sat down to an excellent repast, and after the dinner several addresses were made by the delegates outlining their methods of developing local sections and the success which had been accomplished. Vigorous addresses were made by President Ferguson, Secretary Pope and Paul Spencer, chairman of the Sections Committee. Mr. Ferguson stated that the board of management was in hearty sympathy with the work that the sections were doing and that they would receive every financial and moral support that was possible. At the same time, the work of the sections entailed a large burden of expense and too much must not be expected of the administration. The local officers of the sections must, by initiative, create an interest in their territories and strive to do as much for themselves as possible. Where papers presented at local section meetings were of such a nature as to be worthy of presentation in the proceedings, this recognition should and would be accorded them. The board of managers had given the matter of section work the most careful consideration, and plans were under way to effectually afford great help and stimulus to this work during the coming year.

Opinions were expressed concerning the necessity and advisability of holding joint meetings with other engineering societies in local sections, as was pointed out by President Ferguson at Atlantic City, to the end that the Institute membership should be preserved and to the discouragement of the formation of specialized and special organizations. Dr. Steinmetz took the lead in suggesting plans for the correlation of effort, and D. B. Rushmore also spoke vigorously upon the necessity of so arranging Institute effort that duplication of work between engineers interested in various phases might be eliminated.

TUESDAY EVENING SESSION.

The paper entitled "Corona Phenomena in Air and Oil and Their Relation to Transformer Design," by W. S. Moody and G. Faccioli, was read by Mr. Moody.

An extensive series of experiments was conducted by the authors on the subject of corona and their relation to electric apparatus, particularly to static transformers. The first series of tests were made on a cylindrical conductor parallel to the plate. Various size wires from one-eighth to one-half inch in diameter were used, at distances from nine to eighteen inches from the plate. A pure sine-wave potential was used throughout. The corona in such cases appeared on the conductor very abruptly, the luminous phenomenon being accompanied by the characteristic noise. For the one-half-inch wire the corona appears at 85,000 volts at a distance of nine inches and at 95,000 volts at a distance of eighteen inches. The condition of the surface of the conductor was found a very important point affecting the final results. A rough metallic spot forming a point on the conductor begins to glow at much lower voltage than the conductor itself. Spots of insulating material on the surface of the rod also began to glow before the body of the rod itself. Such points were eliminated with great care to obtain constant and consistent results. An extended study of their effect was made. It was found that the shorter the length of the rod the greater the voltage required to establish the corona. A further detailed study was made of the development of the corona from the center of the rod toward its ends. In general, all the phenomena were found to be very delicate and affected by very slight changes in condition. It was found that the position of the grounded plate did not affect the location and spreading of the corona; for instance, the removal of the grounded plate entirely, so that the floor, ceiling and walls of the room took its place, did not produce any material change upon the factors just mentioned. A series of tests were made to check the formula that had been developed. While the results of this attempt were rather erratic, still in general it was shown that a small rod at a comparatively great distance from the plate requires a higher voltage than a large rod at a correspondingly small distance from the plate. Another series of experiments was made with a type of condenser having rods forty-five inches long, suspended at both ends by copper wires. These rods were located in the center of a metallic disk. With rods ranging up to one-fourth inch in radius the corona voltage varied from 26,500 to 62,000. Metallic tubes of different lengths were inserted and supported by the cylinder previously used. The longer the cylinder the lower is the corona voltage. Variations of these tests were also made, including the study of the spread of the corona. All these experiments forced the general conclusion that the voltage at which the corona appears in apparatus of limited dimensions depends not only on the dimensions of the apparatus itself and the mutual action of the different parts, but is the complex function of several quantities and conditions. At the close of the paper brief reference was made to the appearance of corona under oil. It was stated definitely that the common belief that oil eliminates corona is not correct. There are really no essential differences in manifestation in air and in oil. For instance, two needles submerged twelve inches apart in oil produce no noticeable glow up to 100,000 volts, but with 1,000 volts more the glow becomes perceptible in the form of a small, steady, noiseless brush, green in color. On further raising of the potentials the brushes increase in size and eventually touch each other, following which soon occurs the disruption of the oil. With needles six inches apart a corona is established at about 78,000 volts; with needles three inches apart the corona starts at about 72,000 volts. In conclusion, the authors emphasize the importance of further study of these phenomena, since their appearance in commercial transformers designed for high voltages becomes a serious problem.

There was a spirited discussion, and the paper entitled "Surges on Cable Systems with Aluminum-Cell Protection," by E. E. F. Creighton and S. D. Sprong, was read by Mr. Creighton.

A series of tests of the large underground cable system of the United Electric Light and Power Company, in Manhattan, Borough of New York city, was conducted by the authors about a year ago and the results are given and discussed in this paper. The distribution is by three-wire, two-phase currents, having 3,000 volts between outer conductors. Each feeder has a motor-operated induction regulator for governing its potential. An aluminum-cell surge protector was connected from the substation busbars to ground. A series of oscillograph records was obtained with a cable grounded and an increasing number of feeders in circuit. Among the leading features noted in the tests were: A gradual decrease in the natural frequency of the circuit as the number of cables in service was increased, thus bringing it within the range of the harmonics of the generator; a general increase of current in the arc to ground with an increase in number of cables; a variable duty required of the surge protector, which apparently depends upon the suddenness of the discharge; a by-pass cell on a potential regulator is called upon to give a high discharge in order to protect the regulator; the maximum surge voltage across the grounded phase of a regulator coil is directly proportional to the maximum surge current to ground; the gap length determines the voltage, and therefore the current of the static charge to the cable; the shorter the gap length, the greater the number of discharges for each alternation of the generator wave. Besides the nearly score of oscillograms shown of this system, two oscillograms are reproduced that were obtained on the Brooklyn Edison system; these show very markedly the superposition of higher harmonics, which are magnified by the capacity so that they predominate over the fundamental.

At the close of the discussion of this paper the paper entitled "Split-Pole Converters and Storage-Battery Regulation" was read by the author, J. L. Woodbridge.

This paper describes the installation and operation of the battery and regulating equipment at the Gary steel works. The battery consists of two sets of 125 cells each, operating in parallel. Each cell has 73 plates, 18.625 inches square. Its capacity is 4,320 ampere-hours at the one-hour discharge rate. The regulating and emergency rates are greatly in excess of this. Discharges as high as 25,000 amperes have been taken from the combined battery. In order to provide for automatic transfer of energy between the battery and the alternating-current system, two split-pole rotary converters have been installed. The auxiliary apparatus for these rotaries is described in some detail. The converters were originally designed as three-part-pole machines, but are now operated with two main pole sections combined as one, and supplied with constant excitation from the exciter busbars; the auxiliary pole is energized from a special synchronous exciter that is connected to totalizing series transformers, which are affected by the fluctuations of the alternating-current load. If this load increases, the exciter current is such as to cause the battery to discharge through the converters; if the load decreases, the exciter current affects the converter so that the battery is charged through it. The degree of regulation can be adjusted to any desired point. Recording-voltmeter charts are shown in the paper to compare the regulation with and without the battery in service. A load curve is also given to show the steadying effect of the battery. It is stated that without the battery it is impossible to maintain satisfactory voltage regulation, and the speed of the gas engines varies over a wide range, while with the battery in service the regulation of speed and voltage is all that could be desired. It also enables the rolling mill to be operated at higher and more regular speed, thus permitting its output to be materially increased. Besides these advantages, the battery is ever ready for emergencies and

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thus eliminates costly delays in the operation of the plant.

In discussing Mr. Woodbridge's paper D. B. Rushmore said that this was a description of a specific case typical of general conditions applying in industrial work. The wide fluctuations of load involved were similar to those found in mine hoisting and railway work. It also was a case where the prime mover worked at the best efficiency over a narrow range of output and possibly not at the best speed regulation. The paper also indicated the necessity of continuous operation in this class of work.

The paper by H. W. Fisher, which was left over from the morning session, was then taken up. Mr. Fisher described a number of tests to discover the effects of flow of current in armored single and multiple-conductor cable when the armoring had varying electrical relations with regard to the sheath.

The results of these tests indicated broadly that wherever possible multiple-conductor cable under one armor is preferable to single-conductor cable. It also indicated that it was almost necessary to bond the armor of single-conductor cable to avoid arcing and electrolysis, even when the conductor was laid under water.

During the discussion of this paper Dr. Steinmetz said that it was apparently demonstrated that steel-armored single-conductor cable was unsafe and that the ordinary few tests usually made on cables were not sufficient in this case, but the investigation should be extended over the entire range of normal and abnormal conditions likely to arise in practical operation.

WEDNESDAY MORNING SESSION.

The paper entitled "Electrical Control for Rolling-Mill Motors," by C. T. Henderson, was the first paper read at the Wednesday morning session.

This paper describes the great advances which had been made in automatic control of electrical operations in all phases of steel-mill practice. Marked efficiency now characterized the apparatus used in rolling mills, and these improvements had been possible only by displacing mechanical control by electrical features.

The paper entitled "Automatic Motor Control," by H. E. White, was then read.

Since a few years ago, when the drum controller was quite sufficient for any motor in use, the use of larger motors and the need for automatic features have resulted in the development of a great variety of magnetically controlled switches, and of various means for operating them in control systems. Control by contactors is universally adapted to service under special conditions and a long list of their advantages over other devices was given in the paper. Properly designed contactors have the inherent advantage of opening and closing quickly, thereby lessening the chances of local fusion and consequent wear. Operation at high-contact pressure results in much quicker opening. In case the contactor is required to carry a very large current for a long time, an auxiliary laminated copper contact is used. The magnetic blowout has been found equally effective for both direct and alternating current. Voltage variation greatly affects the operation of contactors, inasmuch as the pull of a solenoid varies approximately as the square of the voltage. With abnormal voltage conditions, therefore, the amount of copper used in the solenoid must be sufficient to carry the current at full voltage without overheating, and to give enough pull at low voltage to insure reliable mechanical action. In the case of contactors operated by alternating current, laminated magnets are necessary to insure operation without excessive heating. The alternating-current contactor closes at a great speed, while the direct-current contactor closes more leisurely, due to self-induction. Humming in alternating-current contactors can be reduced by the use of "pole-shading" devices. In applying contactors to the control of motors a so-called current-limit control is usually employed. In all of the simpler systems the contactors are so arranged that as each one closes it completes the actuating circuit for the next contactor, thereby causing the controlling resistance to be short-circuited step by step. One or more overload relays are so arranged that this progressive action will be interrupted without causing any contactors to be opened whenever the current exceeds a predetermined amount. As soon as the current decreases and the relays fall, the operation is renewed, until finally the motor is operating at full speed. The counter-electromotive-force system was also described and discussed. In some cases, time-limit control is useful; that is, the contactors are arranged so that they will be energized in a given time, regardless of other conditions. In this case an escapement or dashpot is usually employed. The pilot-motor control, as used in printing-press work and in the 2,000 and 6,000 horsepower rolling-mill motors at the Gary steel works, was also described. Two other comparatively distinct systems of current-limit control are also in common use. In one of these a single relay is used, with series and shunt coils. The other system makes use of a separate relay for each contactor. By using separate relays, acceleration can be secured at an increasing, or a decreasing, rate step by step. As ordinarily arranged, each relay is cut out of circuit as soon as the next contactor closes.

In the discussion of this paper, D. B. Rushmore brought up the point that in rolling-mill practice there were many engineering features which it was important for the electrical engineers of steel mills to discuss. He suggested the advisability of these engineers and manufacturers of electrical apparatus getting together for mutual information. He said also that steel-mill operators were realizing the inadvisability of allowing the price of material to govern its purchase. In this connection, when it was so important that the first installations of electrical apparatus must make a good showing, the control of the purchasing should be in the hands of the electrical engineer.

Charles F. Scott called attention to the rapid development which has taken place in the electrical operation of steel mills and said that the electrical engineeer in the steel mill had been rapidly brought forward from a position in charge of a minor part of the equipment to a position of first importance in the whole steel plant. The success of electrical development, therefore, depended largely upon the development of the engineer himself, and a great deal could be gained by the steel-mill engineers discussing their problems with engineers busy in other lines of work.

President Ferguson announced that, as the discussion was becoming very general, he would call for the presentation of the remaining papers and then turn the meeting over to a general discussion.

The paper entitled "Function of Flywheels in Connection with Electrically Operated Rolling Mills," by H. C. Specht, was then presented.

Mr. Specht considers that for all motor drives where load conditions are unstable, especially in rolling mills, the use of a suitable flywheel to take up shock and equalize the unsteady loads is necessary to produce the cheapest installation and to obtain the most satisfactory and economical operation. An equation was analytically evolved by the author showing the relation of the torque of the motor and flywheel, from which several torque curves for different flywheel effects and speed-torque characteristics were shown. From these it was evident that the greater the flywheel effect and the greater the slip for a given torque, the better will be the equalization of loads. Although the best equalizing effect and the highest combined efficiency and power-factor would apparently be obtainable with an automatic control, the load conditions in rolling mills are usually such that an automatic control cannot follow the changes of load, and so its use is inadmissible. In most cases a permanent resistance in the secondary circuit, or a control operated by hand, is most desirable. With regard to the choice of apparatus, the cheapest outfit is not always the most desirable, nor does it always give the lowest operating cost. Even if it requires considerable time to work out the best arrangement in all the details, the entailed expenses will be saved many times in the installation and operation. The author selected a typical illustration of how to arrive at the most economical result and worked out in detail his example, which was selected with load characteristics similar to those of a universal plate or rail mill.

The paper entitled "Power Requirements for Rolling High-Carbon Steel of Small Section," by B. Wiley, followed.

Mr. Wiley's paper consisted of a record of a series of tests taken from a nine-inch merchant mill having seven stands of three-high rolls and one finishing stand of two-high rolls, driven by a two-speed, two-phase, sixty-cycle, 2,200-volt induction motor of squirrel-cage rotor construction, connected to the mill by means of a forty-two-inch three-ply belt. The ratings of the motor are 600 horsepower at 600 revolutions per minute (synchronous speed) and 450 horsepower at 450 revolutions. The pulley reduction gives a mill speed of one-half these values. The product of this mill is high-carbon steel of comparatively small section, and all material is rolled on the slow speed. The flywheel effect of the system is practically limited to that of the rotor of the motor. This effect is comparatively small, as the slip of the motor is but three per cent at full load. The peak load conditions have duration of approximately six seconds. To equalize this load to the average power would require an excessively large flywheel on the mill shaft, and the slip of the motor would have to be increased approximately three times the present value, thereby lowering the efficiency of the motor. From the average working conditions as estimated from the various power curves for usual mill operation, it would require approximately a fifteen-ton flywheel eight feet in diameter, with a ten per cent drop in speed for 250 horsepower increase of load,

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in order to lower approximately the peak values of the load. The time and efficiency costs of this equalization do not warrant the use of a flywheel in the system. It is generally supposed that, due to its hardness, more power is required to roll the high-carbon steel than the ordinary mill steel, but at the same temperatures the energy required is practically the same. Owing to the high percentage of carbon the harder steel billet must not be heated as hot as the milder steel, and it is therefore rolled at a lower temperature, the lighter sections being finished at a black heat.

The paper entitled "Alternating-Current Motors Versus Direct-Current Motors in Steel Mills," by K. A. Pauly, was not ready for presentation and was passed over.

An extra paper, entitled "Electrical Problems in Steel Mills," was presented by R. Tschentscher.

Mr. Tschentscher classified steel mills in four divisions, the first class consisting of steel rolling mills where ingots or bars were purchased from other sources. The second class embraced steel-making plants where scrap and raw material were purchased; the third class embraced self-contained plants which handled the raw material and turned out the finished steel; the fourth class embraced self-contained plants with electrical equipment supplying power for other industrial uses.

The plant at South Chicago operated by the Indiana Steel Company is electrically equipped throughout from the unloading of the ore to the finishing of steel plates. A present capacity of 19,000 kilowatts is in operation and 7,000 kilowatts capacity is being added. There are 2,000 motors, with an aggregate horsepower output of 75,000. There is a converter equipment of 7,000 kilowatts capacity and a transformer equipment of 33,000 kilowatts capacity, not including the converter equipment. He did not believe that the first effort should be made to utilize the exhaust steam from non-condensing mill engines, as this put a premium on the retention of this unit. The South Chicago works were installing a low-pressure turbine utilizing the waste steam from the mill engines with a nominal capacity of 7,000 and a maximum rating of 9,000 kilowatts. Where the company was supplying power to other users, power-factor correction had to be watched. The South Chicago company is just installing two 1,600-kilovolt-ampere synchronous condensers at the end of an eleven-mile transmission line which would effect a net saving of $10,000 per year at the delivery point.

In connection with electric-furnace work, the South Chicago plant for the past two months had been using fifteen-ton, three-phase furnaces utilizing 750 kilovolt-amperes at twenty-five cycles. To displace an ordinary open-hearth furnace plant yielding 4,000 tons per day would require from 20,000 to 30,000 kilowatts capacity.

The paper entitled "Rolling-Mill Motors," by E. W. Yearsley, and the paper entitled "Electrically Driven Rolling Mills," by E. Friedlander, were abstracted by Mr. Rushmore.

Large motors, says Mr. Yearsley, should be enclosed in compartments, ventilated by clean air if necessary, or should be of the totally enclosed type, to give protection from dust, moisture, etc. Main motor drives are superior to engine drives, even when power must be derived from a steam engine-driven generator plant fed by coal-fired boilers. Steam losses due to condensation and leaky valves and rings are surprisingly large, but usually escape definite measurement. Where waterpower or waste gas is available there is no question of the greater economy of electric drive. Mechanical strength and simplicity are the main points to be observed in designing controlling apparatus for mill service. Heavier and more mechanical switches and circuit-breakers, better protected and more durable rheostats and more dependable automatic controlling devices, requiring less attention, are badly needed. For large main-drive motors the advantage of continuous running at constant speed is so great that it would appear advisable to make the design of the mill suit the characteristics of the motor, and avoid the extra expense and complication of devices like the reversing drive. There seems to be no great difficulty in designing mills for continuous-running motors. By combining such motors with a suitable flywheel, it should be possible to keep the line load sufficiently uniform. Tests of these characteristics will be comparatively easy on electric mills, so that data will rapidly become available for supplying the system with the proper inertia. The importance of low armature inertia for reversing motors is now well recognized, but designs could be improved by still further reducing in speed. The writer is decidedly against the use of high-speed motors for any kind of mill service and believes the extra cost of slow-speed machines well warranted. For mill apparatus which must be handled directly, especially for direct-current apparatus, the author favors a maximum of 250 volts. Alternating-current and direct-current motors and apparatus both have their advantages for steel-mill installations. Local conditions must determine which is superior. Unless transmissions are too long, the author favors a direct-current installation, especially if the plant has many machine tools.

Mr. Friedlander states in his paper that the introduction of the electric drive in rolling mills has made it possible to get the best relation among rotating masses, speed, time, and horsepower, and has helped the designer to calibrate rolls in such a manner that the power characteristic for all the passes is uniform, thereby avoiding high-power peaks, decreasing the size of the prime mover, and reducing first cost of fuel consumption. The watt-hour meter acts as a continuous indicator diagram to the roller and enables him to tell at a glance just what his rolls are doing and how the steel is behaving in rolling, besides giving much other accurate information on power requirements hitherto unobtainable. The ideal motive power for rolls should drive them slowly when the steel enters and faster as the piece lengthens. For this the characteristics of the electric motor are much better than those of the steam engine. Even with double its full torque the efficiency is good and the motor will not stop. With regard to flywheels, tests have shown that rotating masses are sometimes not only of no use but that they often prove a drag on the motor, necessitating that careful study should be made of each particular case. On blooming and roughing mills, where the pieces are very short and the intervals long, rotating masses supply the largest part of the energy during the rolling period and should therefore be large. The reverse of this takes place at the finishing passes, where pieces are long and follow each other rapidly. Heavy rotating masses would in this case be useless, and would even require larger motors for their quick acceleration. Curves showing the number of pieces in the rolls at the same time, the lengths of passes and intervals, the power required for each pass, etc., should be plotted, where one motor drives roughing and finishing rolls. These will enable the best relation between the sizes and speed of the motor and flywheel, and other data, to be determined. The use of electric motors in place of reciprocating engines renders the operation of the reversing mill nearly automatic; no skilled operator is required and all danger to the motor and mill is eliminated. A motor generator which will give large currents with low excitation, and one that will be quickly magnetized and demagnetized, is needed to facilitate quick reversing. In mill work where power and speed variation are considerable, the direct-current motor, on account of its load and speed characteristics, is better adapted for driving rolls than the alternating-current motor; in fact, for reversible roll drives it is used exclusively. The use of higher direct-current voltages in connection with large rolling-mill motors should be satisfactory; but no doubt high-tension alternating-current transmission and induction motors direct on the line will be generally employed, especially in new installations.

During the discussion of these papers K. A. Pauly said that the use of non-automatic control was to be preferred with rolling-mill motors. Automatic alternating-current contactors had not been sufficiently developed, and direct-current contactors, because of the high resistance in the open coil, were sluggish. There might still be something to be gained, however, in acceleration and retardation over small ranges. The use of permanent resistance eliminated a troublesome part of the equipment.

J. B. Parker said that the advantages of flywheels with electrically driven apparatus obtained in other industrial operations besides rolling-mill practice. The use of the flywheels brings about improvement in the quality of service, particularly with refrigerating machines, where the pulsations of double-cylinder, single-acting plungers caused a bad flickering in the lighting circuit.

Mr. Scott pointed out that usually one of the first considerations in applying electricity to industrial purposes involved the question of the supply of power; this, however, was not the prime consideration, as the power must be used effectively in order to secure successful operation. Rolling-mill operation had its analogy in machine-shop work, where the harmonizing of the motor and the machine tool has brought about a change in the design of the latter.

Mr. White, replying to a question concerning the use of dynamic braking with induction motors, said that no method had been developed which would operate without a tendency to start the motor in the opposite direction after stopping. An effort was being made to apply the retarding current in the reverse phase and

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use some other method to shut off the current just as the motor was approaching standstill.

W. H. Abbott contributed an interesting suggestion to the discussion concerning the calculating of flywheel effects. Some time ago, when investigating the amount of variation of speed of a flywheel, he had approached a solution of the problem by plotting a curve of the moving mass upon co-ordinate paper, using time as abscissæ and power as the ordinates. Measuring the distance between the base line and the curve by a planimeter and dividing by the time a line can be drawn through the power curve giving the average power. This may be used as a base, assuming the flywheel to be stationary. From these data can be calculated the energy given to the flywheel. Investigation shows that there is a swinging movement backward and forward of the rotating mass, the impulses in the forward direction being measured by the arcs above the base line and the retarding effect by the arcs below the base line. The curve also indicates that where the power line crosses the average power base line the direction of the flywheel tends to change, and the motion will lag behind the impressed power. Wattmeter curves will show the impressed power, and a calculation can be made for the impressed velocity which will be given to the mass forward and backward.

WEDNESDAY MORNING—PARALLEL SESSION.

The parallel session on Wednesday morning was called to order at 10 a. m. by Paul M. Lincoln, who acted as chairman. The first paper presented was that entitled "Some Considerations in Designing Heavy Capacity Fuses," by L. W. Downes. The paper was abstracted by the author.

The argument of this paper is to show the advantages of multiple-link fuses. A study is made of exactly what occurs when a fuse is blown on short-circuit and it is found that it is extremely desirable to have about the fuse material itself as much filling material as possible in order to cool the resulting gases formed. In order to bring the filling material as completely as possible in contact with the fuse conductor a subdivision of the latter, or an arrangement of it so as to have a maximum amount of surface preferably distributed evenly throughout the area, as it is in multiple-link fuses, is shown to give the best results. A number of tests of enclosed fuses are described and oscillograms are given. These show that the multiple-link fuses invariably operated quietly, whereas the single-link fuses generally burst, the worst case being that in which a single, round wire was used. These results show that where the greatest possible contact with the filling is provided the avenues for the escape of the gases have the greatest extent, and therefore such fuses are the safest to use.

The discussion was opened by C. F. Harding, who noted with pleasure the wide use of the oscillograph for greatly varying sets of conditions. He believed that there must be considerable moisture left in the filling of the fuse and that the testing on short-circuit does not reproduce commercial conditions, since usually the fuse is under heavy load before the short-circuit takes place, and therefore the amount of moisture present would seem to be variable. J. C. Lincoln and W. S. Andrews also discussed the paper briefly.

In closing the discussion Mr. Downes stated that the construction of the multiple and of the single-link fuses that were tested was identical. The filling mostly used consists of different salts of calcium, particularly calcium carbonate and calcium sublimate. This filling contains from sixteen to eighteen per cent of moisture when completed. It is necessary to raise it to a temperature of 600 to 700 degrees to drive the moisture off to any extent. After this has been reduced to about four or five per cent it remains practically constant and is not affected to any extent by atmospheric conditions. The investigations were made in order to find the best method of avoiding the most serious difficulty of enclosed fuses, that is, explosion of the casing. Such explosions have frequently resulted disastrously, and the conditions of the tests were made to correspond to commercial conditions actually met with. In answer to Mr. Lincoln's query regarding the accuracy of the fuse, this depends upon the care with which it is designed. It is not difficult to make a fuse which is correct within ten per cent of its rating. There are two methods of making the reliability of enclosed fuses of a higher order. The most common is the notching of the link to bring about a high current density at the center, and the other is the use of an air drum by means of which a small body of air is confined about the central portion of the link. This latter type of fuse possesses a very high degree of accuracy whether cool or hot. In regard to the use of metals for the fuse link, the harder metals—copper and silver—are not well adapted on account of their higher boiling points.

A paper entitled "Comparative Costs of Twenty-five-Cycle and Sixty-Cycle Alternators," by Carl J. Fechheimer, was then abstracted by the author.

Twenty-five-cycle alternators are known to be more expensive than sixty-cycle machines built for the same output, speed, voltage and phase. In this paper the author endeavors to explain some of the reasons for this increased cost and to point out the actual increase that should be expected. For purpose of comparison sixty-cycle and twenty-five-cycle alternators built for three-phase operations at 2,300 volts and designed in one case for 300 and in another case for 100 revolutions per minute, are considered. The higher speed was taken to apply to water-wheel-driven alternators and the lower speed to engine-type alternators. In each case revolving-field machines with rectangular poles were compared. In twenty-five-cycle machines the flux from each pole is about three times as great as in sixty-cycle machines, but the density used is greater. As more ampere-turns must be used for the lower frequency machines the radial height of the poles is greater. After eliminating all variable costs and reducing them as nearly as possible to the same basis the author concludes that a twenty-five-cycle machine is about 42 per cent more expensive at 300 revolutions per minute and 30 per cent more costly at 100 revolutions per minute than a sixty-cycle machine for the same output, voltage and phase. In small machines for high speed the difference is still greater. The great weight of the field structure for twenty-five-cycle machines guaranteed to stand a large overspeed makes their cost considerably greater. The great length of the end connections of the stator coils for twenty-five-cycle apparatus of large size and high speed necessitates that they be supported. This is not necessary in most sixty-cycle machines and is another element that makes the twenty-five-cycle machine even still more costly than the figures previously given for high-speed machines.

J. C. Lincoln started the discussion by questioning whether the cost of the armature copper and of the field copper is the same at 2,500 kilowatts as is indicated in the paper. Ordinarily the cost of the field copper is several times that of the armature copper for a machine of that size.

M. G. Lloyd thought it was unfair that in comparing the total costs the 300-revolution machine had included its base, shaft and bearings, while the 100-revolution machine cost did not include these items. He also wished to know whether silicon steel had been taken into consideration in any of the calculations, since it seemed to him probable that it is going to be used in alternators and motors.

Mr. Fechheimer replied that the relative proportion of the copper and the iron depend to a great extent upon the excitation used and the degree of ventilation attained. The reason for including shaft and bearings for the 300-revolution machines was that they are intended for waterwheel drive, in which case the generator manufacturer must furnish these parts.

The 100-revolution machines are engine-type generators, for which the engine manufacturer usually supplies the shaft, bearings and base. As to the use of silicon steel, no calculations have as yet been made in comparison, but complete tests are under way with this material also.

In the absence of the author, I. E. Hanssen, his paper entitled "Calculation of Iron Losses in Dynamo-Electric Machinery" was read by title only.

It is well known that the iron losses in motors and generators are greater in actual practice than those that have been calculated from iron-loss curves. In this paper the author discusses some of the reasons for the discrepancy and gives some rules for determining the corrections that should be made to the calculated values. In the case of smooth-core armatures the lack of uniformity of distribution leads to an increase of the losses as does any imperfection in the insulation between disks. To prevent teeth from bulging out extra heavy disks are generally placed at the end of the core and next to the ventilation ducts. In these heavy disks from four to nine times as large eddy-current losses occur as in the thin disks. The magnetic field in the armature is not an alternating one, as is usually the case in tests of iron samples, but is of a rotating nature. Lack of concentricity of the armature and field produces eddy currents in the field poles. Under the best conditions in smooth-core armature machines the actual iron losses are twenty-five to thirty-five per cent greater than those calculated. In toothed

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armatures the distribution is still less uniform. The losses due to filing and burrs in the teeth are much greater. In machines having wide-open slots, the variations in gap density are very marked and produce eddy-current losses in the pole shoes. In the case of direct-current and of synchronous machines these losses may also occur in the rotating element.

A written discussion on this paper was submitted by R. E. Hellmund, who thought that Mr. Hanssen's method represents a very good medium between the exact theoretical and the purely empirical formulas. It is a well-known fact that machines of the same type which are manufactured at the same time show core losses differing from each other by as much as twenty per cent, or even more. However, the results obtained from Mr. Hanssen's method always came very close to the average value of the tests on a number of machines of the same type.

A. E. Averrett did not believe that a slight cut in a lathe will increase the service loss as much as fifty per cent. He was familiar with machines in which the results were not affected appreciably by such turning. If the turning is done properly it very seldom increases the core losses to any extent. He advocated the use of silicon steel for high-frequency machines, since it decreases the core losses very much and is therefore desirable in spite of its increased cost.

V. Karapetoff thought that the most reliable procedure in the calculation of core losses was to determine from a large number of machines actually built the exact iron loss at a definite density and at definite frequency and then to use the average of such data. He explained that the photographs given in Mr. Hanssen's paper are not photographs of actual lines of force, but were obtained by Professor Hele-Shaw from fluid flowing between two glass plates; to this fluid coloring matter is added and a projecting lantern is used when the photograph is obtained. These pictures give a good idea of the magnetic distribution, however.

The next paper taken up was that by J. V. Dodd, entitled "Auxiliary Poles for Direct-Current Machines." The paper was read in abstract by the author.

This paper deals with the practical design and testing of commutating-pole machines. The subject of commutation is at first briefly discussed. Perfect commutation occurs when the current is divided equally over the surface of the brush and where the rate of reversal is the same at all points. In order to obtain this, three conditions must be present: (1) Each bar must make perfect contact with the brush over its entire surface. (2) The resistance of contact surface between brush and bar must be high with respect to the resistance of the coils or of the connections to the commutator, otherwise the edges of the brush will carry more than their share of the current; this condition is practically attained by the use of carbon brushes. (3) There must be no electromotive-force generated in the coils short-circuited by the brush; this is the principal cause of poor commutation. The fundamental necessity for auxiliary poles lies in the need of annulling the armature flux, and particularly that part of it passing through the commutated coil, in order that equally good commutation at full load and no load should result. In designing auxiliary poles, the first step is to calculate the voltage of armature self-induction. A wide pole-face is desirable, as the pole tip must cover the extreme positions occupied by any of the armature coils at the time of commutation. The flux passing through the auxiliary pole should be proportional to the load, i. e., the pole must be unsaturated up to the specified overload limits. The curves of armature induction and of auxiliary pole flux when plotted should coincide to insure sparkless operation. Two causes might prevent this coincidence: (1) not enough turns on the auxiliary coil, and (2) saturation of the auxiliary pole at full load. The first can be remedied by adding turns, the second is almost hopeless, especially for high-speed machines. After giving an example of auxiliary-pole design, the paper is concluded with some notes on the exact testing of the efficacy of the auxiliary poles. The best way to make the test is to measure the voltage between points on the commutator under the brush with a low-reading, direct-current voltmeter. If a zero reading results from this measurement, the armature flux has been properly annulled, and if the mechanical condition of the commutator and brushes is good, the commutation will be perfect.

Cyril J. Hopkins discussed the subject of air gap in railway motors having commutating poles. With motors that do not possess the auxiliary poles the air gap is usually determined by the necessity for satisfactory commutation, while with commutating pole motors the air gap length is much diminished and is limited by the necessity of considering the wear of the bearings. It is desirable to allow as much as possible in the wear of bearings so as to get a reasonable length of service from the motor before it becomes magnetically unbalanced, and it seemed to him that with a diminished air gap that the same amount of wear would produce unbalancing sooner than with a long air gap. It was desirable therefore to make use of ball bearings which should not show any appreciable wear.

J. C. Lincoln described graphically the method of calculation he had made use of. This was especially to get an absolutely straight line of the speed with a change of load. Professor Karapetoff endorsed Mr. Lincoln's method of calculation which is to put enough ampere turns on the pole to neutralize the armature reaction. The commutating pole must give such a flux that the conductors that are short-circuited and pass under the commutating pole induce a voltage equal and opposite to the voltage of self-induction.

C. A. Adams stated that Mr. Dodd's method is not strictly a new one, but his explanations are from a new point of view. He believed it desirable to separate the main armature flux from the flux which is due to the coil undergoing commutation. With the ordinary number of coils it is impossible to include that with the armature flux, as Mr. Dodd seemed to have done.

The discussion was concluded by Mr. Dodd, who stated that the present paper had not taken account of railway motors, but was confined almost entirely to generators. He explained his method of making the voltage test on the commutator bars under the brush. He believed his method of calculation agreed with that described by Mr. Lincoln.

The paper on "Electric Measurements on Circuits Requiring Current and Potential Transformers" was then abstracted by its author, L. T. Robinson.

The growing use of current and of potential transformers in connection with measuring instruments requires that an exact knowledge be possessed of the transformation ratios and the relation of phase angles in various conditions of frequency, voltage, and power factor of the circuit being tested. The author, therefore, discusses at first the errors in the use of commercial ammeters, voltmeters and wattmeters. The use of these transformers, in connection with wattmeters, is liable to be the most prolific source of errors. Tables of connections for use with wattmeters are given. From the table it can be seen that within certain limits of accuracy and power factor the correction for phase angle may be neglected. The current transformer is then considered somewhat in detail and the method of determining the exact ratio and phase angle by means of reflecting dynamometers is described. The method of determining the ratio by means of current-carrying resistances and an alternating-current comparator was also described. A similar study is then made of the potential transformer. Various methods for the accurate determination of the ratio and phase angle are given in detail. In conclusion, it is pointed out that if current and potential transformers are carefully designed they may be used with small errors resulting from the various devices connected with the secondary circuit and with the primary current varying between the limits of the connected instrument scales, and also with the voltage and frequency variations met with in commercial practice. If care is not used is selecting suitable apparatus for particular conditions, errors as great as five or ten per cent, or even more, may occur. Where low power-factor is present or where a high degree of accuracy is required carefully determined corrections for ratio and for phase angle must be applied.

Clayton H. Sharp said that, in order to get the best results in the measurement of the ratio of current transformers, the two instruments used should have as nearly as possible the same natural frequency of oscillation. The method which Mr. Robinson outlined is one that has been used in his laboratory for several years. It is a bridge or zero method, in which the result is obtained in terms of the ratio of two resistances. He had found the use of the rotating commutator rather unsatisfactory and described several methods for eliminating it. His method dispensed with the necessity for using two wattmeters and did not require three observers and a steady current. The entire apparatus can be attached to a switchboard and the measurement of the transformer ratio and its phase angle made on the transformer in place. He had with him some of this apparatus, which on account of the lateness of the hour he did not explain in detail.

M. G. Lloyd described the methods made use of at the Bureau of Standards, Washington, D. C. He also did not get

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good results with the use of a rotating commutator. The determination of the phase angle was made almost simultaneously with the transformer ratio. In general it can be said that an instrument transformer is a precise piece of apparatus when it is used under proper conditions. There is one way in which error may be introduced even when the transformer has been properly calibrated and when it is not subject to aging. This is due to the fact that iron in some cases requires a different magnetizing current than it does in other cases. This may be brought about by magnetizing too highly in one direction and then subsequently breaking up the magnetizing current. He thought that the matter of wave form should have been taken up by Mr. Robinson.

The paper was also discussed by John W. Dorsey, L. W. Chubb, Albert F. Ganz, and by Mr. Robinson.

The last paper at this session was that entitled "Electromotive-Force Wave-Shape in Alternators," by Comfort A. Adams. It was presented in abstract by its author.

The shape of the electromotive-force wave of an alternator at no load is dependent upon the shape of the flux-distribution curve and upon the arrangement of the armature conductors. The electromotive-force of one phase of an alternator is generally made up of several of the slot electromotive-forces added together with their proper phase relation, the electromotive-forces of two adjacent slots being displaced by an angle corresponding to the slot pitch. In adding the slot electromotive-forces it is necessary to analyze the flux-distribution curve into its fundamental and harmonics and to make a vector addition of the fundamentals in the proper slot electromotive-forces and separately of the corresponding harmonics to get a fundamental and a set of harmonics, which when combined give the complete phase electromotive-force. This method of the author is then applied to various types of armature winding. A summary of this study shows that there are several differential actions combining to reduce the electromotive-force induced in the armature of the alternator, but they affect the fundamental and the various harmonics in different degrees, the amount of reduction of the fundamental being in general very small as compared with that of the harmonics. These differential actions are classified as follows: Belt differential action, between the several slots of each phase belt; pitch differential action, between the two belts of each coil group; mid-coil differential action due to the mid-coil connection and the consequent equivalent widening of each belt, and phase differential action, between two phases connected in series as in three-phase star connections. By proper combination of these various differential actions it is possible to reduce all the harmonics of an alternator electromotive-force to very low values without seriously reducing the fundamental even when the flux distribution is far from sinusoidal. The paper is concluded by giving a number of examples of the author's method of relating the shape of the flux distribution curve to that of the electromotive-force wave.

This paper was briefly discussed by J. C. Lincoln and Mr. Adams, after which the meeting adjourned.

THURSDAY MORNING'S SESSION.

The first paper called for on Thursday morning was entitled "The Modern Telephone Cable," by F. B. Jewett, which, owing to the absence of the author, was passed over.

A resolution of thanks was offered to the American Telephone and Telegraph Company and to the Central New York Telephone and Telegraph Company for the local and long-distance telephone privileges which had been accorded to the members. A resolution was also introduced thanking the members and associates who had contributed to funds for entertainment, these funds having been secured entirely without aid from anyone connected either directly or indirectly with the manufacturing interests.

The paper entitled "The Training of Non-Technical Men," by C. R. Dooley, was read.

This paper describes the work which is carried on at the Casino Night Technical School at Pittsburg.

The author, in the course of his highly suggestive paper, gave an account of the educational activities of the Westinghouse interests at East Pittsburg, Pa., in the training of non-technical men. Accounts of the apprenticeship system and of the night schools were given in which was shown the extraordinary effort put forward by instructors (themselves practical men in employment at the works) and also by the students to their mutual instruction and upraising. In conclusion, he said that while it is not within the province of a manufacturing concern to provide a liberal education for its men, with the present degree of education among young men it is within the principles of good business to provide and maintain a training in those fundamental subjects which will assist in developing skilled mechanics and workmen of higher ideals to carry on the business of the future.

The paper entitled "The Value of the Classics in Engineering Education," by Dr. C. P. Steinmetz, was briefly abstracted by the author.

Education is not the learning of a trade or profession, but it is the development of the intellect and the broadening of the mind, afforded by the general knowledge of all subjects of interest to the human race. It is the stock-in-trade which enables a man intelligently to attack and solve problems for which no previous data exist. These problems are practically the same in all walks of life, and the general education of the mind and intellect required by engineers, lawyers and physicians, and all other professional men is practically the same. The only differences in the various professions are those pertaining to the specific instructions and the study of the details of the peculiar branch of human knowledge which will be the life work of the student. The study of the Latin and Greek languages has been for ages the foundation for all education, and the latter-day neglect of the classics, owing to the development of empirical science and its application, is to be deplored. There is a considerable utilitarian value in the study of these languages and the terminology of science is entirely based on Latin forms with Greek and Latin roots. The modern languages are not in the same class with the classic languages and to the engineer particularly the knowledge of them offers no appreciable help in following the engineering progress of other countries, as practically all that is worth reading is translated into English either in full or in abstract. Even to a reader who has made considerable progress in a modern language the lack of knowledge of the technical terminology of that language is often an unsurmountable barrier. Since the modern languages have no appreciable educational value they should be dropped from the engineering curricula of our colleges. The author concluded his paper with an outline of his proposed methods of classical instructions and with a résumé of the best authors to be studied in this connection.

This paper was supplemented by a letter from F. P. Fish, who said the Institute was under an obligation to Dr. Steinmetz for the preparation of this paper. Too many of the members have given little consideration to this subject. Mr. Fish was in full agreement with the general principles of Dr. Steinmetz's paper and considered it unfortunate that many engineers did not have the opportunity of studying the great authors of Greece and Rome. Anyone, he thought, who studied the classics was better fitted to take a sane view of broad topics and was a better judge of human nature. The literature of other lands should also be given considerable study.

Prof. C. A. Adams said it was a matter of great interest to witness the change which had come about in the attitude of manufacturers in the treatment of employes, and that today men were giving greater consideration than ever to the improvement of the men at work in the shops. He did not agree entirely with Dr. Steinmetz that the study of the classics was essential to proficiency in engineering. It was a fine thing to have, but in the present day it was not likely that boys undertaking the study of engineering work would take kindly to the study of classics.

Charles F. Scott called attention to the severely commercial aspect of Mr. Dooley's paper, and said that the work described fulfilled the important and essential conditions for engineering training. He agreed in general with Dr. Steinmetz that great breadth of knowledge and culture were of value, but considered that we had been getting away from speculative and philosophic lines of thought in our assumption of scientific grappling with the problems of today.

Farley Osgood said that there appeared to be a tendency in the engineering colleges to train men to become designers and manufacturing engineers rather than operating engineers. One of the greatest difficulties public-service corporations have is getting young men from college who have been properly trained to become good managers and executives. The operating engineer meets with a multiplicity of problems, coming at him quickly, and he must be a rapid, accurate thinker. Further than this, his success will largely depend upon his ability to so describe his needs and the logic of their being met that the people upon whom he must depend for the money to carry out his enterprises will be convinced that he is correct in his conclusions.

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Dr. M. G. Lloyd said there was no doubt of the value of broadening our educational endeavors, and we should seek to apply these efforts so as to make the benefit possible to all young men. The conditions are general and not peculiar to engineering, and are extraneous to technical training. Emphasis should be placed on the importance of teaching languages and kindred subjects in the lower grades and keeping scientific studies upon a higher plane.

J. B. Parker said that the work described by Mr. Dooley and the results which were being achieved indicated a way in which we may realize the fundamentals of our democracy in doing away largely with class consciousness.

D. B. Rushmore said that one of the first questions to be answered looked to a reasonable analysis of what we are trying to do. All men have to perform a multiplicity of functions, chief of which apparently was the necessity of providing a livelihood. Apparently in the last analysis a man must confine himself very closely to what is going to be his life-work.

Dr. C. H. Sharp said that if the engineer was going to be not merely an engineer but a leader in human affairs, he must have a broad cultural training. The teaching of languages was largely a waste of time unless they were so taught as to persuade a mastery sufficient to absorb the spirit of the original writing. He thought we should do more of what the schools of law, theology and medicine are doing and secure as students for engineering institutions young men who had had considerable classical education.

J. G. White made a strong plea for a more consistent and coherent study of English in our engineering schools and also expressed the opinion that Spanish should form a part of the student's opportunities.

Dr. George F. Sever raised a note of warning against adding to the complexity and extending the variety of subjects taught in engineering schools. If we aspire to the broad cultural lines indicated by Dr. Steinmetz, we will have to extend our courses. He believes, however, that any man who had been properly trained as an engineer could make himself a scholar through individual work.

Mr. Rushmore, at this point, took occasion to point out the very happy condition which had marked every event of the present convention and the splendid results which had attended Mr. Ferguson's administration. He said that probably never before had the personality of the president been so definitely felt in the administration of affairs. The board of managers had decided to take a step in recognizing the services of the president for the first time this year, and as a token of their appreciation took the highest pleasure in presenting to Mr. Ferguson a gold medal.

Mr. Ferguson made a brief reply to Mr. Rushmore and said that for whatever success had been achieved he took no personal credit, that it was entirely due to the board of managers and the officers and members of the various committees, upon whom the greatest variety and volume of work was incumbent, and to whom should be extended the appreciation of every member of the Institute.

In closing the discussion on the educational papers, Dr. Steinmetz said that the earning of money as a purpose in life was the mistake of our age and nation. The suggestions he had made in his paper were only a few of the many possible solutions. He thought that there should be interposed between the high school and the college a course in the classics and that the engineer, after graduating, should have a rounding-off period. This would mean a period of twelve years from the time of entering high school to entrance into the profession. What should be done immediately, however, was to recognize classic languages as equivalent to modern languages. The student should have a choice of Latin, Greek, French, German and Spanish, two of these being selective.

The paper entitled "Pole-Face Losses," by C. A. Adams, A. C. Lanier, C. C. Pope and C. O. Schooley, was abstracted briefly by Professor Adams.

Experiments were undertaken to establish a reliable and, if possible, a rational quantitative relation between the pole-face losses and the principal variables involved therein. In any dynamo-electric machine with a toothed armature the magnetic flux density at the pole-face opposite a tooth is greater than that opposite a slot, and as the armature rotates, the teeth carry waves of flux across the pole-faces. At the ordinarily high tooth frequencies the eddy-current loss predominates; with solid pole-faces the hysteresis loss is negligible. The transverse portions of the eddy-currents are the ones which will produce the damping of the flux pulsations and are predominant in the case of solid shoes. These are called the "damping currents." Those parts of the eddy currents in the circumferential direction are ordinarily relatively small, and as their tendency is to screen the center of the pole from the flux pulsations and to drive the latter to the two circumferential edges, they are called the "screening currents." With laminated pole shoes the screening currents predominate and the damping currents are reduced in magnitude and effectiveness; that is, the pulsations will penetrate much deeper into the pole shoe and the advantage of the laminations will be considerably neutralized. The chief difference between the damping and screening currents is that whereas the damping currents tend to force a more uniform flux distribution, the screening currents tend to disturb an otherwise uniform flux distribution over the section of the laminas. Both tend to increase the reluctance of the magnetic circuit and to decrease the eddy-current loss. The screening currents, however, tend to increase the hysteresis loss. Another source of energy loss in the pole face, often of considerable magnitude, is that due to the pulsation of reluctance of the main magnetic circuit caused by a variation in the number of teeth under a pole. This has been overlooked in previous investigations. A mathematical analysis of pole-face losses followed, after which was given an account of the results of the experiments undertaken by the authors. The machine employed was provided with detachable poles and pole shoes, and with three armatures, each with a different number of teeth. Three sets of pole shoes were used, one set of solid annealed steel castings, one set of 0.014-inch laminations, and the third set with 0.06 laminations. Constant speed tests and constant flux tests were made. The most important experimental data were summarized in curves showing the relation of the pole-face watts per square inch to the ratio of slot opening to air gap. The effect of the reluctance pulsation was averaged out and the curves then showed the largest pole-face loss in the case of the solid pole shoes. The effect of laminating pole shoes was discussed more or less in detail, as was an inquiry into the additional pole-face losses due to rivets, screws, etc.

Farley Osgood said that Professor Adams should be thanked for the spirit of his presentation, and that this paper would be peculiarly appreciated for its usefulness.

Mr. Rushmore said that it was to such papers as this that we owe our continuous advancement in the development of electrical apparatus.

Dr. Steinmetz said that it was immaterial whether a paper such as this came at the beginning or at the end of a convention; it was not for discussion, but for perusal and use, and he thought that no one would disagree with him in hailing Professor Adams as the leading designer of electrical apparatus of our American universities.

The convention then adjourned.

ENTERTAINMENT.

On Monday evening there was a reception and dance at the Hotel Frontenac, followed by a buffet supper. On Tuesday afternoon the qualifying round in a handicap golf tournament was played, the first eight qualifying for the semi-finals. There was also a woman's putting test, the first prize, a solid silver cardcase, going to Mrs. Louis A. Ferguson. The second prize, a gold-enameled belt-buckle, was won by Miss Alice A. Reed. For the third prize, a topaz hatpin, three ladies were tied, the play-off being won by Mrs. F. A. Donohoe. Mrs. W. I. Schlichter and Mrs. H. G. Reist made high scores, giving Mrs. Donohoe a hard contest for third prize.

On Tuesday evening there was a woman's bridge tournament, the first prize, a pearl brooch-pin, being won by Mrs. J. M. Wakeman. The second, a fine pair of gold-enameled bar pins, was won by Miss Alice A. Reed.

In the qualifying round of the handicap golf tournament the best gross score was made by F. A. Donohoe, winning as a prize a handsome mahogany humidor. A solid silver safety razor set was the prize of F. P. Cox for the best net score.

On Wednesday afternoon the semi-finals of the golf match were played off, Louis A. Ferguson and A. I. Totten qualifying, with Mr. Ferguson allowing Mr.

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Totten twelve strokes in the final. The driving contest was won by Professor C. A. Adams, the second prize going to C. W. Stone. There was also an exciting baseball game between two teams designated as the "Has Beens" and the "Never Was," the latter winning by a score of twenty-one to twenty. The game afforded many a laugh for the spectators and a good deal of excitement and fun for the players. There was one casualty, Professor Langsdorf receiving a dislocated shoulder as the result of a collision with Mr. Tillman.

The fine eighteen-hole golf course offered a great opportunity for the enthusiasts and the lure of the links rivaled the technical sessions in attractiveness.

On Wednesday evening there was a fifty-mile searchlight trip among the islands on a large steamer for both the ladies and gentlemen.

On Thursday afternoon the finals on the golf tournament resulted in a victory for Mr. Totten, who won with one up, Mr. Ferguson almost overcoming his handicap of twelve strokes.

The prize for the largest fish went to Mr. John H. Finney and for the largest catch to Frank H. Gale.

The following were in attendance:

Louis A. Ferguson, Chicago; Ralph W. Pope, New York; James G. White, New York; Calvert Townley, New Haven; Paul Spencer, Philadelphia; Paul M. Lincoln, Pittsburg; Percy H. Thomas, New York; Morgan Brooks, Urbana, Ill.; David B. Rushmore, Schenectady; W. G. Carlton, New York; Charles W. Stone, Schenectady; A. W. Berresford, Milwaukee; D. Frederick Schick, Philadelphia; S. D. Sprong, New York; Earl Wheeler, Washington, D. C.; W. N. Ryerson, Duluth; F. Creedy, Pittsburg; Frank H. Gale, Schenectady; F. L. Hutchinson, New York; M. O. Troy, Schenectady; Cyril J. Hopkins, Philadelphia; M. G. Lloyd, Washington, D. C.; Howard S. Knowlton, Boston, Mrs. Howard S. Knowlton, Boston; Martin P. Rice, Schenectady; H. G. Reist, Schenectady; Mrs. H. G. Reist, Schenectady; Charles F. Scott, Pittsburg; Brent Wiley, Pittsburg; Mrs. Brent Wiley, Pittsburg; Clarence Selden, New York; Mrs. Clarence Selden, New York; Mrs. Louis A. Ferguson, Chicago; H. H. Barnes, Jr., New York; C. T. Henderson, Milwaukee; R. J. Randolph, Jr., New York; Mrs. S. D. Sprong, New York; James H. Harnden, New York; Mrs. James H. Harnden, New York; John C. Reed, Steelton, Pa.; Charles T. Mosman, Boston; J. G. Zellar, New York; Floyd A. Norris, Brooklyn; Frank R. Schalck, Chicago; C. A. Adams, Cambridge, Mass.; Mrs. C. A. Adams, Cambridge, Mass.; J. M. Wakeman, New York; Mrs. J. M. Wakeman, New York; Arthur B. Lisle, Providence; Mrs. Arthur B. Lisle, Providence; John B. Given, New York; Farley Osgood, West Orange, N. J.; Mrs. Farley Osgood, West Orange, N. J.; August H. Kruesi, Schenectady; Charles A. Terry, New York; Mrs. Charles A. Terry, New York; Miss Catharine L. Terry, New York; Matson C. Terry, New York; T. N. Hicks, Niagara Falls; C. E. Robertson, Toledo; James F. Kinder, New York; A. E. Kennelly, Cambridge, Mass.; E. F. W. Alexanderson, Schenectady; Mrs. E. F. W. Alexanderson, Schenectady; Mrs. J. G. White, New York; J. D. White, New York; Lewis B. Stillwell, Lakewood, N. J.; Mrs. Lewis B. Stillwell, Lakewood, N. J.; W. F. White, New York, Mrs. W. F. White, New York; Foster White, New York; Frederic White, New York; W. A. Hall, Pittsfield; E. P. Peck, Atlanta; R. F. Schuchardt, Chicago; Mrs. R. F. Schuchardt, Chicago; Walter I. Slichter, Schenectady; Mrs. Walter I. Slichter, Schenectady; John B. Taylor, Schenectady; Mrs. John B. Taylor, Schenectady; W. I. Donshea, Brooklyn; Miss Jane E. Donshea, Brooklyn; Dugald C. Jackson, Boston; Mrs. Dugald C. Jackson, Boston; W. L. Abbott, Chicago; K. A. Pauly, Schenectady; E. A. Wagner, Fort Wayne; H. L. Wallau, Cleveland; C. W. Ricker, Cleveland; W. B. Brady, Cleveland; L. T. Robinson, Schenectady; O. A. Kenyon, New York; C. E. Magnusson, Seattle; A. E. Averrett, Schenectady; Antonio Guell, Urbana, Ill.; William H. Horton, St. Catherines, Ont.; G. Faccioli, Pittsfield; Mrs. P. M. Lincoln, Pittsburg; Henry W. Fisher, Pittsburg; Tracy D. Waring, Perth Amboy, N. J.; Prof. Dalemont, University Fribourg; L. W. Chubb, Pittsburg; H. C. Specht, Pittsburg; Azel Ames, Yonkers, N. Y.; J. C. Lincoln, Cleveland; A. H. Armstrong, Schenectady; Albert F. Ganz, Hoboken; Floyd W. Smith, Canton, N. Y.; S. B. Charters, Jr., Stanford University, Cal.; V. G. Converse, Niagara Falls; Mrs. V. G. Converse, Niagara Falls; Charles D. Knight, Schenectady; W. S. Andrews, Schenectady; A. Clarke, Folsom, W. Va.; W. S. Lee, Charlotte, N. C.; E. P. Coles, Charlotte, N. C.; F. M. Farmer, New York; Charles E. Waddell, Biltmore, N. C.; James L. Chaphe, Cazenovia, N. Y.; W. E. Rundle, New York; Harry Barker, New York; F. B. H. Paine, Buffalo; Mrs. F. B. H. Paine, Buffalo; Francis E. Donohoe, New York; Mrs. Francis E. Donohoe, New York; V. Karapetoff, Ithaca; Mrs. V. Karapetoff, Ithaca; Ainslie A. Gray, Chicago; M. C. Beebe, Madison, Wis.; Henry A. Reed, Newark, N. J.; Mrs. Henry A. Reed, Newark, N. J.; Miss Alice A. Reed, Newark, N. J.; Henry W. Peck, Rochester, N. Y.; L. C. Nicholson, Buffalo; George F. Sever, New York; B. E. Kenyon, Austin, Tex.; Thomas R. Rosebrugh, Toronto; Hall F. Hoxie, Ridgewood, N. J.; C. L. de Muralt, New York; Mrs. C. L. de Muralt, New York; Master Carl de Muralt, New York; G. H. Reid, Schenectady; H. D. Garretson, Warsaw, N. Y.; T. C. Martin, New York; Mrs. R. W. Pope, Elizabeth, N. J.; Miss Mary E. Durant, Elizabeth, N. J.; Alexander Maxwell, New York; J. S. Van Bylevelt, Cambridge, Mass.; Mrs. C. C. Townley, New Haven; Charles W. Miller, Rochester, N. Y.; C. N. Pratt, Rochester, N. Y.; Andrew Pinkerton, Pittsburg; E. E. F. Creighton, Schenectady; S. H. Blake, Pittsfield; G. N. Chamberlin, Swampscott, Mass.; Henry Price Ball, Pittsfield; John B. Whitehead, Baltimore; J. L. R. Hayden, Schenectady; Charles P. Steinmetz, Schenectady; Frederick Bedell, Ithaca; C. J. Fechheimer, Milwaukee; L. B. Cramer, Portland, Ore.; John C. Parker, Rochester, N. Y.; R. H. Tillman, Rochester, N. Y.; A. M. Dudley, Swissvale, Pa.; John H. Finney, Washington; J. W. Fraser, Charlotte, N. C.; J. L. Watson, Atlanta; John W. Dorsey, Schenectady; Arthur Simon, Milwaukee; J. Mason Knox, Schenectady; Mrs. J. Mason Knox, Schenectady; J. E. Jennings, New York; Mrs. J. E. Jennings, New York; T. E. Crossman, New York; Clayton H. Sharp, New York; Miss Dorothy M. Sharp, White Plains, N. Y.; Walter S. Moody, Schenectady; Mrs. Walter S. Moody, Schenectady; Miss Jean Moody, Schenectady; Frank J. Sprague, New York; Mrs. Frank J. Sprague, New York; Mrs. I. M. McKinnon, New York; Ellery B. Paine, Urbana, Ill.; A. S. Langsdorf, St. Louis; C. W. Koiner, Los Angeles; A. H. Lawton, New York; Frederick A. Stoughton, Massena; Lewis R. Mather, Utica; William S. Aldrich, Potsdam, N. Y.; Byron F. Burch, Potsdam, N. Y.; A. W. Henshaw, Schenectady; Henry H. Humphrey, St. Louis; William B. Hale, City of Mexico; H. Frodsham, Schenectady; Mrs. C. W. Stone, Schenectady; John W. Upp, Schenectady; H. E. White, Schenectady; Mrs. H. E. White, Schenectady; F. W. Throop, Niagara Falls; Philip B. Woodworth, Chicago; J. Lester Woodbridge, Philadelphia; J. L. Burnham, Schenectady; Miss Helen Robinson, Providence; A. I. Totten, Schenectady; Mrs. A. I. Totten, Schenectady; Mrs. R. J. Randolph, Jr., New York; A. R. Sawyer, East Lansing, Mich.; Mrs. A. R. Sawyer, East Lansing, Mich.; C. R. Dooley, Pittsburg; Mrs. C. R. Dooley, Pittsburg; Lewis L. Holladay, Charlottesville, Va.; R. H. Taber, Worcester Polytechnic Institute; John Langan, New York; E. W. Allen, Schenectady; N. J. Neall, Boston; F. P. Cox, Lynn; Jean R. Wagner, New York; Ralph D. Mershon, New York; Edward Van Wagenen, New York; A. D. Robb, Niagara Falls; H. B. Alverson, Buffalo; Robert Charles Cole, Hartford; C. Francis Harding, La Fayette, Ind.; Robert L. Allen, Syracuse; C. P. Ackert, St. Louis; Howard R. Sargent, Schenectady; Louis W. Downes, Providence; W. Butler, Lockport, N. Y.; Mrs. W. Butler, Lockport, N. Y.; H. M. Van Gelder, New York; Mrs. Therese Fechheimer, Altoona, Pa.; J. N. Dodd, New York; Mrs. G. S. Mather, Utica; Robert N. Davidson, Salt Lake City; Edward L. Nichols, Ithaca; W. Edgar Reed, Pittsburg; Charles A. S. Howlett, Chicago; S. W. Mauger, Schenectady; A. U. Hart, Hamilton, Can.; Morse O. Dell Plain, Syracuse; Arthur C. Eastwood, Cleveland; R. I. Wright, Cleveland; R. Tschentscher, Chicago; Charles F. Hunter, Albany; W. A. Blanchard, Syracuse; William A. Bucke, Toronto; W. G. Kellogg, Ogdensburg; Mrs. W. G. Kellogg, Ogdensburg; Miss Ethel A. Egert, Ogdensburg.

For Extra Subway Tracks.

The New York City Board of Estimate has appropriated $875,000 for turning the Chambers Street station of the Brooklyn loop line of the subway from a four-track to a six-track way. It is estimated that about $1,000,000 besides this will be required for acquiring additional property.

Moving Platform Subway.

The New York Public Service Commission has sent to the Board of Estimate of New York city a letter asking that a special committee consider moving platforms during the summer months. The proposition the commission has in mind is for a moving platform subway, as submitted by E. P. Ripley, president of the Atchison, Topeka & Santa Fe, and Max E. Schmidt, president of the Continuous Transit Securities Company, to run from Tenth Street to about Forty-second, which the commission says can be operated without interfering with other rapid-transit routes, and from its point of view appears to be feasible and desirable. Chairman Willcox says: "At the present time the matter has not reached the stage where it could be either formally or completely submitted to you, but in view of the early adjournment, the commission desires to call the general subject to your attention and to suggest the advisability of the reference of this matter to a committee so that it may be taken up during the summer months."

More Electrification.

The Colorado & Southern Railroad is preparing to electrify its road from South Park, Colo., to Clear Creek, Colo., and to Estes Park, Colo., making these branches part of the Denver terminal. John F. Stevens, vice-president of the New York, New Haven & Hartford Railroad, will prepare the plans and look after the arrangements in place of J. J. Hill, the president of the road. Plans will also be submitted for a $1,000,000 power plant, to be located at Mill Gulch, in the South Platte Valley, to furnish the power for a part of the line, while it is understood that the Central Colorado Power and Lighting Company will furnish the power for the other part of the line.

Lighting Plant for Pennsylvania Terminals and Tunnels.

The Pennsylvania Tunnel and Terminal Company, operating the Pennsylvania Railroad tunnels under New York city and the rivers, is installing in its Long Island City power house two Westinghouse turbine-alternator sets of 2,500 kilowatts capacity each, for lighting the tunnels and terminals. The dependability required in this service has demanded that every precaution be taken to insure absolute continuity of operation of the generating and distributing systems. The alternators will supply three-phase, sixty-cycle current at 440 volts.

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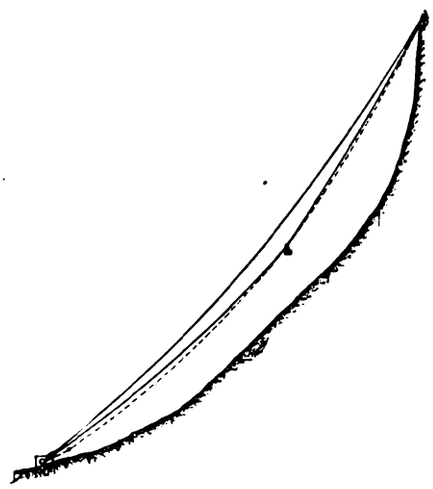
THE WETTERHORN CABLE ROAD OF THE GRINDELWALD GLACIER, SWITZERLAND.

BY FRANK KOESTER.

A very unique electrically-operated cableway, the first of its kind, has recently been installed in the Bernese highlands, Switzerland, to make the journey part way up the Wetterhorn Mountain. While the topmost peak of the Wetterhorn is 12,150 feet above sea-level, the first section of the cableway, at present constructed, conveys the tourist 1,377 feet from the lower station at the Wetterhorn Hotel, near the upper Grindelwald Glacier, 5,500 feet above sea-level.

The method adopted is the Feldmann cable system. Its principal advantages are quick and direct transit between high mountain points and exceptionally low first cost and cost of maintenance, as compared with other mountain railways.



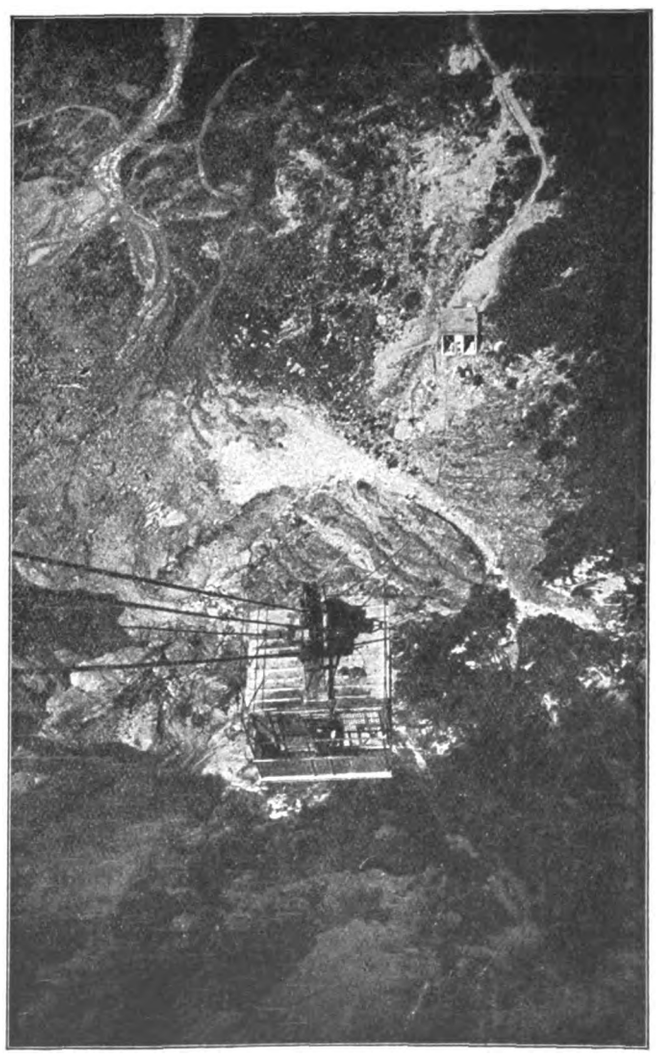
PROFILE OF CABLEWAY—VERTICAL PROJECTION, 1,377 FEET; HORIZONTAL PROJECTION, 1,197 FEET.

Before describing the installation, a rough outline of the system will be given. Two sets of cables are stretched between the lower and upper stations. The two trolley cables for each hoist are not placed side by side, but one above the other, to secure stability in operation. The upper ends of each set are securely anchored, while the lower ends form a loop by a short Gall's chain, provided with a counterweight to maintain tautness. The trolley, from which the car is suspended, runs on these cables and is drawn by a pair of hoisting cables. The latter are so connected, that when one car ascends, the other descends, thus counterbalancing one another. The hoisting apparatus is located in the upper station.

An accompanying diagram gives a profile of the Wetterhorn cableway, showing the location of the upper and lower stations. The vertical height between these terminals, as previously stated, is 1,377 feet; the horizontal distance is 1,197 feet. Two cables for a hoist are represented in the illustration by a single line. The upper line represents the catenary when the cables are free; while the middle line shows the form of the curve when the car is half-way between stations. The dotted line shows the envelope of the curves which the cables take when the car passes on its queer journey up and down.

The trolley cables have a diameter of about two inches, and have a weight of

General View of the Cableway from the Side.



View from the Upper to the Lower Station.

THE WETTERHORN CABLE ROAD OF THE GRINDELWALD GLACIER.

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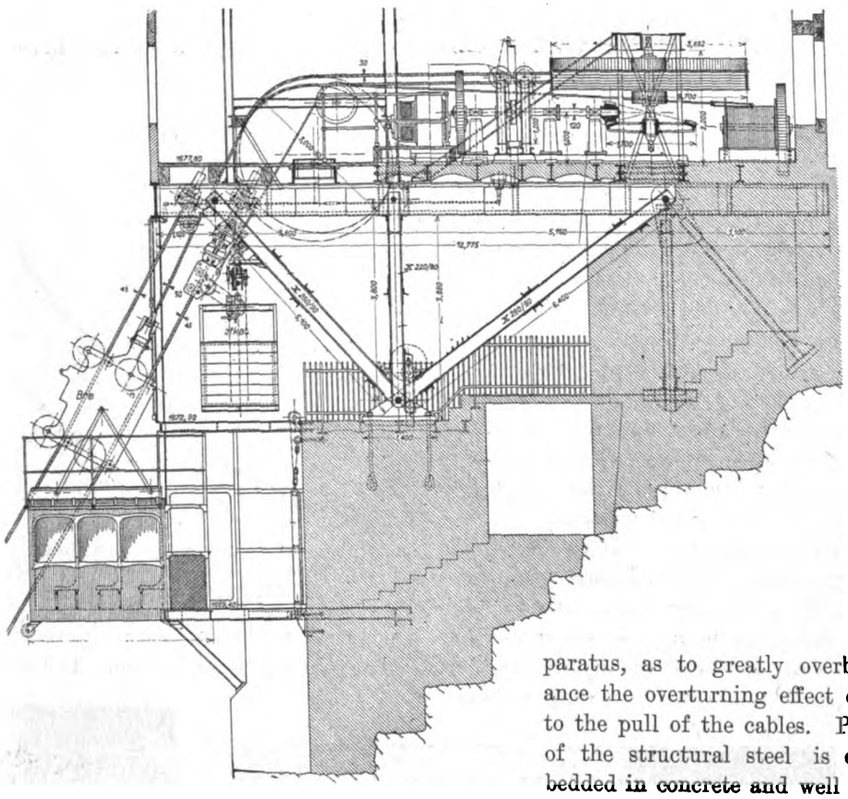
7.4 pounds per running foot, and consist of ninety-six wires in five layers. While the maximum tensile strength required is exactly 13.8 long tons, tests show that the actual tensile strength is 154.3 long tons, thus giving a factor of safety of eleven.

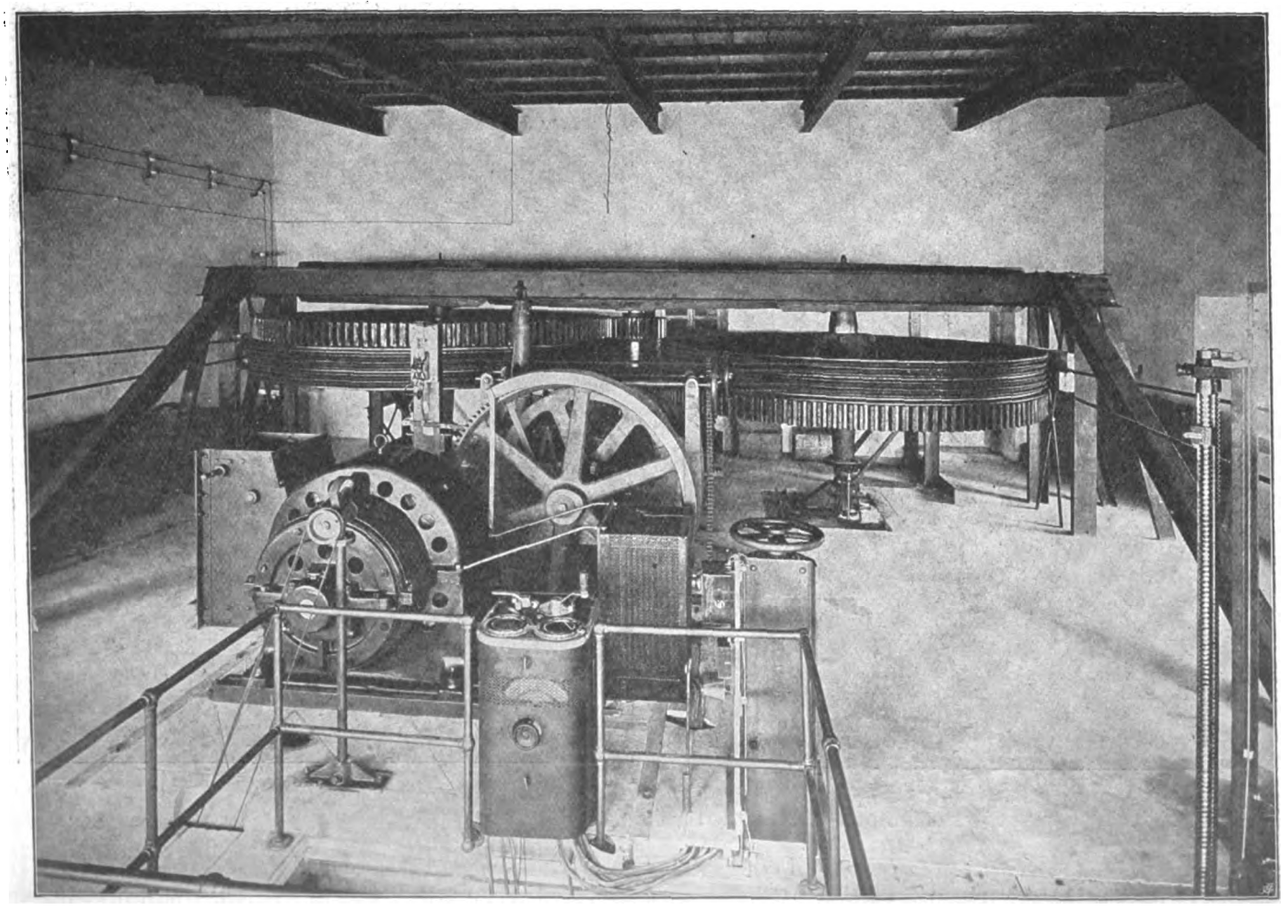
The hoisting cables have a diameter of one-and-one-eighth inches, and are composed of ninety wires in six layers. The normal tension required for each cable is 2.5 long tons, while the actual strength is 43.75 long tons, which means a factor of safety of 17.5. The two hoisting cables of each car are 5.4 feet apart. While the fastenings of the hoisting cables on the trolley have no special features, much study was devoted to the design of the anchor fastenings of the trolley cables.

The diagram herewith shows a section of the upper station and the design of this anchorage. The upsetting of the cable is done in the usual way, while the grip rests on sets of segment roller bearings, to accommodate the various positions of the cable when the car is in motion. The distance between a pair of trolley cables is 2.9 feet; that between the cableways is twenty-six feet.

As the upper station is, of necessity, on a steep mountain slope, a heavy concrete foundation in step-form is provided, and so arranged, with the structural steel of the building housing the hoisting apparatus, as to greatly overbalance the overturning effect due to the pull of the cables. Part of the structural steel is embedded in concrete and well anchored; the remainder rests on an inverted triangle, the apex serving as a pivoting point. To further insure stability, most of the ma-



VERTICAL SECTION THROUGH UPPER STATION.



VIEW OF THE HOISTING MACHINERY IN THE UPPER STATION.

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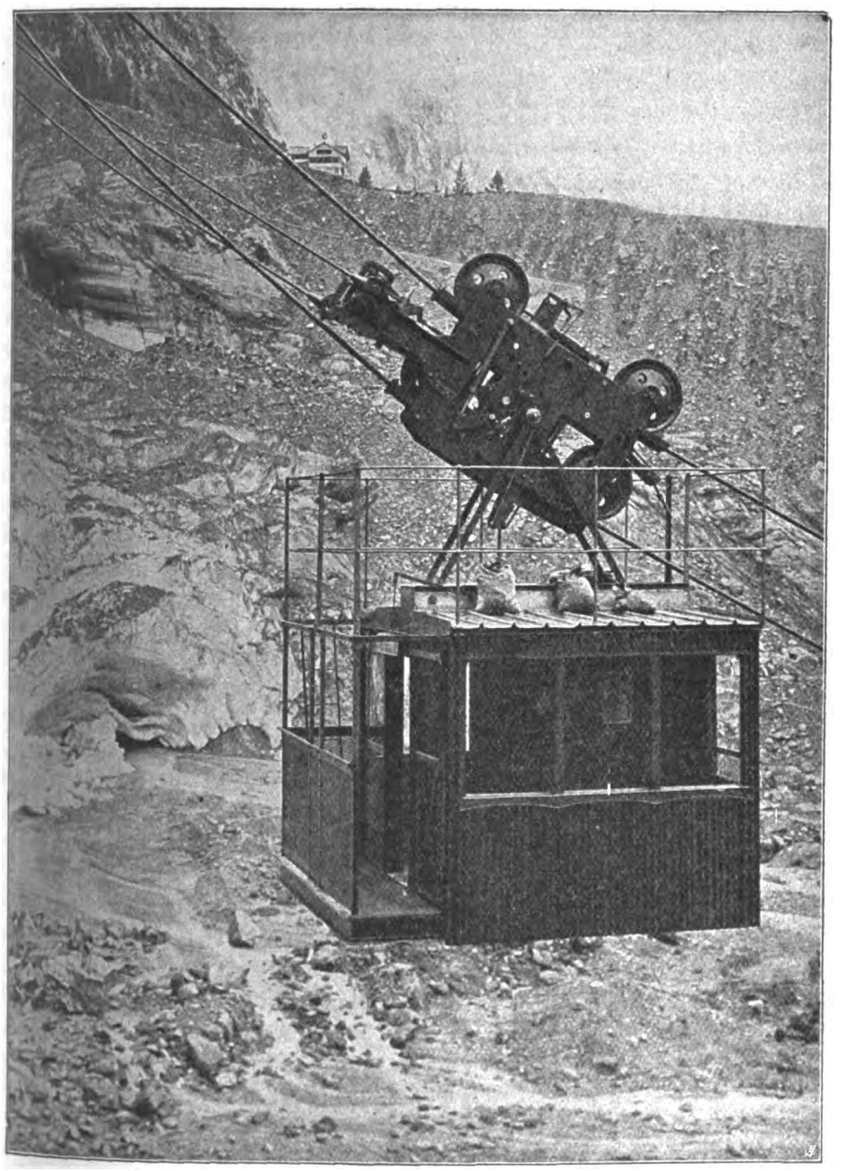
chinery is placed in the rear of the hoisting room. In addition to this the floor in the rear, and the rear wall itself, are made exceptionally heavy, while the remainder of the floor and walls are of light design.

The hoisting apparatus, as shown in an accompanying view, consists of a forty-five-horsepower motor, operating, by means of gears, two sheaves having six grooves, 12.13 feet in diameter, thus giving each cable three grooves. The two hoisting cables of each car are guided to the winding drum by guide sheaves, 9.8 feet in diameter, set in an inclined position. The cable is not wrapped completely around one drum, instead it laps half the circumference of both.

By a special arrangement of switches the driving motor serves as a magnetic brake, which comes into action in case the current supply is cut off; should the motor overspeed, rheostats are cut in automatically; and finally, to prevent the car from entering too far into the station, an automatic brake device is applied. This device is provided with manual control, in connection with speed and elevation indicators. In addition to the automatic brake there is a separate hand brake, whose sole purpose is to bring the car into gradual approach to the platform. Thirteen feet from the platform the current is cut off automatically from the motor, and the rheostats are thrown in and gradually cut out in steps.



VIEW OF CAR AND TROLLEY CARRIAGE.

In order to have the trolley-cable tension equally distributed, the lower ends of the cables of each road are connected by a Gall's chain, running over wheels, to a traverse, from which a weight of 18.5 long tons is suspended into a pit. The traverse contains three spurs, over which the chain leads. The two outside ones are free, while the middle one is fixed and set to accommodate slight variations in sag, due to the expansion, which have occurred during the early period of operation. After conditions have become normal, the weight will keep the sag uniform. To prevent the chain from slipping through the guide, in case of a break in a single cable, two fixed points are provided; in such a case the car can continue on a single cable, which, it will be remembered, has a factor of safety of eleven.

In a view herewith is shown the car or cage, and the method of suspension from a four-wheeled trolley carriage. It is made in two compartments, separated by a slot open on one side, to accommodate the cable as the car travels. This slot had to occupy the entire length of the car, because the steepest gradient in the cable is at the upper end, being 200 per cent. The car is 10.5 feet wide and 8.2 feet long. At one end is a platform 2.7 feet wide for the operator. The car is large enough to accommodate sixteen persons, eight seated and eight standing. The frame is of structural steel; the interior is finished in wood, and the outside with corrugated iron. Above the seats abundant window space is provided for observation purposes. The top of the car is provided with a railing, so that in case of emergency, the operator can make a safe inspection of the trolley carriage. The car with its carriage weighs 4.1 long tons; to this must be added 1.275 long tons, the weight of the complement of sixteen passengers and operator. The trolley carriage is made of steel and wrought-iron throughout, no cast-iron being used.

Probably one of the most difficult propositions on the whole undertaking was to provide the trolley carriage with an effective brake device, so that in case one or both hoisting cables should part, the car could automatically come to a standstill. The principle is that each cable runs through a split conical feather which fits in a sleeve. Two strong blade springs resting against the cones, when tipped, force the feathers against the cables. In case the brake has been applied during the run, it can be released from the top of the car by means of a special tool. It may be stated here that the cable manufacturer was unwilling to give any guarantee for cables subjected to such conditions. The builders of this cable road, L. von Roll's Iron Works, Gerlafingen, Switzerland, made tests with this braking device, showing that the car comes to a standstill within ten inches after the brake has been tipped, although the cables are greased. Considering this short breaking distance, it must be borne in mind

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that the sag of the cable counteracts the strain due to the sudden application of the brake, thus acting as a buffer. The braking device, as well as the rest of the equipment, was for several days rigidly subjected to governmental tests before being turned over for public service.

Current for operating the hoist is supplied by a power house at Grindelwald, over a single-phase line at 2,400 volts. In the lower station is a motor-generator set to convert the supply into direct current at 800 volts, for the forty-five-horsepower, shunt-wound, hoisting motor. For emergency cases there is installed a seventy-four-ampere-hour storage battery capable of furnishing energy for twenty-five trips. Should both sources of current supply fail the winding drum can be manually operated for bringing the cars to the stations.

In addition to these precautions, in case the brake should become jammed, there is provided for each hoist an emergency car, the windlass of which is operated by a single-phase eight-horsepower motor, or by hand. This car is guided on the lower of the two cables, and has a capacity of four or five passengers. Telautograph communication is maintained between the cars and the upper station, while between the upper and lower stations, independent telephone service is established.

The many and various emergency devices employed were installed to gain the confidence of the traveling public for an entirely new departure in passenger transportation. With the exception of the electrical equipment supplied by Brown, Boveri & Company, of Baden, the installation was furnished and erected by L. von Roll's Eisenwerke, Gerlafingen, both of Switzerland.

Electric Lights Better Than Police Patrol.

The town of Xenia, Ohio, has reduced its police force by one-half as the result of better lighting service. Instead of five patrolmen and a chief, the city will now have to get along with the chief and two patrolmen.

The City Council, at a recent meeting, decreed that electric lights were more valuable to the town than patrolmen, and as there was not enough money for both necessities, the Council compromised and took the lights. The new rule went into effect July 1. Xenia is a dry town and is reducing its expenses to the minimum.

Electrical Exports for May.

Electrical exports from the United States for the month of May show improvement over April and are better than for the same month a year ago. Trade is evidently picking up again, although not yet back to the figures of the earlier months. Prospects are, however, quite good.

As prepared by the United States Department of Commerce and Labor, the official statistics on the electrical exports are as follows:

	May, 1909.	April, 1909.	May, 1908.
Appliances	539,424	490,483	464,114
Machinery	479,951	489,026	469,088
	1,019,375	979,509	933,202

A list of the principal countries to which electrical products were exported during May, 1909, with the value of these exports, is given below:

Exported to—	—Electrical— Appliances.	Machinery.
United Kingdom	40,585	41,308
Belgium	3,838	26,542
France	2,299	3,229
Germany	17,352	16,307
Other Europe	6,581	119,673
British North America	171,970	69,196
Central American States and British Honduras	19,331	32,850
Mexico	56,802	7,307
Cuba	22,745	1,158
Other West Indies and Bermuda	2,938	11,041
Argentina	21,197	25,925
Brazil	91,354	4,208
Other South America	18,299	309
Chinese Empire	.....	981
British East Indies	.....	84,356
Hongkong	.....	30,740
Japan	21,905	12,626
British Australasia	2,318	2,579
Philippine Islands	32,608	7,350
Other Asia and Oceanica	.....	17,834
British Africa	3,373	53
Other countries	3,929	.....

Western Electric's Business.

Preliminary returns for May show that the business of the Western Electric Company is running at the rate of between $46,000,000 and $48,000,000 per annum. This would make the gross returns for the first half of the company's fiscal year ended with May, exhibit business of close to $23,000,000, or an average of nearly $4,000,000 a month.

April sales were fifty per cent larger than in April, 1908, and the sales in May were seventy per cent greater than the corresponding month in the preceding year.

Electrical Development in English Mines.

A great awakening to the advantages of the use of electricity in coal mines is taking place in the Lancashire mines in England, and about a dozen of the foremost companies have placed orders for electrical equipment to the aggregate value of upward of a million and a quarter dollars.

The New Point of View.

The state of Massachusetts is beginning to take a somewhat more liberal view of the legitimate necessities for which corporations may increase their capitalization. Governor Draper has signed an amendment to the street-railway laws of the state which gives to traction companies a latitude in capitalization that they have never enjoyed before. The amendment authorizes street railways, with the approval of the railroad commissioners, to issue new securities for the purpose of providing working capital. Hitherto Massachusetts has rigidly adhered to the principle that every dollar of capitalization must represent at least $1 of property.

The amendment does not involve the abandonment of the former safeguards, but it is supplementary to it, and recognizes the fact that, with street railways at least, the margin of profit above charges is so narrow that it is impossible to accumulate out of surplus earnings a fund for working capital. Of the eighty-two street railways in the state forty-three, or fifty-two per cent, do not even pay dividends at present. The new law authorizes street railways, with the approval of the railroad commissioners, to issue up to five per cent of their stock in new stock for working capital or to issue such amount of bonds as shall not impair the security of bonds outstanding at the time application is made.

About eighty per cent of the street-railway traffic of Massachusetts is handled by the Boston Elevated, Boston & Northern, Old Colony, Worcester Consolidated and Springfield Street Railway companies. These companies regularly require from seven to ten per cent of their capital in cash or materials. The new law will make it possible for the street railways of the state to avoid the necessity of creating floating debt in order to carry on the ordinary conduct of their business by giving them a reasonably adequate working capital.

Electrical Projects in Santos, Brazil.

Consul D. P. De Young reports that a new company, composed of Americans and Brazilians, is negotiating for a franchise to operate a line of street cars in Santos, to be constructed up Monte Serrate and to the beach, and that Doctor Ferreira dos Santos, chief of the Bureau of Telegraphy, is negotiating for the installation of a wireless station on Monte Serrate, overlooking both sea and city.

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Chicago Electric Club.

Following the regular Wednesday noon luncheon held on June 30 in the Grill Room of the Chicago Automobile Club, the Chicago Electric Club listened to a very excellent address on "Some Phases of Steam-Railroad Electrification, Particularly Comparing Chicago and New York as Possible Future Centers," by E. N. Lake, division engineer of the Board of Supervising Engineers, Chicago Traction.

Mr. Lake's address related to three aspects of the electrification problem, namely, growth, centers and systems. In taking up the first of these the speaker traced the rapid development of electric traction within the last score of years. In the Baltimore & Ohio tunnel was the first example where the electric locomotive demonstrated its ability to handle heavy traffic. Since 1890 the application of electricity to street railways has brought about an extension of city traction systems to somewhat over four times the mileage. In 1890 electric railways constituted less than one-sixth of the street railways of the country. In 1907 they formed about ninety-nine per cent. After the urban development of electric street-railway systems these were extended into suburban districts. Following the growth of suburban lines, came the development of interurban systems connecting nearby cities and towns. The fourth stage of this development, viz., that of electrification of transcontinental systems is at hand.

As the traction electrification has extended from urban lines outward, so now railroad electrification is about to be extended from terminal cities, over the entire line. A case in point is that of the New York, New Haven & Hartford Railway, which has its New York terminal already electrified, and is now contemplating electrification of its Boston terminal, the two cities to be ultimately connected by electric service entirely. Mr. Lake predicted great activity in the next ten years in the electrification of trunk lines. New York city is now the center of electrification in the East. Chicago ought to be that in the West. On drawing circles of some 400 miles radius about each of these cities it is found that in the New York zone there are fourteen states, in the Chicago zone nine states. The land area of the Chicago zone is about twice that of the New York zone; both these zones contain two-thirds of the entire population of the United States. From these facts Mr. Lake feels certain that Chicago is bound to become a great center of electrified railroads. It already is the greatest railroad center, as within its zone there is about one-third of the country's railroad mileage as against one-sixth in the New York zone.

The railroad-electrification problem consists of the substitution of three electrical elements for the locomotive equipment. These are: A generating station, a distributing system, and a locomotive system. Steam-railroad men are inclined to overrate the effect of electrification upon the equipment of steam locomotives. The valuation of the entire railroad property in the country on June 30, 1908, gave a total of $13,000,000,000. The total number of steam locomotives was 55,000; their average value was $11,500 each, thus making a percentage value of the locomotives of only 4.86 of the total. The annual renewal of steam locomotives is now in excess of this figure, so that the gradual substitution of electric locomotives does not mean the wholesale scrapping of the steam equipment; in fact, it is doubtful whether a larger number of steam locomotives would be turned to the scrap pile than are now.

There are now being tried out in New York city, side by side and under similar conditions, the two apparently most promising systems of electrification. In the case of the St. Clair and the Detroit River tunnels a similar comparison of the single-phase overhead and of the direct-current third-rail systems will be made. Each system has already demonstrated not only its feasibility, but its economy and operating advantages. The result of the comparative performances is being watched, and the system best adapted for the use of long trunk lines will be discovered very soon.

At the meeting of the Chicago Electric Club, held on Wednesday noon, July 7, A. A. Gray, managing editor of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, gave a condensed review of the recent annual convention of the American Institute of Electrical Engineers at the Thousand Islands, Frontenac, N. Y. He abstracted briefly the papers that were presented and spoke enthusiastically of the excellent arrangement of the technical sessions and entertainment features, the cordiality that was everywhere manifested, and the general good time enjoyed by all who attended. C. A. S. Howlett, president of the club, added his impressions of the conflicting papers relating to the use of flywheels for motors.

Announcement was made by John J. Schayer, chairman of the entertainment committee, that arrangements for the first annual Electric Club picnic were practically completed. It will be held at Michigan City, Ind., on Saturday, July 17. An entire deck on the S. S. Theodore Roosevelt will be reserved for the club. The steamer will leave the dock at the Clark Street bridge, Chicago, at 10 a. m. Returning, boats will leave Michigan City at 4:20 p. m., arriving in Chicago at 7 p. m., and also at 7:45 p. m., arriving in Chicago at 10:15 p. m. The fare for the round trip is $1.50, which includes also a good dinner at Michigan City at 1 p. m., and admission to the amusement park, concessions, etc. There is an excellent bathing beach and good facilities for baseball and other athletic sports. The entries for the field sports are being received by O. B. Duncan, chairman of the athletic committee. Ladies are especially invited to the picnic.

Navy Department Supplies.

The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on July 20 for the following electrical material: Miscellaneous connection boxes, 20,000 carbon arc lamps, miscellaneous knife switches, switch fittings and rubber-covered wire, for delivery at Brooklyn, N. Y.; for miscellaneous conduit, elbows, outlets and bushings and miscellaneous wire, for delivery at Pensacola, Fla.; miscellaneous rheostats and starting panels, for delivery at Annapolis, Md.; for three transformers, for delivery at Boston, Mass.

Bids will be opened on August 3 for two electric jib cranes, for delivery at Mare Island, Cal.

Bids will be opened on August 10 for one armature-binding and field-coil-binding machine, and one motor-driven derrick, for delivery at Puget Sound, Wash.

Technical Book Publishing Consolidation.

The book departments of the McGraw Publishing Company and the Hill Publishing Company have been consolidated under the corporate name of the McGraw-Hill Book Company, with offices at 239 West Thirty-ninth Street, New York, N. Y. The officers are John A. Hill, president; James H. McGraw, vice-president; Edward Caldwell, treasurer; Martin M. Foss, secretary. The consolidation is an important move for the making and selling of technical books. The company will also make a feature of the prompt importation of any foreign technical book not in stock.

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Electrical Notes From Great Britain.

By Our British Correspondent.

The city of Calcutta is supplied with electricity by an English company—the Calcutta Electric Supply Corporation, Limited—and this company is doing a rapidly increasing business, the demand for energy for lighting and power, the latter especially, including electric fan purposes, being reported as very gratifying. The company's license covers an area of seventeen-and-one-half miles, north to south, and thirteen miles, east to west, but much of this area is as yet undeveloped. The engineer reports a large demand for factory power, and he further considers that a ring main should be laid round the city giving supply to the substations. Though this plan is still under consideration the board admits that it has no alternative but to adopt the proposition, and it recognizes that it must extend not merely in order to carry out the company's statutory obligations, but in order also to prevent any rival entering the district.

Gradually a spirit of greater hopefulness seems to be coming over even men connected with electrical industry in England. T. O. Callender, managing director of the big cable manufacturing company which bears his name, in indulging in reflections concerning the past and in guarded prophecy as to the future, showed that the cable business, just as the dynamo and turbine lines, has been greatly affected by the metallic-filament lamp—the electricity suppliers having found their mains sufficient to deal with the demand. But, he said, they looked on that lamp as the best thing they could have, because they believed that next year, or at least the year after, there would be a big boom in electrical supply, due to the large extension coming from the new lamp, because mains would be carried into districts which hitherto had been considered out of the region of electric supply. Mr. Callender reports a distinct improvement in electric cable trade—demands from old customers are increasing, and there is a decided move toward extensions elsewhere. Other leading men in British electrical industry have also been voicing the view that there are evidences of real improvement.

As bearing upon the question of competition between gas and electricity, of which so much is heard in England, it is interesting to observe that in the city of Bradford, where both the electricity and gas departments are owned and operated by the municipality, though run as separate departments, the gas committee has come forward with a proposition which is intended to pave the way for a compromise. It advises that for the present no canvassing of the public should be done by either the gas or the electricity departments, one department against another, in any district where there are now gas mains or electricity cables, but that where applications are received for a supply of either electricity or gas, the department shall be at liberty to canvass for customers, on giving notice of such intention to the other department; neither of the foregoing proposals to "affect canvassing for power purposes where the other department is not affected." While there is undoubtedly room for co-operation rather than such severe rivalry between the apostles of the two systems, it seems unlikely that the above proposal will be acceptable to an electrical department with a progressive mind at its head, but it may serve as a basis for a discussion of the matter.

Once again efforts are being made to provide organizations which shall more adequately represent the various electrical interests of the United Kingdom. The National Electrical Manufacturers' Association, with its forty or fifty members, has not attracted the larger electrical manufacturing concerns to its membership, and the importing element has been too strong to make outsiders consider it a desirable body with which to become associated. Changes that have recently been made, together with the present efforts to explode certain wrong ideas that have become prevalent, are hoped to strengthen the body by bringing in several makers of large plant—an element that has too long been practically absent. Another movement that is on foot is headed by Sir William Preece, who has just expressed himself on the desirability that exists for forming a National Electrical Industrial Association which, when it speaks, shall lead Parliament and the world to believe that it represents everybody and everything electrical.

H. Mozley, the tramway manager of Burnley, in his annual report just received, records his experience in attempting to obtain for one of his routes a more economical car than the four-motor equipments. He had an experimental car running for more than twelve months using first of all Simpson and Park radial trucks. These proved unsatisfactory and were abandoned, and the trucks were converted to simple pony trucks, but with a new arrangement of the carrying body springs and king pins. The whole weight of the body is carried on the driving axle, thus increasing the adhesion compared with the Brill maximum trucks under the double-deck cars, and the king pin by being placed in the center of the axle greatly reduces the work of the pony wheels, which act as guides to the truck. Mr. Mozley says that so far the result is very satisfactory. The tire sections after nine months' service are practically perfect, and the car runs smoothly and noiselessly compared with the four-motor equipments. There being only two motors, and the truck being lighter, there is a saving of about three tons in dead weight; moreover, the motors are four-turn and thirty-seven horsepower as against five-turn and twenty-eight horsepower, which means about nine per cent improvement in speed. The new type uses twenty per cent less energy. It is believed that the new type of truck and two-motors may be applied to the old type of body, as the weights are nearly alike, and Mr. Mozley suggests converting one four-motor car with the view to converting the remainder if successful. He says that the new type of car is ideal for relief and shuttle services on the main line.

At the moment of writing the annual convention of the Incorporated Municipal Electrical Association is in full swing at Manchester, the electrical engineer of which city, S. L. Pearce, is president. One looks in the inaugural address of this body less for novelty and originality than for a summary of the more important matters of the moment bearing on the commercial and technical sides of municipal electricity supply. Mr. Pearce's address touched briefly on a variety of topics that have recently been under discussion. He alluded quite early to the importance of municipal departments attending to such matters as depreciation and antiquation before distributing profits among the ratepayers, in order to insure financial stability. The rapid adoption of

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metallic-filament lamps which has affected the undertakings of so many municipal engineers during the past year, of course came in for attention, as did also some of the questions which arise as practical issues from its adoption. There is at present a slump in output of energy, but from this there is bound to come a reaction, as consumers recognize the advantages of the lamps. Raising charges for energy is to be deprecated at any time, but it is a particularly questionable policy just now. Mr. Pearce believes that the worst of the check has been experienced, and he advocates marking time in the matter of price reductions, even though revenues should suffer for the time. "Nothing," he said, "should be done to arrest an increase in new connections just when they are most urgently wanted." The present cost of wiring practically precludes the oncoming of the small consumer, and the president holds that, where æsthetic considerations do not enter in, encouragement should be given to the use of "flexible" and other surface wiring systems, such as are now so much to the fore, but such cheapening must not involve, in any shape or form, a lowering of the standard of safety. Later in his address, Mr. Pearce remarked that it was chiefly to the large power users that, in the future, supply undertakings will have to look for increased sales and substantial growth. The status of the municipal electrical engineer, a subject of particular interest just now for several reasons, was another point briefly referred to. There was never a time when it was more necessary for the municipal engineer to uphold his position in connection with electrical undertakings. Pushfulness, he admits, the engineer may lack, but it cannot be said that any engineer worthy of the name lacks commercial knowledge and aptitude, and as in the administration of electricity departments science and technical knowledge enter in at every point and largely determine all questions of high policy, the engineer must be referred to in the end as the controlling officer acting under and subject to the municipal committee.

The first paper to occupy the attention of the convention was by Councilor A. Sinclair, and it dealt with the subject of "Cheap Units." Under certain circumstances 6d per unit may be cheap, while in others even 1d may be dear. The author endeavored to analyze the various classes of supply, thus arriving at something like a basis from which to calculate on its merits the selling price of each class of unit. Sufficiently low prices could be charged to make energy from a public supply undertaking attractive, and still leave a fair margin of profit. Good business was often lost by trying to obtain too high prices.

E. E. Hoadley, electrical engineer of Maidstone, introduced "The Influence of Metallic-Filament Lamps on the Electrical Industry, and on Street Lighting," touching the first part of the subject very briefly, leaving others to speak of the particular effect on each manufacturing and selling branch of the electrical industry, while he devoted the greater part of his attention to the effect of the lamps on the supply stations. He urged all station engineers to unite in trying to obtain what he considered the necessary powers to enable them to utilize to the full the immense power put into their hands by this epoch-marking invention, and by themselves getting into personal contact with their consumers, putting before them the great advantages of more light for the same money, instead of the same light for less money.

"Modern Cable Systems" was the title of E. M. Hollingsworth's paper, and underground cables of electricity undertakings were chiefly the subject discussed. The author said it was within the bounds of possibility that other and cheaper materials than those used at present for the manufacture of cables might be found suitable, but on the question of reliability, combined with cost, it hardly seemed possible to improve the methods now usually adopted for protecting the cables underground. The probable use of aluminum was touched upon, after which Mr. Hollingsworth discussed rubber insulation, vulcanized bitumen insulation, paper insulation, systems of laying cables, "direct system," "solid" system, "draw-in" system, subways, and the value of overhead conductors for supplying isolated districts.

An excellent paper by Alfred Blackman, borough electrical engineer of Sunderland, set down certain definite opinions held by the author on "Steam Turbines: From the User's Point of View," his object being to promote discussion. "Notes on Condensing and Water-Cooling Plants," by E. Lunn, followed.

The members present at the meetings at Manchester and Liverpool from June 21 to 25 had the opportunity of visiting a number of leading generating stations and works of manufacturers, and a visit to the Mauretania with its unique electrical equipment was one of the most attractive features.

It is reported in some quarters that the North Eastern Railway is about to proceed with the long-expected extension of its electric suburban system. The proposal is said to be for equipping the lines between Newcastle, South Shields and Sunderland for direct-current working as employed on the present electric sections. It was said that the North Eastern, like some other English railway systems, was waiting to watch the experience of the London and Brighton Company's single-phase system before proceeding, but so far as practical working is concerned there has not been time to admit of any opinion being based upon that. ALBERT H. BRIDGE.

London, June 26, 1909.

Telephones Open Up National Forests.

During the present fiscal year $600,000 will be spent for the construction of roads, trails, telephone lines and other permanent improvements on the national forests. Congress has appropriated the same amount for this purpose for the fiscal year of 1909-10.

Trails are being constructed along routes which give the best control of the areas to be patrolled by the forest rangers. In many districts telephone lines have been built between the supervisor's office and ranger headquarters and to prominent peaks which are used for lookout stations to observe fires. These telephone lines and trail systems are of vital importance, resulting in the remarkably small area burned over since forests have been under government supervision.

Bulk Supply in Colorado.

The Northern Colorado Power Company has retired from the field in the Greeley and Fort Morgan districts as a retail distributor of electric current. The Home Gas and Electric Company, of Greeley, Colo., will in future buy the current from the Northern and act as the distributing agent. The Home Company will also begin at once the extension of its lines east toward Fort Morgan, and will serve the entire territory of farm land between here and that city. The wires will also be extended north practically to Cheyenne. Just how closely the two companies may be allied is not known, but it is considered to be merely the relation of a jobber and merchant, the Northern Company making the "juice," selling at wholesale price to the Home Company, and the latter selling it again at retail and looking after the small detail work.

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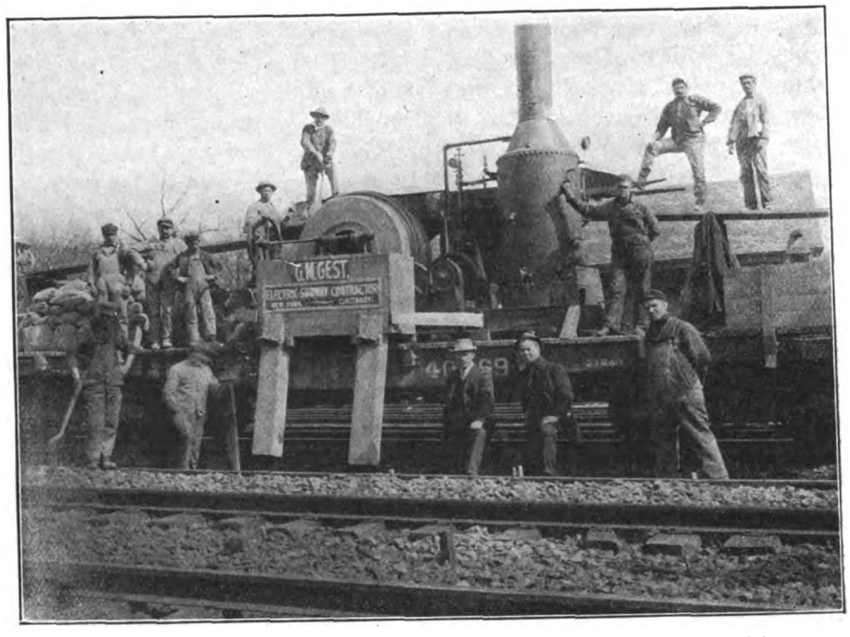
High-Speed Conduit Construction.

In railway signaling the reliability of the line is an essential feature if continuity of service is to be secured and insurance against the attacks of inclement weather is the primary consideration if this condition is to be obtained. In line with modern methods some of the more progressive railroads are establishing conduit systems for their signal lines, thus eliminating the possibilities of interruptions to service, a striking example of which occurred at the time of the inauguration of President Taft last March when telephone and telegraph wires went down in every direction, and trains were stalled on many roads leading into Washington, due to the failure of the overhead signal lines.

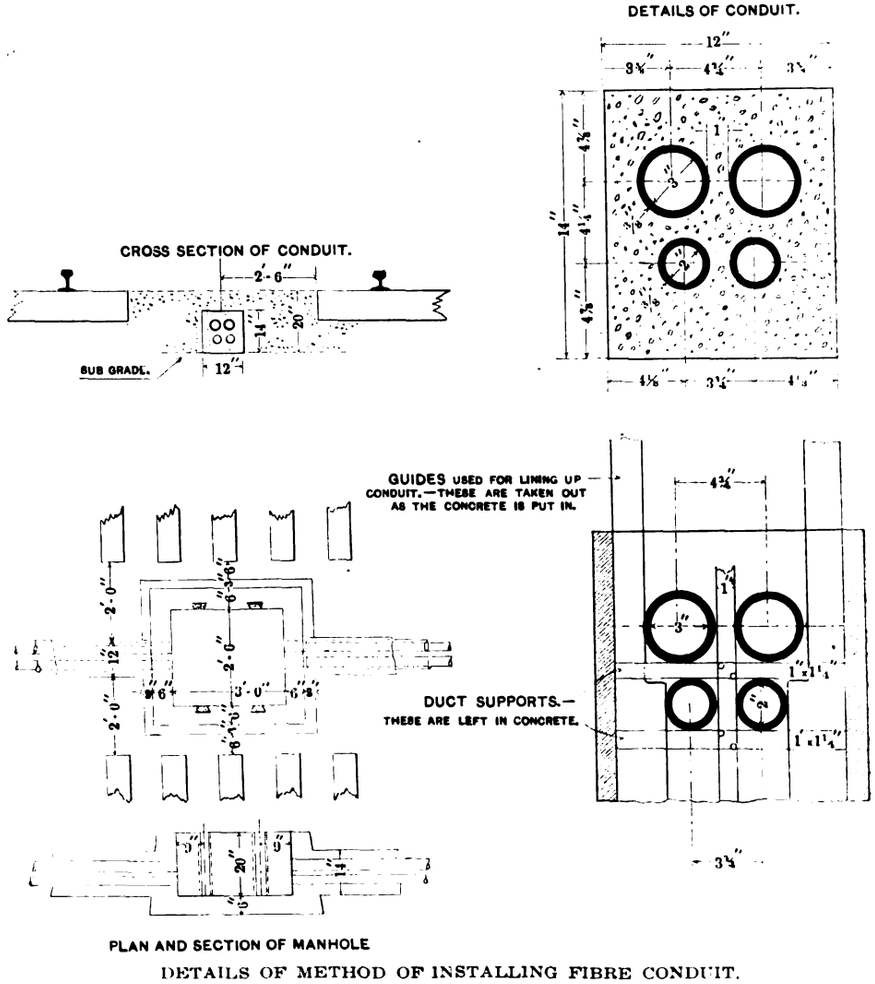
The New York, New Haven & Hartford Railroad has just installed on the Harlem River branch, over a stretch of its right-of-way twelve miles long between New Rochelle, N. Y., and the Harlem River, a four-duct conduit system which has been laid in by G. M. Gest, electric subway contractor, under his patented method of fibre conduit installation. The accompanying illustrations tell the story, and the following description will be merely to amplify the various features indicated in the views printed herewith.

One of the main features of this method of conduit construction lies in the employment of a construction train which carries all of the workmen and materials of construction, absolutely eliminating any littering of the roadbed with implements or material either before or after construction. A locomotive and a train of seven flat cars and a box car carrying cement, gravel or crushed stone, sand, water, conduit and forms, are taken along the right-of-way, and from 1,500 to 2,500 feet of trench are installed complete each working day. This is an important item, as it is quite essential that there be no unnecessary occupancy of the track for construction of this character. In this case the speed which Mr. Gest was able to make was entirely satisfactory to the railroad and did not interfere in any way with the regular movements of the trains.

In laying down this system the ballast between the tracks is shoveled up on to either side of the roadbed, an ordinary trench is excavated, and skilled conduit builders place wooden forms in proper position with their tops true to gauge. Wooden or concrete block spacers are placed at predetermined distances, and the conduit threaded and suspended in position along a predetermined run. At certain distances on each side of the suspended conduit wooden spacing and locking paddles are placed sidewise in the trench, given a right-angled turn so as to bring the conduit true to line laterally, and the cement and concrete poured in. As was noted above, all of the materials are carried on the working train, the cement, sand and gravel being carried to a Ransom mixer on runways from their respective flat cars. Water is siphoned from a water tank carried on one of the



THE WORK TRAIN, SHOWING THE CONCRETE MIXER AND CHUTES.



DETAILS OF METHOD OF INSTALLING FIBRE CONDUIT.

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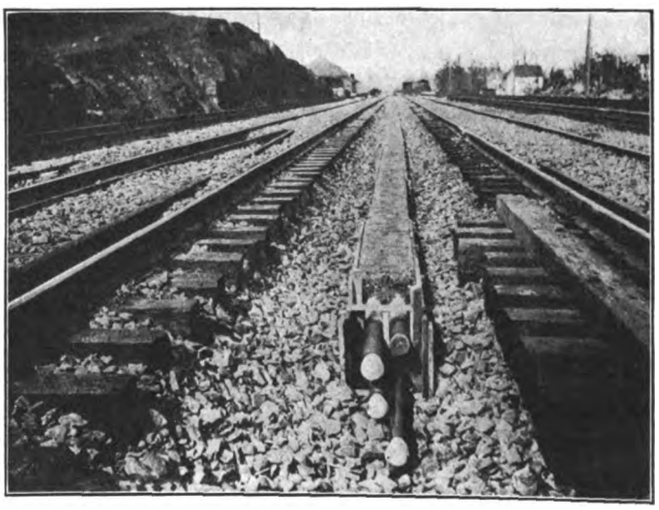
cars, and the concrete is delivered from an engine-driven mixer into a sectionalized hopper. From the hopper the concrete is fed into the excavation from two chutes, one placed ahead of the other. The sectionalized hopper makes it convenient to feed into the bottom of the trench from the forward chute, and into the top of the trench from the rearward chute as the train proceeds along the conduit run. As soon as the trench is filled to the top of the forms with concrete the ganging and alining paddles are withdrawn and the concrete allowed to set.

When the concrete is set the side forms are withdrawn and the ballast shoveled in and around the completed structure leaving the roadbed in exactly the same condition as it was before operations were started. In this connection it is to be emphasized that during all the period of construction the profile was absolutely unimpaired and the construction caused no change whatever in the weight or speed of the trains passing.

During construction the manholes were built in at the same time the conduit was laid so that as each run was completed there was no necessity for returning for additional construction or excavation. Where it was necessary to cross a bridge the conduit was brought out into three-inch galvanized iron pipe, run over the bridge truss, with a manhole at each end of the bridge. The conduit used consisted of two two-inch ducts and two three-inch ducts of fibre conduit, manufactured by the Fibre Conduit Company, of Orangeburg, N. Y.

Mr. Gest maintains engineering offices in New York, Cincinnati and Chicago, the latter office in the Monadnock Building, in charge of J. A. Doyle. The work was laid out by E. Gagel, chief engineer of the N. Y., N. H. & H. R. R., C. H. Morrison, signal engineer, and constructed under the direction of I. D. Waterman, division engineer of construction of the Harlem River branch.

DUCTS SUSPENDED IN FORMS READY FOR THE CONCRETE.



CONDUIT IN PLACE AND CONCRETE READY FOR REMOVAL OF FORMS.

Electric Locomotive Headlights.

A singular condition is apparent in Indiana relative to recent legislation concerning the use of electric headlights on locomotives when compared with the situation in Georgia and North Carolina. The Indiana Legislature passed a law empowering the Railroad Commission to compel the use of power or electric headlights if, after careful investigation, the Commission finds them to be more efficient than the oil headlight. Similar legislation was had in South Carolina, where the locomotive engineers are making strenuous efforts to have the law carried out and electric lights installed, while in Indiana the engineers have unanimously condemned the electric headlight and have declared their preference for the ordinary twenty-candlepower oil light. The third conference on the headlight question will be held before the Indiana Commission June 29, and it is fair to presume that if the Commission is guided by the evidence of the engineers there will be no order entered for the compulsory use of electric headlights. The engineers say the light is too intense and prevents their reading the signal lights correctly. S.

Manhattan Elevated Pays $1,582,038 to New York City.

The Manhattan Railway Company, the old elevated railway company of the Interborough-Metropolitan consolidation, has paid the city of New York $1,582,038 in taxes.

The Sensible Way.

Delaware County, Pa., is to be lighted by one big central-station plant. By a vote of the stockholders of the Media Electric Light Company, of Media; the Citizens' Electric Light and Power Company, of Clifton Heights; the Faraday Light Company, of Morton, and the Philadelphia Suburban Electric Light Company, of Lansdowne, these companies have merged into the Delaware County Electric Company, a concern which now practically controls all of the electric-light companies in Delaware County, Pa. It is understood the plans contemplate the erection of a big central plant. The operation of the plants will all be under one management.

The following officers of the Delaware County Electric Company have been elected: President, W. Roger Fronefield, of Media; vice-president, William F. Morris, of Penn Yan; secretary and treasurer, Joseph W. Taylor, of New York; general superintendent and engineer, J. W. Barstow, of New York.

The Indiana Municipal League.

The nineteenth annual meeting of the Indiana Municipal League was held in Lafayette, June 22, 23 and 24. The attendance was the best in the history of the association. Among the numerous questions of interest to municipalities that were considered and discussed, the question of municipal ownership of public utilities provoked the most extensive and warmest discussion.

The next meeting will be held in Richmond in December and the program committee was instructed to make municipal ownership the most prominent subject for the first day's discussion. S.

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The Ohio Electric Light Association.

The Ohio Electric Light Association will hold its fifteenth annual convention on Tuesday, Wednesday and Thursday of next week, July 13, 14 and 15, at the Boody House, Toledo, Ohio, where the most successful previous meetings of the association have been held.

The Ohio Electric Light Association has an enviable reputation among electrical men, and present indications are not wanting that this year's convention will at least be up to the high standard previously attained in former conventions.

The convention this year has been arranged one month earlier than usual in order to avoid the rush season of August.

In order to afford ample time for discussions the number of papers has been limited in amount but not in quality or interest. The following is the list of papers to be presented:

"Residential Lighting," "The Supplying of Electric Current to Other Towns from a Centrally Located Station," "Engine-Room Management," "The Commercial Organization of Electric Lighting Companies and Their Relation to the Public," "Boiler-Room Economy," "Factors to be Considered in Making Street Lighting Contracts," "Plans to be Followed in Supplying Lamps to Consumers," "The Titanium Arc Lamp" and "Tungsten Lamp Experience." Upon some of these topics more than one paper will be presented.

A handsome souvenir programme is being prepared by the association, and will be distributed at the convention. The following is a list of the projected entertainments, the final arrangements for which will be found in the programme:

Tuesday—Auto ride for the ladies; trip to Casino, with 6 o'clock dinner and theatre party for all. Wednesday—Trip to Fort Meigs for the ladies; trip to Toledo Beach, with frog-leg dinner and ball for all. Thursday Afternoon—Trip to Cedar Point, Ohio, with banquet, lagoon ride and ball in the evening. Transportation in the city and to Cedar Point, and the dinners, banquets, rides, balls and all other features of the entertainment will be free to all attending.

A large exhibit room has been arranged in the Hotel Boody for the free use of exhibitors, and an ample supply of single-phase, 115 and 230-volt sixty-cycle current will be available. If the demand justifies the light company will supply three-phase current at the same voltages.

Hotel rates at the Boody for the convention will be: European plan, $1 to $2.50 per day; American plan, $2.50 to $5 per day. However, the convention furnishes the evening meals of Tuesday, Wednesday and Thursday. Reservations for rooms should be made directly with the Boody House Company.

The National Electrical Contractors' Association.

The annual meeting of the National Electrical Contractors' Association will be held at Toledo, Ohio, July 21, 22 and 23. Hotel headquarters will be established in the Boody House, the meetings being held in the Chamber of Commerce rooms.

On July 21 an open meeting will be held at the Chamber of Commerce at 10 a. m. and a business meeting at 2 p. m. On July 22 an open meeting will be held at the Chamber of Commerce rooms at 10 a. m., a ladies' trolley ride at 10:30 a. m., a business meeting at 2 p. m., the men's banquet in the Boody House banquet hall at 8 p. m. and the ladies' banquet in the Boody House parlor at 8 p. m.

On July 23 there will be an all-day outing at Sugar Island, leaving at 9 a. m. and returning leaving the island at 5:30 p. m.

It is expected that this meeting will be one of the most successful in the history of the organization. The open meetings will be especially interesting, the following speakers having been officially announced:

W. H. Blood, Jr., president of the National Conference on Standard Wiring Rules, will deliver an address on "The National Electric Code and the Relations of the Contractor to the Central Station."

C. S. Elliott, "Illuminating Engineering in the Contracting Field."

George C. Nimmons, "Relations of the Contractor to the Architect."

James R. Strong, "The National Electrical Contractors' Association."

It is expected that there will be two other speakers on timely topics.

The convention will be opened by M. W. Hansen, of Toledo, the chairman of the local entertainment committee, and the delegates will be welcomed by Mayor Whitlock of Toledo and President Millner of the Toledo Chamber of Commerce.

The ladies' trolley ride will be one of the features of the entertainment, covering a trip up and down the Maumee Valley, luncheon being served at the beach.

The outing on July 23 will be full of interesting features and there will be a baseball game between eastern and western contractors. James R. Strong of New York will be captain of the eastern team and E. McCleary of Detroit will be captain of the western team.

"Exide" Meeting at Dayton, Ohio.

The Dayton Lighting Company extended invitations to an illustrated lecture given under the auspices of the Electric Storage Battery Company, of Philadelphia, on Tuesday, June 22, in the auditorium of the Y. M. C. A. Building, Dayton, Ohio.

The meeting was opened by F. M. Tait, general manager of the Dayton Lighting Company. He spoke of the popularity of the electric vehicle in Cleveland, Buffalo, Chicago and other cities and stated that the object of the meeting was to arouse public interest in this type of vehicle which Dayton, up to this time, had neglected.

H. M. Beck, engineer of the operating department of the Electric Storage Battery Company, delivered the principal address, touching briefly on the history and development of the Exide battery and covering very fully and clearly all points regarding the operation of these well-known batteries.

The address, illustrated with lantern slides, was greatly appreciated by an audience of about 100, a number of whom took part in the discussion which followed the reading of Mr. Beck's paper. The meeting aroused considerable interest in the electric vehicle and in the potentialities for its successful exploitation in Dayton, and gave a much clearer understanding of the subject to the electrical engineers, garage men and vehicle owners, who were present, than they had hitherto possesed.

Approve Issue of Bonds.

On June 28, 1909, a general meeting of the stockholders of the New Orleans Railway and Light Company was held at the offices of the company, No. 317 Baronne Street, in New Orleans, La., for the purpose of considering the proposition submitted to them by the directors, in accordance with the provisions of the charter, of authorizing the issuance of $50,00,000 five per cent forty-year first and refunding mortgage bonds, with the following result: Out of a total of 300,000 shares, preferred and common, entitled to vote, there were cast 200,524 shares, 182,490 shares voted in favor of the issuance of the bonds and 18,034 shares voted against, which gave a majority of 164,456 shares in favor of such issue.

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Commonwealth Edison Company Submits Profit-Sharing Plan to Employes.

Directors of the Commonwealth Edison Company, of Chicago, have adopted and submitted to their employes a combination savings and profit-sharing plan from which excellent results are expected. The idea originated with the employes.

A committee consisting of Samuel Insull, president of the company; Edward L. Brewster and Benjamin Carpenter, directors, and L. A. Ferguson, J. H. Goehst, W. L. Abbott and P. Junkersfeld, employes, has been appointed to take charge of the fund and to handle the plan. The committee has elected Mr. Insull chairman, John F. Gilchrist secretary and J. H. Gulick auditor. William A. Fox, treasurer of the company, is ex officio treasurer of the committee.

It is thought that fully a third of the company's 2,500 employes will avail themselves of the opportunity to obtain the stock on the favorable terms offered.

Any employe who has been in the continuous service of the company for one year or more may become a subscriber to the fund. At his own option he may pay into the fund either three or five per cent of his salary as it is received. Unless terminated sooner, each subscriber's period of subscription shall continue for five years.

At the end of that period each subscriber or his estate will receive back all the money contributed by him to the fund, with interest compounded semi-annually at the rate of six per cent a year. If the employe's subscription continues for the full five years he may, at his election, receive instead of a cash payment as much of the company's capital stock as the amount due will pay for at par if the stock is selling above par, or at the average price for two months if the price is below par.

Commonwealth Edison stock is generally above par, and it would be profitable, of course, for the employe to take the stock instead of cash. At present Edison shares are selling at about $121. At that price an employe would make $21 a share on all the stock his accumulated subscriptions and interest would buy at $100 a share.

For employes who terminate their subscription periods within the five-year period or who do not keep up their payments regularly, the terms are not so favorable. An employe who voluntarily discontinues his subscription agreement and remains in the employ of the company will receive four per cent interest instead of six, and employes who fail to make three or more payments promptly in any one year will receive only three per cent.

Leave of absence or temporary lay-off because of a reduction of the company's working forces will not affect a subscriber's rate of interest. Any employe's subscription period will terminate if he leaves the service of the company.

The company has prepared regular savings bank books in which each payment and the interest will be entered as it accrues. The books are patterned after those used by one of the largest savings banks in the city.

An Electric Subway for Mail.

The postal authorities of Vienna, Austria, are considering a scheme for linking together the general postoffice in that city with the sixty-four substations and the nine railroad stations, by means of electric subways, for the transmission of postal matter. This would replace the 450 mail wagons and 700 horses now in use.

The proposed plans call for a subway five feet high and a little less in width. The cars will each carry eighty packages, which is the load of the present type of one-horse mail wagon. The service is intended to be operated from 5:30 a. m. to 10 p. m. each day, and the trains of eight cars will run every twenty minutes. The trains will be automatically operated from the several despatch stations and will travel at a speed of about twenty miles an hour.

It is reported that an electrical firm has undertaken to build and equip the line entirely, and to lease it to the city and postal authorities.

Third Avenue Claims.

Special Master William L. Turner, who was appointed to take evidence in court claims against the Third Avenue Railroad Company, New York city, has filed his report in the United States Circuit Court. He states that Special Master Lay, in the years 1902, 1903, 1904 and 1907, proved claims of $592,956; Special Master Wadhams in the years 1905 and 1906 proved claims of $175,632; Special Master Coxe in the year 1906, $223,970, and Special Master Turner himself, $312,466. In addition claims or accidents happening within four months to date of the appointment of the receivers amounted to $298,502. These claims make a total of $1,903,526.

The American Society of Engineering Contractors.

With the issue last month of Vol. 1 of its *Journal,* containing the constitution and the list of members, the American Society of Engineering Contractors may be fairly said to be launched upon its career.

This latest addition to our engineering societies is the culmination of the efforts of Halbert P. Gillette, consulting engineer, and managing editor of *Engineering-Contracting,* of New York.

In the early part of the year 1906, Mr. Gillette, through the medium of the trade paper of which he is the editor, asked for the co-operation of engineers and others particularly interested in the contracting end of the profession, toward the formation of a society to be devoted to the forwarding of their interests. The need of such a society was evident, and the response was immediate and decidedly encouraging. A large number of gentlemen sent in their names, and after much energetic work on the part of Mr. Gillette a meeting was held in New York on April 14 and 15 last.

The following officers were elected: President, George W. Jackson, president of Geo. W. Jackson, Inc., contractors, of Chicago, Ill.; first vice-president, Halbert P. Gillette, managing editor of *Engineering-Contracting,* of New York; second vice-president, D. E. Baxter, president of the Southwestern Construction Company, of New York; secretary, Daniel J. Hauer, of New York; treasurer, Prof. Alex. Haring, professor of railway and bridge engineering at the University of New York.

The charter list of members comprises about 1,500 names, and it is expected to begin the regular monthly meetings in October next.

The society has been invited to hold a convention in Chicago in February of next year in connection with the Chicago Cement Users' show. The board of directors will very probably act on this invitation at their meeting this month.

To Increase Its Plant.

The General Electric Company, Schenectady, N. Y., will shortly begin the erection of a five-story reinforced structure, 202 by 73 feet in dimension, and to cost over $200,000. The big building will be used exclusively for the storage of patterns and will be fireproof. The contract is to be awarded within a short time.

The company is also doing considerable other construction work.

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REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

REMOVING HAIR BY ELECTROLYSIS.

The removal of superfluous hairs by means of electrolysis is a very satisfactory minor operation when well carried out. Frequently, however, a small scar is produced at the seat of operation, and in order to avoid such a scar a simple precaution is necessary which is not mentioned in works on medical electricity. It is often spoken of as if the root of the hair were burned by the electricity as a nævus is burned by a cautery point. This is quite a wrong view to take of the operation. The destruction of the root of the hair is caused by an acid or an alkali, generated at the positive and negative poles, respectively. If a needle which is not acted on by acids is used, such as gold or platinum, and it is connected to the negative pole, then nascent chlorine appears round the needle with the formation of hydrochloric acid and destruction of the hair bulb. It is as if a minute quantity of free hydrochloric acid had been injected into the hair follicle. If a needle which is acted on by hydrochloric acid is used, such as zinc, the acid attacks the zinc, forming chloride of zinc, and this goes into solution. If a non-corrodible needle such as gold is used for the operation, and it is connected to the positive pole, free sodium is liberated at the surfaces of the needle; this at once combines with the water of the tissues to form caustic soda, which in turn attacks and destroys the root of the hair. If a corrodible needle, such as a steel needle, is used and is connected to the positive pole free sodium is liberated at the surface of the needle, which at once becomes caustic soda, which attacks the iron, forming oxide, and hydrate of iron. This remains in the hair follicle and therefore does not stain permanently the skin. But there is a much more important action going on in this case which does stain the tissues, and that is the transport of iron ions from the steel needle into the actual cells of the skin, where they are fixed and remain as iron oxide or rust. For this reason a corrodible needle must never be attached to the positive pole in this operation. No pigmentation is therefore produced if one uses a corrodible needle, provided it is connected to the negative pole. When the current is turned on and the needle which is attached to the negative pole touches the skin, acid formation at once begins. As the needle sinks into the hair follicle the acid also penetrates deeper till it reaches and destroys the bulb of the hair. The needle must be left a sufficient length of time to allow sufficient acid to collect in the follicle to destroy the root of the hair. But while the root is being destroyed, so is the skin around that part of the hair which is embedded in the upper layer of the skin, and this destruction of surrounding tissue is the cause of future scarring. This can easily be avoided by a simple method of insulating the needle to within a sixteenth of an inch of its point. When a needle is so insulated and thrust into the root of the hair, the free acid attacks only the root and therefore there is no scarring left after the operation. The method of insulating the needle is very simple. In the first place a fine wire is to be preferred in place of a needle. The wire supplied with the finest hypodermic needle is useful for the purpose. It is finer than a No. 12 sewing needle, which is the finest sewing needle obtainable. Another advantage of this wire is that it has not a sharp point and therefore is not so likely to leave the hair follicle and make a false passage. If too much force is used in introducing the wire it bends and makes further progress impossible. By its extreme fineness it finds its way down by the side of the hair, and in the case of hairs whose roots take a curved course in the skin it follows the curve instead of making a false passage, as the finest sewing needle does. Unless the point of the needle reaches the actual bulb of the hair the operation is useless. Therefore a fine wire with a blunt point is better than a fine sharp needle for the purpose. The wire should be insulated as follows: Hold a piece of shellac in the left hand and the wire in the right. Heat the wire to redness in a Bunsen flame, and while red hot embed it quickly in the shellac all except its point and lift it out again quickly, thus leaving a sixteenth of an inch uncovered by shellac. There is thus a thin layer of shellac left on the wire, and it fits it so well that no irregularity appears to the naked eye in the outline of the wire as compared with its former state. The tip of the wire must not touch the shellac. One-sixteenth of an inch remains naked at the tip of the wire. The wire cuts into the shellac when it is red hot as one cuts a banana with a knife. To sum up, the essentials of good results in this operation are: (1) Connect the needle to the negative pole; (2) use a fine stiff wire as a needle (the wire supplied with the finest hypodermic needle is a suitable one); and (3) insulate the wire so that only the last one-sixteenth of an inch supplies the current. The advantages of this method are two—(1) no scarring after the operation; and (2) a lower per cent of re-growth of hair.—*Extracted from The Lancet (London), June 7*.

ELECTRICAL BLEACHING.

A recent publication of the Siemens establishments calls attention to the advantages offered by electrical bleaching installations in textile, paper and cellulose factories, etc. The electrical bleaching process involves the preparation of a highly concentrated hypochlorite-of-soda solution. The operation is carried out in a special type of Kellner electrolyzer, consisting of a number of receptacles of insulating material divided by vertical glass partitions into two compartments. The elements are arranged alongside of each other and the separating partitions alternate between them in such a way that the electrolyte has to circulate in a serpentine channel. This disposition makes it possible to connect the apparatus directly to an ordinary circuit of 150 volts or less. The horizontally superposed electrodes consist of platinum-iridium grates, the cathodes being placed above and the anodes below. They can be easily removed and replaced. The installation of such an apparatus presents no difficulty. A suitable quantity of brine is prepared in a first vessel and then allowed to settle in a second reservoir of wood or masonry. The clear solution is sent through a cooler forming part of the electrolyzer. From there a small centrifugal pump forces it through the electrolyzer, where the current is passed through it and transforms it into a concentrated hypochlorite-of-soda solution, which may be immediately utilized for bleaching. The cooler contains a coiled pipe, through which

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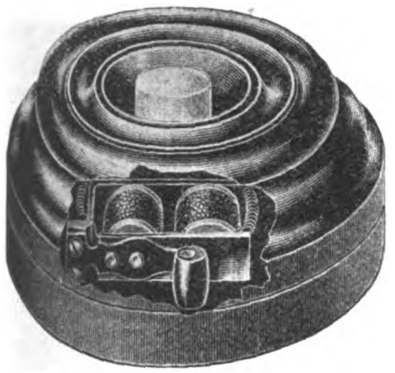
water circulates. A reservoir may be connected with the electrolyzer for storing the concentrated liquid, if it is not to be utilized at once. If the solution is not sufficiently concentrated, it is only necessary to pass it through the electrolyzer again.—*Translated and abstracted from Société Belge d'Electriciens, Bulletin Mensuel (Brussels), June.*

AN INDICATING BELL PUSH.

In order to enable a person operating a bell push to be sure that the bell is in working order, a useful modification of the ordinary push has been designed by the Sun Electrical Company, of London. The device is known as the "Bouverie" indicating push, and gives audible evidence that the bell has been set in motion when the button is pressed. The hardwood base contains a small buzzer connected in series with the line, so that it vibrates synchronously with the bell.



AN INDICATING BELL PUSH.

Apart from its value as an indicator that the bell circuit is in proper working order, the device gives warning of the approaching exhaustion of the battery by its feebler operation. Although intended primarily for simple bell circuits, the "Bouverie" principle could be adapted for use with any push-button-operated system, or with battery call telephones, either of the domestic "Metaphone" pattern, or the more complex types employed for intercommunication purposes.—*Extracted from The Electrical Times (London), June 17.*

A NEW INSTRUMENT FOR X-RAY WORK.

In the field of Roentgen-ray work measuring instruments are wanting almost entirely. Milammeters with movable coils have usually been employed for measuring the current flowing through a Roentgen tube, but their indications are not correct, for the reason that the current is not direct, but more or less unsymmetrically alternating. An induction coil, the primary of which is excited by interrupted direct current, gives a tension in the secondary which may be represented by a curve with positive and negative maxima of different values, the smaller negative half-wave being caused by the retarded closing of the circuit. The amount of current forced through a Roentgen tube is therefore dependent, not only on the maximum values of the positive tension, but negative waves will also pass through it, if its resistance is not too high. A movable-coil milammeter will give correct indications only when the tube is so hard that none but the high-tension, positive-current impulses can pass; but this condition is very rare, and usually a current flowing in both directions, with smaller negative waves, has to be reckoned with. A current of this kind affects the movable coil of the instrument in two directions, and each positive impulse is decreased by the smaller negative impulse, so that the instrument indicates a current equal to the average difference between the two half-waves. Thus it may happen that, under the proper conditions, the needle of the milammeter will point to zero or even give a negative indication. Electromagnetic measuring instruments with a movable soft-iron core in the interior of a coil are independent of the direction of the current, so that the effect of a positive wave is not diminished, but maintained by a succeeding negative wave. An instrument of this kind, connected in series with a Roentgen tube, will indicate the full current intensity. However, it will not show how much current is effective in the production of the rays and how much is lost in the negative waves; but from the indications of both instruments, these relations may be easily ascertained. By connecting one of each type of meter in series with a Roentgen tube, all the variations in the circuit and changes in the condition of the tube may be observed, and the tubes may also be compared as to hardness. The Hartmann & Braun Company, of Frankfort, has combined the two instruments into one measuring arrangement for use in Roentgen-ray laboratories.—*Translated and abstracted from Elektrotechnische Zeitschrift (Berlin), June 3.*

ELECTRICITY IN COAL MINES.

In the course of a recent lecture at the Heriot-Watt College, Edinburgh, Scotland, before an assemblage of mining men, Prof. F. G. Baily gave an account of the dangers of the use of electricity in coal mines, and suggested reforms to minimize them. The lecturer pointed out that in a fiery mine a flame or spark of any kind was fatal, and, unfortunately, in the manipulation of electricity sparks were practically unavoidable. The blowing of a fuse produced a most vigorous flash. The breaking of the electric current by a switch produced a spark, large or small. The starting switches of motors produced sparks, and at the commutator of a direct-current motor there were invariably sparks. The explosion due to gas in a motor was demonstrated. The advantage of the three-phase motor, especially the kinds without slip rings, was pointed out. Managers and inspectors responsible for the safety of mines should be well trained and adequately recompensed, and facilities should be afforded for the testing of electrical mining plant under realistic conditions, so that they could know whether their endeavors to increase the safety of the appliances were along the right lines. —*Extracted from The Engineer and Iron Trades Advertiser (Glasgow), June 22.*

CARBORUNDUM IN RADIOTELEGRAPHY.

Carborundum is now being extensively used as a detector in wireless telegraphy, and is supplanting silicon, molybdenite, and other substances for this purpose because of its greater reliability, inasmuch as it is affected to a hardly noticeable degree by the heavy discharges of the sending apparatus and so does not require a new adjustment after each period of sending. Carborundum comes from the electric furnaces at Niagara Falls in cakes about an inch or two in thickness, and in color ranges from a silver-gray to plain black, sometimes with all the colors of the spectrum interspersed. This color scheme does not mix in one jumble, but runs in sections, and the dark blue, solid portion of a cake is the part the wireless man is after. Carborundum seems to be the hardest when the color is dark blue, and when a piece of this kind is used the oscillations give a sharp, clear tone in the receiving telephones, which quality seems to be lacking in the other colors: for when it is of any other color it seems to be softer and the sounds are inclined to be mushy. The writer (J. O. Smith) has made a careful study of this question and can procure no carborundum of any color that can approach in any way the dark blue for sensitiveness and general utility. Carborundum has a positive and negative side and careful adjustment must be made with this in view in wireless work. It also has a high resistance to direct current, but is susceptible to alternating-current oscillations, one reason why it is so useful in wireless telegraphy. — *Extracted from Power and The Engineer, June 29.*

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

A NEW OVERLOAD INVERSE-TIME-LIMIT RELAY.

BY HAROLD W. BROWN.

From the standpoint of uninterrupted service, the ideal protection against overload on a heavily loaded power or lighting circuit is one that opens the circuit only after the overload has continued long enough to approach more or less nearly to the danger point. The greater the importance of uninterrupted service, the nearer is it wise to approach the danger point. For such automatic control the protecting apparatus must have a time limit that depends on the amount of overload—being almost instantaneous in case of a short-circuit, but allowing a considerable time element in case of a small overload. It should also be capable of variation so that the time element and the rated full load may be increased or decreased as conditions require.

A new relay having several unique features, and offering exactly the protection just referred to has been designed by the Westinghouse Electric and Manufacturing Company and is known as its type B. It is successful in overcoming the greatest difficulties hitherto experienced in the operation of overload inverse-time-limit relays.

This relay is shown in Fig. 1. The same instrument with the cover removed is shown in Fig. 2. It is simple in its construction. The stationary part consists of a current coil mounted in a laminated-iron shell, and a needle valve in the metal framework of the bellows. The moving part consists of a brass rod on which are mounted an iron core inside the coil, a contact cone below, and the bellows above the coil. The relay is enclosed in a dustproof case. The winding of the coil is represented diagrammatically in Fig. 3. One end of the winding connects to one of the binding-posts, and leads are brought out from several points.

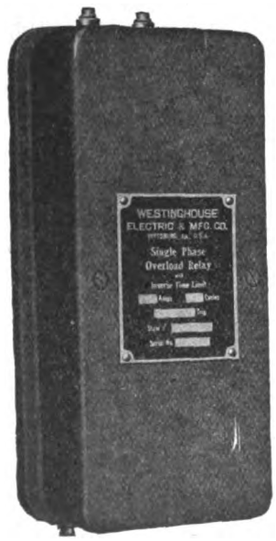

FIG. 1.—VIEW OF COMPLETE RELAY.

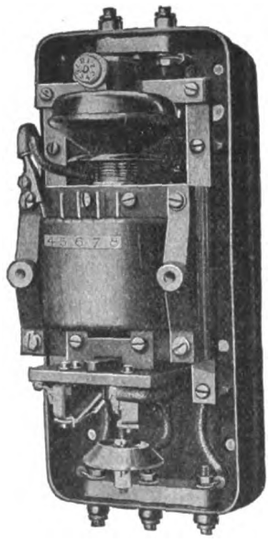

FIG. 2.—VIEW OF RELAY WITH COVER REMOVED.

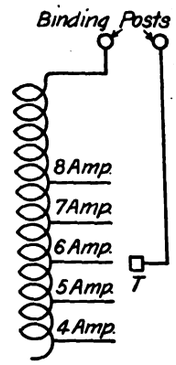

FIG. 3.—DIAGRAM OF RELAY CONNECTIONS.

The terminal T is on a flexible cable and may be connected to any one of the leads from the coil. Thus a part or all of the winding may be connected in circuit between the two binding-posts of the relay. There are five current settings, viz., for four, five, six, seven and eight amperes. The number of turns decreases in proportion as the current rating increases, so that the ampere-turns are the same for any current setting. The size of wire is larger for the larger current capacities, so that the loss in watts at full load due to resistance is approximately the same for any capacity, being seven watts in case of the four-ampere setting, and eleven watts with the eight-ampere setting. This watt loss is exceptionally low for an instrument of this kind.

The laminated-iron shell around the coil has an ample sectional area, and forms a good magnetic circuit with the core. The shell supports the coil firmly, and is mounted on the base of the relay. The core is very light, but so constructed magnetically that it exerts an ample force for drawing up the moving parts and making the contact.

The bellows leather consists of two thicknesses of a fine quality of lightweight leather, specially treated to render it impervious to air, flexible and durable. The escape valve of the bellows is a needle valve. Each needle is specially ground to allow the right escapement of air. A numbered dial is mounted on the needle to indicate the setting of the valve. This dial renders it possible to set the valve with great accuracy.

This instrument is adjusted at the time of calibration so that the iron core just strikes the iron shell when the moving element is in its highest position. Such an adjustment prevents violent vibration of the moving element. This violent vibration has introduced a serious difficulty of the operation of other relays of this kind on heavy overloads at low frequency, because it prevented their operating properly in the normal time. It was overcome in the original design of this relay, because one of the first conditions imposed was prompt and normal operation on low frequency with very heavy overload. It would be impossible to use this method of damping out the violent vibrations, if the various current settings were obtained by moving the iron core, but inasmuch as the core is in the same position for all set-

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tings of the relay its behavior is very satisfactory.

The weight of the moving element is counterbalanced by a spring, so that only a slight magnetic pull is required to make it operate. For this reason, and on account of the small weight of the core and the good magnetic circuit, it is possible to have the resistance and inductance of the relay very low. This has two distinct advantages. First as to heating: The relay runs cool under all conditions. If the load is heavy enough to heat the relay more than forty degrees centigrade, it is enough to make it operate and open the circuit, so that it is practically impossible for the relay to heat more than this, but the winding has a special insulation capable of withstanding several times this amount of heating. The second advantage is that of low voltage drop: These relays are ordinarily used with series transformers and unless the voltage drop is low the accuracy of the transformer ratio is affected. This matter is of considerable importance where measuring instruments are connected to the same series transformers.

This relay is capable of a very wide range of adjustments as illustrated by the curves in Fig. 4. The number on each curve corresponds to a number on the needle-valve dial. All the curves except No. 1 are the same for all relays. There is a small variation of No. 1 on different relays. One of the great advantages that this relay possesses is the fact that variations may be made in the time setting without affecting the normal full-load rating, and variations may be made in the normal full-load setting without affecting the time of operation at a given percentage in excess of full load. The curves are drawn showing the operation on a basis of percentage overload, assuming that the overload begins as soon as the current exceeds the normal rating, which may be anything from four to eight amperes. From this it will be seen that the relay has an extremely wide range of adjustment. For example, without changing the current setting the time required for operation at fifty per cent overload may be varied from one to eleven seconds. This range may be still further increased by varying the current settings. It will be noted that the scale divisions indicating the horizontal distances in Fig. 4 are not uniform, but are made on a logarithmic scale. This method of representation is employed because the curve is more compact when drawn in this way. It is thus possible to show clearly the operation of the relay on any load up to five times full load.

In some cases two relays are affected by the same overload. For example, one may be on a main feeder and one on a branch; or one may be at the generator end and the other at the load end of the same feeder. In either of these cases it is essential that if possible only the relay nearer the load end shall operate when the overload occurs. The other relay serves as a protection in case of ground on the line between the generator and the second relay. This selective action may be secured either by adjusting the relay nearer the generator for a longer time element, or by setting it for a larger current. By referring to the time-load curves, this setting may be accomplished with ease because there are wide spaces between the curves, and because the relation between time element and percentage overload is absolutely independent of the current setting on which the rated full load is based.

Another point of excellence of this relay is its "resetting," or returning to its position of rest. The relay must reset promptly whether the overload continues long enough to trip the circuit-breaker, or whether it is too short to exceed the time limit. This resetting condition is necessary because if the relay does not reset it does not introduce a sufficient time element when the next overload occurs. On the other hand, if the relay resets too quickly it may interfere with the normal operations. This relay resets in the same time as it takes to operate at twenty to fifty per cent overload, and it begins to reset as soon as the load drops to sixty per cent of the load that would make the relay operate. This time for resetting is so short that if the circuit-breaker is opened the relay resets before the circuit-breaker is closed, but it is not so short as to interfere with the normal operation of the relay.

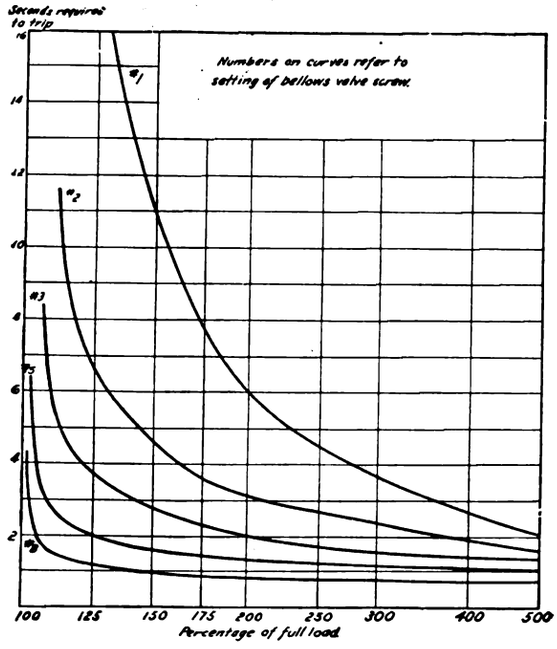
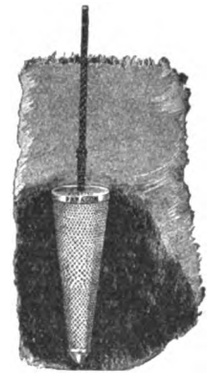


FIG. 4.—OVERLOAD CURVES FOR RELAY OPERATION.

The Paragon Ground Cone.

The Paragon ground cone is a pure copper cone, perforated to allow the entrance of moisture. The cone is filled with charcoal, which attracts and holds moisture, thus keeping the earth around the cone damp all the time, and insuring a perfect ground.

It is a well-known fact that telephone distributing frames and protector frames should be grounded, and it is also a general practice to ground pole cable terminals and large toll-line arresters. Many companies also ground the messenger and the cable sheath, and for all of these purposes the Paragon ground cone is well adapted.



PARAGON GROUND CONE.

The Paragon ground cone is very easy to install, as it is necessary only to bore a post hole and drop the cone in. Moreover, the cone can usually be buried to a much greater depth than makeshift grounds and at practically no extra expense.

The cone is made in one-foot and two-foot lengths. The one-foot cone furnishes ample surface for grounding distributing frames or switchboards up to 100-pair capacity. The one-foot cone is also recommended for pole-cable terminals of any size for grounding the sheath or messenger and for toll-line arresters. The two-foot cone is adapted for use on frames or switchboards up to 1,000 lines, and for larger frames the cones are generally

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used in batteries; that is, several leads are run off from the ground wire and each attached to a cone or else several ground wires are run, each one ending in a Paragon ground cone.

A hollow, braided copper cable runs entirely through the cone, as shown in the illustration. This cable is made hollow, so that the ground wire can be inserted and pushed right down to the bottom of the cone; then, by simply pulling the cable, it closes tight around the ground wire, in somewhat the same manner as a cable come-along closes and pulls on the cable. The ground wire should then be soldered to the cable around the top of the cable, and a perfect connection will then be absolutely assured. Many

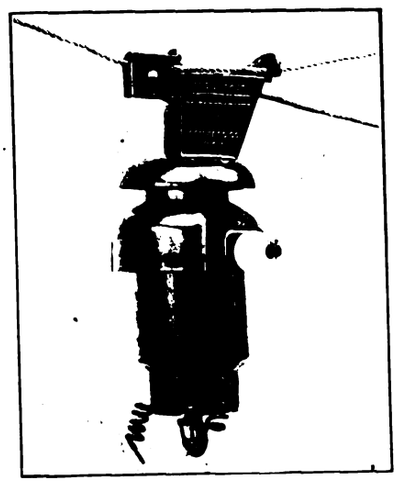


FIG. 1.—AUTOMATIC HANGER AND CUT-OUT FOR SPAN SUSPENSION IN SERVICE.

telephone companies also put coke around the outside of the cone when burying it, but in most soils this is not necessary.

The Paragon ground cone has already been adopted by a large number of telephone companies and electric-light, power and traction companies. Frank W. Pardee, of 48 Fifth Avenue, Chicago, is the manufacturer.

New Cut-Outs for Arc-Lighting Service.

A new design has been perfected in cut-outs for both series and multiple arc-lighting circuits, which will add greatly to the convenience and safety of lamp trimmers. The old style of cut-out made use of a switch for breaking the circuit, whereas the improved form is automatic in action, the lamp being disconnected from the line by simply pulling the supporting rope.

Fig. 1 shows the series cut-out as connected in service. The circuit is closed by means of spring contacts, and a unique locking device holds the lamp in position. This device is very ingeniously contrived to release the lamp when it is lifted slightly from its normal position. It can then be lowered to the ground, as shown in Fig. 2, and necessary repairs can be made without the slightest danger to the lineman.

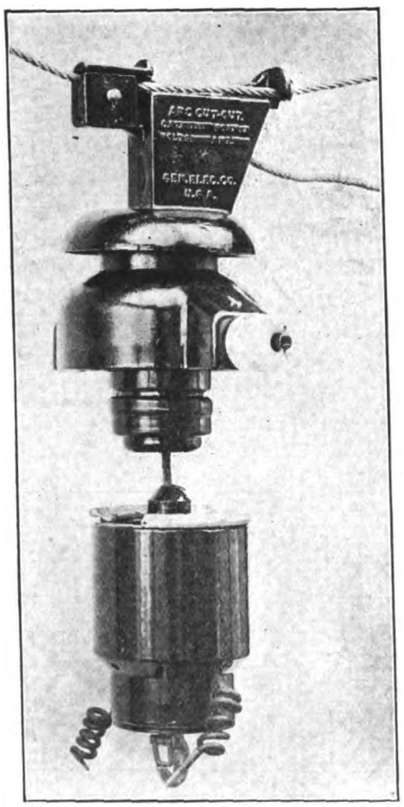


FIG. 2.—AUTOMATIC HANGER AND CUT-OUT FOR SPAN SUSPENSION, LOWERED FOR REPAIRS.

A cut-out of similar design is available for use on multiple arc-lighting circuits. Both the cut-outs are manufactured by the General Electric Company.

Recent Installations of Electric Mining Machinery.

Among some of the recent notable installations of electrical mining machinery in several of the western states there may be noted the following:

A new blower house at the Washoe smelter of the Anaconda Copper Mining Company, at Anaconda, Mont. It contains four 600-horsepower motors driving Root blowers, and two additional 600-horsepower, slow-speed motors driving high-pressure air compressors for pneumatic locomotive service.

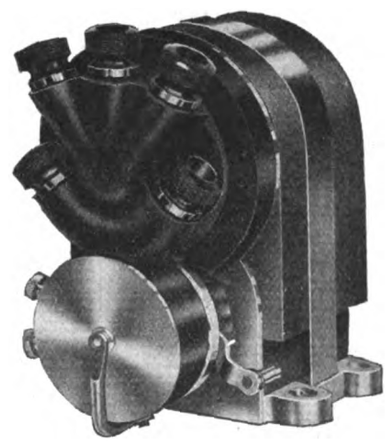
The Helena Power Transmission Company has equipped a turbine plant at Butte, Mont. This supplies the local Butte mines in parallel with a 70,000-volt, eighty-five-mile transmission line. This turbine plant has made some remarkable records in overload and emergency service.

The installations mentioned above have been furnished by the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

A Simple Low-Tension Magneto.

The low-tension magneto illustrated herewith is probably one of the simplest and most efficient machines on the market. This is the Model E "Radium" magneto for four-cylinder four-cycle internal-combustion engines and is manufactured by the General Accumulator and Battery Company, of Milwaukee, Wis.

The system used is that having an armature of but one winding, and during each revolution two impulses of current are produced and distributed to the various cylinders by means of a distributor on the



MODEL E "RADIUM" MAGNETO.

magneto. The insulation presents no difficulties on account of the low-tension current produced. The current is discharged through a transformer having low and high-tension windings similar to a regular spark coil. This steps the current up to a voltage sufficiently high to enable it to jump the gap of the spark plug.

The mechanical details have been perfected to the simplest possible form consistent with reliability. No tools beyond an ordinary screwdriver are necessary for taking down, assembling, or adjusting. H. & B. ball bearings are used throughout, no oiling is necessary, and the whole device is thoroughly dustproof.

The magneto is designed for continuous service, and is sold under guarantee.

The over-all dimensions are as follows: Height six-and-seven-eighths inches, width five-and-one-half inches, length eight inches. The distance between the lugs from center to center is four-and-one-half inches, and the distance between centers on the holes for the cap screws, two inches.

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Electric Drive in Patternmaking.

One of the best installations of electrical apparatus in a pattern shop in Western Pennsylvania is located at West Homestead, in the works of the Mesta Machine Company. The two floors of a reinforced concrete building are devoted exclusively to the pattern shop, giving it an exceptionally favorable location in every respect. The natural light is excellent, the machines are all driven by individual motors, so that there are no overhead belts, and the wiring is entirely concealed, making the general appearance of the shop particularly clean and attractive.

The shop is equipped throughout with new machinery suitable for the preparation of the patterns required for the large engines and rolling-mill machinery manufactured by this company, and everything is modern and up-to-date in the equipment.

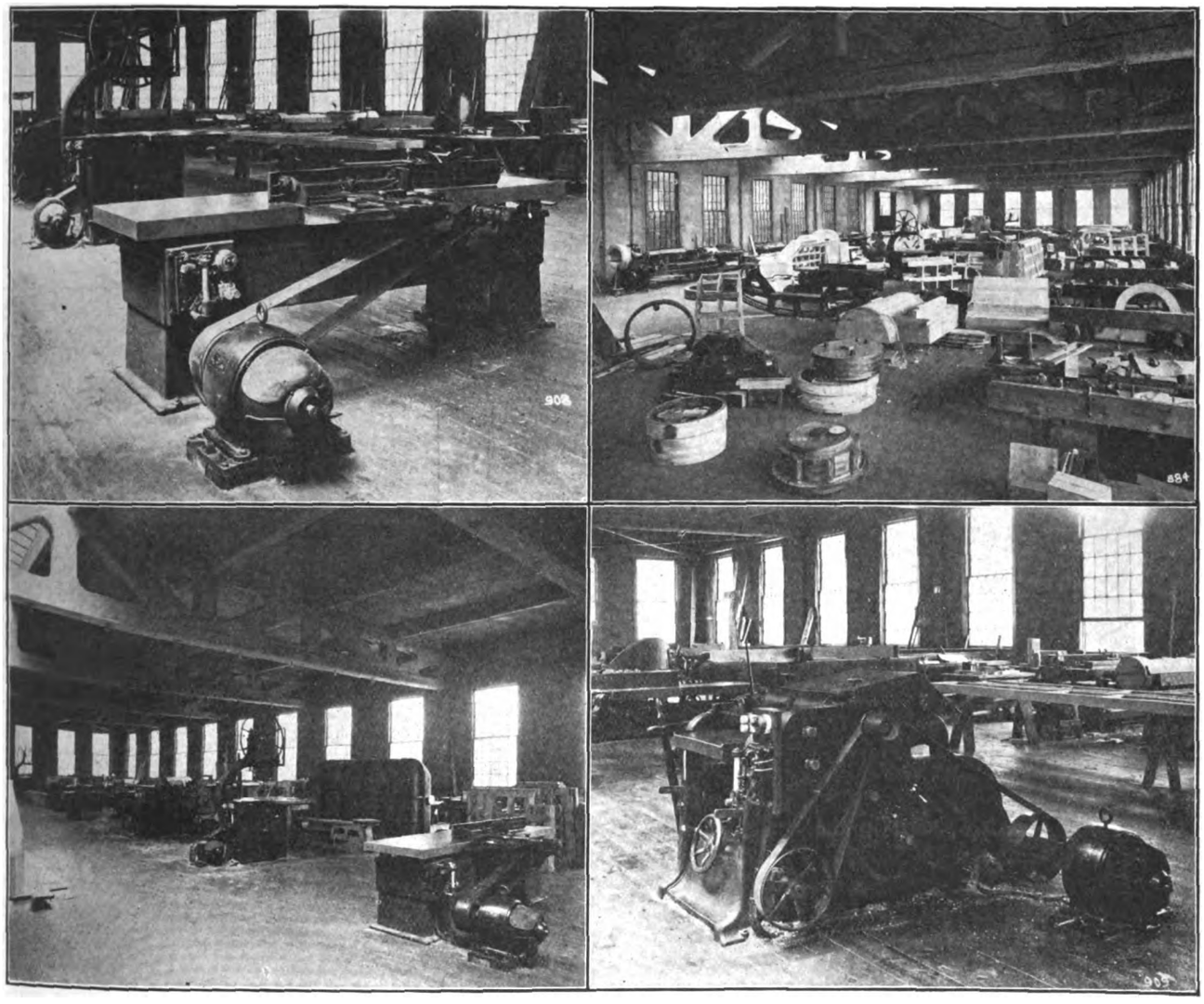
An idea of the general layout of the shop is given in the illustrations. One of these shows the shop floor cleared of work, while another photograph was taken with patterns of various descriptions in different states of completion.

The equipment includes three bench saws, three band saws, a swing saw, three surfacers, three jointers, three lathes, a pony planer and a pattern scroll saw. Each machine is driven by its own motor, either belted or, in a few cases, as with the two speed lathes, direct-connected. The planer and the surfacers are driven by a countershaft to which the motor is direct-connected. The motor for the scroll-pattern saw is directly coupled to the crank-wheel, providing a most compact equipment.

The motors are largely three-and-one-half or five horsepower. This is due to the fact that it was desired to secure as many motors as possible of one size, in order to keep the repair parts carried in stock a minimum. These five-horsepower motors, running at 1,600 revolutions per minute, and the three-and-one-half horsepower motors, running at 1,050 revolutions per minute, are built on the same frame, and all parts, except armatures and field windings, are interchangeable. Spare armatures and field coils of each type are kept in stock in readiness for any accident.

The motors are of the direct-current, 220-volt, shunt-wound type. To prevent damage to the commutator by the accumulation of dust and dirt, the electrical superintendent, F. G. Galbraith, has devised a neat wire covering, which affords ample ventilation and yet prevents the shavings, etc., from getting inside the motor. Protection to the belts from dirt, etc., and to the operator in case of a broken belt, is afforded by a special steel guard, which is fastened to the floor and to the motor frame, and completely encloses the belt. This device, made by the Mesta Machine Company, for this purpose, is shown in the illustrations.

The wiring is all carried in an eight-inch conduit, in the floor, which runs the



MOTOR-DRIVEN JOINTER.
GENERAL VIEW OF PATTERN SHOP.

INTERIOR OF PATTERN SHOP, SECOND FLOOR.
MOTOR-DRIVEN PONY PLANER.

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full length of the shop, with outlets at each machine. This conduit is packed with kiln-dried silica sand, which absolutely prevents any possibility of arcing or fires. The switchboard is in a separate room, where the saw filing and knife grinding are done by an automatic filing machine, which is arranged so that the band saws may be loosely looped over an old band-saw wheel.

In addition to the motor there are nine glue pots, electrically heated, where all the glue is warmed. Practically the entire motor equipment, together with the glue pots, was supplied by the Westinghouse Electric and Manufacturing company. The motors are known as type R, for direct-current service.

An Improved Metal-Clip Wood Cut-Out Box.

With storm or cut-out boxes exposed to the inclemencies of the weather it is desirable to have a catch which can readily be released or secured by one hand so that the other hand may be free for other purposes. The common form of rotary knob and latch used in house doors is too complicated and withal too expensive for this purpose.

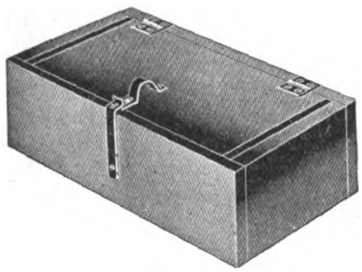

FIG. 1.—ASHLAND CUT-OUT BOX.

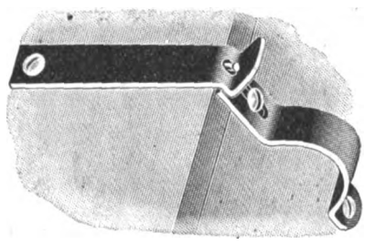

FIG. 2.—ASHLAND PATENT BOX STRAP AND LATCH.

The new form of catch shown in the accompanying illustrations, has been invented by Thomas Q. Andrazyk, of Chicago, which completely fills all the above requirements. The catch is made of steel and is practically indestructible. Only three screws and one pilot pin are necessary to attach it to the box, and it can be readily opened by the thumb and forefinger of one hand.

Fig. 1 shows the cut-out box with this new form of catch, and Fig. 2 is an enlarged view of the catch itself.

The box is made of wood and is provided with a hinged cover. It is designed for use as a storm box, or for holding electric apparatus as cut-outs, switches and the like. It is painted inside with asphaltum paint, or lined with asbestos, depending on the particular use for which it is intended. The box is so constructed that the cover will shut down between the ends and sides of the box, and the cover is further devised so as not to be affected by warping.

This improved form of cut-out box is manufactured by the Ashland Electric Company, of Chicago, Ill.

Car Lighting with Opalux Reflectors.

Within the past year the subject of electrically lighted trains has received much attention by the railroad managements, and an indication of how important the development is considered by those interested in car lighting is the organization and growing membership of the Association of Car-Lighting Engineers.

The introduction of tungsten lamps has given a decided impetus to car lighting, and with this has come a demand for new types of reflectors. One of the most serious practical drawbacks to efficient car lighting with reflectors is the inevitable collection of dust or dirt, and, as is well known, the efficiency of the average type of reflectors is seriously impaired by this unavoidable accumulation. With the ordinary type of reflector it is absolutely essential that the lamps be removed, and the reflectors subjected to a thorough washing in order to remove the dust or dirt. This necessitates constant attention, and is frequently costly, in that, aside from the actual expense of time and wages of the caretakers, an additional and very heavy expense is introduced due to the breakage of reflectors and tungsten lamps incident to the necessary handling, and which is quite unavoidable.

Realizing the disadvantages under which the car lighting is being conducted, the Central Electric Company, of Chicago, has been experimenting with its well-known "Opalux" reflector, and the results so far have proven very gratifying. The accompanying illustration shows a dining car completely equipped with Opalux bowl-type reflectors, and from the experience so far gathered it would seem that this new type of reflector will prove a very efficient aid in the proper illumination of railway cars. Opalux reflectors are artistic in appearance, and the reflected light is slightly opalescent. The transmitted light shows a variation of soft colored tints, and illuminates the ceiling with a warm glow, entirely free from sharp contrasts in intensity. The ornamental detail has been designed to present no sharp corners or deep grooves, but affords an even surface very readily cleaned.

The results secured by these reflectors in connection with car lighting will be closely watched, as it is a subject which is receiving the most careful attention from car-lighting engineers.

DINING-CAR LIGHTING WITH OPALUX REFLECTORS.

Electric Vehicle Reorganization.

The Columbia Motor Car Company of Hartford, Conn., which is to take over the property of the old Electric Vehicle Company for the manufacture of automobiles, has filed with the Secretary of State a certificate of amendment, before organization, to the certificate of incorporation whereby the new company's capital stock will be increased from $48,000 to $3,000,000. The stock is divided into 30,000 shares of the par value of $100 each, divided into 20,000 shares, or $2,000,000 preferred stock and 10,000 shares or $1,000,000 common stock.

The holders of the preferred stock shall be entitled to non-cumulative dividends at the rate of six per cent per annum before any dividends shall be paid on common stock.

After the payment of the six per cent on the preferred stock during the year, five per cent may be paid on the common stock. The amount of the authorized capital stock with which the company will start business is $2,389,200. The incorporators are Lucius F. Robinson, Albion B. Wilson and Francis M. Cole.

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Committees of the Underwriters' National Electric Association.

The following list of committees of the Underwriters' National Electric Association has been submitted by C. M. Goddard, secretary, 141 Milk Street, Boston, Mass.:

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Committee on Rule 64, Signaling System.—F. E. Cabot, chairman, 55 Kilby Street, Boston; Ralph Sweetland, 141 Milk Street, Boston; E. A. Fitzgerald, Box 298, Syracuse, N. Y.; C. H. Hill, 316 Walnut Street, Philadelphia, Pa.; Minor M. Davis, 253 Broadway, New York city; C. C. Johnson, 195 Broadway, New York city; H. S. Warren, 15 Dey Street, New York city.

Committee on Rule 2-A.—G. E. Bruen, chairman, 135 William Street, New York city; Arthur Williams, 55 Duane Street, New York city; W. H. Blood, 147 Milk Street, Boston.

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Committee on Recodification of Code.—C. M. Goddard, chairman, 141 Milk Street, Boston; H. O. Lacount, 31 Milk Street, Boston; J. E. Cole, 11 Wareham Street, Boston; W. H. Blood, Jr., 147 Milk Street, Boston; E. McCleary, 423 Stevens Building, Detroit, Mich.

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Committee on Wireless Telegraphy.—F. E. Cabot, chairman, 55 Kilby Street, Boston; A. R. Small, 382 Ohio Street, Chicago, Ill.; C. E. Russell, 18 Western Avenue, Cambridge, Mass.

Committee on Rules 41-45.—Dana Pierce, chairman, 382 Ohio Street, Chicago, Ill.; F. H. Wentworth, 87 Milk Street, Boston; G. E. Bruen, 135 William Street, New York city; A. H. Nuckolls, 382 Ohio Street, Chicago, Ill.; Wallace S. Clark, General Electric Company, Schenectady, N. Y.; G. T. Manson, Okonite Company, New York city.

Committee on Rule 1-D.—W. S. Boyd, chairman, 125 Monroe Street, Chicago, Ill.; Dana Pierce, 382 Ohio Street, Chicago, Ill.; R. S. Twitchell, Western Electric Company, 115 Purchase Street, Boston.

Committee on Junction Boxes.—F. E. Cabot, chairman, 55 Kilby Street, Boston; Dana Pierce, 382 Ohio Street, Chicago, Ill.; J. C. Forsyth, 34 Nassau Street, New York city.

Committee on Street Railway Property.—Ralph Sweetland, chairman, 141 Milk Street, Boston; William McDevitt, 131 South Fourth Street, Philadelphia, Pa.; B. E. Loomis, 19 Liberty Street, New York city; O. B. Johnson, 55 Kilby Street, Boston; H. F. Strickland, 27 East Wellington Street, Toronto, Can.

Convention of the American Street and Interurban Railway Association.

The American Street and Interurban Railway Association, in a bulletin issued July 1 to the members of the American Street and Interurban Railway Association, Railway Accountants' Association, Railway Engineering Association, Claim Agents' Association, Railway Transportation and Traffic Association and the Railway Manufacturers' Association, makes some important announcements concerning the approaching convention in Denver.

The Brown Palace has been decided upon as the headquarters hotel of the American Association, and similarly of the Manufacturers' Association. The Savoy Hotel will be the headquarters of the Accountants' Association, and the Adams will be the headquarters hotel of the Engineers. The Claim Agents' Association will utilize the Metropole as headquarters and the Transportation and Traffic Association will establish its headquarters at the Albany Hotel.

The matter of transportation is being vigorously pushed, but at this date it is not possible to give definite information on this point. The association has been able to secure positively for its delegates an extension of the summer-tourist rates from Chicago to Denver, but the matter of a similar extension from the eastern territory has not yet been decided, and positive announcement on this point cannot, therefore, be made. It is the intention of the association, however, to issue a bulletin devoted to the matter of transportation, and it is hoped to distribute this information as soon as possible. This proposed bulletin will contain as much detailed information as possible on railroad fares and equivalent Pullman rates, from various cities of the country, also information concerning transportation committees, giving the names of the committeemen and the territory assigned.

The date of the convention is October 4 to 8, 1909.

Rockingham Power Company Sale.

Advices from Raleigh, N. C., announce the sale of the Rockingham Power Company's property on Monday, July 12. The case is entitled "In the United States Circuit Court of the Eastern District of North Carolina: S. Morgan Smith Company, complainant, against the Rockingham Power Company and the Knickerbocker Trust Company, defendants.

"Knickerbocker Trust Company, cross-complainant, against Rockingham Power Company, William H. Browne, and W. A. Leland, as receivers of the property of the Rockingham Power Company, and S. Morgan Smith Company, respondents."

The sale will take place in Wadesboro, N. C., when there will be offered all of the property of the company included in a deed of trust to the Knickerbocker Trust Company, given July 1, 1906, and made a part of the cross-bill in the above entitled suit, with all property acquired by the company since the filing of the mortgage. The property embraces extensive water rights, waterpowers, etc., along the Pee Dee River in North Carolina, together with properties, etc., conveyed by Hugh MacRae & Company, of Wilmington, to the Rockingham Contracting Company, also all dams, power houses, material, structures, telephone lines, etc., and electrical machinery, and appliances, plans, and the like, of the Rockingham Power Company; also about 250 rights-of-way, etc., the purchaser to put up $25,000 cash, or to furnish $100,000 bonds issued to the Knickerbocker Trust Company, the remainder of the purchase price to be paid in bonds issued under the aforesaid mortgage, bonds to be received at sum equivalent to the sum which would be payable out of the net proceeds of such sale to the holder of said bonds for a just share of that character of such net proceeds upon a due accounting and apportionment, etc., of such proceeds. The court reserves the usual rights and privileges in such cases, these being enumerated in the notice of sale of the property.

This property and plant has for many months been the subject of much tangled litigation. The property is exceedingly well located and a large sum has already been expended in this centrally located electrical development.

L.

Radium on Free List.

One of the changes made in the tariff bill is the adoption of a new amendment putting radium on the free list in the interest of medical science.

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Current Electrical News

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, JUNE 28.—The following new companies have been formed at Paris: The Heinz Accumulator Company; Wurtz and Buisson, electric-light fixtures; Burel, Pont et Cie., electric plants; Chobillon and Guyot, electric apparatus; Carpentier, Rivière et Cie., electric supplies. In France there have been formed the Champagne Electric Company, at Arc-Senans; Sir and Morel, at Vincennes, electric light and power; G. Devise et Cie., at Escouté, electric lighting; Eug. Wibratte, at Lille, for electric-light plants; Paradis et Cie., electric apparatus, at St. Etienne. At Brussels, I note the formation of the Belgian Siemens and Halske firm, having its headquarters at Brussels, and the Auxiliary Electric Enterprise Company, in the same city.

Some interesting experiments in wireless telephony were carried on not long since by Captain Colin and Lieutenant Jeance, of the French Marine. One station was located on the shore of the Mediterranean near Toulon, and the other upon the vessel "Condé" of the fleet. They were able to make communication when the vessel was 110 miles out at sea during these experiments. These results have attracted considerable attention, and are among the best which have yet been obtained in Europe.

For about a year past, the Austrian government has been considering the matter of making arrangements with the International Electric Company and the Redlich and Berger firm for the electrification of the Trieste-Opcina section of the state railroads. At present the question is nearing a conclusion, according to the most recent reports. The Arad-Hegyaljer Railroad is to change over from the steam to the electric system in the near future.

A large turbine plant is being erected in Switzerland by the municipality of Zurich. It is located near Sils in the Grisons canton. The barrage will afford an artificial lake having some 420,000 cubic meters water storage. In the plant there are to be used eight main turbine and alternator sets of 2,000 kilowatts each. The machine voltage of 7,000 volts is raised by a bank of transformers to 40,000 volts for the power line, this latter being eighty miles in length. It is expected to finish the plant during the present year. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, JULY 3.—Sir Sandford Fleming, of Ottawa, the most eminent authority in Canada on telegraph cables, has left for England to consult with the Hon. Henniker Heaton regarding cheaper cable communication between Great Britain and the overseas dominions of the empire.

T. C. Fellowes, of Toronto, the last member of the Smith-Verry-Chase party, who have been surveying the dams, power house and transmission line from Matebetchewan to Cobalt, has gone to North Bay, Ontario, for which place the firm has undertaken the work of surveying the power line from dams, power house and right-of-way for a proposed new power line from Powassan. The power will be brought a distance of twenty miles to the city, and it is expected that the company will be able to transmit electric energy some time near the end of the present year.

Reports received at the department of public works, in this city, indicate that satisfactory progress is being made with the extension of the government telegraph line from Athabaska Landing westward to Lesser Slave Lake. During the past winter the poles were cut for the entire distance, and last month work was begun on erecting the poles and stringing wires. Notwithstanding heavy rains, that greatly impeded transportation of material, the first twenty miles had been completed on the 18th of June. The report states that hot, dry weather then set in so that even better progress on the work was anticipated. The Dominion government has already in operation telegraph lines from Edmonton to Athabaska Landing, a distance of 100 miles.

Sir Wilfrid Laurier has received a communication from the British Minister to Sweden, giving details as to the establishment of an electric smelting plant at Trollhatten Falls in that country. This work, which is on the model of the one at Domnarfvet, makes three commercial plants now in operation in Scandinavia, two in Sweden and one in Norway. The new Trollhatten plant has three furnaces, each of 2,500 electric horsepower, and a capacity of 7,500 tons of pig iron. The cost of the electric energy will be $7.50 per horsepower for the first ten years, and rising to $10 in the second ten years. The ores treated there carry percentages of phosphorus ranging from 4-10 to 1 9-10. The iron deposits of Ontario and Quebec, and particularly in the valleys of the Ottawa and Gatineau rivers, present this very peculiarity, so that Dr. Haanel, chief of the mines department of Canada, is extremely sanguine as to the feasibility of the establishment of an iron industry in Central Canada. He is making an examination of the iron ores of this section of the Dominion in view of the disclosures in the Swedish experiments. A. V. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

CONNECTICUT COMPANY TO BUILD POWER PLANT—The Connecticut Company, the New York, New Haven & Hartford Road's trolley corporation, is planning the erection of a large power station to supply current to the trolley systems of Waterbury, Bridgeport and New Haven and their suburban connections. It is understood that the new plant will cost from $400,000 to $500,000. The site favored is on the Naugatuck River, Waterbury, and an application has been made to the Board of Aldermen for permission to dam the river near the present distributing station of the company. This plant has nothing to do with the electrification of the steam road from Stamford to New Haven and will be devoted entirely to trolleys.

CHAPALA POWER AND IRRIGATION COMPANY—Manuel Cuesta, of Guadalajara, who is at the head of the Chapala Power and Irrigation Company, which has just been organized in the City of Mexico, Mexico, with a capital stock of $8,000,000 Mexican money, says that the hydroelectric plant which the company will construct for the purpose of providing water for irrigation will cost more than $2,000,000. It is probable that two of these power plants will be built—one to be located on the Santiago River near Guadalajara and the other on a stream that empties into Lake Chapala. Transmission lines will be built to operate the pumps which will be located upon the shore of Lake Chapala, the water of which will be used to reclaim 75,000 acres of land. The government loan of $3,000,000 which was recently made to the company is secured by a lien upon the land that is to be reclaimed on a basis of $250 per hectare. An additional loan of $2,000,000 has been made the company by the Caja de Prestamos, or Loan Bank, of this city. This money will be used to build about 110 miles of main irrigating canals, and to establish three pumping stations. While the first unit of this gigantic system of irrigation will provide for the reclaiming of 75,000 acres of land, the plans when completely rounded out will involve the irrigation of more than 500,000 acres. The Pimental interests of the City of Mexico, which own the street railway, light and power systems of Guadalajara, are associated with Mr. Cuesta in the big enterprise. W. D. H.

LIGHTING AND POWER.

(Special Correspondence.)

KONAWA, OKLA.—The city has voted $35,000 water and light bonds.

SOUTH BETHLEHEM, PA.—The Halcyon Electric Light Company is installing a new plant.

BLACKWELL, OKLA.—This city is to issue bonds for the construction of an electric-light plant.

STORY CITY, IOWA—It has been voted to bond the city for the purchase of the electric-light plant. C.

SUTTON, NEB.—An election will be held July 23 to vote on electric-light and waterworks bonds to the amount of $39,000.

BARTLESVILLE, OKLA.—The Bartlesville Light and Power Company has been incorporated with a capital stock of $200,000.

ROCHESTER, MINN.—Owing to mismanagement, presumably, the municipal electric-light plant is running behind about $8,000 a year. C.

SAN JUAN, CAL.—A franchise has been granted the San Benito Light and Power Company to extend its lines through the town.

McMINNVILLE, ORE.—At a bond election held in this town last week $30,000 was voted to complete the municipal electric-light plant.

NOBLESVILLE, IND.—The Noblesville Heat, Light and Power Company has increased its capitalization from $50,000 to $70,000 for the purpose of making extensions and improvements to the

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plant. Thos. C. Reynolds, president, and Alex. C. Holliday, secretary. S.

NEVADA COUNTY, CAL.—The management of the Snowden Hill Mine is to install a number of machine drills and an electric-lighting plant. U.

DES MOINES, IOWA—The Downing Electrical Supply Company, of Fort Dodge, Iowa, will establish an electrical supply jobbing house in this city. C.

SEATTLE, WASH.—The City Council has passed resolutions providing for the installation of additional street lights on certain thoroughfares within this city.

ROUNDUP, MONT.—The Roundup Coal Mining Company expects to have its plant for supplying the city with electric light in running order by July 15. C.

BELLINGHAM, WASH.—The E. K. Wood Lumber Company is to erect an electric planing mill, construction of which is to commence in the immediate future. U.

FORT PIERCE, FLA.—The City Council has passed an ordinance granting a franchise to the St. Lucie Ice Company to construct an electric-light and power system.

TULIA, TEX.—The Tulia Light and Ice Company, recently reported incorporated with $10,000 capital stock, will erect a twenty-five by ninety-foot building for light plant.

BARTLESVILLE, OKLA.—The Bartlesville Light and Power Company has been incorporated with $200,000 capital stock by L. A. Rowland, S. J. Smallwood and R. L. Beattie.

WINONA, MINN.—N. M. Argabrite, of the Winona Railway and Light Company, has become superintendent of the combined electric-light, gas and heating plant at Belvidere, Ill. C.

PRICE, UTAH—A Salt Lake firm has submitted to the Price town board a proposition to install an electric-lighting plant for Price, on which the board will take action in the immediate future. U.

ATLANTA, GA.—The Electric Construction Company has applied for a charter, capital stock $12,000. Incorporators: Charles M. Coyne, W. M. Gregory, J. Prince Coyne and Carroll B. McGaughey. L.

WETUMKA, OKLA.—A proposition has been submitted to the City Council of Wetumka by the Franklin Construction Company, of St. Louis, which proposes to install a modern electric-light plant here. U.

BLACKWELL, OKLA.—The city is completing arrangements for proposed issuance of $58,000 of bonds for waterworks and sewer extension, electric-light plant and street improvements. A. Sparks, city clerk.

ST. HELENS, ORE.—The City Council has granted the McCormick Company the right to operate an electric lighting plant in this city. Machinery has been ordered and operation will begin as soon as the equipment can be installed.

BOULDER, COLO.—The Eastern Colorado Power Company is to expend about $5,000,000, and it will require something like five years to complete its work. The initial power plant, furnishing about 20,000 horsepower, will be installed this year. U.

BOSTON, MASS.—The Gas Commission has approved of an issue of $40,000 twenty-year five-per-cent bonds by the Milford Electric Light and Power Company to cancel outstanding obligations and for additions.

SHERIDAN, WYO.—J. J. Henry, president of the Southern Colorado Power and Railway Company, of Trinidad, Colo., has made satisfactory arrangements for the purchase of the Sheridan Electric Light Company's plant and lines, and plans will be prepared at once for a power house.

LINDEN, WIS.—It is planned to install street and house lights here, current to be secured from Mineral Point, seven miles away. Banker John Harker is pushing the project. The original plan called for a generating station at Linden, but the overland transmission is now favored.

SPOKANE, WASH.—Sam Berry, J. B. Valentine and Sidney Berry, of the Columbia Water Power Company, have announced plans for the construction of a $50,000 power plant on the Methow River. A high-tension power line will be built to convey the power to Bridgeport, Brewster, Pateros, Methow and other towns in the vicinity.

LITTLE ROCK, ARK.—The secretary of state has granted a charter to the Garland Power and Development Company, the headquarters of which will be at Hot Springs. The company is capitalized at $1,500,000, with the following incorporators: Henry Ralloff, president; P. J. Hannon, vice-president; J. A. Stallcup, treasurer, and Simon Cooper and George Belding, stockholders. It is proposed to build extensive dams and power plant on the Ouachita River, in Garland County, for the purpose of supplying electric current to points in adjacent counties.

JEFFERSON, OKLA.—The Jefferson Power and Improvement Company, recently reported incorporated with $100,000 capital stock, contemplates the development of 1,500 horsepower, with thirty miles of transmission line. The company will erect a concrete dam about twenty-five feet high and forty feet long; also a steel dam about 600 feet long.

SALMON, IDAHO—R. L. Edwards, of the firm of Brown & Edwards, mining engineers, who is manager of operations at the Kittie Burton Gold Mines Company, of Ulysses, has announced that the Kittie Burton people have in contemplation the erection of a large power plant, hydroelectric, to furnish power for operating the mill, light plant, and air compressors. U.

AUSTIN, TEX.—Attorney-General Davidson, acting on behalf of the state, has filed suit in the District Court, at Austin, against the Dallas Interurban Electric Railway Company for the forfeiture of its charter on the ground of insolvency, for the appointment of a receiver and for the cancellation of an alleged fictitious issue of stock amounting to $2,000,000.

GREEN CASTLE, IND.—W. S. Blatchley, state geologist, is conducting a survey of Eel River through this county, where the banks are high, for the purpose of ascertaining the power possibilities. It is believed the source of water supply in Eel River is sufficient to warrant the construction of dams and the installation of plants for the generation of electricity to be transmitted to the adjacent cities and towns. S.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company has commenced negotiations with the City Council with a view to settling the dispute over the price to be paid for street lights. The company will offer to supply these lights at seventy dollars each per annum, the amount provided for in the Council resolution, if the Council will make satisfactory settlement for the unpaid bills for this service. C.

PIQUA, OHIO—The Orr Felt and Blanket Company has awarded the contract for a new mill, to cost $75,000, exclusive of machinery or its installation, which will bring the total cost up to $200,000, to be built in this place. The contract calls for the completion of the structure by January 1, 1910. The company is making government army blankets. All the power for the new mill will be electrical, generated within the plant.

LEWISTON, ME.—The Union Water Power Company has secured control of the waterpower privileges of the International Paper Company, on the Androscoggin River, for a distance of six miles between what is known as the Babbitt & Googin dam and the Turner Center bridge. Between these two points, which are from five to eleven miles above this city, there is a fall of forty-four feet, and it is capable of developing over 10,000 horsepower.

NEVADA CITY, CAL.—The Middle Yuba Hydro-Electric Power Company has been incorporated here with a capital stock of $400,000 by A. D. Foote, C. M. Wilson, W. H. Martin, L. M. Hancock, L. N. Wagner, C. T. Jones and Dr. A. H. Tricknell. The company has rights on the Middle Yuba River above Graniteville, where a power house will be built. The company plans to distribute power to the mines and towns of Nevada and Sierra counties.

YREKA, CAL.—Harvey J. Sarter has completed the survey of the new power line of the Siskiyou Electric Light and Power Company from the Fall Creek power house as far as Sisson, a distance of fifty-five miles. The company is extending the south end of the Fall Creek power house to accommodate another 1,000-kilowatt generator. The poles, wire and insulators are now at Ager, Montague, Weed and Sisson, ready for distribution along the line.

PHŒNIX, ARIZ.—The articles of incorporation of the Arizona Orange-Land Water Association have been filed with the territorial auditor. Negotiations have been tentatively closed with the Pacific Gas and Electric Company to furnish the necessary power. The Pacific will extend its power line to Glendale, and the beet factory, and from there a power line will be run to the lands of the association. Frank L. Wright is president of the new company. U.

CHARLOTTE, N. C.—The large new mill to be projected at Roanoke Rapids will be a $500,000 enterprise. Organization will be effected, with the Patterson Mills as the title. Sam F. Patterson, treasurer of the Roanoke Mills Company and the Rosemary Manufacturing Company, both of Roanoke Rapids, is the principal promoter. The equipment will consist of 20,000 spindles and 750 looms on the production of ginghams. Electric power will be used.

REDDING, CAL.—E. V. D. Johnson, manager of the Northern California Power Company, Consolidated, says that the new plant at South, with a capacity of 6,000 horsepower will be completed and ready to furnish power early in July. After this, work is to be started at the Inskip plant, where 8,000 horsepower will be developed, and at the company's main Battle Creek plant, where it is planned to develop 24,000 horsepower. It is expected to have this completed before the end of 1910. The company has

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just secured additional water rights and property by the purchase of the C. W. Hamilton ranch and water rights east of Redding.

MODOC, S. C.—The Twin City Power Company, Thomas O'Connor, president, 54 Broad Street, Waterford, N. Y., has begun the construction of a waterpower-electric plant. The company will construct a steel dam with concrete, sixty feet high from mean low water; initial development, 26,000 horsepower; final development, 46,000 horsepower; total cost, $4,000,000; constructing engineer, Ambursen Hydraulic Construction Company, 176 Federal Street, Boston, Mass.

CHATTANOOGA, TENN.—Electricity is now being supplied to Chattanooga from the new power plant at Hale's Bar, where the great lock and dam is being constructed, seventeen miles from this city. The plant will furnish 56,000 horsepower. The power is sufficient for all uses for a city many times as large as Chattanooga. The completion of this lock and dam will result in the opening of the Tennessee River to navigation as far as Chattanooga the year around.

LOS ANGELES, CAL.—The Los Angeles Gas and Electric Company has reorganized, substituting the word "corporation" for "company" and increasing its capitalization to $30,000,000. The incorporators are W. B. Cline, C. S. Vance, C. A. Luckenbaum, T. P. McCrea, W. E. Houghton, H. R. Austin and C. P. Houghton. Within ninety days an offer for the Pasadena Consolidated Gas and Electric Company will be made, and eventually all the minor plants about Los Angeles are planned in the merger.

CHESTER, S. C.—The Southern Power Company's current has just been turned on in Chester, where the Chester Light and Power Company, a subsidiary corporation to the Southern Power Company, incorporated under the New Jersey laws, has taken charge of the city's lighting interests and the sale of power to several large manufacturing plants in and about Chester. The formal transfer of the property to the Chester company was arranged to take place as soon as the meter readings had been completed. L.

FORT WAYNE, IND.—The Indiana Lighting Company has let a contract to the Western Gas Construction Company for the installation of gas-producing machinery that will double the capacity of the company's local plant. When completed the capacity will be 2,500,000 cubic feet daily. The contract price is $50,000. The Indiana Lighting Company has also awarded a contract to the Kerr-Murray Manufacturing Company for the construction of large gas holders at Lebanon, Frankfort, Decatur and Lafayette. S.

HICKORY, N. C.—Following the reported opposition of the Thornton Light and Power Company to the entrance of the Southern Power Company into the town, an agreement has been perfected whereby the Thornton company will receive current from the second-named company, which will be permitted to enter Hickory with its extensive lines. The Thornton Light and Power Company held the lighting franchise, and this company will distribute power brought in by the Southern Power Company, it is stated now. L.

BOSTON, MASS.—The Massachusetts Electric Companies, through its subsidiary companies, has recently placed orders for forty semi-convertible cars, the purchase of which represents a total investment of about $200,000. These cars were ordered from the Laconia Car Company. All the new equipment of the Massachusetts Electric properties is now confirmed to this class of car, which can be used at all seasons of the year and does not necessitate the company buying summer equipment, which can be used only for about six months of the year.

HAMILTON, MONT.—Articles of incorporation have been filed in the office of the Ravalli county clerk and recorder by the Stevensville Light, Power and Improvement Company, which will begin the construction of an electric light system in Stevensville. The company is organized with a capital stock of $35,000, divided into 350 shares of $100 each. The organizers of the company are C. B. McCarthy of Helena, George T. Baggs of Stevensville, and W. H. Rager of Stevensville. The principal place of business of the new company will be at Stevensville.

NORTH ABINGTON, MASS.—The Electric Light and Power Company, of Abington and Rockland, has petitioned the board of gas and electric-light commissioners for the approval of the purchase of the property and franchises of the Cohasset Electric Company. The Cohasset Company furnishes light for Scituate as well as Cohasset, and it is the intention of the local company to light these towns from the big plant recently installed in East Bridgewater. The company recently added Hanover and Norwell to its circuit, and the system will be extended to Cohasset.

FRESNO, CAL.—Manager A. G. Wishon, of the San Joaquin Light and Power Company, will leave in a few days for a trip to Los Angeles to look over the plans for the extension of the power lines in this city. A survey at Crane Valley has been completed and a good portion of the ditch to convey water from the south fork to the middle fork of the San Joaquin River, has been finished. Equipment for the $50,000 dam is now being received and construction work will soon begin. The old power plant is to be increased from a capacity of 2,500 horsepower to a total of 17,000 horsepower.

ASHLAND, WIS.—The Ashland Light, Power and Street Railway Company has taken possession of the White River power plant. The deed of transfer is signed by E. A. Edmunds as president and C. A. Wixson as secretary of the White River power plant, and conveys to the Ashland Light, Power and Street Railway Company all the right, interest and title to the holdings of the White River Power Company. The transfer includes the flowage rights, dam and power house at White River, transmission lines and poles, substation at Ashland, and all rights granted the company by the state and others.

PHILADELPHIA, PA.—The Delaware County Electric Company, which is being incorporated to own and control four electric-light properties in Delaware County, Pa., has made a contract for its power supply with the Philadelphia Electric Company. There will be an issue of $300,000 first-mortgage bonds, which will be issued for extensions and improvements. Montgomery, Clothier & Tyler have underwritten and sold all of the bonds of this issue. The Delaware County Electric Company will be controlled by the Associated Gas and Electric Company of New York, a corporation controlling and operating fourteen gas and light properties in New York, Pennsylvania and Ohio.

ELECTRIC RAILWAYS.

(Special Correspondence.)

NEW YORK, N. Y.—The New York, Westchester & Boston Railroad is at work on the construction of that portion where it crosses the New Haven road at New Rochelle. Nearly all of the right-of-way from the terminus of the Lenox Avenue subway at One Hundred and Seventy-seventh Street to New Rochelle has been contracted for or purchased, and work on the entire road will probably be begun by the middle of July.

SPOKANE, WASH.—President Robert E. Strahorn, of the North Coast Railway Company, announces that his company is developing a plant in the Cascade Mountains which will generate electricity for operating the road over the summit. A contract has been let for sixteen miles of grading, which will carry the line to within eight miles of North Yakima. Flumes over eight miles in length will carry water from the Cowlitz River providing an 800-foot fall, able to generate some 30,000 horsepower.

TOLEDO, OHIO—C. R. McKay, who for the past two years has been manager of the electric-lighting and heating departments of the Toledo Railways and Light Company, at Toledo, has tendered his resignation, to take effect on July 1. Mr. McKay will become general manager of the Union Light, Heating and Power Company, of Covington, Ky., one of the largest plants in the country, and furnishing light, heat and power for seven cities. The vacancy which has been caused by his resignation has not yet been filled. H.

REDWOOD CITY, CAL.—The Sierra and San Francisco Power Company has filed articles of incorporation here, the capital stock being placed at $20,000,000. The incorporators are all connected with the office of Chickering & Gregory, of San Francisco, attorneys for the United Railroads in the matter of the absorption of the Stanislaus Electric Power Company and its allied corporations. It is understood that the new incorporation marks another step in the consolidation of the railway and power companies.

SEATTLE, WASH.—Construction of the Tacoma-Seattle Short Line will be resumed immediately and will be completed within a year, according to plans perfected at a reorganization of the company. To this end a contract has been entered into with H. A. Eastman, of Detroit, and E. J. Felt, of Tacoma, to finance and construct the line. Mr. Felt was chosen because of his success in financing and building the Pacific Traction Company's lines at Tacoma. Funds are being raised through the sale of $3,500,000 in bonds.

MINNEAPOLIS, MINN.—An electric interstate railway providing connections between the Twin Cities and many points in southern Minnesota and Iowa is the latest project to receive the attention of the people living on both sides of the state boundary line. The distance from Jackson to Owatonna, where the Dan Patch Air Line would be joined for a route into the Twin Cities, is about 100 miles. It is practically the last stretch between the proposed Minnesota system and the system now long in existence in Iowa.

SYRACUSE, N. Y.—The New York State Railways, the new controlling corporation of the Vanderbilt-Andrews electric railway holdings, including the Rapid Transit of this city and the Oneida Railway, has applied to the Public Service Commission, Second District, for permission to increase its capital stock from $23,140,200 to $23,860,200; to purchase and acquire the stock of various street railroad corporations; to execute a first consolidated and refunding mortgage upon its property, rights and franchises to secure $35,000,000 of coupon or registered bonds, and to issue at present $6,500,000 in bonds under this mortgage. The

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$6,500,000 of bonds to be issued are for the purpose of refunding the outstanding bonds of the Rochester & Eastern Rapid Transit Railway, to acquire the Rome City ,Railway Company bonds and the notes of these companies: Rochester & Suburban Railway, Syracuse Rapid Transit Railway, Utica & Mohawk Valley Railway, Ontario Light and Traction Company, Oneida Railway, Rochester Railway and Rochester & Eastern Rapid Railway.

MIDDLETOWN, PA.—At a special meeting of the stockholders of the Central Pennsylvania Traction Company, held at Harrisburg, a resolution was unanimously passed, authorizing a $2,000,000 loan for the improvement of the company's system and the construction of a new car barn on North Cameron Street. The bonds will be four-and-one-half per cent and $300,000 worth will be issued at once for use this year. Another matter that will now be taken up will be the extension of the Rockville line to Dauphin.

HARRISBURG, PA.—A charter has been granted to the Philadelphia Suburban Traction Company. This company will operate a line in Montgomery and Bucks counties. The company has a capital of $25,000, the incorporators being W. E. Watts, Dubois, president; John L. Grogan, H. C. Case and John A. Bonnell, Philadelphia, and W. A. Merrick, Newtown. The route set forth in the charter application is from Southampton, Bucks County, to Davisville, and then to Johnsville, ending at the borough line of Hatboro.

VALLEJO, CAL.—Captain Charles Hatch, of the Monticello Steamship Company; President W. Botsford, of the Vallejo & Napa Valley Electric Railway Company, and Superintendent McIntire, of the same company, have been in Lake County selecting a route for the proposed extension of the Vallejo & Napa Valley line into Lake County. The company's St. Helena-Clear Lake extension has now been surveyed as far as the Graystone Winery and construction will begin immediately, the rails and ties being now on hand.

AUSTIN, TEX.—The attorney-general has approved for filing an amendment to the charter of the Marshall & East Texas Railway Company, increasing its capital stock from $75,000 to $200,000, and providing for an extension. The road is now operated from Winnsboro, Wood County, to Marshall, and is the old Texas Southern property reorganized. It is proposed to extend south from Marshall through the counties of Harrison, Panola, Shelby, San Augustine, Sabine and Newton to the town of Newton, a total of 125 miles.

UVALDE, TEX.—The line of the Uvalde Street Railway Company, which connects the station of Uvalde with the town of Uvalde, a distance of three miles, is to be extended from Uvalde to Batesville, twenty miles, according to present plans. This line is operated by gasoline engines and is the only railway of its kind in Texas. It has proved very successful. The line does a heavy freight as well as passenger business. The contemplated line to Batesville will cover a territory now without railroad transportation of any kind. D.

HAILEYBURY, ONT.—Arrangements have been completed for the first electric railway in the north country. It is understood that all contracts have been signed and that work has virtually been commenced, so the people of Haileybury and Cobalt will soon be connected by a twenty-minute service, operated by an up-to-date electric railway. The company's directorate is made up of a number of Americans and Canadians, most of whom now have their residence in Cobalt or Haileybury. It is called the Nipissing Central Railway Company.

ALLENTOWN, PA.—The Allentown and Reading Traction Company announces big plans for extensions. It is to build lines to the Perkiomen Valley, including Lyons, Bowers and Trexlertown. From there another line will be built to Fogelsville and through the cement region there. This will open up a section of country to Allentown and Reading, which at the present time is cut off from trolley connections with these two cities. Their line will run through Alburtis, Hancock, Pennsburg and the many little towns down the Perkiomen.

AUBURN, N. Y.—The Public Service Commission has granted the application of the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Company for permission to construct an extension of its railroad from Seneca Falls across Cayuga Lake to Auburn. The order requires that the detail plans for the crossing of Cayuga Lake be filed with and approved by the Commission before actual construction is commenced. The Commission has also granted the application of this company to change its name to Geneva & Auburn Railway Company.

HOUSTON, TEX.—The Galveston-Houston Electric Company will have completed the electric interurban line which it will build between this city and Galveston, a distance of fifty-one miles, in time to have the line in operation at the completion of the new reinforced concrete causeway across Galveston Bay. With the building of this causeway the railway will have a way of crossing the bay to the island upon which Galveston is situated. The company also expects to build branch lines to the different seaside resorts about Galveston. D.

SPOKANE, WASH.—It has been unofficially announced that Jay P. Graves, the president of the Spokane & Inland Empire Electric Railroad, which already has 239 miles of interurban road in operation besides its city traction service, has raised $7,000,000 on the company's bonds during his visit to the East, and that the company will expend all of this immense sum on improvements and betterments during the next twelve months. Among the admitted projects of the company is a branch line from the Palouse line to Colfax, a distance of twelve miles, and a thirty-eight-mile line through the big bend to the junction of the Spokane and Columbia rivers. U.

SAN FRANCISCO, CAL.—In pursuing the plan for the acquirement of mountain power rights and the construction and control of electric railways in California, E. H. Harriman has bought from Henry Hunt the electric power and electric railroad properties in and around the town of Fresno. The consideration, as approximately as can be ascertained, was $2,000,000, payable part in cash and part in Southern Pacific Company four per cent bonds. One of the properties purchased is the plant of the San Joaquin Power Company, in the mountains east of Fresno. Another property is the Fresno Electric Traction system, consisting of about twenty-two miles of road.

NASHVILLE, ILL.—The Nashville Interurban Railroad has been granted an amendment to its charter increasing the capital stock from $400,000 to $600,000. The object of the increase in stock is simply to cover the increased cost of the road over and above the first estimate of the division built, and to put it in first-class condition. The extension to Mt. Pleasant will begin probably during this year, but certainly within the next twelve months. The next division will be through to Mt. Pleasant, a distance of forty miles. But the management says that no extension will be attempted until the division already built is in first-class running order and as near perfect as it is possible to make it.

DES MOINES, IOWA—Articles of incorporation of the Iowa & Omaha Short Line Railway have been offered for filing in the office of the Secretary of State. The company is incorporated for $1,000,000. The railroad is a contemplated electric line between Des Moines, Council Bluffs and Omaha. It will run through Pottawattamie, Shelby, Audubon, Guthrie, Dallas and Polk counties, in Iowa, and Douglas County, in Nebraska, a total of 140 miles. Headquarters of the company will be at Pierre, S. D., in the office of John A. Holmes, but a business office will be operated at Walnut, Iowa. The incorporators of the company, with the exception of Holmes, are residents of Treynone, Adaira and Walnut.

BIG RAPIDS, MICH.—The town of Mason, Mich., must allow the Michigan United Railways to cross the city where it pleases on a private right-of-way. This is the decision of the Michigan Supreme Court, in which six justices agreed. Justice McAlvay dissented and Justice Hooker wrote a separate opinion, affirming, however, the decision of Judge Wisner, of Flint, in denying to the city a permanent injunction to restrain the company from crossing the city where it pleases. The decision is one of great importance to cities as well as to railways in Michigan, as the court holds that electric railways may incorporate under the general steam railway law for the purpose of forcing a route through a city on a private right-of-way, and then operate as an electric line.

GRAND RAPIDS, MICH.—Hodenpyl, Walbridge & Co., of New York, and E. W. Clark & Co., of Philadelphia, are promoting a consolidation of the Springfield Railway and Light Company, of Springfield, Ill., the Peoria Light Company, the Evansville Light Company, and the Rockford and Suburban Railway Company. The present companies are capitalized at $10,964,000 and bonds, $2,050,000 preferred stock and $8,000,000 common stock, and have net earnings of $687,188.05. The consolidation will be known as the Union Railway, Gas and Electric Company, and will be capitalized at $8,250,000, preferred stock on bond, and $6,000,000 common stock. Anthony G. Hodenpyl and Henry D. Walbridge are former residents of this city, and E. W. Clark is president of the Grand Rapids Railway Company. Mr. Hodenpyl was formerly secretary of the Michigan Trust and Savings Bank. His father was a well-known Dutch diamond merchant of New York.

PORTLAND, ORE.—President B. S. Josselyn, of the Portland Railway, Light and Power Company, has returned from the East with the announcement that improvements and extensions to the various departments of the service, aggregating $6,000,000, will be made this and next year. The budget for 1909 contemplates an outlay of $2,500,000 and, for 1910, $3,500,000. Items embraced in the current year's appropriations have all been announced, while the most essential expenditures for next year will be devoted to the construction of a $2,500,000 power plant, three miles above the present system at Cazadaro. With this electric plant and a new auxiliary steam station on the river north of The Oaks, the traction, light and power syndicate will have 100,000 of available horsepower for commercial and public-service usage. President Josselyn also stated that fifty new cars for the various lines of the street-railway division will be laid down here early in the fall.

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OAKLAND, CAL.—Active work has been begun on the proposed Key Route extension along Sacramento Street, from the Oakland boundary line to the extreme northern section of Berkeley. A force of men commenced work this week on the grading of a private right-of-way in northern Oakland to connect the franchise route with the Adeline Street trunk line, near Fortieth Street. The company hopes to have the road in operation within sixteen months. Besides the trunk line on Sacramento Street, which will be five miles long and double track, the extension will include a single track line on Hopkins Street into the northern section of Berkeley and a single-track line through the new town of Ocean View to the Alameda County line at Richmond.

TOLEDO, OHIO—At a recent meeting of the Kenton, Ohio, Commercial Club the following trustees were elected, in whose names the right-of-way for the proposed Toledo-to-Columbus Interurban line will be securerd: J. W. Caine, H. E. Hoge, J. H. Allen, William J. Ochs, W. A. Norton. These gentlemen are representative business men, a number of them bankers of high standing. The club has given out the following communication, which was recently received from President Kerper, of the Toledo, Bowling Green & Southern: "If the right-of-way is immediately secured in Hardin and Hancock counties I will have cars running from Findlay to Kenton by January 1." A mass meeting of Kenton citizens was called and plans for securing the right-of-way outlined. W.

ALBANY, N. Y.—Application has been made to the Public Service Commission, Second District, by the New York State Railways, which has control of several up-state trolley companies, for permission to increase its capital stock from $23,140,200 to $23,860,200, to purchase the stock of various street-railway companies, to execute a first consolidated and refunding mortgage upon its property to secure $35,000,000 of coupon or registered bonds, and to issue at present $6,500,000 under this mortgage. The proposed increase is to be common stock, and with $674,700 of such increase it is proposed to purchase from the New York Central and the Central Railway Syndicate their holdings of stock of the Rochester and Suburban Railway Company, giving in exchange an equal amount of the new common stock at par.

RICHMOND, VA.—John R. McLean and Senator Stephen B. Elkins, of West Virginia, have purchased the Bluemont branch of the Southern Railway, which extends from Washington to Bluemont, Va. It is the plan of Messrs. McLean and Elkins to convert the road into an electric system and make it a part of the line which runs from Washington to Great Falls. The valuable falls of the Potomac River and the power plant are controlled by Elkins and McLean, and the power for the system will no doubt be generated from that point. The Bluemont-Washington branch is fifty-nine miles in length, and passes through the most beautiful part of Northern Virginia. Many persons who do business in Washington live on this road, and there has been great complaint that the fare by the steam road has been excessive and accommodations poor.

KANSAS CITY, MO.—It is reported that arrangements are all but completed for money to build a trolley line to Excelsior Springs and St. Joseph, a line which contemplates a new bridge across the Missouri. This is the enterprise in which Leslie M Shaw, of Iowa, formerly secretary of the treasury, is interested. "The line will be open for business within two years," one Kansas City banker stated. "Considerable work has already been done." When asked if there had been any deviation from the original plans to run to St. Joseph through Platte City, with a spur to Excelsior Springs, the banker said that there had been. "The changes are extensions, however. The present plans are to couple up the cities to the south and east. There will be an electric line to St. Louis before we stop building. The first thing, though, will be the completion of this trolley to St. Joseph."

RICHMOND, VA.—The proposed rehabilitation of the physical properties of the old Virginia Passenger and Power Company, now known as the Virginia Railway and Power Company, will be an extensive task. Among the extensions under consideration is the completion of the Richmond and Chesapeake Bay line on to Washington, thus affording the first electric-railway connection into the capital from the South, excepting the Baltimore line. In Richmond it is proposed to rebuild the system in accordance with the traffic demands of a growing town, curtailing some lines, and building new ones to whatever sections at the present time are wanting in electric-railway facilities. It is expected that work will be started at Ashland, the present terminus, and at Fredericksburg, also, on the Washington complete line. It is proposed to secure franchises between Broad and Main streets west of Beech street. Another issue is that of a bridge across the James River that will carry the weight of the Petersburg cars, twenty-eight miles distant, several sites having been examined, and with the lines to Washington and Petersburg, the Virginia Railway and Electric Company will have perhaps the longest system of lines in the southeastern states. L.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

WACO, TEX.—The Texas Central Telephone Company has been incorporated with a capital stock of $6,000.

BURKE, S. D.—The Whitestone Valley Telephone Company has been incorporated with a capital stock of $5,000.

OGILVIE, MINN.—The Northwestern Telephone Exchange Company has been granted a franchise in this place.

SELBY, S. D.—The Walworth County Farmers' Telephone Company has been incorporated with a capital of $6,000.

CHOTEAU, MONT.—The Co-Operative Telephone Company of Choteau County has been organized with a capital stock of $40,000. C.

FLORENCE, MISS.—The Florence Telephone Company is installing poles, and will soon complete connection with the Cumberland lines.

LINCOLN, UTAH—The Progressive Telephone Company has been incorporated here with a capital stock of $5,450; J. W. Whitehouse is president.

SOUTH BEND, IND.—The South Bend Home Telephone Company will enter upon the work of expending $50,000 for extensions and improvement of its plant July 6. S.

SAN FRANCISCO, CAL.—The earnings of the Pacific Coast Telephone and Telegraph Company for May were over $1,000,000, the largest in the history of the company.

THOMPSON FALLS, MONT.—The Western Montana Telephone Company has been organized here with a capital stock of $12,500. Incorporators, A. S. Ainsworth and others.

FORT D. A. RUSSELL, WYO.—The contract for the construction of an electric-lighting plant for the fort has been let to the F. E. Newberry Electric Company, of St. Louis.

GLASGOW, MONT.—The Moore Telephone Company of this city has been incorporated with L. W. Gibson, president; R. G. Moore, vice-president, and C. O. Moore, secretary and treasurer.

STATESVILLE, N. C.—The Iredell Telephone Company, independent, has bought a site on which it is proposed to erect a telephone building fifty by forty feet, sufficient to meet all local demands for telephone service. L.

INDIANAPOLIS, IND.—Governor Marshall has ordered telephone companies to deny service to gambling houses or where pools are sold. If his orders are not complied with local authorities will be instructed to cut the wires. S.

PORTLAND, IND.—The Bell Telephone Company has sold its exchange and telephone property to the Portland Independent Telephone Company and will abandon the field. The taking over includes the Bell toll line business also. S.

ROCK HILL, S. C.—A deal has been completed for the overhauling and improvement of the local telephone system, R. M. Lewis, of Atlanta, being in charge of the work. The system will be put in modern shape, with new switchboards and the common battery system. L.

COLUMBUS, IND.—According to report the Bell Telephone Company, the Citizens' Telephone Company, the Hope Telephone Company and the Hartsville Telephone Company have been consolidated and will hereafter be operated under one management as an independent system. S.

MINNEAPOLIS, MINN.—C. E. Yost, of Omaha, president of the five recently combined western Bell Telephone companies, including Minneapolis, St. Paul and Duluth, has been perfecting the details of the consolidation. He says the company will spend $1,000,000 this year on extensions and betterments.

INDIANAPOLIS, IND.—The Indianapolis Telephone Company has entered upon the work of making improvements and extensions to its plant to cost half a million dollars. Considerable underground cable will be laid and the switchboards in at least three of the branch exchanges will be enlarged. S.

OMAHA, NEB.—The railway commission has authorized the Nebraska Telephone Company to reduce rates between South Omaha and Bellevue from fifteen cents to ten cents; Lincoln to Germantown, twenty cents to fifteen cents, and to publish a new rate between Albright and Gilmore and Sarpy of ten cents. C.

HOPE, IND.—The Hope Telephone Company's property and business has been sold to the Asby Brothers. The sale includes also the Hartsville plant. The new owners announce that they will go into the market soon and purchase material and equipment to improve and extend the plants into one large system. S.

MANSFIELD, ARK.—The Mansfield City Council, at its recent meeting, granted a franchise to the Boothe Telephone Company to enter and do business in Mansfield. It is the intention of the company to put in an up-to-date system. The company

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is composed of citizens of Scott County who live at Boothe and vicinity.

PHŒNIX, ARIZ.—L. H. Chalmers, local attorney for the Consolidated Telephone and Telegraph Company, has received word from the president of the company, Colonel E. Randolph, that the company intends to improve its system and at an early date extend its line to Yuma and also to Kelvin and adjacent mining camps.

WICKLIFFE, IND.—The Patoka Telephone Company has filed articles of incorporation with the Secretary of State. The company proposes to build and equip a telephone system in Crawford and adjoining counties, with principal exchange in Wickliffe. Jacob Heeklenew, John Zimmerman and Ross Hamilton are the directors.

RICHMOND, VA.—The ordinance committee of the City Council has instructed the city attorney to prepare an ordinance to require the Southern Bell Telephone Company to improve its local system or surrender its charter. This action resulted from a discussion in the Council, several members alleging that the service was inadequate. L.

YONKERS, N. Y.—The New York Telephone Company, which operates in Yonkers, has taken over the Westchester division of the Hudson River Telephone Company, which has been covering the towns from Peekskill to Croton and from Briarcliff to Brewster. Several towns on the west side of the river, including Haverstraw, Nyack, Tappan and Spring Valley, also supplied with telephones by the Hudson River Company, are absorbed in this deal. In the district involved in the transfer there are about 5,000 instruments.

RALEIGH, N. C.—An important step has been taken by the Southern Bell Telephone Company here looking to the increase of rates in the cities of Asheville and Wilmington, N. C. The application has been filed with the state corporation commission, and that from Asheville is instituted by the Asheville Telephone Company, controlled by the Bell Company. It is asked that the company in the two towns named be permitted to increase rates to a basis equivalent to that in use at Charlotte and some other towns in the state. L.

ANACONDA, MONT.—At the annual meeting of the Independent Telephone Company the report showed that 4,088 telephones were in operation, as compared with 2,521 for the previous year. Long-distance connections have been established with Helena and Anaconda and between Butte and Billings. During the coming year the following additions will be made to the plant: Exchanges at Missoula, Stevensville, Hamilton and other points in the Bitter Root Valley; long-distance connections, Deer Lodge to Missoula, Missoula to Wallace and Missoula to Hamilton. C.

BLOOMFIELD, N. J.—The poles, conduits and franchises of the Bloomfield and Montclair Telephone Company have been sold at auction to James B. Curtis for $51,825. Mr. Curtis is a lawyer, living in Montclair, and is said to represent the bondholders of the company. The Fidelity Trust Company held a mortgage for $27,225 on the tangible assets of the Bloomfield concern, which was formed as an independent enterprise to serve Bloomfield, Montclair and East Orange. It is claimed by the mortgagee that the interest on the mortgage has not been paid since May 22, last.

NEW PUBLICATIONS.

STONE & WEBSTER, publishers, of Boston, Mass., announce that their "Current Literature References" on public utilities, etc. (construction, operation, finance), for 1908, are about ready for distribution. The edition is 500 copies, and it is desired that the gratuitous distribution of this pamphlet shall be to such libraries or persons as will be likely to find the references of decided use. The issue for 1908 is classified substantially the same as the preceding. References on conservation and water-power development are more abundant than in the previous issue, but the publishers wish it to be understood that all selections are made with a view to the interest of their business, and not with a view to being a complete engineering index.

ELECTRICAL SECURITIES.

Speaking generally, the stock market during the past week has been lifeless. This is on account of the holidays and also because of the absence of big dealers. From time to time many announcements of electrical securities offered the public appear in the daily press, and in all cases such issues are well received. The feature of the week in electrical finance has been the opportunity presented by the Commonwealth Edison Company of Chicago to its employes to obtain stock in the company on favorable terms at par over a period of five years. More extended mention of this is made in another part of this issue.

Boston & Northern Street Railway Company have declared the semi-annual dividend of three dollars per share on the preferred stock, payable August 1 to stock of record July 17. Brooklyn City Railroad declared the regular quarterly dividend of two-and-one-half per cent, payable July 15; books closed from July 1 to July 16. Consolidated Power Company of South Dakota has declared a regular dividend of one per cent on the preferred stock, payable July 1. Old Colony Street Railway has declared a semi-annual dividend of three dollars per share on the preferred stock, payable August 1, to stock of record July 17. Philadelphia City Passenger Railway Company has declared a semi-annual dividend of three dollars and seventy-five cents per share, payable July 10, to stock of record June 28; books closed June 28, and reopened July 12. Quincy (Ill.) Gas, Electric and Heating Company has declared a dividend of one per cent, payable July 20 to stockholders of record July 1; this is the second dividend, an initial dividend of one per cent having been paid in January last. Twin City Rapid Transit Company has declared a quarterly dividend of one-and-one-fourth per cent on the common stock, payable August 16 to stock of record July 21, 1909.

NEW YORK.

	July 5.	June 28.
Allis-Chalmers common	15⅛	14¼
Allis-Chalmers preferred	51¾	51¼
Amalgamated Copper	82⅝	81⅜
American Tel. & Cable	80*	80*
American Tel. & Tel.	140¾	141⅝
Brooklyn Rapid Transit	79½	79½
General Electric	164	161
Interborough-Metropolitan common	16½	17¼
Interborough-Metropolitan preferred	49⅜	51⅜
Kings County Electric	130	130
Mackay Companies (Postal Telegraph and Cables) common	79½	80
Mackay Companies (Postal Telegraph and Cables) preferred	73½	73⅞
Manhattan Elevated	143	142½
Metropolitan Street Railway	20	23
New York & New Jersey Telephone	124	133
U. S. Steel common	69⅛	66⅜
U. S. Steel preferred	125⅛	123⅜
Western Union	72	72
Westinghouse common	84	85
Westinghouse preferred	..	123*

*Last price quoted.

BOSTON.

	July 5.	June 28.
American Tel. & Tel.	140¾	141⅝
Edison Elec. Illuminating	250	248
General Electric	164	161
Massachusetts Electric common	13¼	12
Massachusetts Electric preferred	71	68½
New England Telephone	134½	132
Western Tel. & Tel. common	9¾	9¾
Western Tel. & Tel. preferred	87	86

PHILADELPHIA.

	July 5.	June 28.
American Railways	45¼	45¾
Electric Company of America	12½	12⅜
Electric Storage Battery common	52	52½
Electric Storage Battery preferred	52	52½
Philadelphia Electric	11¾	11⅞
Philadelphia Rapid Transit	28⅝	28¼
Philadelphia Traction	90¾	91
Union Traction	53	52

CHICAGO.

	July 5.	June 28.
Chicago Railways, Series 1	112¾	110
Chicago Railways, Series 2	40½	37½
Chicago Subway	22	24
Chicago Telephone	132	134
Commonwealth Edison	120	120
Metropolitan Elevated common	15½	17½
Metropolitan Elevated preferred	49	50
National Carbon common	91	92
National Carbon preferred	117½	117

PERSONAL MENTION.

CLARENCE H. MACKAY, president of the Mackay Companies, has returned from an European trip of two months.

PROF. H. A. WILSON, F. R. S., of King's College, London, has accepted the appointment of professor of physics in McGill University.

DR. W. H. TOLMAN, director of the Museum of Saefty and Sanitation, sailed on the Rotterdam last week to attend the International Medical Congress in Buda Pesth.

DR. CHARLES W. ELIOT, first president emeritus of Harvard University, had conferred on him by the university on June 30 the degrees of Doctor of Medicine and Doctor of Laws.

W. H. MAW, co-editor with B. A. Raworth of *Engineering*, of London, and a well-known engineer, has been made a Doctor of Laws by the University of Glasgow. Dr. Maw is a member of the Institution of Civil Engineers, and a past-president of the Institution of Mechanical Engineers.

JOSEPH H. WILLIAMSON, who for many years has been connected with the Manufacturers' Advertising Agency, of New York, and the Viennot Advertising Agency, of Philadelphia, Pa., as business manager, has opened an office at 719 Temple Court, New York city, as a representative of trade journals. He is well

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known by publishers of trade papers for his honesty and integrity and has made a host of friends all over the United States.

FRANK J. GOULD, of Tarrytown, N. Y., has been named as the president of the Virginia Railway and Power Company in its petition for incorporation.

MORGAN BROOKS, professor of electrical engineering at the University of Illinois, Urbana, Ill., has been granted leave of absence for a year and expects to sail for Europe in October. He will spend three months in Europe and continue on a tour of the world. Mrs. Brooks will accompany Professor Brooks.

N. M. ARGABRITE, who for the past five years has filled the positions of superintendent and later general manager of the Winona Railway and Light Company, of Winona, Minn., has resigned. Mr. Argabrite's resignation is for the purpose of accepting the general managership of the Public Service Operating Company, of Belvidere, Ill., which position he enters into on August 1.

W. J. LLOYD, after thirty-eight years of almost continuous service, has assumed the office of first district superintendent of the Western Union Telegraph Company at Chicago, left vacant by F. H. Tubbs, retired. Mr. Lloyd, when he was twelve years of age, started as messenger boy in the office of the Western Union at Dubuque, Iowa. Here he learned the Morse code and shortly after took a position as operator with the Illinois Central Line. Later he rejoined the forces of the Western Union at Milwaukee, from which place he was sent to take charge of the joint offices of the Western Union and old Northwestern Telegraph companies at McGregor, Iowa. In 1877 Mr. Lloyd came to Chicago as chief operator of the telegraph rooms in the central offices and has been here since as manager, wire and division chief and assistant superintendent. F. H. Tubbs, the retiring superintendent, is one of the most widely known telegraph men in this country.

PROPOSALS.

POST OFFICE, BELVIDERE, ILL.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., August 9, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Belvidere, Ill., in accordance with drawings and specification, copies of which may be obtained from the custodian of site at Belvidere, Ill., or at the Supervising Architect's office.

POST OFFICE, SHENANDOAH, IOWA—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., July 21, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Shenandoah, Iowa, in accordance with the drawings and specifications, copies of which may be had from the custodian at Shenandoah, Iowa, or at the Supervising Architect's office.

POST OFFICE, PLATTEVILLE, WIS.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., July 26, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Platteville, Wis., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Platteville, Wis., or at the Supervising Architect's office.

POST OFFICE AND COURT HOUSE, BOWLING GREEN, KY.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., August 4, for the construction (including plumbing, gas piping, electric wiring and conduits, and standard clock system) of the United States Post Office and Court House at Bowling Green, Ky., in accordance with the drawings and specification, copies of which may be had from the custodian of site at Bowling Green, Ky., or at the Supervising Architect's office.

POST OFFICE AND CUSTOM HOUSE, EAGLE PASS, TEX.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., August 2, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office and Custom House at Eagle Pass., Tex., in accordance with drawings and specifications, copies of which may be had at the office of the custodian of the site at Eagle Pass, Tex., or at the Supervising Architect's office.

POST OFFICE AND COURT HOUSE, OWENSBORO, KY.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., July 27, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and a standard clock system) of the United States Post Office and Court House at Owensboro, Ky., in accordance with the drawings and specifications, copies of which may be had from the custodian of site at Owensboro, Ky., or at the Supervising Architect's office.

INDUSTRIAL ITEMS.

THE HOLTZER-CABOT ELECTRIC COMPANY, Brookline, Mass., has issued a copy of the "Continental Wireless Code," printed on thick card, suitable for hanging.

THE GENERAL ELECTRIC COMPANY has recently distributed Booklet No. 3779, containing a list of this company's snap switches. It will be of decided interest to the trade.

THE STANDARD UNDERGROUND CABLE COMPANY, Pittsburg, Pa., announces that it has changed its San Francisco office address from the Shreve Building to the First National Bank Building.

THE KUHLMAN ELECTRIC COMPANY, Elkhart, Ind., announces that it has opened up offices at 30 Greenwich Avenue, New York city, where all orders for the well-known Kuhlman transformers will be given immediate attention.

THE GOLDSCHMIDT THERMIT COMPANY, New York city, has issued the second quarterly number for 1909 of its interesting publication, *Reactions*, which contains instructive illustrated articles relating to the well-known thermit welding process and its successful applications.

FRED J. POSTEL and HOMER R. LINN, for many years associated as Postel & Linn, consulting engineers, Fisher Building, Chicago, announce that by mutual consent their partnership was dissolved on June 15, and that each member of the firm will continue in business individually as a consulting engineer.

THE HOLOPHANE COMPANY, New York city, has issued the June number of its publication, "Holophane Illumination," calling attention to the new bulletin, number 51, which promises much illuminating engineering data. It also contains an interesting article on the installation of Holophane glass in a steel mill.

THE NATIONAL ELECTRIC LAMP ASSOCIATION, through its Engineering Department, distributed to those attending the recent Atlantic City convention of the National Electric Light Association, a very conveniently arranged booklet of thirty pages, giving valuable data upon carbon, Gem, tantalum and tungsten incandescent lamps.

ROTH BROS. AND COMPANY, Chicago, Ill., have secured the contract for eleven new motors for use in the new plant of the Sanitary Laundry Company of Chicago. Some of the motors are for direct-connection to mangles and other machines and some are for belt driving through shafting. Postel & Linn, of Chicago, were the engineers for the Sanitary Laundry Company.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., is sending out an imposing message to the trade in the form of a large folder devoted to the excellencies of the firm's improved compact type magneto wall telephone. The folder is nicely illustrated and gives necessary details in particular in regard to the "knock-down" features of this telephone.

THE LORD ELECTRIC COMPANY, of 213 West Fortieth Street, New York city, announces that it has just secured a contract for nearly $500,000 worth of its well-known products from an important electric-railway system. Among the items includel in the contract are third-rail feeders and structural work, laminated soldered rail bonds and various other materials used in the construction work.

THE ELECTRO-MECHANICAL ENGINEERING BUREAU has opened offices in the Monadnock Block, Chicago, where, with a well-trained staff of engineers, it is prepared to undertake experimental work and designing along various technical lines. Special laboratory facilities are available for conducting accurate and expeditious electrical, mechanical and chemical tests, as well as for extended research work.

THE GENERAL ELECTRIC COMPANY is about to put out a bulletin devoted to Tungsten Economy Diffusers, which is the latest publication issued on this subject. The new bulletin, No. 4660, goes more into detail and contains illustrations of this diffuser in connection with fixtures of various designs. This publication will certainly be of interest to those contemplating the use of tungsten lamps.

THE NOVELTY INCANDESCENT LAMP COMPANY, Emporium, Pa., is meeting with a great deal of success in introducing its "Any Angle" tungsten lamp. This lamp is equipped with a spiral filament supported by a central anchor. This lamp is manufactured in all standard sizes, including four-candlepower, five-watt, 10, 20, 25 and 27½ sign-lamp sizes. The forty-watt bulb lamp is made in the same size bulb as the sixteen-candlepower carbon lamp.

THE A. A. AUTOMATIC MANUFACTURING COMPANY, New York city, has issued an attractive booklet, entitled "The Servant Problem Solved," describing three styles of automatic kitchen, which can be supplied for either direct or alternating current. Style No. 1 includes the driving apparatus, porcelain-enameled stand, portable electric cord and plug. No. 2 includes

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driving apparatus, porcelain-enameled table top, stand, portable electric cord and plug. No. 3, similar to No. 2. The utensils include coffee grinder, butter churner, dough mixer, egg and cream beater, fruit press, potato peeler, ice-cream freezer, meat and food chopper.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., brings out monthly what it is pleased to call a "Magazinette" named Trumbull Cheer, its object being to give the trade a hunch for Trumbull material and a boost for everyone. Combined generator and feeder panels are the specialties. This little house organ is full of practical information and good sound business suggestions. The front-page cover will strike the attention at the outset.

THE COMMONWEALTH EDISON COMPANY, of Chicago, is disposing of several thousand G. I. arc lamps through its exclusive selling agents for second-hand equipment, the Power Equipment Company, Fisher Building, Chicago. There are many different types of these G. I. lamps on this list, some of them brand-new, others having been used only for a short time. This is an excellent opportunity for central stations to purchase lamps to fill in their stock at about one-third of the new price.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., has been distributing its price list and discount sheet for May, applying to the 1909 catalogue No. 26. Very complete and substantially bound it is greatly in request by the trade. Attention is directed in well-worded and adequately illustrated announcements to the "Opalux" reflectors, "Opalux" tungsten fixtures, "tungstolite" cluster fixtures, the tungstometer, high-tension drop-out span-crossing protectors and other equally well-known specialties of the company.

THE MOORE ELECTRICAL COMPANY has just finished an installation in the United States Government Bureau of Standards, Washington, D. C., consisting of two tubes of the Moore Light—one white and the other yellow. Various tests will be made, the most important of which, however, is to prove the claim that the average color values of the Moore white tubes are as nearly the equivalent of average daylight as will ever be obtained and that it, therefore, should be adopted as the standard light for color values.

THE STUDEBAKER AUTOMOBILE COMPANY, of South Bend, Ind., is erecting at the corner of Michigan Avenue and Twenty-first Street, Chicago, what will be one of the most elaborate and finely equipped automobile salesrooms and garages in this country. The building will be of solid concrete, seven stories high, with a frontage on Michigan Avenue of seventy-five feet and 175 feet on Twenty-first Street. It is expected that the building will be ready for occupancy about January 1, 1910. The Studebaker-Garford plant at Elyria is turning out 1,500 high-grade cars a year, the plant in Detroit is delivering 1,000 medium-priced cars every month, and the South Bend factory is turning out over 1,000 electric pleasure and commercial cars yearly.

THE ROBBINS AND MYERS COMPANY, Springfield, Ohio, has published two handsome pieces of fan literature. Booklet No. 72 is entitled "Constant Coolness with Robbins & Myers Standard Fans." Booklet No. 74 is entitled "Summer Comfort with Robbins & Myers Standard Fans." In each there are fine halftone illustrations of this company's line of bracket, desk, wall, oscillating, ceiling and electrolier fans for both alternating and direct current.

MACGOVERN, ARCHER AND COMPANY, 114-118 Liberty Street, New York, are sending out a little booklet to the trade giving a list of electrical and steam machinery, cars and equipment, second-hand, but in first-class condition in every respect and ready for immediate shipment. Dated July and superseding all other lists issued, the book is replete with bargains, from large interurban or single-truck closed cars to air compressors, including motors and dynamos of all kinds.

THE LACLEDE-CHRISTY CLAY PRODUCTS COMPANY, St. Louis, Mo., has issued a comprehensive circular dealing with the "Laclede-Christy" chain grate, with roller and dumping attachment. Clear and well-chosen cuts illustrate the workings of this self-feeding, self-cleaning, labor-saving grate, the particular advantages of which are succinctly set forth. It may be remarked that some of the best-known concerns in the county use these grates, and engineers and others interested should see that they have the circular by them.

THE NATIONAL ELECTRIC LAMP ASSOCIATION, Cleveland, Ohio, through its Engineering Department, has published a data booklet upon carbon, Gem, tantalum and tungsten incandescent lamps. This is to be distributed to all central stations, jobbers, dealers and consumers in behalf of the members of the National Electric Lamp Association. The booklet gives a list of the companies supporting the Association, a brief history of the organization, and a statement of the lines of effort of the various departments. Very complete data are given on the various types of lamps above enumerated, together with illustrations showing the various styles and sizes of lamp bulbs used with the different kinds of filaments.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the second issue of each month.)

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary, Lloyd Lyon, secretary and auditor Mobile Light and Railway Company, 158 Government Street, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis Avenue, New York city.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York city.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th Street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, Flatiron Building, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, secretary and treasurer Tri-City Railway Company, Davenport, Iowa.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

AMERICAN STREET AND INTERURBAN RAILWAY TRANSPORTATION AND TRAFFIC ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, superintendent of lighting Hot Springs Light and Railway Company, Hot Springs, Ark.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

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ASSOCIATION OF CAR-LIGHTING ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Chicago, Ill.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, D. L. Huntington, second vice-president and manager Washington Water Power Company, Spokane, Wash.

ASSOCIATION OF EDISON PURCHASING AGENTS. Secretary, J. W. Brennan, Edison Illuminating Company, Detroit, Mich.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, Frick Building Annex, Pittsburg, Pa.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Minnesota, St. Paul & Sault Ste. Marie Railroad, Chicago, Ill.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Pioda, Oak and Broderick streets, San Francisco.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 33 Melinda Street, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Traction Terminal Building, Indianapolis.

CENTRAL ELECTRIC TRAFFIC ASSOCIATION. Secretary, J. T. Brittson, assistant claim agent Chicago, South Bend & Northern Indiana Railway Company, South Bend, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Colo.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Conn.

ELECTRIC CLUB OF CHICAGO. Secretary, Wm. S. Taussig, 204 Dearborn Street, Chicago, Ill.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CLUB OF CALIFORNIA. Secretary, Russell D. Holabird, Argonaut Hotel, San Francisco, Cal.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, George William Russell, Jr., 500 Fifth Avenue, New York city.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine Street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, San Francisco, Cal.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary Franz Neilson, 80 Wall Street, New York city.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau Street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt Street, New York city.

ENGINEERS' CLUB OF PHILADELPHIA. Secretary, H. G. Perring, 1317 Spruce Street, Philadelphia, Pa.

ENGINEERS' SOCIETY OF MILWAUKEE. Secretary, W. Fay Martin, Milwaukee, Wis.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, G. F. Doig, Gainesville, Fla.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Ottawa, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Preston S. Millar, Engineering Societies Building, 33 West Thirty-ninth Street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Frederic Leslie, Muncie, Ind. Next meeting, August 18 and 19, French Lick Springs, Ind.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Allen J. Paylow, Rockport, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Annual convention, Atlantic City, N. J., September 14-16.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis, Parkersburg, W. Va.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, Des Moines, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich. Annual convention, Detroit, Mich., August 17, 18 and 19.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, B. W. Copperthwait, Faribault, Minn.

MISSISSIPPI ELECTRICAL ASSOCIATION. Secretary, J. Abbott, manager Jackson Electric Railway, Light and Power Company, Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATERWORKS ASSOCIATION. Secretary, Claude L. Clary, Sikeston Electric Light and Power Company, Sikeston, Mo.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George W. Schwerer, Windsor, Mo.

MUNICIPAL LIGHTING ASSOCIATION OF MASSACHUSETTS. Secretary, J. C. Norcross, Reading, Mass.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Annual convention, Toledo, Ohio, July 21-23.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago, Ill.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, Frank M. Tait, Dayton, Ohio.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 60 State Street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass. Meetings held on fourth Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

NEW YORK RAILROAD CLUB. Secretary, H. D. Vote, 95 Liberty Street, New York, N. Y.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

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NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary-treasurer, John E. Allen, manager Equitable Electric Light Company, Lake Geneva, Wis.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Toledo, Ohio, July 13-15.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD-TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, Frank J. Scherrer, 195 Broadway, New York city. Annual reunion, Pittsburg, Pa., August 17-19.

ORDER OF THE REJUVENATED SONS OF JOVE. Mercury, C. B. Roulet, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Dr. Henry M. Stein, Harrisburg, Pa. Annual convention, Eagles Mere, Pa., September 8, 9 and 10.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa. Next annual meeting, Louisville, Ky., October 12-14, 1909.

SOCIETY OF AUTOMOBILE ENGINEERS. Secretary, Alexander Churchward, 30 Church Street, New York city. Annual meeting, Chicago, August 5-7.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York city.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. A. Gould, Ennis, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Chairman, William B. Jackson, 115 Adams Street, Chicago, Ill.; secretary, J. H. Warder, Monadnock Block, Chicago, Ill.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 382 Ohio Street, Chicago, Ill.

WISCONSIN ELECTRIC AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Clement C. Smith, president Columbia Construction Company, Milwaukee, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

DATES AHEAD.

Ohio Electric Light Association. Annual convention, Toledo, July 13-15.

National Electrical Contractors' Association. Annual convention, Toledo, Ohio, July 21-23.

Maine Electric Association. Annual convention, Portland, Me., July 29-30.

Society of Automobile Engineers. Annual convention, Chicago, August 5-7.

Michigan Electric Association. Annual convention, Detroit, Mich., August 17-19.

International Association of Municipal Electricians. Convention, Atlantic City, N. J., September 14-16.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) June 29, 1909.

926,088. ELECTRIC-CURRENT COLLECTOR. Andrew H. Angle and Leaddison R. Hecker, Philadelphia, Pa., assignors to Safety Electric Railway Construction Company. Filed July 13, 1907. A laterally movable truck has a bridge piece (carried by a vertical shaft) having sliding engagement with it, a current-collecting medium rotatably connected with the bridge piece, and a hand wheel rotatably mounted on the shaft for raising and lowering the collecting medium.

926,102. PRINTING-PRESS. George R. Cornwall, Rye, N. Y., assignor to American Planograph Company, New York, N. Y. Filed May 27, 1903. Renewed October 23, 1905. A rotary printing press has a flexible metal printing plate mounted on the cylinder, means for holding the plate on the cylinder while electrically insulating it therefrom, and a source of electrical energy in circuit with the plate.

926,114. ADJUSTABLE LAMP-HOLDER. Louis E. Hall, Chicago, Ill. Filed September 12, 1907. Describes an incandescent lamp-holder with a swiveling attachment and adjustable on a vertical standard.

926,128. ELECTROLYTE-CONDENSER. Ignacy Moscicki, Gambach, near Fribourg, Switzerland. Filed October 29, 1907. Has aluminum electrodes immersed in an electrolyte, an alternating-current working circuit in which the electrodes are included, and means for causing a flow of unidirectional current through the electrodes as anodes.

926,154. PANEL-BOARD. Hervey S. Walker and Hermon L. Van Valkenburg, Philadelphia, Pa., assignors to Walker Electric Company, Philadelphia, Pa. Filed July 17, 1908. Describes the details of a panel-board mounting.

926,162. TRANSMITTING DEVICE FOR TELEGRAPH OPERATORS. William C. Achgill, Oklahoma, Okla., assignor of one-half to Edward C. Fritz, Oklahoma, Okla. Filed November 30, 1908. A vibrating dot-making bar has a vibrating-spring circuit-connection with one of a pair of binding-posts to conduct electric current from this binding-post to the bar and to vibrate the same.

926,164. CIRCUIT-CONTROLLER. William L. Bliss, New York, N. Y. Filed August 4, 1904. An electrolytic valve is adapted to permit current to flow in an electric circuit in one direction and to prevent it from flowing in the circuit in the opposite direction, and an automatic switch has an operating magnet connected with the circuit and adapted to remove the valve from operative relation with the circuit while the current in the circuit flows in the former direction.

926,165. LIGHTING SYSTEM. William L. Bliss, New York, N. Y. Filed June 22, 1904. Renewed November 25, 1908. A storage battery and translating devices are arranged in circuit with a generator which is driven at a variable speed, and means are adapted to regulate the generator to confine its output within prearranged limits without interfering with

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the ability of the generator to vary the output in accordance with changes in the loads.

926,175. SWITCHING APPARATUS. Merritt S. Conner, Rochester, N. Y., assignor to Stromberg-Carlson Telephone Manufacturing Company. Filed May 19, 1904. Means are provided whereby upon depression of one of a number of actuating buttons for moving a latch frame, to lock this button in its depressed position; also means for subsequently allowing actuation of the aforesaid button to actuate its switching mechanism with movement of the latch frame, and means for releasing an actuated button from its depressed position.

926,185. ELECTRIC WATER-HEATER. William E. Hayes, Omaha, Neb. Filed March 2, 1909. Describes the details of an electric heater interposed between a supply-pipe and a faucet.

926,188. HEATING DEVICE. Julian R. Holley, Bristol, and Everett D. Holley, Forestville, Conn. Filed September 8, 1908. The heating unit comprises a resistance ribbon wound flatwise into a series of successive convolutions which are separated from each other by uniform air spaces.

926,192. DYNAMO-ELECTRIC MACHINE. Louis J. Hunt, Rhyl, England. Filed June 22, 1906. Windings on either the stator or the rotor are adapted to permit the flow of currents producing magnetic fields of two different numbers of poles, and windings on the other have a number of parallel paths adapted to allow the flow of currents producing magnetic fields of different numbers of poles.

926,199. TOLL APPARATUS FOR TELEPHONE EXCHANGES. Sherwood J. Larned, Chicago, Ill., assignor to Western Electric Company. Filed July 7, 1902. Renewed April 3, 1905. Has a polarized actuating magnet, alternative mechanism actuated thereby, and a reversing switch at the substation controlling the connection of the magnet with the line, a signal at the central office, and means for displaying the same controlled in the movement of the switch, to indicate the condition thereof, a source of current at the central office, and a switch for applying current to the line to excite the magnet toll device.

926,202. IGNITER FOR GASOLINE-ENGINES. Daniel F. MacCarthy, White Bear, and Harry M. Darling, St. Paul, Minn., assignors to Darmac Commutator Company, St. Paul, Minn. Filed February 16, 1906. An electric igniter comprises a rotary part, a non-conducting disk carried thereby, a contact carried by the disk and extending through the side face of it, a non-conducting rocker arm pivotally supported upon the rotary part in contact with the side face of the disk, contacts extending slidably through the rocker arm and projecting from the face of it into the path of the contact carried by the disk, and contact springs bearing against the outer ends of the slidable contacts.

926,225. DYNAMO-ELECTRIC MACHINE. Joseph A. Williams, Cleveland, Ohio. Filed September 13, 1906. Describes the details of a magneto-electric machine.

926,236. ELECTRIC FURNACE. Jean Bouneau, Paris, France. Filed July 17, 1907. The electrodes are mounted on carriages movable on rails.

926,243. SYSTEM OF ELECTRIC-CIRCUIT CONTROL. Francis W. Clary, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed September 9, 1907. In combination with a polyphase alternating-current supply circuit are a receiving circuit and a number of transformers interposed between the circuits, and a pair of double-throw switches for varying the voltage applied to the receiving circuit.

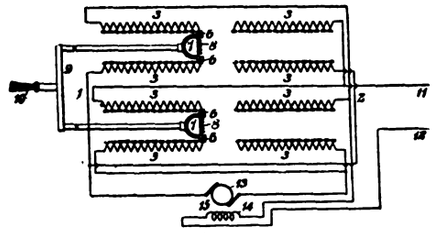
926,246. ELECTRIC OUTLET-BOX. Conrad J. Dorff, Chicago, Ill., assignor to Fredric Greer, Chicago, Ill. Filed April 6, 1908. An electric outlet box in two sections has means for securing the sections together comprising screws in opposite side walls of one section and slotted lugs rigidly fixed on the other section and extending in planes parallel with the side walls and adapted to be slipped beneath the heads of the screws.

926,247. MAGNETIC T-SQUARE. James C. Draper and Joseph W. Reid, Memphis, Tenn. Filed February 13, 1908. A drawing board has an iron strip applied to its edge and a T-square carries an electromagnet adapted to co-operate with the iron strip to hold the T-square in position.

926,248. DYNAMO-ELECTRIC MACHINE. Russell S. Feicht, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed October 5, 1907. The core member has a number of slots with coils partially located in them, and magnetizable strips are insulated from the coils and from the core and disposed near the openings in the slots, and insulating wrappings are disposed around the strips and the corresponding coils.

926,251. HYDROSTATIC INDICATOR. George Harding, Coeur d'Alene, Idaho. Filed April 6, 1908. Means are provided for varying an electric current in accordance with the variation of fluid level, and an indicator responsive to the current variations is also included in the circuit; means under the control of the first-mentioned means are provided for closing another electric circuit at a predetermined change of fluid level, and an alarm circuit under the control of the second circuit is responsive only on the closure of the second circuit.

926,254. RHEOSTAT. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed July 17, 1905. Comprises two groups of resistance elements disposed in rectilinear alinement with each other and having their outer ends reversely connected to a translating device, and reciprocatory contact devices for connecting either group of resistance elements in circuit and for varying the number of active elements.



926,254.—RHEOSTAT.

926,258. TROLLEY-WIRE HANGER. Willard H. Kempton, Hartford, Conn., assignor to The Johns-Pratt Company, Hartford, Conn. Filed December 12, 1908. Comprises clamping plates, a supported toggle block located between the plates, toggle links carried by the block and adapted to draw the plates together, and a nut arranged to force the plates and the toggle in opposite directions, whereby the toggle will draw the plates together.

926,262. FIELD-MAGNET WINDING FOR DYNAMO-ELECTRIC MACHINES. Fred R. Kunkel, Edgewood Park, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed September 8, 1908. The field-magnet structure comprises a polar projection having a small body portion and an enlarged end portion the winding for which consists of a coil formed of a number of loops one or more of which are of less internal peripheral lengths than the enlarged portion of the polar projection and at least one of which is of greater internal peripheral length than the enlarged portion of the polar projection.

926,278. METHOD OF MAKING BATTERY-PLATES. George J. Miller, Toledo, Ohio. Filed August 27, 1906. Consists in scoring the plate at short distances apart to deflect the ridges of the transverse ribs.

926,284. ELECTRICAL APPARATUS FOR PRODUCING SOUND-SIGNALS. Charles H. O'Brien, Augusta, Me. Filed December 11, 1905. Comprises a sound-producing body, a diaphragm, a vibrating armature (provided with contacts) connected centrally of the diaphragm, an electromagnet for vibrating the armature, an electrical source of energy, and means for adjusting the electromagnet with relation to the armature.

926,312. METER-RELAY. Henry S. Baker, Wilkinsburg, Pa. Filed April 4, 1906. Has a pair of stationary contact members and a movable contact member provided with three magnetizable blocks and having its open circuit position between the stationary contact members; also, a stationary magnet so located as to co-operate with the magnetizable block and thereby accentuate the positions which the mov able member is adapted to occupy.

926,330. ELECTRIC IGNITION DEVICE. Theodore Hubert, New York, N. Y., assignor to Charles F. Splitdorf, New York, N. Y. Filed April 4, 1906. In combination with a magneto are an arm mounted to rock transversely with the armature axis, means to cause the arm to move in direction with the axis, a sliding part connected with the arm, and means to convert the sliding movement of this part into rotary adjustment of the magneto armature.

926,368. MAGNETO-ELECTRIC MACHINE. Ernst Troike, Sandusky, Ohio, assignor of one-fourth to Paul Troike, Sandusky, Ohio. Filed November 30, 1908. Describes the details of a magneto-electric machine.

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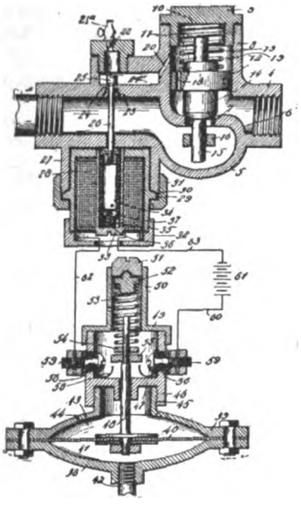
926,369. MAGNETIC MOTOR. William H. Von Tish, Montclair, N. J. Filed September 16, 1907. Means are provided for de-energizing the magnets as the poles of the armature aline with the poles of the magnet.

926,372. PANEL-BOARD. Joseph J. Wesley, Hackensack, N. J., assignor to Metropolitan Switchboard Company. Filed April 7, 1909. A door adapted to close over the panel box has a concentrically located smaller hinged interior door which can be freely opened to uncover a restricted area of the panel board. Switches controlling the branch circuits of the panel board are located in this restricted area, and a pan overlying the switches is adapted to cover all the switches and the busbars of the panel-board when the inner door is opened.

926,386. ELECTRIC PRODUCTION-CONTROLLING DEVICE FOR FACTORIES. William H. Chappell, Chicago, Ill. Filed October 31, 1908. A signal board comprises a number of signaling devices arranged in rows and columns, the several rows being serially indicated and the several columns being distinctively indicated to correspond with the departments of the factory, and switchboards with electric switches thereon are provided for the several departments, so indicated, the several switches on each switchboard being electrically connected for controlling the several signal lamps in the column corresponding to the departments.



926,389.—ELECTRICALLY-OPERATED VALVE.

926,389. ELECTRICALLY-OPERATED VALVE. George W. Collin, Bridgeport, Conn. Filed February 23, 1907. Electrically operated means are provided for seating a supplemental valve to stop the flow to seat the main valve.

926,393. ELECTRICALLY-OPERATED PRICE-CARD. Percy L. Dirking, Spokane, Wash., assignor of one-sixth to Julian D. Miner and one-sixth to Joseph A. Pelkey, Spokane, Wash. Filed February 14, 1908. A magnetically operated mechanism actuates a reciprocating platform upon which is mounted a display member provided with legends to be brought successively into view; a contact mechanism is controllable by the movement of the platform, and electric lamps are connected with the contact mechanism and adapted to be lighted and extinguished thereby.

926,413. PROCESS FOR OXIDIZING ATMOSPHERIC NITROGEN BY ELECTRICITY. Demetrio Helbig, Rome, Italy. Filed January 7, 1908. Compressed air is projected by means of two opposite nozzles arranged in line against an arc produced by a three-phase current between three suitable electrodes arranged at an angle of 120 degrees relatively to each other, whereby a flame disk is produced which spreads out in a plane at a right angle to the axis of the nozzle.

926,426. COMBINED TABLE AND LAMP-STAND. Millard F. Koch and Monroe Koch, New York, N. Y. Filed February 24, 1909. The stand has a table adjustable thereon to different elevations and is composed of telescoping sections, and an incandescent lamp carried by the upper section is arranged to throw the light on the table.

926,433. ELECTRIC-FUSE BOX. Thomas E. Murray, New York, N. Y. Filed January 21, 1908. Parallel partitions, with pairs of metallic clips respectively on opposite sides, extend upwardly from the bottom of the box. Circuit terminals are connected to the clips and an upwardly swinging arm is pivoted between the partitions and connected to fuse cases having metallic terminals, and an upwardly swinging cover is pivoted to one end of the box and free from the arm.

926,437. AUTOMATIC BLOCK-SIGNAL FOR TROLLEY SYSTEMS. Pio N. Pecci, Paterson, N. J., assignor of one-half to Leon Lemieux, Paterson, N. J. Filed June 4, 1908. An electric motor moves first in one direction and then in the other to effect the "danger" and "safety" conditions of the apparatus.

926,445. ELECTROLIER HOLDER OR HANGER. John C. Vogel, Philadelphia, Pa., assignor to The Fairmount Electric and Manufacturing Company. Filed January 9, 1908. A chandelier or electrolier has a body the inner wall of which is roughened, a coupling member having a portion roughened to engage the roughened wall of the body, and cam members adapted to be adjusted to hold the coupling member rigidly in proper position.

926,451. CONNECTION TERMINAL FOR ELECTRIC CONDUCTORS. Herbert G. Addie, Cresco, Iowa, assignor to Arvid L. Peterson, Cresco, Iowa. Filed April 26, 1906. Has a metallic casing forming an inclosure for electrical conductors, and a one-piece terminal member having a hollow portion extending through the wall of the casing and a portion exterior of the casing extending out therefrom and adapted for a terminal for an external conductor.

926,507. ELECTRICALLY-OPERATED POINT-SHIFTING MECHANISM. Alfred Oesterreicher, Vienna, Austria-Hungary. Filed April 21, 1908. Comprises means for operating the switch points from a motor, means operative from the motor for causing a switch arm to traverse the two contacts of a circuit-closing switch, means for closing the circuit through either of the contacts and the switch arm, and means for closing the circuit during the travel of the switch arm when the circuit-closing contact of the latter is broken.

926,510. PARTY-LINE TELEPHONE SYSTEM. Homer J. Roberts, Evanston, and Cyril A. Soans and Albert H. Graves, Chicago, Ill., assignors to Homer Roberts Telephone Company. Filed January 8, 1907. Comprises means for sending differentiated current over a line wire extending through a number of substations and a selectively responsive ringer at each substation, a lockout relay at each substation, contact mechanism actuated and controlled by the relay, talking circuit connections including the contact mechanism, and controlling connections between the ringer and relay of each substation, whereby the operation of the relay is controlled through the ringer.

926,518. LIGHTING SYSTEM. William I. Thompson, Newark, N. J., assignor to Safety Car Heating & Lighting Company. Filed April 15, 1903. A shunt-wound generator has included serially in its field circuit a number of contacting electrodes and positively acting electromagnetic means controlled by the current output of the generator for varying the pressure with which the electrodes contact.

926,536. THERMO-EXPANSION METER. Clifford D. Babcock, New York, N. Y., assignor to The United Wireless Telegraph Company. Filed May 21, 1908. A hot-wire current meter includes a number of expansion elements, a switch adapted in one position to close the circuit through one of the elements and in another position to close the circuit through another of the elements, a pointer, and a scale for each of the circuits with which the pointer coacts.

926,584. ELECTRICAL SWITCH AND THE LIKE. David K. Morris and George A. Lister, Coventry, England. Filed September 22, 1908. The switch has a movable arm with contacts mounted on it, a laterally deflectable conducting strip rigidly connected at its ends with the contacts, and a fixed retaining piece with which the strip can co-operate for holding the arm in the closed position.

926,605. ELECTRIC BRAKE. Frank B. Rae, Detroit, Mich., assignor to Rae Electric Company. Filed January 10, 1906. In combination with a reservoir, brake cylinder, and a valve controlling communication between the same, are means for normally holding the valve with the ports closed, electric circuits controlling the valve, and means for regulating the circuits to actuate the valve.

926,622. PENDENT ELECTRIC SWITCH. George B. Thomas, Bridgeport, Conn., assignor to Perkins Electric Switch Manufacturing Company. Filed March 23, 1906. A push-button pendent switch comprises an outer casing and an insulating cup-shaped body open at the top for the insertion of the switch mechanism, with binding-posts and spring clips at the top, switch mechanism inclosed in the body, and a sheet of insulation separating the binding-posts from the switch mechanism.

926,649. STORAGE BATTERY. John Stirlen and William Gardiner, St. Louis, Mo., assignors, by mesne assignments, to Missouri Electric Storage Battery Company. Filed February 11, 1909. The box-shaped receptacle has a removable cover for

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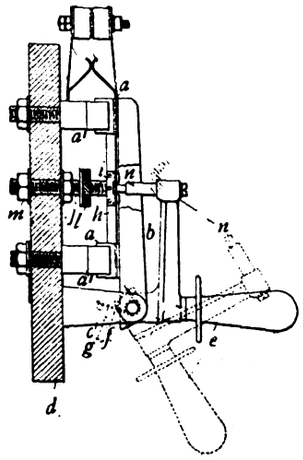
one side, a number of transverse ribs in the bottom, battery members in the receptacle resting on the ribs, and bars between the battery members adapted to support the same in proper position in the receptacle and prevent the members from bulging at their intermediate portions, one end of each of the bars being firmly mounted on the bottom of the receptacle.

926,654. ELECTRICAL IGNITION APPARATUS. Theodore Hubert, New York, N. Y., assignor to Charles F. Splitdorf, New York, N. Y. Filed January 25, 1908. Has a number of induction coils with a vibrator provided with windings having corresponding terminals connected together, the terminals being connected to opposite sides of the circuit of the primaries of the induction coils, and a condenser connected with opposite terminals of the windings.

926,663. TELEGRAPH-REPEATER. Edelmiro Longoria, Monterey, Mexico. Filed February 5, 1909. A repeater for each of a number of transmitters has a local circuit which is opened and closed by the corresponding transmitter, and



926,584.—ELECTRICAL SWITCH.

means operated by the one repeater are provided for retaining the circuit of the other repeater closed during the operation of the first repeater.

926,669. INCUBATOR-ALARM. Perry S. Martin, Broadway, Va. Filed February 17, 1909. Has an electric alarm connected to the damper-controlling mechanism.

926,680. DEVICE FOR MAKING AN ELECTRICAL CIRCUIT OR CIRCUITS. Walter S. Ryan, Indianapolis, Ind., assignor to Ryan Construction Company, Muncie, Ind. Filed March 4, 1907. Describes a form of electric switch with electro-responsive devices to be energized by the current flowing through the terminals and the contact points in the switch bar nearest its fulcrum, to oscillate the switch bar at each operation thereof.

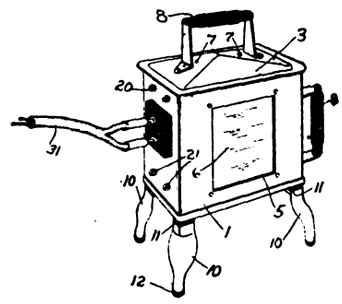
926,681. CIRCUIT-CONTROLLING SWITCH. Walter S. Ryan, Indianapolis, Ind., assignor to Ryan Construction Company, Muncie, Ind. Filed December 2, 1907. A movable member normally rests on a float in a receptacle and depresses the same, an electro-responsive device moves this member to release the float, and a contrivance controlled by the float energizes the electro-responsive device when the float is depressed and de-energizes it when the float is released.

926,682. SIGN-DISPLAYING DEVICE. Walter S. Ryan, Muncie, Ind., assignor to Ryan Construction Company, Muncie, Ind. Filed September 11, 1908. Describes a form of rotary display sign illuminated by a "linolite" lamp.

926,687. ELECTRIC-RAILWAY SIGNAL SYSTEM. Yorke Burgess, Washington, D. C., assignor to American Signaling Company. Filed November 5, 1908. Describes the details of an electrically operated railway signal system.

926,698. ELECTRIC IGNITION DEVICE. Theodore Hubert, New York, N. Y., assignor to Charles F. Splitdorf, New York, N. Y. Original application filed April 4, 1906. Divided and this application filed November 23, 1906. In combination with a magneto having make-and-break contacts are means to operate the movable member thereof, and a contact for a separate circuit arranged to be made and broken by the action of the movable member of the magneto contacts.

926,710. BIFUNCTIONAL STORAGE-BATTERY PLATE. Alfred O. Tate, Toronto, Ontario, Canada. Filed February 18, 1909. The plate embraces interleaved anode and cathode strips with perforated mechanical separators between them, and means are provided for holding the separators apart so as to afford a free circulation of the electrolyte.



926,714.—ELECTRIC TOASTER.

926,714. ELECTRIC TOASTER. Harold E. Bradley, Apponaug, R. I. Filed February 25, 1909. The bread rack is formed of rows of bars spaced apart and secured at their ends to plates of electrically insulating material, and an electric resistance wire is wound lengthwise around the rack whereby the contents of the same may be heated on opposite sides.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired July 5, 1909:

478,097. ELECTRIC MEASURING INSTRUMENT. Sydney Evershed, London, England.

478,139. ELECTRIC LOCOMOTIVE. Elmer A. Sperry, Chicago, Ill.

478,142. DYNAMO-ELECTRIC MACHINE OR MOTOR. Elmer A. Sperry, Chicago, Ill.

478,145. ELECTRIC ARC LAMP. Elihu Thompson, Lynn, Mass.

478,149. INCANDESCENT ELECTRIC LAMP-SOCKET. Henry E. Werline, Lancaster, Pa.

478,155. ELECTRIC ALARM-CLOCK. George C. Darche, Chicago, Ill.

478,175. ELECTRIC RAILWAY CONDUIT. Milton Shoemaker, Sioux City, Iowa.

478,180. TIME-SWITCH FOR ELECTRIC CIRCUITS. Benjamin E. Waters, Brockton, Mass.

478,182. ELECTRICAL DISTRIBUTION FOR CARS. Samuel Young, Morris Moskowitz, Leon D. Adler, and Joseph Loewenberg, Newark, N. J.

478,186. ELECTRIC LIGHTING SYSTEM. Edward T. Cooke, and William H. Mackay, St. Louis, Mo.

478,201. ELECTRICAL BRAZING DEVICE. Willis Mitchell, Malden, Mass.

478,230. SECONDARY BATTERY. James H. Gerry, Brooklyn, N. Y., and Charles E. Long, New York, N. Y.

478,242. ELECTRIC LOCOMOTIVE. Sidney H. Short, Cleveland, Ohio.

478,274. ELECTRIC INDICATOR. William E. Decrow, Boston, Mass.

478,276. RHEOSTAT. Winslow P. Eayrs, Nashua, N. H.

478,324. INDICATOR FOR ELECTRICAL SIGNALING SYSTEMS. Charles F. Gillette, New York, N. Y.

478,344. SYSTEM OF ELECTRICAL DISTRIBUTION. Harry W. Leonard, New York, N. Y.

478,346. ELECTRIC RAILWAY. Frank Mansfield, New York, N. Y.

478,367. ELECTRIC CABLE. William H. Sawyer, Providence, R. I.

478,475. ELECTRIC MOTOR. Jerome B. Secor, Bridgeport, Conn.

478,477. ELECTRIC LOCOMOTIVE. Sidney H. Short, Cleveland, Ohio.

478,485. ELECTRIC BATTERY. Charles F. Waldron, Boston, Mass.

478,510. ELECTRIC ARC LAMP. Rudolph M. Hunter, Philadelphia, Pa.

478,529. DYNAMO-ELECTRIC MACHINE. Charles W. Thomas, Jersey City, N. J.

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CONTENTS.

EDITORIAL:
The Telephone in Theatrical Management 93
Load Factors 93
Some Motor Loads 94
The Annual Report of the Commissioner of Patents 95
Court Upholds Readiness to Serve Charge 95
New York State Public Service Commission 96
Distorted Waves and Their Analysis 97
Electric Equipment of the Battle Creek Shops of the Grand Trunk Railroad 103
Secrecy in Wireless Transmission 106
Regenerated Rubber 106
A Notable Address by Caryl D. Haskins 107
The Association of Railway Telegraph Superintendents 108
The New York Street Railway Association 108
Joint Convention of the Wisconsin Electric and Interurban Railway Association and the Northwestern Electrical Association 109
Compilation of Load Factors 110
The National Electrical Contractors' Association 113
To Celebrate Tunnel Opening 114
The New Haven Road Sells Its Street Railroad Securities 114
Pennsylvania Railroad Completes Bergen Hill Tunnel 114
QUESTIONS AND ANSWERS 115
Denver Gas and Electric Company Reorganization 116
An Interesting Freight Classification and Rate Decision 116
Physical Society of London 117
A British Electrical Industrial Association 117
Government Takes Telephone Lines 117
The Telefunken System of Wireless Telegraphy 117
Quebec's Light, Power and Traction Merger 117
Ohio Electric Light Association 118
Collapse of Dam Deprives Southern Nevada of Power 118
Electrical Development in Porto Rico 118
Hudson-Fulton Aeronautics 119
Projected Big Telephone Merger 119
Specifications for Hard-Drawn Copper Wire 119
For An International Wireless Law 119
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 120
McCall Ferry Power Plan Extended 121
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE 122
INDUSTRIAL SECTION:
Continued Improvement of Westinghouse Business 124
Popularizing the Electric Oven 124
Two-Piece Molding Rosettes 124
Orders for Allis-Chalmers Steam Turbines 124
Water Softening by Electricity 124
Lord Lightning Arresters and Grounding Devices 125
Magnetos and the Automobile 125
Western Electric's Half-Year 126
An Interesting Pole Yard View 126
Western Electric Exhibit at Detroit 126
A Supplementary Storage Battery for 24-Hour Service 127
A New Trolley Wheel 127
Fan Controller 127
Improvement in Nernst Lamps 127
The Roan Type Gathering Locomotive 128
The Leeds & Northrup Mercury Ammeter 128
CURRENT ELECTRICAL NEWS 130

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THE TELEPHONE IN THEATRICAL MANAGEMENT.

It would appear that the applications of electricity especially in the spectacular effects for illumination in those concentrations of human activities which we term the stage, had been carried to the point of exhaustion, yet the wonderful presentation of Schiller's play of Joan of Arc in the Harvard Stadium has added a new picture to the subject.

The seventeen hundred performers in that great amphitheatre is considered the largest number ever appearing in the rendition of a scenic production, and the vast audience which nearly filled the seats, which have a capacity for twenty-one thousand, was certainly the greatest audience ever witnessing a theatrical production.

In this realistic and succession of scenes of action depicting the career of the Maid of Orleans the distances were so magnificent as to be beyond the usual methods of theatrical management.

Although the actors and groups of supernumeraries were under the instruction of managers, yet there was even more of a necessity for a supreme head than on the usual boards. This was provided by a bower among other scenery in the middle of the amphitheatre, where the stage manager and his immediate associates operated the lighting by means of the switches, by signal bells which gave instructions to others operating the switches in different parts of this great structure, and in addition to the greater uses of electricity there were a number of telephones reaching to those in management of different parts of the play.

As this great spectacle was without precedent, it is probably equally true that it will not be repeated on account of the lack of an amphitheatre sufficient to give provision for the representation of these movements of armies on such an extended scale.

LOAD FACTORS.

One of the most engrossing topics to which the central-station manager has in recent years fortunately had his attention directed is the study of load factors. He has come to realize that by the improvement of the load factor of his plant he can materially increase the returns on the investment, or, in other words, reduce the percentage of the fixed charges. Of equal importance is the matter of load factors of consumers' installations. In order to know what is likely to be a prospective consumer's maximum demand, so that proper provision

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be made for his service, and in order to estimate his revenue-producing power, so that an equitable rate be adopted, it is necessary to predetermine his probable load factor. This applies particularly to power consumers. Data on such load factors have hitherto been very scarce, however.

Among the many important papers presented before the recent convention of the National Electric Light Association was one by Mr. E. W. Lloyd, entitled "Compilation of Load Factors." This paper is practically the first to supply reliable data along the lines referred to above. It was undoubtedly one of the most valuable papers submitted to the central-station men at the convention, and is given quite fully on other pages of this issue. While these data are based on industrial conditions in Chicago, and are of the highest value where similar conditions prevail, they are worthy of the closest study by all central-station men, even in communities where conditions are radically different. This interesting collection of data should prove an incentive for the compilation of load factors by every central-station company.

SOME MOTOR LOADS.

A study of the motor loads on the electrical supply systems in a number of cities and towns shows that power service is still rendered with both direct and alternating current at a variety of voltages.

Either water power or steam serves for the operation of a large motor load, and such loads vary greatly in amount per thousand of the population, and in earnings per unit of motor capacity.

Generating stations of large capacity are supposed to show high efficiency and to attract motor loads by low rates, but it appears that some of the lowest annual incomes per horsepower of motors served are found in the small cities and the towns. While large cities with diverse lines of manufactures may appear to offer the best fields for motor loads on electrical supply systems, the fact is that rather small places with only two or three important industries often lead, not only in the horsepower of motors per thousand of population, but in total horsepower as well.

For the purpose of illustrating the facts as to motor loads, all of the electrical supply systems with motor loads of more than 900 horsepower capacity each in an important state have been considered. These electrical systems number seventeen, and serve populations that range from about 11,000 to more than half a million, and operate motor loads that vary from 935 horsepower as the minimum to nearly 40,000 horsepower for the maximum.

Out of the seventeen electrical supply systems, eight operate direct-current generators at 500 to 550 volts for all or parts of their motor loads, and in the other eight systems the same generators furnish current for both motors and incandescent lamps. Three of these latter systems operate direct-current three-wire circuits, and at least a large part of their motor loads are supplied from the two outside wires of these circuits. In at least two large stations the alternating current, generated at about 2,300 volts, is transformed to 550 volts and distributed by separate lines to induction motors at this voltage. An alternator is operated at 2,300 volts, especially for power work in one case.

The largest motor load per thousand of the population was 108 horsepower, in a town of about 13,000 inhabitants, while the smallest motor load per thousand of population was 11.2 horsepower, in a city of more than 100,000 inhabitants.

Per horsepower of connected motors, the least power income during a recent year was $14.04, for an electrical supply system in a city of about 28,000 people; but the system that served more than half a million people got $15.73 per connected horsepower, and the system supplying about 11,000 people got only $16.08 per horsepower.

The highest income per horsepower of connected motors was $30.17, but this rate secured a load of only 12.2 horsepower per thousand inhabitants, in a city with more than 100,000 people.

A town with a rather large number of manufacturing plants of the same sort, each plant using only a few tens of horsepower, furnished the maximum connected load of 108 horsepower in motors per thousand inhabitants, and the income from this load was $21.40 per horsepower during the year. Steam was the only source of power for the station that operated this load, and the current for the motors was generated at 2,300 volts, sixty cycles and three-phase. Circuits for the distribution of power to motors carried no lamps, and the line voltage was transformed to 110 for most of the induction motors.

The town with a total load of 935 horsepower in connected motors, or eighty-three horsepower per thousand population, was supplied with electric energy from both steam and water power, but the water power was from a very variable river, with only slight storage area. Each connected horsepower of motors earned $16.08 for this electric system during the year, and all the current was generated by alternators.

In the city with a connected load of 1,192 horsepower in motors, but only 11.2 horsepower per thousand of the population, the electric income from motors was $25.55 per horsepower. This city of more than 100,000 people is a great center of textile industry, in which large amounts of power are used, but the local electric system has not made the rates necessary to attract this load. While the electric system in this case includes no water power, it is very favorably located for the cheap development of power with steam.

Another city with large textile interests had a connected motor load of 2,154 horsepower, or sixty-five horsepower per thousand inhabitants, this load per thousand being larger than that of any other city in the group. The gross income from this motor load was $22.36 per horsepower during the year, and the electric generating station was operated entirely with steam power.

In this case all of the motors were operated with sixty-cycle, three-phase current, many of them being connected to

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550-volt alternating power lines that ran from the generating station, and much of the power load was cotton-mill work.

The electric system having a connected motor load of 6,435 horsepower, the second largest in the state, operated 58.1 horsepower of motors per thousand of the population served, and earned $17.40 gross per motor horsepower. In this case the motor service was partly with direct and partly with alternating current, the former at 500 volts, and a large percentage of the motor load was in textile mills, though the electric generating station was operated entirely with steam power.

With a load of only 1,238 horsepower in capacity of connected motors, or forty-four horsepower per thousand inhabitants, the income rate of $14.04 per horsepower of connected motors was reached, and the electric system that rendered this service had no water power. The power supply in this case was with both direct and alternating current, the former at 550 volts.

One of the electric systems using both water and steam power had a connected motor load of 1,771 horsepower, or 19.7 horsepower per thousand of the population, and this load paid an income of $22.78 per horsepower.

Another system operating in part with water power had 2,576 horsepower of connected motors, that paid $19.30 per horsepower during the year, and this load amounted to 51.6 horsepower per thousand persons in the supply area.

The one other of the seventeen electrical supply systems that used waterpower had 3,799 connected horsepower in motors, or forty-four horsepower per thousand people, that paid $23.06 per horsepower during the year.

In the largest electric supply system of the state, with 30,422 horsepower of connected motors, the earnings per horsepower were $15.73, and there were 56.1 horsepower per thousand of the population. Some of the power service in this case was with 500-volt direct current, but the great bulk of the load was connected to the 250-volt outside conductors of a three-wire system.

THE ANNUAL REPORT OF THE COMMISSIONER OF PATENTS.

The annual report of the Commissioner of Patents to Congress for the year ending December 31, 1908, makes interesting reading. The receipts from all sources amounted to $1,896,847 and the expenditures were $1,712,303, leaving a balance of over $184,000. The balance in the treasury on January 1 amounts to nearly $7,000,000. The total number of applications for patents for inventions, designs and for reissues was 61,475, and of this number there was a total of 33,682 patents issued.

In proportion to the population more patents were issued to citizens of the District of Columbia than to those of any state, one to every 1,115.

The reorganization of the bureau under the system inaugurated by Secretary Garfield has resulted in vastly improving the conditions heretofore existing. The bureau has been given twenty-three additional rooms, the force has been augmented and the salaries increased. The new conditions created by Congress and the Secretary of the Interior have made it possible to bring up the work of the Patent Office so that it is now current except in five of the examining divisions out of the forty-one.

In his report Commissioner of Patents Moore invites the attention of Congress to the necessity for legislation which would result in the establishment of a patent bar. It is suggested that a law be enacted providing that before an individual be permitted to practice before the United States Patent Office he shall be required to first pass an examination as to his moral, legal and technical qualifications; that a committee shall be appointed by the Commissioner of Patents composed of Patent Office officials and patent attorneys of well-known standing in the profession, who shall conduct the examination under the direction of the Commissioner of Patents, and the report of said committee shall be subject to his approval.

This report is decidedly refreshing and should be a cause of sincere congratulation on the part of those who were instrumental in bringing about the movements referred to by the Commissioner of Patents. There is still a very large surplus in the Patent Office treasury, and this will make it possible to make still further improvements.

It is unfortunate that the fine record announced in this report must be coupled with an explanation that this week it has been impossible to publish a list of electrical patents issued on Tuesday, July 6, owing to the failure of the delivery of the Official Gazette of the United States Patent Office up to the time of going to press.

COURT UPHOLDS READINESS TO SERVE CHARGE.

The Supreme Court of Arkansas on June 14 last rendered a decision in favor of the Little Rock Railway and Electric Light Company establishing the right of the company to stipulate a "readiness to serve" charge in making a contract with a new customer. The plaintiff in the original suit contended that the act of the General Assembly of 1905 did not provide for a readiness to serve charge or a minimum rate charge, as the act specifically fixes upon the company the furnishing of meters to customers without charge, the supplying of printed tables showing the price charged for current, and basing the charge for the commodity upon the reading of these meters.

The court holds that the manifest design of the act was to provide means whereby the consumer may be informed as to the exact charge for service and to require a uniformity of charges against all customers using like quantities of the commodity. Nowhere does the statute attempt to say that persons using different quantities of the commodity in a given time must be charged the same price per unit, nor that a minimum charge per month for service may not be imposed. The Legislature did not intend to compel the company to put in a meter and hold itself in readiness to serve those who use none of the commodity to be supplied, and the language of the act does not warrant the construction that the fixing of a minimum charge was to be forbidden.

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New York State Public Service Commission.

The Public Service Commission completed the second year of its existence on July 1, and Chairman William R. Willcox, of the Commission for the First District, makes the following statement as to the work of the Commission since its creation:

"Inasmuch as the greatest problems before the Commission lie in the field of transportation, the bulk of our work has been directed largely to paving the way for new rapid-transit facilities and increasing and improving the service on existing lines. In both directions, I think, the Commission has made substantial progress. The Commission has encouraged the entrance of competitors into the traction field and has framed a law, which was passed by the Legislature, amending the Rapid Transit Act, so that the city now has three ways of building rapid-transit lines, against one method allowed by the old law. It has also proposed and advocated the passage of a constitutional amendment, which will be submitted to the people next fall, providing that bonds used for the construction of self-supporting rapid-transit lines will not be included in computing the debt limit, thus adding about $100,000,000 to the city's borrowing capacity.

"In speaking of the new law, I refer to the Travis-Robinson bill amending the Rapid Transit Act, which was passed by the last Legislature, signed by the Governor, and is now on the statute books. Under the terms of this law it is now possible for New York city, in addition to building subways with its own money, to defray the cost of rapid-transit lines either by assessment upon the property benefited or by the enlistment of private capital. This law has already been productive of offers from private interests to build new subways, and there seems to be no question that when the Commission advertises the new routes there will be no lack of bidders.

"During the last two years the Commission has planned a new system of subways to connect the boroughs of Manhattan, the Bronx and Brooklyn, and as soon as the detailed plans and forms of contracts can be prepared—a work that will be pushed immediately—will advertise for bids for its construction. This system embraces the Broadway-Lexington Avenue route as laid down by the Commission, extending from the Battery to and through the borough of the Bronx: the Fourth Avenue subway, extending from the Brooklyn terminal of the Manhattan Bridge through Flatbush Avenue extension and Fourth Avenue, Brooklyn, to Forty-third Street, with branches to Fort Hamilton and Coney Island; the Canal Street subway, extending across Manhattan from the Hudson to near the East River, and the Broadway-Lafayette subway in Brooklyn, leading from the Brooklyn terminal of the Williamsburg Bridge out Broadway and back through Lafayette Avenue to a junction with the Fourth Avenue subway. The Commission has also prosecuted work on the Brooklyn loop subway, which is to connect the Manhattan terminals of the Brooklyn, Manhattan and Williamsburg bridges, and which, when completed, will form an important part of the new system.

"It has been the fortune of the Commission to witness the relief of the Brooklyn Bridge crush by the extension of the city subway to Brooklyn, and by the practical elimination of delays caused by trolley cars. The accomplishment of the latter has been due to the orders issued by the Commission for the overhauling and repair of trolley cars, and since these orders have been enforced, the blockades on the trolley tracks over the bridge have almost entirely disappeared.

"The Commission's orders for overhauling and repair of the surface cars also have resulted in great improvement in the surface. Millions of dollars have been spent by the companies in overhauling their equipment and providing new cars, and the result is apparent in the decreased delays due to breakdown. The spectacle of long lines of surface cars, blocked by reason of the breakdown of the car at the head of the line, is now very rare.

"The present subway has claimed a great deal of attention from the Commission. Its service has been improved in many ways, and the Commission has recently ordered the equipment of all cars used in the express service with side doors. The Commission has also provided for the lengthening of the station platforms in the subway, so that they will be able to accommodate ten-car express trains and six-car local trains, the present platforms being limited to eight-car express trains and five-car local trains. The speed-control system, recommended by the Commission's consulting engineer, Bion J. Arnold, has been tried with good effect, and the Interborough company plans to extend it until the entire express service will be covered. When all of these improvements have been made, the service will be greatly bettered and it will be possible to use the subway to the limit of its capacity.

"In regard to surface-railroad transportation, the Commission has brought about improvement in service in all parts of the city. While it is impossible, with present facilities, to provide every passenger a seat during the rush hours, the companies have responded to the efforts of the Commission to obtain better service with excellent results.

"In a thorough investigation, the Commission opposed the methods by which the Metropolitan Street Railway system was wrecked, and brought to light many other things, the 'paper railroad' deal, by which a local company was forced to pay $965,000 for a franchise for which the owner asked only $250,000, the final result of the exposure being the restitution by the recipients of the money paid over and above the purchase price. The repetition of such methods, I believe, has been carefully guarded against by the precautions which the Commission has taken to insure the keeping of uniform system of accounts by the railroad and street-railroad companies subject to constant supervision by the Commission."

UP-STATE COMMISSION'S REPORT.

The Public Service Commission for the Second District had upon the close of business, June 30, handled 2,990 cases; 2,003 of these were treated informally and 1,721 of them disposed of and closed on the records during the two years' existence of the Commission. In this period 987 cases were made formal and orders served in each case; 859 hearings were given, at which formal cases were heard.

The number of applications received for capitalization was 145, and the total amount authorized $155,708,925.49. Of this amount $111,200,500 were bonds, $19,454,600 capital stock, and the remainder various kinds of evidences of indebtedness.

The building of nine new railroads and street railroads has been authorized and permission to extend lines has been granted in fifteen cases.

The elimination in grade of twenty-five crossings has been ordered. Work in this direction can proceed no further because the Legislature has made no appropriation this year for continuing this work.

Thirty-seven gas and electric corporations and two municipalities have been authorized to exercise franchises and fifteen companies have been given permission to assign, transfer or lease their properties to new corporations.

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DISTORTED WAVES AND THEIR ANALYSIS BY A SIMPLE METHOD.

BY HENRY HERMANN.

I. Introduction.

It is a well-known fact, that pressure waves obtained from synchronous machines, especially under load, deviate more or less from the true sine form; that is, instantaneous values of the induced electromotive-force do not follow a simple sine law. Similarly, if a sine wave of electromotive-force is impressed upon a circuit containing iron, the cyclic variation of the magnetic reluctance brings about a distortion of the current wave. As a rule, self-induction in the electric circuit reduces, capacity augments the higher harmonics initially present in a distorted pressure wave. While in some cases this distortion of wave shape is of little importance, and the deviations from the true sine form may be neglected, there are instances where it becomes desirable or even necessary to resolve the distorted wave into its harmonic components. Considering complex waves from the standpoint of the mathematician or physicist, that is, treating the curve as a series of sine functions the members of which are unknown, the analysis of such waves is at the best a time-consuming process.

Dealing with the problem of distorted waves in engineering practice, the electrical profession, which up to a comparatively short time ago has practically ignored the irregularities originated by the presence of higher harmonics, has come to recognize that frequently it is not permissible to replace the distorted wave by its equivalent sine wave, that is, the true sine wave of equal intensity and power as the distorted wave.

In all those cases, then, where it becomes necessary to consider the fictitious[1] components of the complex wave individually, experience has shown it to be sufficient to determine the amplitude of the fundamental wave and a few terms of higher order.

Apart from the case of very complex waves (and even here it is possible to tell beforehand what principal harmonics are present), it is not difficult to determine the equation of a distorted wave from the oscillogram exact enough for most practical purposes. Moreover, in almost every instance where the distortion of wave shape must be taken into account we are dealing with a typical distorted wave, the constituents of which are known to the engineer engaged in alternating-current work. Such waves may be conveniently analyzed by the method outlined below. In the latter part of the paper several tables will be found, showing a number of typical waves, together with the formulas, expressing the amplitudes of the harmonic components in terms of certain ordinates.

[1] It hardly needs mentioning, that the fundamental wave as well as the higher harmonics are merely mathematical fictions. They have no independent physical existence.

II. Principal Features of Distorted Waves.

Before occupying ourselves with the subject of wave-form analysis, let us briefly consider the principal features of distorted pressure and current waves.

(a) Symmetrical and unsymmetrical waves.—No-load pressure waves obtained from synchronous machines obviously are symmetrical with respect to both axes. For brevity we will call them "symmetrical waves."

Pressure waves with the machine delivering power, as well as current waves,

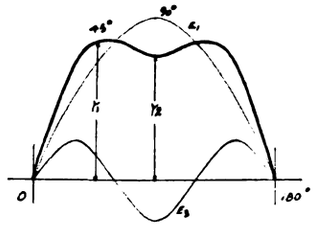

FIG. A.

quite often are no longer symmetrical with respect to both axes. By reason of symmetry, however, both half waves must be alike, that is, one must be the exact image of the other. Waves of this type, which are characterized by the presence of a time-phase displacement between the complex wave and its harmonic components, we will call "unsymmetrical waves." It is the symmetry just referred to, that only harmonics of odd order enter the equation of a distorted wave.[1]

(b) Principal higher harmonic, and its effect upon the general appearance of the distorted wave.—The general appearance of distorted waves is determined by the principal higher harmonic, which is either of triple or quintuple frequency.

[1] Evidently the distribution of the field in the air gap, under a north pole, must be the same as that under a corresponding south pole. This implies that in the wave of induced electromotive-force ordinates lying 180 degrees apart have the same numerical value, their signs, however, being reversed. The question whether only odd harmonics with a time-phase displacement are present in unsymmetrical waves has not been settled beyond doubt. Recent experiments seem to indicate that the magnetic oscillations due to the armature teeth in synchronous machines superimpose higher harmonics of even order, which, however, reverse their sign every half cycle. The discussion of this point is beyond the scope of the present paper.

(α) *Effect of a pronounced third harmonic.*—As seen from Figs. 1 and 2, Table I, a pronounced harmonic of triple frequency affects the appearance of the wave as follows: If the third harmonic is positive, that is, if counting the time from the zero point of the complex curve, E_3 rises positively (in the same sense as E_1), the complex wave will be flat topped. (Fig. 1, Table I, and Fig. A.) If, however, E_3 is negative, that is, if, after crossing the base line, it rises in opposition to E_1, its effect will be to produce a distorted wave of the peaked type. (Fig. 2, Table I.) This holds true, both in the case of symmetrical and unsymmetrical waves.

(β) *Effect of prominent fifth harmonic.*—Contrary to what has been said regarding a prominent third harmonic, a strong harmonic component of quintuple frequency gives rise to a peaked (sawtoothed) wave, if E_5 is positive. If the fifth harmonic rises in opposition to the fundamental, a flat-topped wave is the result. (Figs. 3 and 4, Table I.)

(c) Minor higher harmonics.—Besides the principal higher harmonic, that is, either the third or the fifth, sometimes there are present to an appreciable extent harmonic components of higher order than the principal member. For example, a wave with a prominent triple harmonic may contain a fifth, a seventh or a ninth harmonic, or probably several of them, a similar reasoning applying to waves with a principal fifth harmonic. The order of the highest harmonic present to an appreciable extent may be arrived at from the number of singularities contained in the distorted wave. Referring to Fig. 5, Table II, which represents a wave of the equation $y = E_1 \sin \omega t + E_3 \sin 3\omega t + E_9 \sin 9\omega t$, the presence of a noticeable ninth harmonic is indicated by the nine singularities, marked 1 to 9. When coming to the discussion of the tables below, more details pertaining to the characteristic features of the distorted waves will be given.

III. Analysis of Typical Waves.

A.—Method Applied to Symmetrical Waves.

The method consists in measuring as many ordinates as the complex wave contains harmonic components, the amplitude of the latter being determined by a simple mathematical process.

(a) Waves containing a fundamental and one higher harmonic.—Let us apply

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the principle indicated to a wave, as shown in Fig. A, which has the equation,

$$y = E_1 \sin \omega t + E_3 \sin 3\omega t$$

where ωt is a time angle having its value indicated. To determine E_1 and E_3, the amplitudes of the fundamental wave and of the third harmonic, respectively, erect and measure the ordinates y_1 at 45° and y_2 at 90°. Obviously, the instantaneous values of the distorted wave, as measured by the ordinates y_1 and y_2, respectively, are:

$$y_1 = E_1 \sin 45° + E_3 \sin 3 \times 45° = \frac{1}{\sqrt{2}} (E_1 + E_3)^1$$

or $y_1\sqrt{2} = E_1 + E_3$;

$$y_2 = E_1 \sin 90° + E_3 \sin 3 \times 90° = E_1 - E_3.$$

From these two equations there result,

$$(a) \ldots . y_1\sqrt{2} + y_2 = 2E_1$$
$$E_1 = .71y_1 + .50y_2$$
$$(b) \ldots . y_1\sqrt{2} - y_2 = 2E_3$$
$$E_3 = .71y_1 - .50y_2.$$

In the same manner the amplitudes of the harmonic components of the other waves shown in Table I have been obtained.

(b) Waves with a fundamental and two higher harmonics.—The determination of E_1, E_3, and E_5 of a wave as shown in Fig. B, with the equation,

$$y = E_1 \sin \omega t + E_3 \sin 3\omega t + E_5 \sin 5\omega t$$

requires three ordinates to be measured, namely, y_1 at 30°, y_2 at 45°, y_3 at 90°. Substituting for angle ωt in turn the values 30°, 45°, and 90°, into the equation of the wave, we obtain:

$$y_1 = E_1 \sin 30° + E_3 \sin 90° + E_5 \sin 150° = \frac{E_1}{2} + E_3 + \frac{E_5}{2}$$

$$y_2 = E_1 \sin 45° + E_3 \sin 135° + E_5 \sin 225° = \frac{1}{\sqrt{2}} (E_1 + E_3 - E_5)$$

$$\text{or } y_2\sqrt{2} = E_1 + E_3 - E_5$$

$$y_3 = E_1 \sin 90° + E_3 \sin 270° + E_5 \sin 450° = E_1 - E_3 + E_5$$

Solving successively for E_1, E_3, and E_5, we finally obtain:

$$E_1 = .71y_2 + .50y_3$$
$$E_3 = .67y_1 - .33y_3$$
$$E_5 = .67y_1 - .71y_2 + .17y_3$$

Table II shows the most important symmetrical waves, with two higher harmonics, the amplitudes of the latter being determined in the same manner as indicated in the preceding.

(c) Waves containing a fundamental and three higher harmonics.—As an instance, we select a wave, as shown in Fig. C, the equation of which is

$$y = E_1 \sin \omega t + E_3 \sin 3\omega t + E_5 \sin 5\omega t + E_7 \sin 7\omega t$$

The number of the harmonic components being four, we require four ordinates, namely: y_1 at 30°, y_2 at 45°, y_3 at 60°,

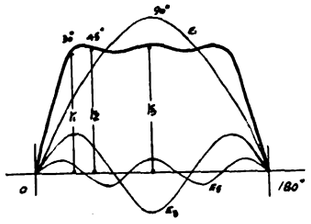

FIG. B.

y_4 at 90°. Assigning to ωt in turn the values 30°, 45°, 60°, and 90°, and proceeding, as explained above, we find

$$y_1 = \frac{E_1}{2} + E_3 + \frac{E_5}{2} - \frac{E_7}{2}$$

$$y_2\sqrt{2} = E_1 + E_3 - E_5 - E_7$$

$$\frac{2y_3}{\sqrt{3}} = E_1 - E_5 + E_7$$

$$y_4 = E_1 - E_3 + E_5 - E_7^1$$

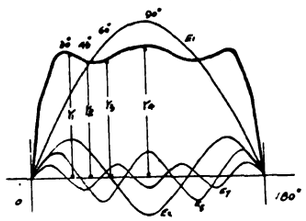

FIG. C.

Solving in turn for E_1, E_3, E_5, and E_7, respectively, we obtain

$$(a) \ldots . y_1 + y_4 = \frac{3}{2} (E_1 + E_5 - E_7)$$

$$\text{or } E_1 + E_5 - E_7 = \frac{2}{3} (y_1 + y_4)$$

$$E_1 - E_5 + E_7 = \frac{2y_3}{\sqrt{3}}$$

$$\text{hence } E_1 = \tfrac{1}{3} (y_1 + y_4) + \frac{y_3}{\sqrt{3}}$$

$$(b) \ldots . 2y_1 = E_1 + 2E_3 + E_5 - E_7 - y_4 = -E_1 + E_3 - E_5 + E_7$$

$$\text{or } 3E_3 = 2y_1 - y_4 \text{ and } E_3 = \tfrac{2}{3}y_1 - \frac{y_4}{3}$$

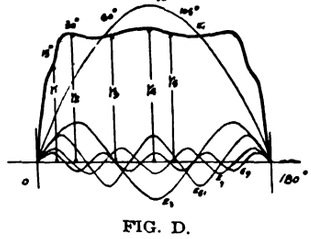

FIG. D.

Similarly we obtain for E_5 and E_7, respectively,

$$E_5 = \tfrac{2}{3}y_1 - \frac{y_2}{\sqrt{2}} + \tfrac{1}{6}y_4$$

$$E_7 = \tfrac{1}{3}y_1 + \frac{y_3}{\sqrt{3}} - \frac{y_2}{\sqrt{2}} - \tfrac{1}{6}y_4$$

As a final result, we may note:

$$E_1 = .33 (y_1 + y_4) + .58y_3$$
$$E_3 = .67y_1 - .33y_4$$
$$E_5 = .67y_1 - .71y_2 + .17y_4$$
$$E_7 = .33y_1 + .58y_3 - .71y_2 - .17y_4$$

In Table III, there are shown a number of typical symmetrical waves containing a fundamental and three higher harmonics.

(d) Waves with a fundamental and four higher harmonics.—It is in the nature of things, that if certain harmonics are predominating, others will be suppressed. Taken as a whole, then, it appears to be logical to conclude that in all cases where the distortion of wave shape is considerable, hardly more than two, or at the utmost three, members of higher order will be present. In fact, the more a distorted wave approaches an extreme form, the smaller will be the number of harmonic components which constitute the complex wave. The only exception from

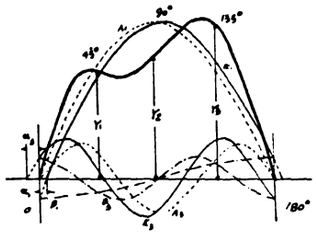

FIG. E.

this rule is probably a curve closely approaching rectangular shape. Here all odd harmonics, up to the ninth, may be present to an appreciable extent. Such a wave has been plotted in Fig. D, the equation of the wave being,

$$y = E_1 \sin \omega t + E_3 \sin 3\omega t + E_5 \sin 5\omega t + E_7 \sin 7\omega t + E_9 \sin 9\omega t$$

Analyzing the curve by our method, we determine the instantaneous values corresponding to the ordinates, y_1, y_2, y_3, y_4, y_5, as shown in Fig. D. Substituting the values $\omega t = 15°, \ldots\ldots, 105°$, successively into the equation of the wave, and solving for the amplitudes of the individual sine waves, we arrive at the following result:

$$E_1 = .33 (y_2 + y_4) + .58y_3$$
$$E_3 = .50y_2 - .55y_6 + .15y_1 + .29y_4$$
$$E_5 = .40 (y_1 + y_6) - .58y_3$$
$$E_7 = .40 (y_1 + y_6) - .33 (y_2 + y_5)$$
$$E_9 = .33y_5 - .17y_2 + .29y_4 - .55y_6 + .15y_1$$

B.—UNSYMMETRICAL WAVES.

Turning our attention to unsymmetrical waves, we shall apply our method to waves with one, two, and three higher harmonics.

(a) Waves with a fundamental and one higher harmonic.—A typical example of

[1] $\sin 135° = \sin 45° = \frac{1}{\sqrt{2}} = 0.707$

[1] Compare these equations with the diagram Fig. C.

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a wave of this type is shown in Fig. E, the curve being expressed mathematically, by the equation,

$$y = E_1 \sin(\omega t - a_1) + E_3 \sin 3(\omega t + a_3)$$

As a first step we resolve the sine waves of fundamental and triple frequency into two components each, one, A_1 and A_3, respectively, in time phase with the distorted wave referred to the zero point, and one, B_1 and B_3, respectively, in quadrature therewith.[1] The last equation may then be written

$$y = E_1 \sin \omega t + A_3 \sin 3\omega t - B_1 \cos \omega t + B_3 \cos 3\omega t.$$

For the purpose of analyzing the wave, erect and measure the three ordinates at 45°, at 90°, and at 135°. Proceeding, as shown repeatedly in the above, we obtain for the instantaneous values corresponding to these ordinates:

$$y_1 = A_1 \sin 45° + A_3 \sin 135° - B_1 \cos 45° + B_3 \cos 135°$$

or $y_1\sqrt{2} = A_1 + A_3 - B_1 - B_3$

$$y_2 = A_1 \sin 90° + A_3 \sin 270° - B_1 \cos 90° + B_3 \cos 270° = A_1 - A_3$$

$$y_3 = A_1 \sin 135° + A_3 \sin 405° - B_1 \cos 135° + B_3 \cos 405°$$

or $y_3\sqrt{2} = A_1 + A_3 + B_1 + B_3$

Eliminating the individual members from these equations, we arrive at the formulas:

$$A_1 = .354(y_1 + y_3) + .50y_2$$
$$A_3 = .354(y_1 + y_3) - .50y_2$$
$$B_1 = .354(y_3 - y_1) = B_3$$

It needs no further explanation to show that $B_1 = B_3$ (since $B_1 - B_3 = 0$).

In Table IV, eight typical waves of this type, including the formulas for the amplitudes of the harmonic components, have been reproduced.

(b) **Waves with a fundamental and two higher harmonics.**—Choosing, as an instance, a wave with a principal third, and a minor fifth harmonic, Fig. F, and proceeding as before, the equation of the wave

$$y = E_1 \sin(\omega t - a_1) + E_3 \sin 3(\omega t + a_3) + E_5 \sin 5(\omega t - a_5)$$

may be written thus:

$$y = A_1 \sin \omega t + A_3 \sin 3\omega t + A_5 \sin 5\omega t - B_1 \cos \omega t + B_3 \cos 3\omega t - B_5 \cos 5\omega t$$

On determining the instantaneous values corresponding to the ordinates y_1, y_2, y_3, y_4, y_5 indicated in Fig. F, and after finally solving the equations, we obtain

$$A_1 = .354(y_2 + y_4) + .50y_3$$
$$A_3 = .33(y_1 + y_5 - y_3)$$
$$A_5 = .33(y_1 + y_5) - .354(y_2 + y_4) + .17y_3$$
$$B_1 = .354(y_4 - y_2)$$
$$B_3 = .58(y_1 - y_5) + .71(y_4 - y_2)$$
$$B_5 = .58(y_1 - y_5) + .354(y_2 + y_4)$$

See also Table V.

(c) **Waves with a fundamental and three higher harmonics.**—In the preceding we have shown how the amplitudes of the individual sine waves may be found by determining certain instantaneous values. As a final example, we propose the analysis of an unsymmetrical wave with

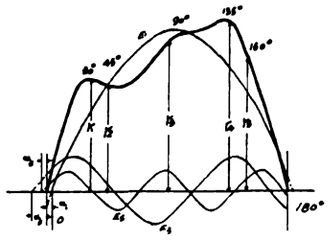

FIG. F.

three higher harmonics, as shown in Fig. G. The equation of this wave

$$y = E_1 \sin(\omega t - a_1) + E_3 \sin 3(\omega t + a_3) + E_5 \sin 5(\omega t + a_5) + E_7 \sin 7(\omega t - a_7)$$

may be written thus

$$y = A_1 \sin \omega t + A_3 \sin 3\omega t + A_5 \sin 5\omega t + A_7 \sin 7\omega t - B_1 \cos \omega t + B_3 \cos 3\omega t + B_5 \cos 5\omega t - B_7 \cos 7\omega t$$

Substituting into this equation in turn the values $\omega t = 30°, \ldots\ldots 150°$, and obtaining the instantaneous values corre-

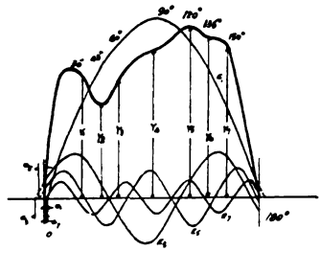

FIG. G.

sponding to the ordinates y_1, y_2, y_3, y_4, y_5, y_6, y_7, inclusive, we arrive at the final result

$$A_1 = .17(y_1 + y_7) + .29(y_3 + y_5) + .33y_4$$
$$A_3 = .33(y_1 + y_7 - y_4)$$
$$A_5 = .33(y_1 + y_7) - .354(y_2 + y_6) + .17y_4$$
$$A_7 = .17(y_1 - y_4 + y_7) - .354(y_2 + y_6) + .29(y_3 + y_5)$$
$$B_1 = .29(y_7 - y_1) + .17(y_5 - y_3)$$
$$B_3 = .33(y_5 - y_3)$$
$$B_5 = .354(y_6 - y_2)$$
$$B_7 = .354(y_6 - y_2) - .29(y_7 - y_1) - .17(y_5 - y_3).$$

Let us verify these results. The curve Fig. G has been plotted to scale after choosing the following values for the amplitudes of the individual harmonics.

$E_1 = 50$ mm.; $E_3 = 12.5$ mm.; $E_5 = 7.5$ mm.; $E_7 = 4.5$ mm. Scaling off the ordinates, $y_1, y_2 \ldots\ldots y_7$, we find them to measure

$y_1 = 33$ mm.; $y_2 = 25.5$ mm.; $y_3 = 33.5$ mm.; $y_4 = 41.5$ mm.; $y_5 = 47$ mm.; $y_6 = 44.5$ mm.; $y_7 = 43$ mm. If our formulas developed above are correct, the substitution of the actual values of the ordinates as taken from the diagram into the equations must obviously give us the amplitudes as arbitrarily assumed when plotting the curve. We have

$A_1 = .17(76) + .29(79.5) + .33(41.5) = 49.7$ mm.

$B_1 = .29(10) + .17(13.5) = 5.2$ mm.

Hence, $E_1 = \sqrt{A_1^2 + B_1^2} = \sqrt{49.7^2 + 5.2^2} = \sqrt{2497} = \pm 50$ mm.

$A_3 = .33(34.5) = 11.4$;

$B_3 = .33(13.5) = 4.5$

Hence, $E_3 = \sqrt{11.4^2 + 4.5^2} = \pm 12.5$ mm.

$A_5 = .33(76) - .354(70) + .17(41.5) = 7.3$;

$B_5 = .354(18.5) - .33(14.5) = 1.9$.

Therefore, $E_5 = \sqrt{7.3^2 + 1.9^2} = \pm 7.5$ mm.

$A_7 = .17(34.5) - .354(70) + .29(79.5) = 4.1$;

$B_7 = .354(19) - .29(10) - .17(14.5) = 1.25$

Hence, $E_7 = \sqrt{4.2^2 + 1.25^2} = \pm 4.5$ mm.

Table VI contains a few more examples of unsymmetrical waves with three higher harmonics.

IV. Tables Showing Typical Waves and Their Analysis.

A.—Symmetrical Waves.

(a) **Table I. Symmetrical waves with one higher harmonic.**—We have already discussed (under II, **b**, α, and β) the general effect produced by the superposition of a triple or a quintuple harmonic upon a simple sine wave. In addition to these remarks, we gather from Table I, that a

Fig	Equation of the Wave	Amplitudes of Harmonic Components in Terms of Ordinates		Indicates if harmonic is present
1	$y = \sin \omega t + .25 \sin 3\omega t$	$E_1 = .17y_1 + .29y_3 + .33y_4$ (1)	$E_1 = .17y_1 - .29y_3 + .33y_4$	$y_1 = y_7$, $y_2 = y_6$, $y_3 = y_5$
2	$y = \sin \omega t - .25 \sin 3\omega t$	$E_3 = .33y_4 - .17y_1$ (2)		
3	$y = \sin \omega t + .25 \sin 3\omega t + .25 \sin 5\omega t$	E_5 same as (1)		
4	$y = \sin \omega t - .25 \sin 3\omega t + .25 \sin 5\omega t$	E_5 same as (1)		

TABLE I.—SYMMETRICAL WAVES WITH ONE HIGHER HARMONIC.

negative third or fifth harmonic tends toward a flat zero, while if E_3 or E_5 is positive, a sharp zero is the result.[1] Re-

[1] In the diagram Fig. E, the full-drawn lines marked E_1, E_3, respectively, represent the fundamental and the third harmonic. By the dotted lines we indicate the sine members, A_1 and A_3, while the dotted curves are to represent the cosine members, B_1 and B_3, referred to above. Here, as well as in the other examples dealt with, the fictitious components of the complex waves have been plotted with the object in view of aiding the reader in understanding the mathematical part of the paper.

[1] The dotted curve in the diagrams represents the fundamental wave. The equation

$$y = \sin \omega t + .25 \sin 3\omega t$$

thus indicates that a sine wave of triple frequency, the amplitude of which is about one-fourth of that of the fundamental wave, has been superimposed upon the latter.

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garding the formulas expressing the amplitudes of both sine waves in terms of the ordinates y_1 and y_2 erected at the points 45° and 90°, respectively, it is interesting to note: First, the formula for E_1 is the same in all four cases; second, a positive third and a negative fifth harmonic are determined by the same formula. Analogously, an identical formula applies to $-E_3$, and $+E_5$. As seen, formulas 2 and 3 contain the same members with signs reversed, hence the absolute value of E_3 in either case is the same. Thus we conclude: The analysis of any distorted wave consisting of fundamental and one higher harmonic, may be accomplished by measuring the ordinates y^{45} and

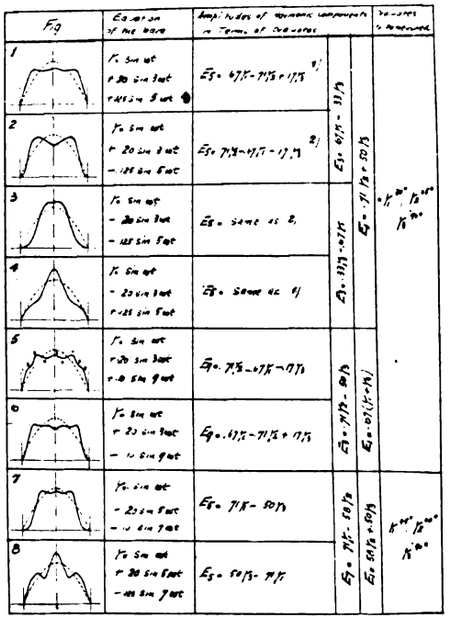

TABLE II.—SYMMETRICAL WAVES WITH TWO HIGHER HARMONICS.

y^{90}. The amplitudes are then found by the formulas:

$E_1 = .71y^{45} + .50y^{90}$.

$E_3 = E_5 = .71y^{45} - .50y^{90}$.

(b) Table II. Symmetrical waves with two higher harmonics.—Discussing the contents of Table II, we observe the following features regarding the effect produced by the individual higher harmonics, as well as the formulas in the third column of the table.

(α) *Waves with a third and fifth harmonic.*—If E_3 and E_5 are both positive (Fig. 1), there is a tendency to produce a flat-topped wave with a sharp zero, the wave approaching more the rectangular shape. (Compare Figs. 1 in Tables I and II.) If E_3 is positive and E_5 negative (Fig. 2), there is a tendency toward a flat zero (but less so than in the case of Fig. 4, Table I). In waves of the peaked type, that is, curves with a principal third harmonic of negative sign, a negative fifth harmonic (Fig. 3) tends toward a very flat zero and a flattened peak, while if E_5 is positive (Fig. 4), a rather sharp zero and a pointed peak will result. As to the amplitudes of the harmonic components, their numerical values are given, irrespective of the phase relation between the individual sine waves, by the formulas:

$E_1 = .71y^{45} + .50y^{90}$

$E_3 = .67y^{30} - .33y^{90}$

$E_5 = .67y^{30} - .71y^{45} + .17y^{90}$.

(β) *Waves with a third and ninth harmonic.*—The appearance of a flat-topped wave is affected by a minor, but appreciable, ninth harmonic, as follows: If E_9 is positive (Fig. 5), a sharp zero will be produced, while the singularity at the middle of the top is directed upward. With E_9 negative (Fig. 6), there is a tendency toward a flatter zero, the inflection at the middle of the top being directed downward. As for the rest, the diagrams are self-explanatory. Here, too, the numerical values of E_1, E_3, and E_9, respectively, are obtained from the formulas

$E_1 = .67\ (y^{30} + y^{90})$

$E_3 = .71y^{45} - .50y^{90}$

$E_5 = .67y^{30} - .71y^{45} + .17y^{90}$.

(γ) *Waves with a fifth and a seventh harmonic.*—A negative seventh harmonic in a wave with a principal negative fifth harmonic tends toward a very flat zero, and a rather smooth top (Fig. 7). If the fifth harmonic is positive while E_7 is negative, a pointed peak will result, while in the middle part the wave becomes more broadened. (Compare Figs. 7 and 8, Table II, with Figs. 3 and 4, Table I.) As to amplitudes of the harmonics, their numerical values are found by application of the formulas already given. Concluding our discussion of Table II, we believe that the development of the formulas, in particular those referring to Figs. 1 to 4, inclusive, will prove of some practical value.

(c) Symmetrical waves with three higher harmonics.—Table III contains, as will be seen, six waves with a principal third harmonic, Figs. 1 to 6, and two waves with a principal fifth harmonic, Figs. 7 and 8. All information pertaining to the characteristic features of these curves, may be obtained from a comparison with the corresponding waves in Table II. Regarding the formulas expressing the amplitudes of the harmonic components in terms of the ordinates, we observe: First, the amplitude E_1 of the fundamental wave is given, irrespective of the equation of the wave, by the formula

$E_1 = .33(y^{30} + y^{90}) - .58y^{60}$

Second, comparing the formulas for E_3 and E_5, pertaining to waves with a principal third harmonic, we note that if the order of the highest harmonic is less than nine (Figs. 1 to 4), the numerical values of E_3 and E_5 are determined by the formulas:

$E_3 = .67y^{30} - .33y^{90}$

$E_5 = .67y^{30} - .71y^{45} + .17y^{90}$

The presence of an appreciable ninth harmonic (Figs. 5 and 6) changes the formulas to:

$E_3 = .58y^{60} - .71y^{45} + .33y^{30} + .17y^{90}$

$E_5 = .33y\ (y^{30} + y^{90}) - .58y^{60}$.

Turning to Figs. 7 and 8, which show two waves with a principal fifth harmonic,

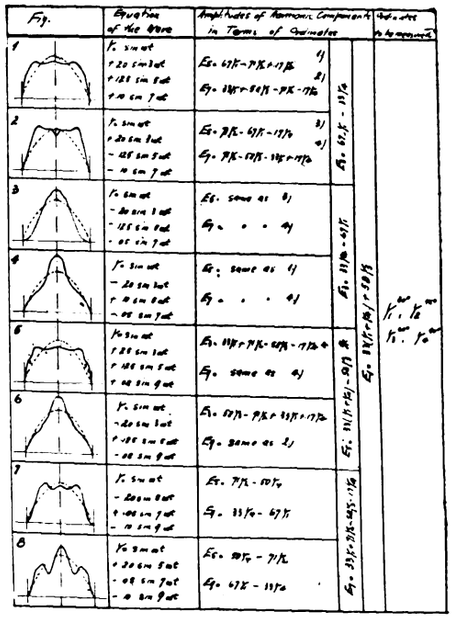

TABLE III.—SYMMETRICAL WAVES WITH THREE HIGHER HARMONICS.

we are interested in first determining the amplitude E_5. The latter is found either by the formula

$E_5 = .71y^{45} - .50y^{90}$

or the formula marked * may be applied. It is not very likely that waves of the type as shown in Figs. 7 and 8 are frequently encountered in practice which contain a ninth harmonic of such magnitude that it must be taken into account in our calculation. In general, then, if the wave recorded does not contain nine distinct singularities, formulas 1 and 2 (Fig. 1) may be applied to determine E_5 and E_7 in waves with a principal fifth harmonic. In the last chapter of this paper the results obtained so far will be reviewed in a condensed form.

B.—UNSYMMETRICAL WAVES.

(a) Table IV. Unsymmetrical waves with one higher harmonic.—This table

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shows eight typical waves familiar to the eye of the electrical engineer. The characteristic features of the waves will be readily understood by comparing them with the curves represented in Table I. From Table IV the location of the maximum ordinate is determined by the phase relation between the complex wave and that of fundamental frequency. In the case of waves consisting of a fundamental and a superimposed third harmonic, a leading E_1 displaces $y_{max.}$ toward the left from the middle ordinate (Figs. 2 and 3), while if E_1 is lagging (Figs. 1 and 4), a maximum instantaneous value is found to the right from y^{90}. If the curve consists of a fundamental and a wave of quintuple

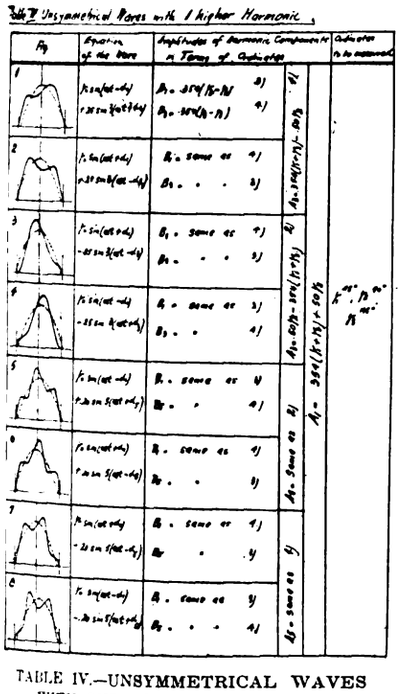

TABLE IV.—UNSYMMETRICAL WAVES WITH ONE HIGHER HARMONIC.

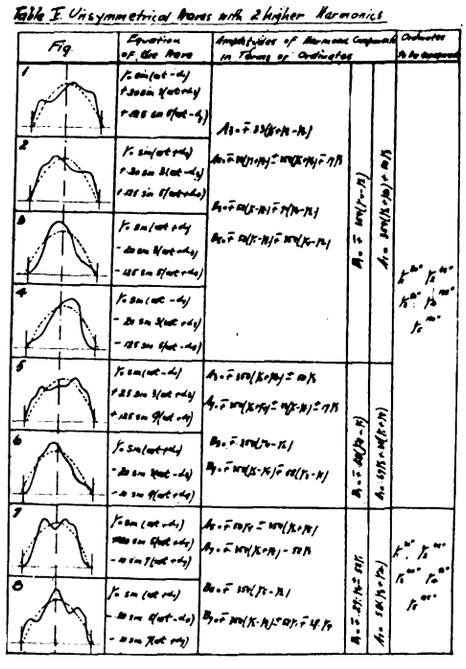

TABLE V.—UNSYMMETRICAL WAVES WITH TWO HIGHER HARMONICS.

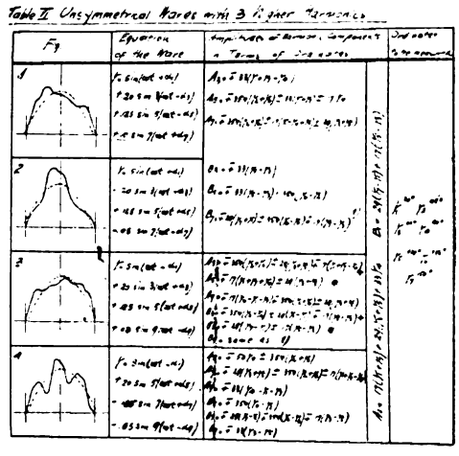

TABLE VI.—UNSYMMETRICAL WAVES WITH THREE HIGHER HARMONICS.

frequency, a displacement of $y_{max.}$ toward the right is the result of a leading E_1, while if E_1 lags $y_{max.}$ is located to the left of y^{90}. As to the formulas, we note that A_1, as well as the numerical values of the components, A_3, A_5, B_3, B_5, are given by the formulas:

$$A_1 = .354\,(y^{45} + y^{135}) + .50y^{90}$$
$$A_3 = A_5 = .354\,(y^{45} + y^{135}) - .50y^{90}$$
$$B_1 = B_3 = B_5 = .354\,(y^{135} - y^{45})$$

(b) **Table V. Unsymmetrical waves with two higher harmonics.**—Of the eight waves shown in this table, the Figs. 1 to 4, and Figs. 7 and 8, are often met with in practice. In particular, waves with a third and a fifth harmonic, as shown in the first half of the table, are quite frequently encountered. The understanding of the typical features of the waves should not present any difficulties. As to the contents of the third column, we may be permitted to add that, if the harmonic component under consideration is of the positive sign, the formulas with the signs in the lower row are the correct ones, otherwise the signs in the top row should be substituted. Considering, however, that we are not concerned at all about the time-phase relation between the individual harmonics, we may ignore the signs in the top row. Indeed, what we are after are the numerical values of the harmonics, which are readily obtained by the application of one and the same formula, no matter whether the component under consideration is of the positive or the negative sign. To illustrate: In the formula

$$B_1 = +.354\,(y^{135} - y^{45})$$

the numerical value obtained in either case is the same, the only difference in the result being, either, a + or a — sign prefixed to the number found. Later on in the present paper we shall return to this subject.

(c) **Table VI. Unsymmetrical waves with three higher harmonics.**—In this last table, four unsymmetrical waves with three higher harmonics each, have been reproduced. Figs. 3 and 4 have been given space in the table with the object in view of illustrating the effect of a ninth harmonic, the amplitude of which is about five to eight per cent of that of the fundamental wave. It has been pointed out above, that in waves with more than two higher harmonics, especially with unsymmetrical waves, as a rule no prominent ninth harmonic is to be expected. Keeping this in mind, the formulas applying to waves with three higher harmonics, are reduced to those accompanying Figs. 1 and 2.

V. SUMMARY AND CONCLUSION.

With the discussion of the contents of Table VI, we have concluded what might be called the theoretical part of the present paper, thus preparing us to take up the more important part, that is, the practical side of the subject. The introduction to this article contains the statement, that, if the distortion of wave shape must be taken into account, it suffices to determine the amplitudes of the fundamental wave, and one, or, at the utmost, two, terms of higher order. In the following, we shall extract from the tables those formulas which enable us to resolve any distorted wave into its harmonic components, with a minimum expenditure of time. We shall also briefly consider a few instances where a distortion of wave shape may be a disturbing factor in heavy current work (power apparatus or power transmission). Let us first establish our formulas for practical work. The practical analysis of distorted waves may be confined to the determination of the amplitudes of (a) the fundamental wave, (b) the principal harmonic, (c) that of the harmonic succeeding the principal one in regard to order. Thus in waves with a principal triple harmonic, besides E_1, we should find E_3 and E_5. In curves with a principal fifth harmonic, we should arrive at the values of E_5 and E_7. Generally speaking, then, if we develop the formulas for E_1, E_3, E_5, E_7, the analysis of any distorted wave is reduced to the measurement of a few ordinates and the application of from two to three extremely simple formulas.

If the oscillogram reveals, besides the principal harmonic, the presence of harmonics of higher order, that is, if the

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wave cannot be treated as a curve with one or two higher harmonics (Tables I, II, IV, V), all waves, whether symmetrical or unsymmetrical, should be considered as consisting of a fundamental wave and three higher harmonics. We now apply the following general formulas:

(A) DETERMINATION OF E_1.

(α) For symmetrical waves:

$$E_1 = .33\,(ya + yd) + .58yc \qquad (I)$$

(β) For unsymmetrical waves[1]

$$A_1 = .17\,(ya + yg) + .29\,(yc + ye) + .33yd$$

$$B_1 = .29\,(yg - ya) + .17\,(ye - yc) \qquad (II)$$

The formulas cited give exact results, if the order of the highest harmonic present does not exceed nine. Should a wave contain all odd harmonics, up to and including E_{13}, the formulas (I) and (II) furnish $E_1 + E_{11} + E_{13}$. Apart from the fact that E_{11} and E_{13} are negligible in magnitude, the chances are that they will completely, or almost completely, cancel one another in the equation. The formulas given for E_1 are thus correct in all cases, no matter what harmonics are present.

(B) DETERMINATION OF E_3.

(α) For symmetrical waves

$$E_3 = .67ya - .33yd \qquad (III)$$

(β) For unsymmetrical waves

$$A_3 = .33\,(ya + yg - yd)$$

$$B_3 = .33\,(ye - yc) \qquad (IV)$$

These formulas give exact results, so long as the complex wave does not contain a ninth harmonic of appreciable magnitude. If the presence of a ninth harmonic is indicated by nine singularities in the complex wave, the formulas marked with + in Table III, Fig. 5, for symmetrical waves, and Table VI, Fig. 3, for unsymmetrical waves should be employed.

(C) DETERMINATION OF E_5.

(α) For symmetrical waves

$$E_5 = .67ya - .71yb + .17yd \qquad (V)$$

(β) For unsymmetrical waves

$$A_5 = .354\,(yb + yf) - .33\,(ya + yg) + .17yd \qquad (VI)$$

Here, too, the formulas are mathematically correct in all instances where there is no appreciable ninth harmonic present. If the oscillogram reveals the presence of a noticeable ninth harmonic, the formulas marked with * in Tables III and IV should be substituted.

(D) DETERMINATION OF E_7.

Although in the majority of instances it will be sufficient to determine E_1, E_3, and E_5, in exceptional cases it might become desirable to arrive at the numerical value of E_7 also. We are enabled to do this with the aid of the formulas:

(α) For symmetrical waves

$$E_7 = .33ya + .58yc - .71yb - .17yd \qquad (VII)$$

(β) For unsymmetrical waves

$$A_7 = .354\,(yb + yf) + .17\,(ya - yd + yg) + .29\,(yc + ye)$$

$$B_7 = .29\,(yg + ya) - .354\,(yf - yb) \qquad (VIII)$$

Having thus established a few simple formulas with the assistance of which we may resolve any complex wave into its principal constituents, we shall briefly consider a few instances where higher harmonics may be a disturbing element in heavy current work. A distortion of wave shape, if considerable, might affect the hysteresis loss in the magnetic circuit of motors or transformers. It has been shown[1] conclusively, that a pressure wave of the peaked type, which gives rise to a flat-topped magnetic wave, entails a larger, while a peaked magnetic wave, which will result if a flat-topped pressure wave is acting in the circuit, causes a smaller hysteresis loss than a true sine wave of the same effective value. All we require in order to predetermine the approximate hysteresis loss, if the wave of impressed voltage deviates considerably from the true sine form, is the ratio $\frac{E_{max.}}{E_{eff.}}$ = electromotive-force factor. This may be accomplished by applying formulas I to IV, or, if the wave is unsymmetrical, formulas II to VI.

A considerable distortion of wave shape might also affect the performance of induction or synchronous motors. Here, if the distortion of the voltage wave acting at the motor terminals is considerable, the rotating field produced will be more or less of a pulsating character. Induction motors might operate uneconomically with probably dead points in the starting torque, or considerable counter torque during running. Synchronous motors or rotaries may hunt, or even fall out of step. Or if the wave shape of induced counter-electromotive-force greatly differs from the pressure wave acting at the terminals of a synchronous motor or rotary there might be excessive heating, thus lowering the efficiency of the system. These results are, of course, to be expected only if the distortion is considerable. Probably without exception the disturbing factors are the third and perhaps the fifth harmonic, which may be most easily determined by availing ourselves of formulas I, III, V, or II, IV, VI.

Besides the two points just mentioned, there is a possibility of disturbing elements in power transmission work if the pressure waves are badly distorted. Resonance or consonance may result, thus giving rise to excessive voltages at certain points of the line. Unless the distortion is noticeable to a marked degree trouble from this source need not be expected.

It is beyond the scope of this paper to discuss in detail the effects of higher harmonics.

In conclusion, the writer wishes to emphasize that the method expounded in the above is not to supersede any other mathematical method. It must be repeated that these formulas are mathematically correct only so long as the order of the highest harmonic does not exceed nine. Considering, however, that harmonics of the order eleven or thirteen or even higher, provided they are present at all in pressure waves obtained from modern alternators (see footnote 2), will never entail any consequences in heavy current work, it is maintained that these formulas are mathematically correct and sufficient for all requirements of engineering practice.

A few words may be added pertaining to the illustrations accompanying this paper. The following considerations prompted the writer to compile the tables I to VI in addition to Figs. A to G, inclusive. Firstly, quite often we are dealing with typical waves, such as are represented in Figs. 1 to 4, Table I; Figs. 1 to 8, Table IV; Figs. 1 to 4, and 7 and 8, Table II and Table V. If the wave to be analyzed happens to be one of these, the simple formulas given with each figure may be made use of. Secondly, to those not so familiar with the phenomenon of distorted waves, the illustrations might be welcome as a means to study the effect of higher harmonics of a certain magnitude, upon the appearance of the wave. Lastly, instead of putting down final formulas without showing how they were obtained, it was considered advisable to go through the entire course of their development.

[1] Here and in the following formulas we use the symbols

$$ya = y^{30};\ yb = y^{45};\ yc = y^{60};\ yd = y^{90}$$
$$ye = y^{120};\ yf = y^{135};\ yg = y^{150}$$

[1] See article by Dr. Benischke, *Elect. Tech. Zeitsch.*, 1906.

An International Cotton Exposition.

An International Cotton and Fiber Exposition will be held in London, in 1912, in conjunction with a conference for the purpose of thoroughly considering the cotton question. It is expected that many novel exhibits of electric drive for cotton-mill machinery will be shown.

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ELECTRICAL EQUIPMENT OF THE BATTLE CREEK SHOPS OF THE GRAND TRUNK RAILROAD.

BY L. C. BROWN.

As a good example of the uses to which electrical apparatus is put in the modern locomotive repair shops, the Battle Creek (Michigan) shops of the Grand Trunk Railroad stand out very prominently. The shops are new, and consist of a group of four buildings, viz., the office building, the forge shop, the power house and the main or locomotive shop. All of the buildings are of modern fireproof brick, concrete and steel construction, and are connected by industrial railway tracks and a ten-ton yard crane running from the receiving track over the "midway" between the office building, store rooms and power house on one side, and the locomotive and forge shops on the other. The power house and locomotive shops are, from the electrical viewpoint, of most interest.

The plant is primarily an alternating-current plant, direct current being used for variable-speed machine tools and cranes only. The 120-ton crane, the plate-bending rolls and others of the larger variable-speed tools are exceptions to this rule, and are driven by phase-wound induction motors. The lighting system is also alternating current, the yards being lighted by twenty-five 6.6-ampere, Western Electric, enclosed, series arc lamps, and the interior shop lighting being taken care of by 140 type "F," 254-volt Cooper-Hewitt lamps. As a whole the plant is a well-balanced combination of alternating and direct-current driven machinery. It is also a splendid example of proper combination of individual and group-driven apparatus.

The power house is actually more nearly a substation than a generating station. Under normal operating conditions the entire power is supplied by the local Edison company from a 4,750-volt, three-phase, sixty-cycle transmission line. This is stepped down by three 250-kilowatt transformers, connected in delta, to 440 volts for local transmission. There are also three seventy-five-kilowatt, 4,750 and 440 to 152-volt transformers for feeding a 200-kilowatt, 250-volt, 900-revolutions-per-minute rotary converter with an engine-driven exciter. As a reserve unit, there is in the power house, a 200-kilowatt, 440-volt, three-phase, sixty-cycle, 150-revolutions-per-minute alternator direct-connected to a Wisconsin Engine Company sixteen by thirty simple Corliss engine. Steam is supplied by a battery of four hand-fired boilers at 300 pounds pressure.

The switchboard is of oiled slate, and consists of fourteen panels for the control of the incoming, alternator, exciter, rotary, arc lamp and several shop circuits. The board is arranged so that the rotary may be supplied by the seventy-five-kilowatt transformers, stepping down from the 4,750-volt line, or by the same transformers, using the 440-volt taps, to step down from the alternator voltage to the 152 volts required by the converter. There is also a synchronizing panel for the alternator when running in parallel with the Edison circuit. The board is fully supplied with oil switches, indicating and recording wattmeters, voltmeters, etc.

The locomotive shop is a structure 825 by 175 feet, running north and south. This is subdivided by a brick fire wall into a machine and erecting shop, and a boiler and tank shop, the latter occupying 200 feet of the south end. This portion is subdivided into four bays, running east and west, or across the building. Each bay is equipped with an overhead traveling crane.

The machine and erecting shop is divided into three bays running with the length of the building. The eastern bay, shown in Fig. 1, is for erection, and contains twenty-five pits; over these travel a ten-ton and a 120-ton crane. The latter is the alternating-current crane referred to previously. All the cranes were furnished by the Morgan Engineering Company. The central bay, shown in Fig. 2, is for the heavy machine work. The western bay, shown in Fig. 3, over which a balcony extends, is devoted to the lighter machine tools. The group-drive motors for these lighter machine tools are shown arranged on the platforms mounted on the roof columns at the east side of the bay. The greater portion of the roof is of the saw-tooth construction, and in every bay thus formed are suspended three Cooper-Hewitt lamps. These are spaced approximately twenty-four feet apart lengthwise, and sixty-five feet apart crosswise of the shop. These lamps, with the exception of those over the erecting pits, are thirty-six feet above the floor level. Those over the pits are fifty feet above the floor. Upon entering this building one is much impressed by the excellent system of lighting, due both to the electric lights and generous window space; and also by the well-kept appearance of the equipment because of the strict system of cleanliness enforced by the management.

From the power house to the locomotive

FIG. 1.—ERECTING PIT BAY OF LOCOMOTIVE SHOP.

FIG. 2.—HEAVY MACHINE-TOOL BAY OF LOCOMOTIVE SHOP.

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shop there are five 250,000-circular mil, three-conductor, rubber and lead-covered cables for the alternating current and two

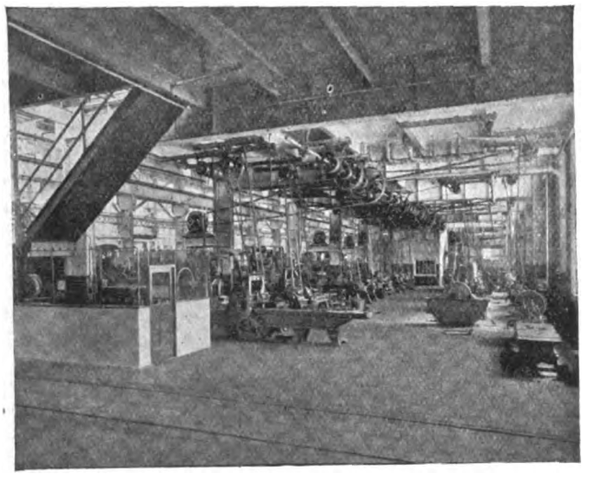

FIG. 3.—LIGHT MACHINE-TOOL BAY, SHOWING MOTORS FOR GROUP DRIVES.

1,000,000 centimetre direct-current cables laid in two three-multiple ducts. These cables enter the locomotive shop

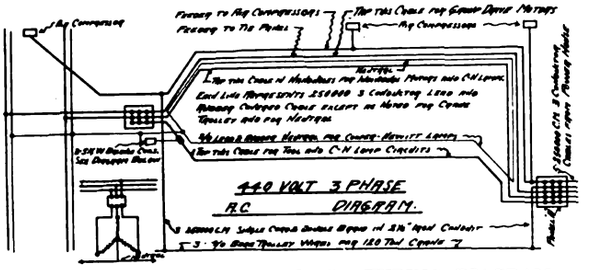

FIG. 4.—440-VOLT, THREE-PHASE WIRING DIAGRAM.

through a manhole and panel "A" in the accompanying diagrams, Figs. 4 and 5. Referring to these diagrams, it will be

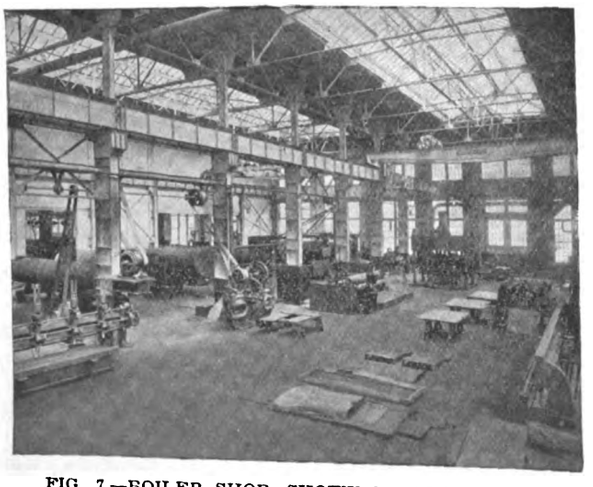

FIG. 7.—BOILER SHOP, SHOWING MOTOR-DRIVEN PLATE ROLLS AND HYDRAULIC PRESS.

seen that there are three lines of conductors. The one along the edge of the balcony on the west side of the building,

closest to the air compressors in the first diagram, is carried in two three-multiple ducts. The central lines are carried in a single three-multiple duct. These two lines of ducts are tapped every twenty-four feet by two foot by two foot hand-holes, with room for six service boxes in each. The leads are carried from these hand-holes to the motors in one-inch conduit. The third line of conductors is composed of the crane trolleys, these being used in parallel with the regular three-

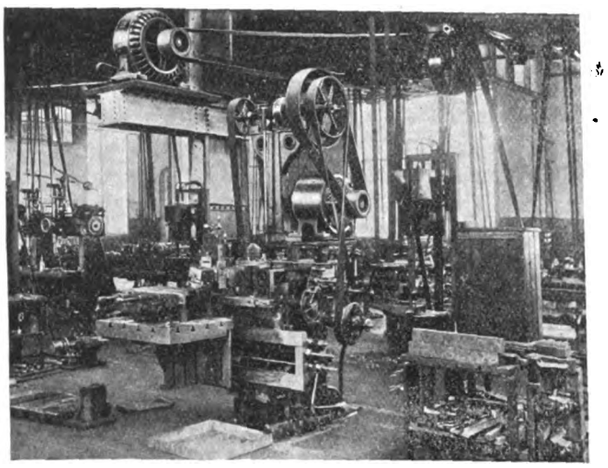

FIG. 6.—SHOWING MOTORS FOR BOTH ALTERNATING-CURRENT AND DIRECT-CURRENT GROUP AND DIRECT DRIVE IN MACHINE SHOP.

The alternating-current cables are tied together at panel "A" into two circuits, see Fig. 4. The lighter one, composed of

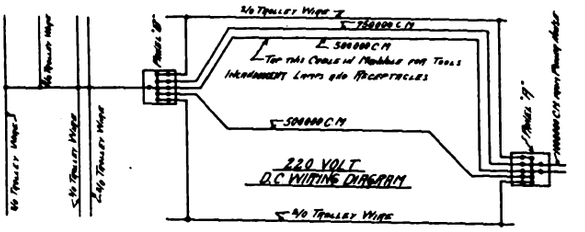

FIG. 5.—220-VOLT, DIRECT-CURRENT WIRING DIAGRAM.

two sets of the incoming cables, is used for the three 100-horsepower air compressors and the 120-ton crane. The sec-

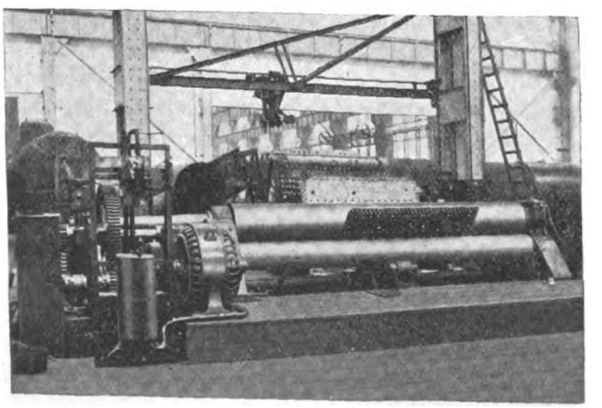

FIG. 8.—MOTOR DIRECT-CONNECTED TO BENDING ROLLS.

ond line, made up of three incoming cables, sends two cables through the west and one through the central ducts. One

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of these cables is for group motors only; the other two are for individual-drive-tool motors and one side of the Cooper-Hewitt lamp circuits. These latter three cables are again tied together at panel "B," and from this point two cables, for all purposes, are run into the boiler and tank shop. At panel "B" the cable for individual motors and lamps is tapped and three five-kilowatt balance coils connected in Y across the three conductors of the cable. From the center of the Y a neutral is brought out and run through the central and west ducts, as shown. Across this neutral and each of the three conductors of the cables "for C-H lamps," the lamp load being divided equally between the three phases, are connected the 254-volt Cooper-Hewitt lamps. This method has proved very satisfactory.

The two direct-current cables from the power house are tied together at panel "A" and again split up into five sets of leads, see Fig. 5. Three of these are pairs of single-conductor cables, and the other two leads are the trolley wires of the two ten-ton cranes over the machine and erecting shop. At panel "B" these are again all tied together and one circuit run to the four bays of the boiler and tank shop. The wiring was done by the construction department of the Western Electric Company.

As before stated, most of the variable-speed machine tools are driven by direct-current motors. These motors are all of the interpole type and give speed variations of from one to two up to one to four, depending upon the requirements of the tool driven. All of the motors are on the 220-volt circuits. The motors are controlled from individual panels, built up of angle irons, on which are mounted a fuse box, an automatic oil switch and a drum-type reversible controller. The controllers were furnished by the Cutler-Hammer Manufacturing Company. The view of the machine shop, Fig. 6, is a splendid illustration of how nicely the alternating and direct-current machinery is made to work together. In the upper portion of the photograph is seen one of the group-drive motors taking care of its load of small machine tools located under the balcony. In the foreground there is an interpole direct-current motor mounted on and belted to a shaper which requires variable-speed drive. To the right of this motor is the panel for its control. The controller itself is mounted close to the floor, where it is readily accessible.

A Ryerson flue rattler for cleaning scale from removed boiler tubes is driven by a twenty-five horsepower motor and the twelve-foot plate-bending rolls by a thirty-five-horsepower motor. Both are phase-wound rotor induction motors giving one to two speed variation. A general view of the boiler room is shown in Fig. 7, with hydraulic press at the end and bending rolls in the center. This bending roll, with its geared motor and controller, is also shown in Fig. 8. Just above the roll will be noted a horizontally swinging stay bolt drill, which is driven by a small direct-current motor mounted on the column to which the drill is hung. The transmission from the motor to the drill is by means of the horizontal shaft and sliding bevel, pinion and gear.

All the larger constant-speed machine tools have individual squirrel-cage, induction-motor drives. For example: Sixty-inch planers with twenty-five horsepower motors, sixty-inch shears with ten-horsepower motors, 400-ton hydraulic press with fifteen-horsepower motors, radial drills with various size motors, etc. One of the sixty-inch planers with its two driving motors, each twenty-five horsepower, mounted on top, is shown in Fig. 9. Fig. 10 is a view of the 400-ton hydraulic press, for forcing drivers on their axles. Mounted on the back of it is a geared motor for driving the triplex pump used to produce the hydraulic pressure. These motors each have individual starting panels. In connection with the individual drive it should be stated that, as many of the machine tools were old and not arranged for motor drive, J. T. McGrath, master mechanic of the shop, has made many ingenious mountings for the motors.

Next in the motor equipment come the smaller machine tools. These are combined together in sixteen groups; ten of twenty, five of thirty and one of forty horsepower demand. These group motors are mounted on wooden platforms built up on two channel irons which are riveted to the roof columns of the building. This arrangement puts the motor well up out of the way of the workingmen and also in good position relative to the line shaft. Under each motor is set up its control panel, similar to the individual motor panels, each having a fuse box, an automatic oil switch and a Western Electric auto-starter. The arrangement of the group drives is clearly shown in Fig. 11, which is a photograph of one of the groups on the balcony of the locomotive shop, shown in Fig. 3. The platform of channel irons is clearly shown. Under the motor is to be seen its panel. The conduit for the power line, up to the panel and from the panel to the motor does away with all the fire hazards and complications of open wiring. This method of wiring has been followed throughout the shop where it has been

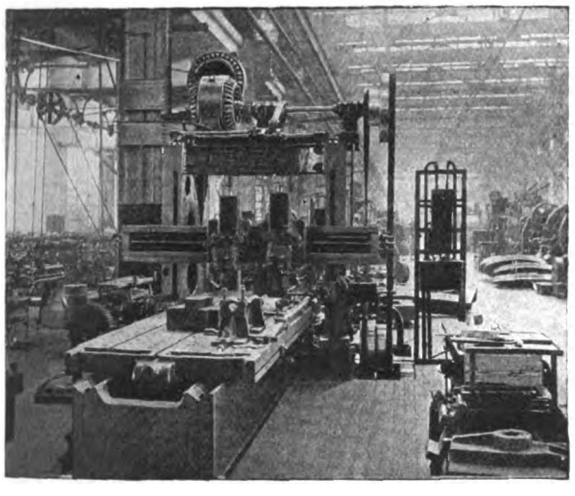

FIG. 9.—SIXTY-INCH PLANER DIRECT-DRIVEN BY TWO TWENTY-FIVE-HORSEPOWER MOTORS.

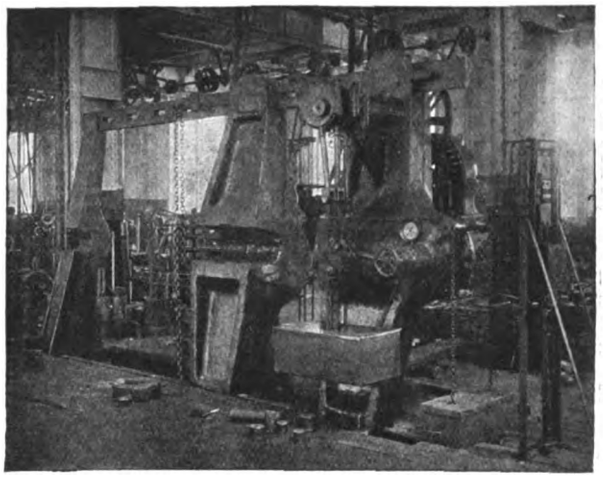

FIG. 10.—MOTOR MOUNTED ON AND CONNECTED TO 400-TON WHEEL PRESS.

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necessary to run the leads above the floor.

Another distinctive use to which motor drive is put is in the hydraulic system. In this system a pressure of 1,500 pounds per square inch is maintained by the accumulator, a tank filled with scrap iron and having approximately twelve-foot vertical play, and two three by eight triplex Goulds pumps driven by two forty-horsepower geared Hawthorn phase-wound induction motors. The pumps are controlled by float switches and Cutler-Hammer automatic controllers. The hydraulic pressure is used to operate two shears, a punch and a bulldozer in the forge shop, and a 500-ton press for shaping boiler plates, etc., in the boiler shop. In addition to this system there are 200-ton and 400-ton individually-driven hydraulic presses. The pump equipment is shown in Fig. 12. It comprises a ten-horsepower motor for the 200-ton and a fifteen-horsepower motor for the 400-ton presses, the pumps being located just behind the motors on either side of the column. The accumulator is the tank to be seen back of and to the left of the roof column. In the illustration it is shown at about the lowest point of its vertical movement. The secondary resistance grids, for the motor control, are mounted on the left of the column, while the controlling panel is behind it.

On the column, in this same picture, will be noted the valves and tap, with hose attached, for compressed air; and just above this a plug, connected to the direct-current circuits, for the attachment of portable lamps and small motor-driven tools. On each column, throughout the locomotive shop, is mounted a similar equipment.

In this shop compressed air is used for many portable tools, for small hoists, for cleaning out cylinders, etc., and for driving some of the very high-speed machine tools, such as packing-ring turning and grinding tools. All the forges and welding machines burn crude oil, which is forced from the storage tanks to the forges, and there atomized by compressed air. Also all the lubricating and other oils are forced from the storage tanks outside into the petty store rooms by aid of compressed air. All of the air used is furnished by three Ingersoll-Rand, two-stage compressors direct-driven by Western Electric induction motors with a total horsepower of 106. Cutler-Hammer automatic control is used. The motor is mounted directly on the shaft of the compressor and is set partially in a pit so as to bring it down into alignment with the shaft.

With the exception of a very few of those on the older tools, the entire motor equipment was furnished by the Western Electric Company. The Arnold Company, of Chicago, engineers and constructors, had entire charge of the design and erection of these shops.

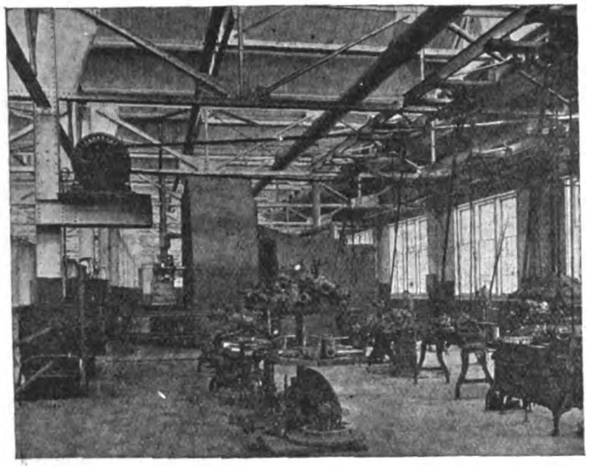

FIG. 11.—GROUP DRIVE ON BALCONY OF LOCOMOTIVE SHOP, SHOWING METHOD OF MOUNTING HAWTHORN INDUCTION MOTORS AND CONTROLLING APPARATUS.

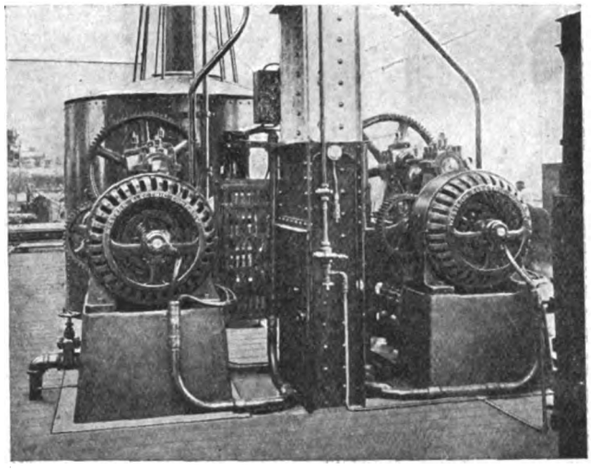

FIG. 12.—HYDRAULIC PUMPS DIRECT-CONNECTED TO TWO HAWTHORN INDUCTION MOTORS.

Secrecy in Wireless Transmission.

News dispatches from Seattle, Wash., announce that absolute secrecy in wireless telegraphy has been discovered and that important experiments have been conducted from the Aberdeen (Wash.) station of the United Wireless Telegraph Company. The men who have worked out the scheme are said to be R. H. Armstrong, Pacific Coast manager; C. H. Thomas, chief operator, and Mr. Dent, the company's operator at Aberdeen. The station was completed a few months ago.

The Function of the Electric Furnace.

A recent article in *Electro-Chemical and Metallurgical Industry* discusses the commercial aspect of the electric furnace. It should not be overlooked that the introduction of the electric steel furnace does not mean the scrapping of existing metallurgical plants. The electric furnace is not a competitor, but a supplement to existing plants. The electric furnace not only does not mean scrapping of old plant, but it seems destined to prevent the scrapping of old plant, as it promises to give a new lease of life to the converter. The general tendency of recent years has been away from converter steel toward open-hearth steel. It is at this point that the electric process steps in, since the combination of the converter with the electric furnace should satisfy all reasonable requirements. This fact and the undeniable tendency of the times to demand better steel for general purposes, are considerations of utmost importance, if it is questioned whether the cost of electric-steel refining is worth the price.

Regenerated Rubber.

A new process for the regeneration of vulcanized rubber has, says the *Scientific American,* been recently patented in Germany, which should prove of considerable value. Fragments of old rubber are mixed with from one-tenth to one-fifth their weight of anilin, and the mixture is heated until it becomes fluid. The special advantage of the process is the comparatively small quantity of solvent required. The regenerated rubber is said to be little inferior to new rubber in elasticity and other properties. It can be vulcanized in the usual way and regenerated again by the new process.

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A Notable Address by Caryl D. Haskins.

At a meeting of the Brooklyn Company Section of the National Electric Light Association, June 23, 1909, Caryl D. Haskins delivered the chief address, an abstract of which follows:

Mr. Haskins dealt in order with his early reminiscences, with the things of today, and with those things which may be accomplished in the future.

His first memory of the electric-lighting industry carried him back a period of twenty-one years when he started out as a Yankee boy from New England to be identified with one of the very early central-station companies of Great Britain in the old "Grosvenor Gallery Station." In that undertaking he was associated with the late Lord Kelvin, Sir William Thompson in those days, and a little of his very earliest work he was very fortunate in carrying out under that eminent master's instruction. A little later the Grosvenor Gallery Station gave birth to the Deptford Station, an undertaking which was considered extremely large and daring in those days. It contemplated a 10,000-horsepower generator, something so far beyond anything which had been considered prior to that time as to be regarded as quite visionary. In addition to this there were to be two 2,500-horsepower units of the same general type. This station was designed to deliver current over the mains into London at 10,000 volts, an epoch-making event for those early days. Mr. Haskins worked on the plans, but returned home before the station was completed.

On the switchboard in the old Grosvenor Gallery Station the 2,500-volt circuits were handled by means of knife-blade switches, and for use in switching there were provided two pieces of two-inch belting about two feet long, each with a wooden handle. The rule was to take the switch firmly in the right hand and the piece of belting firmly in the other, pull out the switch, and "swat" the arm (laughter). There were very few accidents, and all of these, in fact, in his time were on the mechanical end.

He came home to America about 1889 and took up the work here where it was about as crude, if not cruder, in many respects, as it was in England. He told of a notebook of rules which was in daily use by a meter inspector, in which he found the following excruciatingly funny entry: "Rule for testing recording meters on power service. Examine the installation. Estimate the work being done by the motor and horsepowers—multiply by 746. If meter checks within ten per cent, correct (laughter). If not, estimate the horsepower again" (more laughter).

Mr. Haskins went on to tell about the things which have been achieved by the electrical and mechanical engineers in the past twenty years. He digressed a little to tell of one of the most treasured books in his little library, "Evans' Steam Engineer's Guide," written in Philadelphia in the year 1805. This excellent little treatise, which was away ahead of its day, told of Mr. Evans' efforts to introduce high-pressure steam in steam-engine practice, and, what the speaker alluded more particularly to, his heroic endeavors to project a steam road from Philadelphia to Washington, which failed because of his inability to raise the necessary $8,000 to put the scheme through! That was in 1805.

Mr. Haskins gave some remarkable statistics of the electric-light and power industry in the United States and of its astonishing increase within the last few years. He deservedly gave most of the credit of this huge enterprise to the electric-light men. He went on to speak of the other electrical wonders of the present day, of the X-ray, the wireless telegraph, the wireless telephone, and of the application of electricity to the promotion of vegetable growth. He told of a farm in Idaho of thousands of acres devoted to wheat and alfalfa where every field has its electrical service and where traction vehicles, loaded with alfalfa or wheat, run on temporarily strung trolley wires to the barns. The owner of that farm claims a saving of fifty per cent in operating expense over the old horse and man system. He spoke also of a dairy farm where the handling of the product, the churning of the butter, and especially the milking, are all done electricially. The farmer gets probably two cents a quart more for his milk because he is able to certify that the milk never gets to the air. Even the gas-makers have to use electricity, and as one gas man said to the speaker recently, "Of course, we don't advertise it, but electricity is really the only safe thing to light a gasworks with" (laughter).

Mr. Haskins did not arrogate all the credit for this electrical enterprise to the electric-light men; a great deal of credit must be given to the man behind the gun —the banker. "Bear in mind," he said, "that in 1805 Evans could not raise $8,000 to build a steam traction system from Philadelphia to Washington. In this short twenty years the bankers have had the faith and the confidence to put over a billion of dollars behind us and keep it there! It is the banker, after all, who has contributed quite as much as we to these great works."

Mr. Haskins doubted whether the engineering progress of today, however, is materially more rapid than it was 2,000 years ago; we only saw it better. This was brought home to him in a marvelous way some four years ago during a little exploring trip to Mexico, when he saw a great stone structure covering three acres, a Toltec Temple. No English-speaking man probably had ever seen it before. It stands on the summit of a steep hill, in a country where building rock is scarce. It is a solid mass of masonry and probably not a single stone in it weighed less than two tons! It took engineers to do that job, and those engineers did their work so long ago that not only are they forgotten, but their race is forgotten. Doubtless they said, "We are the first real engineers. Engineering progress has been initiated in our day. Look at that pile of rocks." That is just about what we are saying of electric light.

Mr. Haskins proceeded to look forward into the future. The work ahead, he said, is so gigantic as compared with what has been done that it dwarfs the past and the present. Probably the first great work in the electrical industry will be the banishing of the small central stations. These must be all replaced by a series of great systems, which will spread out and overlap and some day cover the entire country with a few great networks. Good engineering and good banking both dictate this, and in this way we shall give service not to one-half of the population as at present, but at least to eighty per cent of all the people. Another and vastly bigger problem is that of our rapidly diminishing coal deposits. In spite of the vast deposits which are as yet unworked all our coal will eventually be used up. Where then shall we turn? Tide power!—wave power!—plentiful but very expensive to develop. There is the power of the sun! In this we have a great resource of which we will probably take advantage. The power of the winds is one of our greatest potential assets, and Mr. Haskins told in a most interesting way of the extraordinary development of windmills in Holland, where they have a windmill commission which is quite as active as our own public service commission. We have already done some considerable work in this line ourselves, as for instance in Kansas, where the traveler may see in the daytime a constant procession of wind-

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mills marching across the horizon. Some day, perhaps, the wind will help us out when our coal becomes exhausted.

A great deal can be done, however, by us wasteful Americans, toward retrenchment and economy. Houses must be made coldproof. Every house should be a sort of a thermos bottle, so that the heat we put into the house must not be allowed to radiate from it. When this is done—and it is not at all incompatible with good ventilation—the number of heat units which must be put into the house will be greatly reduced and the efficient burning of coals under our boilers will be a practical and economic possibility. Possibly, though, the emergency will not be met in this way. We Americans are a prosperous and a wasteful race. The advertising matter that an ordinary business man daily throws away would yield enough heat units to heat the house, and besides furnish most of the lighting; and if this were not enough the garbage which we throw away would yield just enough alcohol to patch out!

Mr. Haskins continued in a prophetic and anticipatory vein. Perhaps, he said, some great scientist will learn how we can recover unlimited radium from unlimited pitch-blend, and how to use it without being killed in the endeavor. Perhaps, again, we shall face the disappearance of electricity. He told of a very prominent American scientist who, while he hated to think so, would not be surprised if 2,000 years from now we were using a fainter illuminant than we are at present. The efficiency of the firefly and of the numerous types of luminous sea animalculæ is roughly about fourteen times better than the efficiency of the best electric light when measured in heat units, and that he believed if a sufficient amount of money were put behind biologists in the next twenty years, we might very well so improve and develop sea animalculæ that every street lamp would be, in fact, an aquarium.

In conclusion Mr. Haskins touched briefly on the question of war, which, he said, is one great question to be solved by electrical men. War must be made such a dangerous pastime that no sane man dare undertake it. And in that great day, that millennium of tomorrow or next week, when any one of us can from a distance of about thirty miles push a button that will annihilate armies and melt down battleships at sea—and that is not so visionary as it sounds—then there are going to be no more battleships and armies, and we shall have no war.

The Association of Railway Telegraph Superintendents.

About seventy-five active members of the Association of Railway Telegraph Superintendents attended the twenty-eighth annual convention of this association at the Hotel Pontchartrain, Detroit, Mich., on June 23, 24, and 25 last, President W. J. Camp presiding. The delegates were welcomed by the mayor of Detroit and the vice-president of the Detroit Board of Commerce.

After some general business matters had been disposed of, W. K. Morley, of Grand Rapids, first vice-president and organizer of the association, presented an interesting address in which he told of the history of the association and the circumstances that led to its organization.

The committee, consisting of G. A. Cellar, chairman, G. H. Groce and C. Seldon, presented its report on "High-Tension Wire Crossings," in which 700 volts was recommended as a dividing line between low-tension and high-tension work, and specifications were given for overhead and for underground crossings of wires for various voltages.

A paper by H. P. Folsom on "The Preservation of Poles" was read. In the discussion J. McMillan, of Calgary, Alberta, superintendent of telegraph construction of the Canadian Pacific Railway in that district, mentioned the interesting fact that in his section of the country the poles began to decay, not at the ground line, but at a depth of from four to five feet below the surface.

Prof. J. C. Kelsey, in the course of an interesting paper on "Telephone Construction," presented specifications and data for standard work. Other papers were: "Efficiency of Office Organization," by J. B. Sheldon, of Omaha, Neb.; "Wire Testing and Care of Wires," by V. T. Kissinger, of Lincoln, Neb.; "Difference Between a Trouble-Shooter and a Division Lineman," by H. D. Leed, of St. Louis, Mo.; "Dry Batteries," by F. H. Loveridge, of Chicago, Ill.

The following officers were elected: President, John L. Davis, Chicago, Ill., of the Chicago & Eastern Illinois Railroad; vice-presidents, I. T. Dyer, Los Angeles, Cal., of the San Pedro, Los Angeles & Salt Lake Railroad, and George A. Cellar, Pittsburg, Pa., of the Pennsylvania Railroad (lines west of Pittsburg); secretary and treasurer, P. W. Drew, Chicago, of the Minnesota, St. Paul & Sault Ste. Marie Railroad (Chicago Division).

The next annual convention will be held at Los Angeles, Cal., in May, 1910.

The New York Street Railway Association.

The Street Railway Association of the State of New York held its twenty-seventh annual convention at the Hotel Champlain, Bluff Point, N. Y., June 29-30, last, inasmuch as the Fort William Henry Hotel at Lake George, where it was originally arranged to hold the meeting, was completely gutted by fire a few days previously.

W. L. Pattison, general counsel of the Plattsburg Traction Company, welcomed the delegates to Plattsburg, and stated that transportation on the lines of his company during the convention would be afforded those who wore the association badge.

After the secretary had made some general announcements, President Fassett then read his annual address.

Reports of the executive committee and of the treasurer followed, after which Arthur L. Linn, Jr., read a paper on "Electric-Railway Accounting," which was discussed at some considerable length.

In the afternoon, N. W. Bolen, superintendent of transportation, Public Service Railway of New Jersey, read a paper entitled "Schooling of Trainmen." This was also discussed at length.

President Fassett then introduced Ralph R. Rumery, expert appraiser of the State Board of Tax Commissioners, who read a paper entitled "The Work of the State Tax Commission." Several reports of committees followed, which concluded the first day's session.

The Wednesday session was opened with a paper by J. L. Davis on "Latest Improvements in Electric-Railway Apparatus," at the conclusion of which he read a memoir on automobile block systems.

A rising vote of thanks was then extended to President Fassett for his efficient conduct of the affairs of the association and the promptness with which he acted in changing the location of the convention after the fire already referred to.

The following officers were elected: President, E. F. Peck, general manager of the Schenectady Railway Company (see personal column); first vice-president, C. Gordon Reel, general manager of the Kingston Consolidated Railway Company; second vice-president, E. J. Cook, general manager of the Rochester Railway Company; treasurer, H. M. Beardsley, secretary and treasurer of the Elmira Water, Light and Railroad Company.

The next annual convention will be held at Rochester, N. Y.

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Joint Convention of the Wisconsin Electric and Interurban Railway Association and the Northwestern Electrical Association.

A joint convention of the Wisconsin Electric and Interurban Railway Association and the Northwestern Electrical Association, was held at the Grand View Hotel, Chain o' Lakes, Waupaca, Wis., on June 28 and 29 last, at which sixteen electric-railway and lighting companies of the state were represented.

The feature of the convention was the amalgamation of the two associations under the name and title of the Wisconsin Electrical Association. Individual membership will cost $5 per year, and is given to all former individual members of the two associations. The Class A members, who alone possess voting powers, consist of companies which will be assessed one-tenth of one per cent of their gross receipts. The present debts of the Northwestern association, amounting to about $200, will be wiped out by various company members of the Wisconsin association, and it is intended to start with a clean sheet, dues being payable January 1, 1910, and thereafter yearly. No delinquent dues will be collected owing to the incompleteness of the records.

The following officers were selected by ballot to administer to the affairs of the new association to serve until the annual meeting in January, 1910: President, Ernest Gonzenbach, of Sheboygan, formerly president of the Northwestern association; first vice-president, Clement C. Smith, of Milwaukee, formerly president of the Wisconsin association; second vice-president, Irving P. Lord, of Waupaca; third vice-president, George B. Wheeler, of Eau Claire; secretary and treasurer, John S. Allen, of Lake Geneva, formerly secretary of the Northwestern association.

REPORT ON LEGISLATION.

The report on recent legislation in Wisconsin affecting public-utility companies was made by Attorney E. W. Fairchild, of Milwaukee, at the Monday morning session, June 28. Very little of such legislation, Mr. Fairchild said, had been passed during the last session, for the reason that the public-utility law providing for the commission has solved many of the problems in this connection.

The following matters concerning electric-railway companies were covered last session by amendments to the Wisconsin public-utility law: (1) The time before which companies may voluntarily give up their franchises and accept an indeterminate franchise under the power of the commission was extended from July 1, 1908, to January 1, 1911, the question as to whether all companies shall be forced to take this course to be reopened on this latter date. (2) A popular vote must be taken in a city or town before any public utility can be purchased by the municipality. (3) The law requiring the temperature in cars to be kept at seventy degrees under all conditions was altered to read "sixty to seventy degrees whenever reasonably profitable." (4) Waiting rooms are to be provided on interurban railways in towns of 150 population or over. (5) The burden of proof of carelessness of a person injured at a crossing is upon the railroad company. (6) The value limitation has been removed in the case of a person caught stealing electricity, thereby making prosecution much easier.

COAL PURCHASE ON A HEAT-UNIT RATING.

R. T. Gunn, general manager of the Eastern Wisconsin Railway and Light Company, Fond du Lac, presented his paper entitled "Purchase of Coal on Straight Contract or British Thermal Unit Basis."

Mr. Gunn said his company had demonstrated, after a year of investigation, that this was the only proper method of buying coal, and the better-class coal companies are only too wiling to sell coal on a guaranteed number of heat units per pound, and make settlements one way or the other, according as the coal exceeded the guarantee, or fell below it, on analyses at the end of each month. A small sample of each day's delivery should be taken as received, and carefully kept in airtight jars. These samples should be mixed and at the end of the month analyzed and tested. In showing how local conditions determined the question of economy in buying a cheap or a high grade of coal, Mr. Gunn instanced a case of a power plant equipped with two water-tube boilers, one boiler being sufficient to carry the load eighteen hours out of the twenty-four, the other being added for the peak load. In this case, where it would be impossible to clean the ash from the boiler during the eighteen hours' run with cheap coal, an additional boiler was saved by the use of a high-grade coal and a saving of $10,000 per annum was thereby effected. A great saving can always be obtained by forcing boilers to their maximum capacity, and laxity or inefficiency on the part of the firemen is a cause of great expense for the extra coal needlessly consumed.

Ernest Gonzenbach pointed out that a uniform steam pressure did not necessarily mean careful firing, and supported his contention by a case occurring in his experience, where, by a reform in firing methods, in a plant which presented a splendid steam chart, the monthly coal bill was cut down from $5,000 to $2,200

J. R. Cravath, of Chicago, told of the use of the Venturi meter in the Rockford Electric Company's plant at Rockford, Ill., which gave a continuous record of the rate of boiler feed so that the man in charge of the fireroom would know beyond a doubt when the rate of water consumption is in excess of the rated load of the boilers in service, whereupon it was his duty to start an additional boiler, thereby tending to keep all the boilers in use up to their maximum capacity.

W. D. Voth, of Sheboygan, and W. E. Haseltine, of Ripon, gave their experiences on the success of a premium plan by which the power-house force is given a certain percentage of the saving effected in the operation of the plant from a fixed figure representing cost per kilowatt-hour or horsepower-hour.

R. M. Howard, of the Green Bay Traction Company, read a paper on "Summer Parks," which gave rise to an interesting discussion.

TUESDAY SESSION.

Prof. C. M. Jansky opened the Tuesday morning session with a paper and talk on the work that the University of Wisconsin is doing to educate scientifically in a popular manner those engaged in the various industries. Courses are carried on by correspondence and by occasional visits of instructors to places where classes may be formed.

UNDESIRABLE BUSINESS.

Ernest Gonzenbach gave the concluding address with a discussion on the undesirability of certain kinds of business. The electric-light man, he said, had by this time come to recognize that purely peak-load business is not desirable, involving as it does a large investment in apparatus with its consequent large interest and depreciation charges, and in return obtaining only a small yearly revenue. Railway men had apparently done all they could to pile business into peaks, by means of baseball and amusement parks, which, although they provided large crowds, involved the handling of these crowds in a comparatively short space of time, which was not profitable. He had discovered, however, that suburban business provided a considerable percentage of his revenue and consequently he was preparing to boost the idea of getting people to live in the country.

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COMPILATION OF LOAD FACTORS.[1]

BY E. W. LLOYD.

With the rapid adoption of differential rates by central-station companies, based on consumers' load factors, it is absolutely necessary that the commercial man have some practical data on the load factor of different industries before he can arrive not only at the rate per kilowatt-hour which the consumer will earn, but at the quantity of electricity he will consume.

It is not many years since most every manufacturer thought the actual connected motor or lamp load was the real maximum load on his plant, but we know today that this is not true in a great majority of cases, and that the true maximum rarely exceeds seventy-five per cent of the connected load.

In arriving at the load factor of a given plant, already electrically driven, it becomes necessary to install maximum measuring instruments as well as wattmeters. On direct-current circuits, correct reading instruments are available, the instrument being of a type both efficient and cheap; but for measuring the maximum on alternating-current circuits we have not been so fortunate. So far as the author knows, there is not available today a cheap and efficient instrument for this service. There are some expensive printing meters on the market, but no central-station company could afford this expensive instrument for any but large users, and for this reason very few companies have been able to secure data on load factors that are at all reliable.

For the man in the commercial department it is necessary to have some information of this kind, and it is fortunate that some of the larger companies have been collecting information on load factors for some years. This information the author has endeavored to collect on the ordinary classes of business we are familiar with, for the use of commercial men selling electrical energy for power and lighting purposes. There are quite a number of industries outside the list mentioned in this paper, but unfortunately no reliable information is available at this time.

As before stated, a maximum measuring instrument to be used on alternating-current circuits not being available, the Commonwealth Edison Company, of Chicago, serving a territory with alternating-current circuits in which there were thousands of manufacturers, found it necessary to establish a schedule of maximum percentages, based on the average maximum of several thousand customers who had been using direct current for years. The following table is one that has been adopted for alternating-current power business exclusively:

	Per Cent of Connected Motor Load.
Installations under 10 horsepower, where only one motor is used	85
Installations under 10 horsepower, where more than one motor is used	75
Installations from 10 horsepower to 50 horsepower, both inclusive, irrespective of the number of motors	65
Installations over 50 horsepower, irrespective of the number of motors used.	55

The above table does not apply to customers having lighting service as well as power. It is probably at least ten per cent low should lighting be connected with the power.

While the above table may seem low to some for installations above fifty horsepower, we find from actual experience that it is often too high and that we are obliged to install instruments to register the proper maximum. Of course, where a large proportion of the installation consists of blowers or ice machines, or other machinery in this class, the percentages may be low, but generally speaking they are not. However, in order to protect the power company from demands greatly exceeding these percentages, a clause can be incorporated in contracts providing for a test of the maximum at any time.

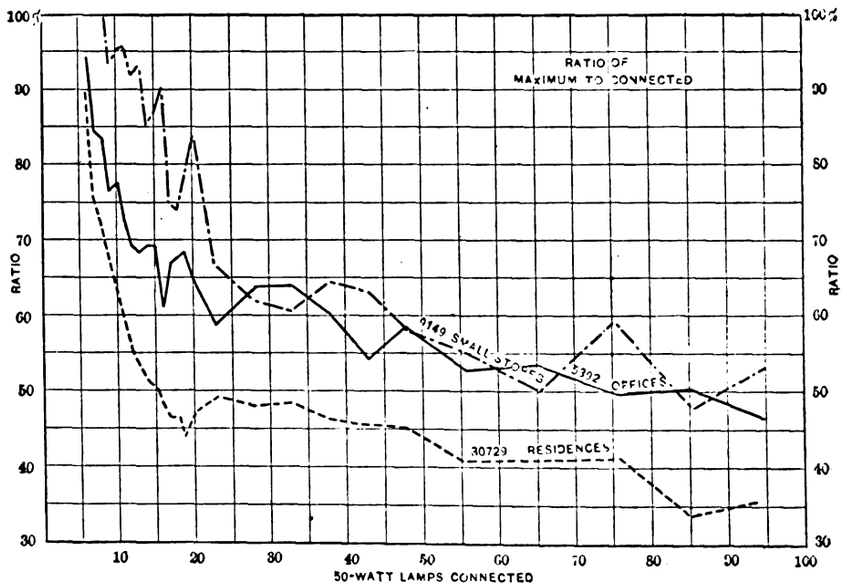
It may be interesting to know that we have found that out of 3,900 consumers of power, having installations aggregating 35,000 horsepower, the average maximum was 53.5 per cent of the connected motor load and that this was subdivided as follows:

	Customers.	Maximum Per Cent of Connected Motor Load.
Installations of 1 to 5 horsepower	2,900	75.4
Installations of 6 to 10 horsepower	456	64.5
Installations of 11 to 20 horsepower	237	64.7
Installations over 20 horsepower	307	42.9

A further subdivision of part of the above customers may be of value to some:

Total Installation In H. P.	Number of Customers.	Total H. P. Connected.	Average Maximum H. P.	Ratio of Max. to Conn. H. P.
1 Motor.				
1 to 5	1,177	2,165	1,862	86.1
6 to 10	124	1,036	676	65.3
11 to 20	32	492	303	61.6
Above 20	17	686	366	53.2
Total	1,350	4,379	3,207	73.3
2 Motors.				
1 to 5	177	412	285	69.1
6 to 10	51	387	261	67.4
11 to 20	30	438	288	65.9
Above 20	6	203	74	36.5
Total	264	1,440	908	63.0
3 to 5 Motors.				
1 to 5	150	381	314	82.5
6 to 10	42	290	238	82.1
11 to 20	33	475	329	69.3
Above 20	14	1,245	657	52.7
Total	239	2,391	1,538	64.3
6 to 10 Motors.				
1 to 5	42	121	80	66.0
6 to 10	21	157	98	62.4
11 to 20	10	155	98	63.1
Above 20	19	931	417	44.7
Total	92	1,364	693	50.8

An analysis of the load factors of over 50,000 consumers of electric light in many different classes should be interesting. The figures are taken from actual reading of watt and maximum meters, and are given on page 111.



CURVES SHOWING RELATION OF MAXIMUM TO CONNECTED LOAD.

The percentages in this table are not based on momentary peaks, but on peaks as registered by Wright demand meters.

For commercial reasons it would not be advisable for a selling company having steam-generating apparatus to establish any system of rates based on momentary peaks. Any ordinary steam plant is capa-

[1] A paper read before the annual convention of the National Electric Light Association, at Atlantic City, N. J., on June 3, 1909.

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ble of taking care of ordinary overloads for at least fifteen minutes without undue strain on the apparatus. Therefore, it is unwise to use momentary peaks as the basis of determining a system of rates.

Considering an isolated plant, generating power for a given industry, this plant must be of such capacity that it can take care of the highest demand to be made on it. This high maximum condition may be during only one week of the year. Fixed charges in such a case are, therefore, greater in proportion to the units output than where the maximum is about the same from day to day. In such a plant the operating charges are also higher per unit generated, because the load factor is generally poor, the generating apparatus being less efficient under these conditions. It is scarcely necessary to point out that fixed charges continue as long as the plant does, and that no matter what the load factor of a plant may be these fixed charges are always the same. Generally speaking, they consist of interest, depreciation, taxes, insurance and rental value of space. After fixed charges are taken care of it becomes necessary to pay for the operation of the plant. These operating charges are labor, fuel, water, supplies, repairs, removal of ashes, lamps, and the like.

In making up a system of rates based on the load factors of possible customers, it therefore seems reasonable to have what are known as primary and secondary charges; the primary charge to consist of a price per kilowatt-year of demand, and a secondary charge per kilowatt-hour. This method of charging has already been adopted by some of the larger central-station companies and is steadily growing in favor. In the use of such systems of charging it is necessary to have information as to the maximum demand as well as the kilowatt-hours' consumption of a possible consumer.

We have succeeded in collecting a large amount of information relative to load factors of different kinds of manufacturing business. These load factors were taken on plants that operated normally during a fifty-four-hour week. Such businesses as department stores, refrigerating plants and hotels continue longer hours, and the load factors are based on their actual running conditions. The load factors for any business that normally runs only an approximate fifty-four-hour week would not apply should any industry in this class run two shifts of men or run a night shift occasionally. Any increase in the hours' use of the current in this way would tend to better their load factor.

The figures include both power and light, and are on the larger class of customers, and in the majority of cases mentioned the power predominates to a large extent, the light having a comparatively small effect on the load factor. These figures are based on the yearly load factor. Some months the load factors are better than in others, but the figures given are an average.

LOAD FACTORS OF SMALL AND MEDIUM LIGHTING CUSTOMERS.

Kind of Business.	Number of Customers.	50-Watt Equivalent.	Monthly Kilowatt Hours.	Total Kilowatt Maximum.	Load Factor.	Ratio of Maximum to Connected Load.
Amusements	245	32,592	100,265	904	15.2	56.3
Automobile garages	204	7,596	20,524	228	12.4	60.5
Barks	100	9,102	35,334	304	16.1	66.8
Barns	542	7,068	17,872	242	10.2	68.5
Baths	17	380	1,086	12	11.8	66.9
Breweries	36	3,314	7,085	74	13.2	44.8
Building owners	147	8,324	39,120	209	26.5	50.3
Buildings (public)	18	3,152	6,750	53	17.6	33.6
Churches	15	3,301	8,274	92	12.4	56.0
Clubs	65	12,071	16,988	244	9.6	28.8
Commission houses	238	4,996	20,164	172	16.2	68.9
Contractors	53	3,327	16,489	99	22.9	59.8
Express companies (small)	89	4,072	14,250	90	21.9	44.3
Flats	24,177	328,939	443,530	8,927	6.9	54.1
Florists	129	3,295	12,205	1,184	10.1	71.8
Foundries and rolling mills	104	6,679	10,939	184	8.2	55.1
Halls, apartment buildings	2,473	9,915	62,863	616	14.2	90.0
Halls (public)	193	14,136	24,317	486	6.9	68.6
Hay, grain, feed and coal	112	2,081	3,888	81	6.7	77.6
Hospitals	34	3,290	6,248	69	12.5	42.3
Hotels	103	9,072	22,443	127	24.4	28.0
Houses	5,151	189,616	229,753	4,076	7.8	43.0
Laundries	42	651	1,647	22	10.3	67.5
Loan firms	35	1,033	3,113	32	13.3	62.8
Manufacturers	1,061	52,129	94,842	1,397	9.5	53.5
Meat markets	325	5,089	12,346	187	9.1	73.5
Milk depots	52	1,192	4,050	37	14.9	63.0
Monuments	4	323	1,215	100	16.4	63.5
Offices (business)	3,704	77,230	163,657	2,482	9.2	64.2
Offices (professional)	1,563	25,529	39,736	817	6.7	64.0
Photographers	159	4,393	6,483	170	5.3	77.6
Pool and billiards	97	2,711	11,007	87	17.4	64.5
Printers and engravers	381	14,680	45,872	433	14.7	59.0
Publishers	94	5,110	9,104	155	8.1	60.8
Railroad business	105	8,510	41,504	320	17.9	75.0
Restaurants	550	20,846	92,308	547	23.4	52.3
Saloons	2,060	50,002	234,711	157	20.8	62.6
Schools	78	5,515	7,639	148	7.2	52.9
Second-hand dealers	47	1,646	2,866	36	11.0	44.0
Shops (bakery)	251	3,746	12,684	133	13.1	71.3
Shops (barber)	443	4,883	14,214	172	11.5	70.4
Shops (bicycle and electrical)	62	761	1,309	23	7.7	61.9
Stores (bird)	2	89	477	3	19.0	78.8
Shops (blacksmith)	109	1,840	2,190	611	5.0	66.5
Shops (carpenter)	58	970	1,135	27	5.8	55.5
Shops (harness)	5	54	98	2	7.5	67.8
Shops (machine)	125	5,715	6,654	106	8.7	37.2
Shops (paint)	107	4,222	8,739	105	12.1	49.8
Shops (plumbing)	39	734	1,090	16	8.9	46.0
Shops (tailor)	552	16,796	30,462	498	8.4	59.3
Small hotels and rooming houses	66	2,022	12,817	684	26.0	67.4
Social settlements	21	3,037	6,140	79	10.7	52.5
Stables (livery)	103	2,612	10,862	68	22.2	52.3
Stores (art)	91	2,203	5,497	75	10.2	68.5
Stores (book and stationery)	80	2,615	7,052	87	11.7	66.4
Stores (cigar)	226	5,562	21,924	180	16.8	64.7
Stores (cleaners and dyers)	133	3,373	5,409	94	8.0	56.3
Stores (clothing)	204	14,293	22,096	378	6.6	52.9
Stores (coffee)	127	2,115	5,169	78	9.1	74.5
Stores (confectionery)	322	6,422	17,193	197	12.5	61.5
Stores (crockery)	19	1,170	1,590	30	7.2	52.4
Stores (drug)	833	17,018	92,809	671	19.3	78.8
Stores (dry goods)	367	11,835	26,774	453	8.2	76.5
Stores (furniture)	225	18,741	28,105	654	6.0	69.7
Stores (gentlemen's furnishing)	157	5,270	15,322	133	11.6	69.3
Stores (grocery)	434	6,576	17,985	240	10.3	73.0
Stores (hardware)	159	7,925	12,182	158	10.6	40.0
Stores (hat)	41	1,662	5,371	54	14.5	65.0
Stores (house furnishing)	8	279	409	7	7.8	52.0
Stores (jewelry)	316	8,813	30,424	283	15.0	64.1
Stores (millinery and dressmaking)	280	9,982	31,793	348	12.7	69.7
Stores (music)	41	1,677	3,664	40	12.4	48.8
Stores (piano)	33	4,260	10,241	108	13.0	51.1
Stores (shoe)	307	6,499	15,172	216	9.8	66.5
Stores (small)	49	3,069	6,293	127	6.8	83.1
Supply houses	372	18,815	49,668	556	12.4	58.8
Telephone companies	15	363	2,592	12	29.0	67.0
Theatres	18	8,264	24,994	200	17.2	49.0
Tunnel companies	6	584	2,284	12	27.0	40.5
Undertakers	103	2,381	4,618	69	9.3	57.9
Warehouses	109	6,686	12,020	138	12.0	41.4
Wholesale houses	201	17,113	55,740	401	19.4	46.6
Wines and liquors	45	1,919	7,214	63	16.0	65.5
Wrecking companies	2	139	917	5	21.2	76.8

Kind of Business.	Load Factor, 8,760-Hour Year, Per Cent.	Ratio of Actual Max. to Connected Load, Per Cent.	Hours' Use per Day of Max. 365-Day Year.
Butter and creamery	20	60	4.8
Breweries	45	60	10.8
Brass and iron beds	20	60	4.8
Biscuit manufacturers	35	55	8.4
Boots and shoes	25	65	6.0
Brass manufacturing	28	50	6.7
Boiler shops	18	45	4.3
Can manufacturers	30	70	7.2
Candy manufacturers	18	45	4.3
Clothing manufacturing	15	55	3.6
Clubs (large)	40	85	9.6
Department stores (large)	30	55	7.2
Electrical Manufacturing	25	55	5.5
Express companies	40	60	9.6
Electroplating	25	75	6.0
Engraving and printing	19	60	4.6
Fertilizer manufacturing	75	40	18.0
Furniture manufacturing	28	65	6.7
Foundries	15	75	3.6
Forge shops	30	49	7.2
Grain elevators	10	75	2.4
Glove manufacturing	25	55	6.0
Grocers (wholesale)	20	55	4.8
Hotels (small)	35	50	8.4
Hotels (large)	50	40	12.0
Ice-cream manufacturing (large)	45	75	10.8
Jewelry manufacturing	18	50	4.3
Large restaurants	50	60	12.0
Laundries	25	70	6.0
Machine shops	26	55	6.2

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Newspapers	20	75	4.8
Packing houses	30	75	7.2
Paint, lead and ink manufacturers	23	45	5.5
Paper-box manufacturers	25	50	6.0
Plumbing and pipe fitting	26	55	6.2
Pneumatic tube	50	90	12.0
Post offices	50	30	12.0
Power buildings	27	40	6.5
Refrigeration	50	90	12.0
Railroad depots	50	50	12.0
Saw manufacturers	30	55	4.8
Seed cleaners	25	55	6.0
Screw manufacturers	30	75	7.2
Sheet-metal manufacturers	18	70	4.3
Small restaurants	30	70	7.2
Soap manufacturers	25	60	6.0
Spice mills	20	55	4.8
Stone cutters	17	55	4.2
Structural steel	22	40	5.3
Textile mills	20	65	4.8
Theatres	16	60	3.8
Twine mills	30	60	7.2
Woolen mills	27	80	6.5
Woodworking	28	65	6.7

The load factors in this table may vary somewhat in different parts of the country, due to the difference in the time of sunset. This, however, would not seriously affect the load factor of the power end of the business, but would apply largely to the lighting. However, adjustment of this difference can be made without much trouble by a little study of the local conditions.

Tests taken by curve-drawing instruments or by the reading of the wattmeters in a given plant during five-minute intervals all day indicate a wide variation in the load conditions on almost all manufacturing plants. Maximum load conditions in factories in Chicago seem to be between 4:30 and 5 p. m., regardless of the time of the year. The maximum load conditions in these industrial plants do not, therefore, come at the time of the peak conditions of the central station. This applies only to plants using power and very little light. There is a point of maximum in these plants at the time of the central-station peak, but generally speaking it is not the highest maximum of the customer. This falling off of the factory load before the time of the central-station peak is one of the reasons why the central-station company is enabled to carry much more business that it would reasonably seem able to. This difference in the time of the maximum of different classes of business makes what is known as the diversity factor.

Large central-station plants are usually capable of taking care of motor and lighting customers having a combined connected load of from two to three times greater than the maximum generating capacity of such a plant. This is demonstrated by the fact that the load factor of large central stations is from thirty to forty per cent, while in the average industrial plant the load factor rarely exceeds twenty-five per cent.

In referring to the load-factor table heretofore mentioned, you will notice considerable variation in the figures. If a central-station company were to secure all of the business in a given city, the diversity factor of all of these customers would be such that the load factor on the station would probably be in the neighborhood of fifty per cent. As in some of the best central stations the load factor at present is in the neighborhood of forty per cent, some may question the possibility of raising this condition to fifty per cent; but if we consider that the time of travel on surface lines and elevated trains is necessarily after the time of the peak, and that the time of travel on suburban steam trains is fully a half hour later; further, that in large centers there is a large amount of summer business, such as amusement parks and large refrigerating plants, and that the time of the house-lighting peak is later in the evening, we can reasonably hope that in the future our load factor will be considerably better as we secure more business.

Even with so good a load factor as fifty per cent, we still have a long way to go before we obtain the ideal in central-station conditions. It seems necessary, therefore, that central-station companies must look to the improvement of their load factors by encouraging the making of by-products from electrical energy; products that could be used in large quantities, such as ice and nitrates.

There has been some discussion as to the advisability of selling power off the peak of the central station. This would be a dangerous thing in a large center where it is nearly impossible to control the situation. If a number of contracts were made with customers off the peak, and they, for some reason, used the energy on the peak, I am afraid the central station would have considerable trouble in adjusting the matter. In a small town it is very easy to watch the few large customers and see that they keep to their agreements. In any small town, where the amount of power used is small, it might be a reasonable proposition to sell the power in this way to advantage.

Any business a central station can get during the summer months should not be strictly considered as off-peak business in the ordinary meaning of the term, and as the time of this load is easily controlled this business should be sought after by all central-station commercial men.

I should like to point out the great value of the collecting of load factors on different industries by the different companies belonging to the Association. It would help the commercial department of the different companies immeasurably if such information were available. No true analysis can be made of current consumption by different customers unless this information is at hand, and if we expect our commercial men to handle larger customers intelligently, we must place in their hands the necessary information. The selling of electricity in larger quantities is becoming common, and we find it becomes more necessary every day to have the men in the commercial department properly educated on every point in connection with the obtaining of this larger business.

In closing, I will say that there seems to be some difference of opinion as to the exact meaning of the term "load factor." The American Institute of Electrical Engineers' Standardization Rules say the "load factor" is the "ratio of the average load to the maximum load." This term ought to be more closely defined. The term "maximum load factor" might mean the ratio of average kilowatts to maximum kilowatts. The term "capacity load factor" might mean the ratio of average load to capacity of the plant, the "connected load factor" the ratio of average kilowatts delivered to connected kilowatts. It might also be stated that there is some misunderstanding as to the term "maximum demand;" whether the load factor is figured on momentary, one-minute, fifteen-minute, or one-hour peaks; whether the absolute or momentary maximum be used or the average maximum be used in determining the load factor. By applying these different conditions you might have many different kinds of load factors, such as momentary or absolute maximum load factor, average maximum load factor to be made up of the average of momentary peak loads, five-minute load factors, half-hour maximum load factors, etc.

Of course, it is understood that all of these load factors would be on the yearly basis, as the monthly load factor might vary considerably from the yearly load factor; for instance, in the case of the refrigerating plant, where in the North for seven months in the year the plant runs at a load factor of, say, seventy-five per cent, whereas in the winter time the load factor probably does not exceed thirty per cent.

It seems to me that it would be a good idea for all interested to get together and adopt a fixed scale of definitions of load factors, in order that there might be no misunderstanding of the meaning when discussing the term.

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THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.

TOLEDO, OHIO, JULY 21, 22, 23.

The ninth annual convention of the National Electrical Contractors' Association bids fair to be one of the largest and most successful ever held by this progressive organization. The convention will be held July 21, 22 and 23, at Toledo, Ohio, hotel headquarters being established at the Boody House, the meetings being held in the Chamber of Commerce rooms. Arrangements have been perfected for vigorous addresses at the executive sessions, and there will also be a number of important papers at the open sessions

The entertainment committee has arranged for a number of special events, including a men's banquet, a ladies' banquet, an all-day outing and a ladies' trolley ride. The following programme has been arranged:

WEDNESDAY, JULY 21.

10 a. m.—Open session, Chamber of Commerce rooms.

2 p. m.—Business session, Chamber of Commerce rooms.

THURSDAY, JULY 22.

10 a. m.—Open meeting, Chamber of Commerce rooms.

10:30 a. m.—Ladies' trolley ride.

2 p. m.—Business meeting.

8 p. m.—Men's banquet, Boody House banquet hall.

8 p. m.—Ladies' banquet, Boody House parlor.

FRIDAY, JULY 23.

All-day outing at Sugar Island. Excursion leaves Toledo at 9 a. m., and returning leaves the island at 5:30 p. m.

The ladies' trolley ride will be one of the features of the entertainment covering a trip up and down the Maumee Valley with luncheon at the Beach.

At the outing on Friday there will be a baseball game between eastern and western contractors, captained, respectively, by James R. Strong, of New York, and E. McCleary, of Detroit.

The National Electrical Contractors' Association was organized in Buffalo in 1901, the first steps toward the organization being taken in New York about 1898. The New York state contractors had organized in 1896, and their organization had grown in numbers and in prestige so that the benefit of solidarity in taking up many of the questions which perplexed the contractors indicated the value of a national organization. In 1901 the New York state association appropriated the necessary money and called a convention at Buffalo. As many contractors as could be reached were notified, and when the first session was called nearly 200 electrical contracting companies were represented. Plans were not completed at the first meeting, but the organization started off with thirty-one members, from which time there has been a steady and continuous growth.

The object of the organization is to improve the conditions of the contracting trade throughout the country. The business of the electrical contractor has become well recognized, and it is realized that upon the ability and integrity of the contractor lies the successful outcome of nearly every installation of any importance throughout the country.

The organization has exerted a powerful influence in securing the proper recognition of wiring rules and inspection laws, and has worked with the Underwriters' Association in securing proper interpretations and making effective the rules of the National Electrical Code.

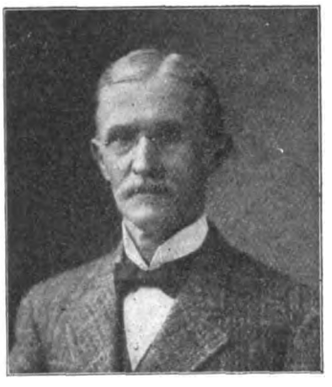
In July, 1902, a committee was appointed from the organization to take up the question of wiring rules and inspection work, and allowed the privilege of the floor at the Underwriters' meeting. In January, 1903, the association obtained membership in the National Conference on Standard Wiring Rules.

Important work has also been done by the organization committees in bringing about satisfactory conditions between labor organizations and employing contractors, and also in the matter of licensing contractors and securing uniform laws, and bringing order out of chaos caused by conflicting ideas and requirements in various cities throughout the country.

One of the most important efforts of the organization has been the adoption of a standard set of symbols for marking electrical work on plans. These symbols cover the subject thoroughly and have been adopted by the American Institute of Architects and several departments of the United States government.

G. M. Sanborn, Indianapolis, President.

C. R. Kreider, Chicago, Second Vice-President.



John R. Galloway, Washington, Treasurer.

W. H. Morton, Utica, N. Y., Secretary.

OFFICERS OF THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.

The officers of the organization are as follows:

President, G. M. Sanborn, Indianapolis, Ind.

First vice-president, M. L. Barnes, Troy, N. Y.

Second vice-president, Charles R. Kreider, Chicago, Ill.

Third vice-president, H. S. Potter, Boston, Mass.

Treasurer, John R. Galloway, Washingington, D. C.

Secretary, W. H. Morton, Utica, N. Y.

Sergeant-at-Arms, J. C. Stearns, Buffalo, N. Y.

The directors are as follows: Arkansas, C. J. Drees, Little Rock; Illinois, J. T. Marron, Rock Island; Indiana, F. H. Cheyne, Indianapolis; Iowa, Edward Kunkle, Davenport; Massachusetts, Seth B. Wetherbee, Boston; Michigan, J. J. Thorne, Bay City; Minnesota, William Burgess, Duluth; Missouri, Charles J.

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Sutter, St. Louis; New Jersey, Paul H. Jaehnig, Newark; New York, James R. Strong, New York city; M. L. Barnes, Troy; James Hilton, Syracuse; Ohio, M. W. Hansen, Toledo; Pennsylvania, W. I. Patterson, Pittsburg; Texas, J. M. Walshe, Texarkana.

To Celebrate Tunnel Opening.

Celebration of the opening of the McAdoo twin tunnel tubes from Cortlandt Street, New York, to Exchange Place, Jersey City, will take place on Monday next. The official train is scheduled to leave the Hudson Terminal Building at 10:15 a. m. The moment it starts Jerseyward a message will be telephoned to Assemblyman Charles Hendrickson, Jr., who will be in the office of General Superintendent Frank L. Sheppard, of the Pennsylvania Railroad, and he will give the signal for the explosion of twenty bombs high above the big train shed. Then the engineers of all railroad locomotives and river craft are expected to toot their whistles.

A special committee will meet the tunnel day guests at the station and escort them in automobiles to a grandstand in front of the City Hall, where addresses will be made. It is expected that Vice-President Sherman, Governor Fort, of New Jersey; William McAdoo, president of the tunnel company; President McGowan, of the New York Board of Aldermen; Mayor Wittpenn, of Jersey City, and others will speak. A band concert will precede the oratory. The speakers and other guests will return to New York city for dinner.

Band concerts will take place at the new West Side County Park at 3 and 7:30 p. m. and a fireworks exhibition will be given in the park from 8:30 to 10:30 o'clock.

Public Service Commission to Advertise for Subway Bids.

The New York City Board of Estimate approved on July 2 the report of its special subway committee to grant the request of the Public Service Commission for permission to advertise for bids on all the subway plans now before it.

When the action of the board was reported to Chairman Willcox of the commission he said that the preparation of contracts and the forms of bids will be started at once. The individual bids and offers on the plans already submitted will come before the board again when they are presented.

The New Haven Road Sells Its Street Railroad Securities.

Over his own signature, President Mellen, of the New York, New Haven & Hartford Railroad Company, informs the State Board of Railroad Commissioners that his company has disposed of its interests in street railways in Massachusetts.

This is in effect a report that the company has complied with the decree of the Supreme Court of Massachusetts that on or before July 1, 1909, it must part with all its holdings in the Worcester & Southbridge, Worcester & Blackstone Valley, Worcester & Webster, Worcester & Dudley, the Berkshire and the Springfield Street Railway companies, and such other street railway interests as it may hold in Massachusetts.

Under the date of New York, July 1, 1909, President Mellen wrote to Charles E. Mann, clerk of the Massachusetts Board, as follows:

"This company is neither directly nor indirectly concerned in the control of any street railways in the commonwealth of Massachusetts."

That something must have happened since February 15 of the present year to change the relation between the New Haven company to some of the street railway interests of the state, forming the basis for the above statement, is to be assumed from the fact that on that date the New Haven company sent to the Legislature a long report admitting that at that time it had not fully dispossessed itself of street railway holdings in Massachusetts. By order of its board of directors the statement made then contained the following:

"All the shares of the New England Investment and Securities Company held by the New England Navigation Company have been sold to individuals for cash at the same price which the said company paid for them.

"With the exception of its interests in securities of the Worcester & Webster and Worcester & Dudley Street Railway companies and the interest of the Rhode Island Company in earnings and indebtedness of Interstate Consolidated Street Railway Company, above referred to, the New York, New Haven & Hartford Railroad Company has not now any interest, direct or indirect, in any of the bonds, stock or indebtedness of any street railway company organized under the laws of Massachusetts."

This report that the company has sold its holdings in Massachusetts, in compliance with the Supreme Court decree, was brought out in correspondence over another matter. President Mellen was asked by the Railroad Commission what companies carry express goods over his lines in Massachusetts and he availed himself of this opportunity to have entered on the records of the board a statement that he has complied with the court decree.

Pennsylvania Railroad Completes Bergen Hill Tunnel.

The Pennsylvania Railroad has completed the construction of its tunnels under Bergen Hill and the Hudson River into its station at Seventh Avenue and Thirty-third Street, New York city.

The Hackensack portal is located 6.1 miles from the junction with the main line at Harrison, just east of Newark, N. J. A temporary track has been installed on the embankment from Harrison to the portal, and materials for the track laying will be carried over this line and into the tunnels.

Thus culminates the construction work on the first two tunnels to be built for trunk-line service under the Hudson River. The first excavation was begun May 12, 1906. The north tunnel was joined on September 12, 1906, and the south tunnel on October 9, 1906. The tunnels under Bergen Hill were connected on May 7, 1908, and April 11, 1908, respectively.

These two tunnels, which are twenty-three feet in exterior diameter, are lined with two feet of concrete and therefore are of nineteen feet interior diameter. They extend from the Hackensack portal under Bergen Hill to Weehawken shaft, a distance of 1.2 miles, and from the latter to Ninth Avenue, New York, 1.4 miles.

The tunnels contain 64,265 tons of cast-iron and steel, while in addition 740 tons of structural steel were used. In bolting the segments together, 2,606 tons of steel bolts were utilized. In the various concrete linings 240,500 barrels of cement were consumed and 170,400 cubic yards of concrete were installed. In addition, there were 4,980 cubic yards of brick work, and in the benches alongside of the tracks 1,827,396 duct feet, or 346.1 miles of conduits were installed.

An Electric Weighing Machine.

A trial electric weighing machine has been built at the Philadelphia Mint from the designs of Frank Davis, a Government employe. It is intended for use by the customs weighers and inspectors for the weighing of imported raw sugar.

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QUESTIONS AND ANSWERS.

DETERMINATION OF MOTOR SPEED.—How is the speed of a motor predetermined, that is, in winding two shunt motors for 110 volts, one to run at 800 and the other at 1,200 revolutions per minute, each motor being rated at ten horsepower?—M. A. L., Peoria, Ill.

The speed of a shunt motor is dependent upon the details of its entire design. In the following equation is given a formula that shows the relation of the speed to the main elements of the machine:

$$n = \frac{(E - I_a R_a)\, c\, 10^8}{M\, p\, N}, \text{ where E}$$

is the impressed electromotive-force, R_a the resistance of the armature, I_a the current through it, c the number of parallel circuits for the current through the armature, M the magnetic flux (number of lines of force) per pole, p the number of poles, N the number of armature conductors, and n the speed in revolutions per second. From this it can be seen that the first thing to be determined is the armature current and approximate resistance, knowing which and the general design of the armature as to the number of circuits and of the field as to the number of poles and the flux per pole, the number of armature conductors N can be determined by solving the above equation for this factor. In the two machines cited, even though they be of the same output, the field construction may not be identical, so that the number of conductors on the armature is not the only variable element in the problem. In a simplified case, however, where the field structures of the two machines were identical, the only factors that would be variable would be N and R_a.

OPERATION OF TRANSFORMERS IN PARALLEL.—Is it good practice to operate distributing transformers in parallel with each other? It has been recommended to us by some and considered inadvisable by others.—G. T. E., Dallas, Texas.

The operation of transformers in parallel has the advantage of equalizing the load, giving thereby a better service per kilowatt of installed capacity. The disadvantages, however, are quite serious and generally outweigh this desired feature. If one of two transformers should become overloaded so that its fuse blows, the other transformer will have to carry the entire load, which probably will cause its fuse to blow also, thus cutting off the service of a larger district than if the trouble were confined to but one transformer. It makes it difficult also to locate where the original trouble developed. Cases have occurred in which, where two transformers were operating in parallel within a few blocks of each other, after replacing the fuse on one transformer, the lineman would find that before he had time to replace that on the other the one he had just worked on would have its fuse blown again. This is evidently because all of the load was thrown upon that transformer. Where the two transformers are operating very close together and preferably upon the same installation, the parallel grouping is desirable when there is not on hand a single transformer that is large enough to carry the combined load. But in general when the transformers are scattered it is rather a poor plan to attempt to operate them in parallel.

LIGHTNING RODS.—In a recent violent storm the chimney of our plant, which is about sixty feet high, was struck by lightning, and a considerable portion of the coping was demolished. This chimney has a lightning rod, which seems to be intact and in good order. Why did it not protect the chimney?—S. N., Louisville, Ky.

In order that the lightning rod be effective in protecting any structure upon which it is erected it must be intact and in perfect working order throughout. In the case in question the lightning rod probably was in good repair as far as casual examination could disclose. In all likelihood, however, there was either a poor ground connection or the upper extremity of the lightning rod had become badly corroded by the smoke and fumes from the chimney. The latter was probably the source of trouble. To guard against this, it is necessary that the upper extremity of the rod be provided with a number of points made of non-corrosive metal of good electrical conductivity. On large chimneys it has been considered necessary to use eight or more points of platinum-coated copper, which, however, makes an expensive installation. Attention should be given to the ground connection to insure that the rod terminates in a ground plate or pipe which is deeply embedded in moist earth. Addition of salt in the vicinity of the ground plate has been found effective in drawing and holding the moisture. On the whole, it is absolutely necessary to make the lightning rod have as perfect conductivity from its extreme point to its connection with the earth and to have it follow as direct a path as possible.

PLANTE AND FAURE STORAGE BATTERIES.—What is meant by Planté and Faure storage batteries? Are these trade names or are they different classes of batteries?—J. M. S., Cleveland, Ohio.

The names Planté and Faure refer to the two principal classes of the commercial lead storage battery. The distinction lies in the manner of plate construction. In the Planté type plates of pure lead, after being mechanically prepared to give them a large surface, are electrochemically treated to change this surface to either of the active materials, lead peroxide or spongy lead. In the Faure type the plates are made by filling into a grid, which is usually of antimonious lead, a paste composed of oxides of lead with dilute sulphuric acid. This latter construction is very much cheaper and is used principally for storage batteries that are subjected to such violent service that their life is comparatively low, so that it is desirable to keep the original cost of plates and of plate renewals to a minimum. Therefore practically all electric-vehicle batteries are now made of the Faure or pasted type. The Planté type is used chiefly for batteries where long life is desired and where space and weight limitations are not so important. For example, in stationary batteries, the Planté or electrochemical plates are chiefly used. In quite a number of batteries it is coming to be the practice to use the Planté positive with pasted negative plates, since the life of positives is less than that of negatives in general, and the life of Planté plates is considerably greater than that of the pasted ones. The names Planté and Faure are derived from two Frenchmen who developed the two types which now bear their name.

X-RAYS ON ALTERNATING-CURRENT CIRCUITS.—Why is it that X-ray coils are not used on alternating-current circuits? How could the coils be connected to work with alternating current?—L. M., Chicago.

The X-ray tube is essentially a direct-current apparatus. This is evident from the fact that X-rays are frequently called cathode rays. With an ordinary induction coil operated by a battery the electromotive-force induced in the secondary on making the circuit is much less than that on breaking it; furthermore, the X-ray tube itself has a tendency to oppose the flow of current through it in any but the right direction. If strong enough current is applied in the opposite direction, the tube is apt to be injuriously affected. Therefore, if such a tube is to be used with alternating current, a rectifier outfit or motor-generator must be used, the induction coil being connected on the direct-current side.

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Denver Gas and Electric Company Reorganization.

Vice-President and General Manager Frank W. Frueauff, of the Denver Gas and Electric Company, has arranged for a reorganization of the company. He confirms the already published statement that there will be a $25,000,000 bond issue this fall for the purpose of taking all the underlying and subsidiary companies of the Denver Gas and Electric Company into the new corporation. These underlying companies include the Lacombe Lighting Company, the Denver Highlands Electric Company, and the Denver Consolidated Gas Company.

Prior to the reorganization, lien bonds of the Denver Gas and Electric Company to the amount of $452,000 will be called in.

Reorganization plans also include an increase in capital stock from $3,500,000 to $10,000,000, and a stock dividend which will give shareholders in the present company about three-and-one-third shares in the new company for their old stock.

The first use of the new bonds, which will be secured by a general mortgage and all the rights and properties of the company, will be used to retire such former bond issues as can be legally accomplished.

There are outstanding now $250,000 of seven per cent interest notes, due in 1910; prior lien bonds of the Denver Gas and Electric Company amounting to $458,000, bearing six per cent, and due in 1918; Denver Consolidated Gas bonds amounting to $936,600, bearing six per cent, and due in 1911; general mortgage bonds amounting to $5,691,000, bearing five per cent interest and due in 1849.

The 1911 bonds cannot be called until due.

A portion of the new bond issue will also be set aside to carry forward about $2,500,000 worth of improvements and extensions.

St. Paul Electrification Plans.

The Chicago, Milwaukee & St. Paul, it is learned, has temporarily given up its plan to electrify fifty miles of its Pacific Coast extension, including the tunnel through the mountains.

It has been found that one of the water-power stations proposed by the road would not be sufficient to supply power the year around, and the management does not care at this time to undertake the construction of two waterpower plants. Later on, it is expected, the use of electric power will be resorted to in order to increase the efficiency of the mountain section of the line.

An Interesting Freight Classification and Rate Decision.

The Interstate Commerce Commission at Washington, D. C., has handed down its decision in the complaint of the Otis Elevator Company against the New York Central & Hudson River Railroad Company and others, which was filed on December 1, 1908, but also involved a complaint offered informally to the Commission in 1907. In the last case the company shipped from Yonkers, N. Y., to San Francisco, Cal., a carload of electrical hoisting machinery and elevator controllers, weighing an aggregate of 35,500 pounds. The originating carrier was the New York Central & Hudson River Railroad Company and the delivering line the Atchison, Topeka & Santa Fe Railway. The initial carrier billed the entire shipment under Class A at a rate of $1.40 per hundred pounds, but when the shipment arrived at its destination the delivering carrier compelled the complainant to pay a rate of $1.40 on the hoisting machinery, which weighed 33,250 pounds, and $3 per 100 pounds on the elevator controllers, which weighed 1,980 pounds, the latter being the first-class rate on less-than-carload shipments of electrical appliances and supplies not otherwise specified, and when shipped in boxes or barrels. The complainant alleged that the Class A rate of $1.40 per 100 pounds should have been applied also to the elevator controllers, as they were parts of the hoisting machinery and were shipped therewith, and reparation was asked for the difference.

The other case involved similar shipments, but in that case the hoisting machinery weighed 43,200 pounds and the elevator controllers 2,685 pounds. This shipment was delivered by the Southern Pacific.

The Atchison, Topeka & Santa Fe asserted that the lawful tariff rate was applied to the shipment, while the New York Central & Hudson River Railroad and the Southern Pacific agree that the elevator controllers were parts of the hoisting machinery and were entitled to the same rate.

Western Classification No. 41, effective October 1, 1906, and in force on the date of the shipment involved in the latter case, names Class A rate on hoisting machines, freight and passenger, s. u. or k. d., also parts thereof as named and parts, n. o. s., straight or mixed carloads, weight to be a minimum of 24,000 pounds. Western Classification No. 42, effective April 1, 1907, and under which the first shipment moved, carried the same provision. The classifications referred to on the dates of the respective shipments involved rated electrical controllers and parts thereof in carloads (subject to Rule 21-B), as Class A. Rule 21-B of the classification is as follows:

"The carload ratings shown in the classification for articles subject to Rule 21-B will not apply to straight carloads of the articles named. In such case the amounts of the articles so designated which may be included shall not exceed 33½ per cent of the minimum weight provided for the mixed carload."

These classifications at the time of said shipments rated electrical appliances and supplies in less than carloads, n. o. s., in boxes or barrels, as first class.

Rule 21-B applies to this case as far as the weight of the shipments is concerned if there is any provision for the mixing of hoisting machines with elevator controllers. It is the opinion of the Commission that the mixture was provided for in the provisions of Classifications 41 and 42, relating to the rating of hoisting machinery and parts thereof. The following provision is also found therein:

"Dynamos and motors forming an integral part of machinery may take the same rating as the machines of which they form a part."

The hoisting machinery comes under the general heading of machinery, and if dynamos and motors form an integral part of any kind of machinery, they certainly would form a part of electrical hoisting machinery. And if dynamos and motors form an integral part of electrical hoisting machinery it necessarily follows that electrical controllers are an integral part of hoisting machinery because they all have to do with generating, applying, and controlling the electrical current.

Therefore, the elevator controllers involved in these cases were part of the hoisting machines with which they were shipped, and under the classification could have been shipped in mixed carloads with elevators or hoisting machinery.

From the record it is the opinion of the Commission that the rate which should have applied to the total weight of each shipment was $1.40 per 100 pounds, and that, therefore, complainant is entitled to the reparation asked for with interest, and an order has been made.—A. F. T.

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Physical Society of London.

At one of the June meetings of the Physical Society of London a number of interesting papers and discussions on electrical topics were presented. Among these was the paper by C. C. Paterson on the units of candlepower that are at present officially accepted in Great Britain, France, the United States and Germany. In this connection the author referred to the recent adoption of the international candle by the first three of these countries, which fact was noted in this journal some weeks ago. The principal discussion on this subject was by Doctor Fleming, who called attention to the fact that what was really required was an international primary standard of light instead of merely a unit, more or less arbitrary. Others who discussed the subject were Doctors Russell and Dyrsdale.

A paper on "Inductance and Resistance in Telephone and Other Circuits," by Dr. J. W. Nicholson, was presented. A number of formulas relating to this matter were presented by the author.

A paper by Doctor Russell and Arthur Wright, on "The Arthur Wright Electrical Device for Evaluating Formulas and Solving Equations," was then read. In this device special slide resistances are used. If R be the resistance of one of these, and a metallic finger make contact with it at a point where the scale reading is x, the resistance between this finger and the terminal of the slide is R/x. The scales of the slides are graduated logarithmically, as in the ordinary slide-rule, and the general manner of using the Wright device is similar to that employed in the slide-rule.

A British Electrical Industrial Association.

A meeting is to be held some time this month in London, at the instance of Sir W. H. Preece, to consider the formation of a society whose suggested name is "The Electrical Industrial Association of Great Britain." The Lord Mayor of London has consented to invite the banking and financial authorities to this meeting to consider the apparent want of confidence existing between capital and home electrical industry in Great Britain, and to suggest a remedy for this state of affairs.

In the course of a letter addressed to a small provisional committee of leading electrical manufacturers, Sir William Preece says: "We require an association which, supported by existing societies, will bring the public voice to bear upon their representations, so as to enable deputations to Government departments, and witnesses before Royal Commissions and Parliamentary Committees, to speak, not merely with the authority of experts, but with the force and weight of numbers from all sections of the industry. The association must in no way savor of the nature of a trade ring or of a trust. Its general constitution, embracing all sections of the industry in all parts of the country, insures this."

One of the causes of this agitation is that the German electrical firms, backed by German bankers, have successfully been competing of late with British firms which have had no bankers to back them in the same way. A German firm, for instance, has recently secured important contracts for the Victoria Falls scheme in Africa, in direct competition, of course, with British firms.

Government Takes Telephone Lines.

The telephone systems in the province of Saskatchewan, Canada, have passed out of the hands of private companies and will now be under the control of the province. The desirability of the public control of telephones has been so decidedly held in this new province that special governmental action was taken to oversee the situation and the officials chosen to do this were placed on an equal footing with those supervising railways—the result being that a department of railways and telephones has been in existence for some little time, and under its direction this absorption of the lines has been managed.

The price paid is understood to be favorable from the public viewpoint. The property includes 348 miles of long distance wires, four exchanges and thirty-one toll stations. There are only four cities in this new province, but there are thirty-nine towns and ninety-four villages, which, being scattered over an extensive area, depend greatly upon their telephone connections for sociability as well as for business arrangements.

The Telefunken System of Wireless Telegraphy.

In the issue of May 29 an article entitled "The New System of Wireless Telegraphy Used by the Telefunken Company," by Count Arco, was published as an original communication. Owing to a misunderstanding in the preparation and transmission of this article credit to the London *Electrician*, at whose expense the translation was made, was omitted.

Quebec's Light, Power and Traction Merger.

Rodolphe Forget, M. P., of Montreal, Can., has achieved another financial triumph. He has won out in his fight for the control of the Quebec Railway, Light and Power Company.

Now that the control of this corporation has passed into the hands of Mr. Forget, and those who gave them their support, financially, the work of refinancing and extending the entire system will be undertaken at once. It is the intention of the new syndicate to form a huge corporation by bringing about a gigantic merger of the street-railway, electric, gas and power interests throughout Quebec district, with a capital possibly of $8,000,000 or $10,000,000.

Following the acceptance of the resignations of the old directors, the important statement is made that at a meeting of the members of the new syndicate recently held at Quebec, the vacancies were immediately filled, by the election of W. G. Ross, Montreal, as president, with Frank Ross, Quebec, as vice-president, and the following directors: William Price, M. P., Quebec; J. N. Greenshields, K. C., Montreal; L. C. Marcoux, Quebec; N. Belleau, Quebec; Rodolphe Forget, M. P., Montreal; Frank Ross, Jr., Quebec, and Senator Robert Mackay, Montreal.

Ontario Government Finances Power Plan.

The Ontario Government is reported to have sold in London $4,000,000 four per cent bonds for the construction of its transmission lines and stations for the distribution of the power which is purchased from the Ontario Power Company of Niagara Falls under the contract of March, 1908. The construction of these transmission lines and stations is now proceeding by the hydroelectric commission.

A Department of Publicity for the Republic of Cuba.

With the beginning of the present fiscal year the Republic of Cuba established a Bureau of Information, President Gomez appointing Leon J. Canova, an American newspaper man, who has resided in Cuba eleven years and has a wide acquaintance with the island, as its director.

Parties wishing information of any nature concerning Cuba can obtain this free of charge by writing to Mr. Canova, Utility and Information Bureau, Department of Agriculture, Commerce and Labor, Havana, Cuba.

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OHIO ELECTRIC LIGHT ASSOCIATION.

(*By Telegraph to the* ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.)

TOLEDO, OHIO, JULY 13.—The fifteenth annual convention of the Ohio Electric Light Association was begun here at the well-known Boody House this morning. The attendance is very good, the programme excellent, the financial and general condition of the association better than ever, and the entertainment features much more elaborate than has been customary. All these elements give promise that this convention will be the largest and best that this, the strongest of the state electrical associations of the country, has ever held.

Shortly after 10 a. m. the first session was called to order by W. P. Engle, of the executive committee and past-president of the association. A communication from President C. R. McKay was read, in which he regretted that the removal of his business activities and residence to South Covington, Ky., enforced his absence from active participation in the convention, to which, however, he sent his greetings and sincere hopes for a very successful meeting.

Addresses of welcome to Toledo were made by Albion E. Lang, president of the Toledo Railways and Light Company, and the Hon. Brand Whitlock, mayor of Toledo. The report of the executive committee was read by W. F. Hubbell, of Wauseon, Ohio. Fifteen new members were recommended for admission. The report of D. L. Gaskill, of Greenville, Ohio, secretary-treasurer, was then presented. The finances of the association were never in better condition. By the publication of the souvenir programme by the association itself, instead of by contract, as hitherto, over $1,600 net profit was made through the liberal advertising of the associate members. Aside from this the net balance of the past year was over $400, twice that of the preceding year.

The paper on "Residence Lighting in Detroit," by F. T. Mather, of the Detroit Edison Illuminating Company, was read by the author. In it he described some features of the phenomenal success in this class of business met with in that city since the adoption of the low differential rate and liberal demand system. He also touched on the success achieved in supplying several suburbs of Detroit. In the discussion of this paper some of the speakers doubted whether business at such low rates could be made to pay except in a thickly populated community.

The afternoon session was called at 2 o'clock. Two important papers, entitled "The Supply of Electric Current to Other Towns From a Centrally Located Station," by O. H. Hutchings, of Dayton, Ohio, and Claude Smith, of Bradford, Ohio, were read by the secretary. These papers pointed out the excellent results secured to the generating and distributing companies and to the communities involved when a network of high-tension transmission lines is built from an economically operated central station to adjacent towns and villages. A spirited discussion of this subject followed, in which it was predicted that the small, poorly managed station is bound to disappear. Transmission networks are rapidly increasing. They enable a community of any small or moderate size, and even farmers, to be supplied with the blessings of electric service from a central plant that can be run efficiently for a greatly diversified load.

A paper on "Engine-Room Management" was read by F. R. Brosius, of Columbus, Ohio. The importance of making periodic inspections and tests of the equipment and of keeping adequate records of performances and repairs was strongly advocated by the author. After the discussion of several topics from the Question Box the session adjourned.

This afternoon automobiles were provided for giving the ladies attending the convention a ride to points of interest in this city. This evening a trolley trip to the Casino at the lake shore was followed by a banquet and theatre party. These entertainment features were much enjoyed by all who attended, which means practically all of the 200 persons now registered.

A detailed report of the convention proceedings will be given in next week's issue.

F. H. B.

Collapse of Dam Deprives Southern Nevada of Power.

From Goldfield, Nev., comes the story of a poorly built dam, causing considerable loss to the power company as well as loss in wages to the men working in the mines. The deflecting dam of the light and power company on Bishop Creek, in California County, collapsed, forcing the suspension of the plant. Temporary repairs were effected, enabling the company to supply a limited amount of electricity for lighting purposes within twelve hours, but the mills and mines did not resume for forty-eight hours. Two thousand men were thrown out of work temporarily by the accident. The loss at the generating plant is estimated at $8,000.

Electrical Development in Porto Rico.

In a bulletin published by the Census Department there is a compilation of the electrical industries of Porto Rico covering the year 1907. It is the latest information obtainable as yet on this matter in Porto Rico. It covers all the electric public service companies, but does not include isolated electric or telephone plants connecting different rooms or departments of the same building and having no connection for communication with the public. The electrical enterprises of the island are not extensive as yet, but much promise is given for the future.

The total cost of plants comprising construction and equipment, not including the telegraph system, was $2,373,258, divided as follows: Street and electric railways, $1,971,512; central electric-light and power stations, $146,705; telephones, $255,041. The total income in 1907 was $663,031, and total expenses, including taxes and fixed charges, $497,124. The plants consisted of fifteen turbines of 3,825 horsepower, three waterwheels of 256 horsepower and twenty-five dynamos with a kilowatt capacity of 2,942. The equipment was all used by the railway, light and power companies.

There were three companies operating telephones in addition to those operated by the government insular system. Altogether there are 1,970 instruments and 1,651 miles of wire for the commercial telephone facilities of the island. There are 310 miles of pole line and 1,464 miles of single wire.

On the island are 469 arc lamps, 34,519 incandescent lamps, sixty-one motors. In regard to the use of electric current for light and power only six towns are lighted by electricity.

The electric railways are the most important branch of the electrical industries of Porto Rico. There were three street railways in operation and another under construction. The operation is on a small scale as yet, compared with the progress in the United States, but the density of population, which is greater there than in the majority of the states, warrants the belief that the increase during the current five years will be much greater than for the preceding period. The output in current of the electrical generators reported for 1907 was three times as great as for 1902.

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Hudson-Fulton Aeronautics.

Former Assistant United States Attorney-General James M. Beck, chairman of the Aeronautics Committee of the Hudson-Fulton Celebration Commission, sailed for Europe July 7. When he finishes professional business which calls him abroad he will devote considerable time to meeting the leading aviators there with the idea of interesting them in the elaborate programme of aeronautics prepared as a feature of the celebration this fall and in getting in touch with the latest developments of aerial navigation. It is probable that international contests, irrespective of a contest arranged by a New York morning newspaper, will be held under the auspices of the Hudson-Fulton Celebration Commission.

The sum of $25,000 has been appropriated by the Hudson-Fulton Celebration Commission for aeronautics, and while the plans are not sufficiently completed for definite announcement, exhibitions and contests of great interest and educational advantage are assured. One of the most important features will be a series of spectacular flights and evolutions by aeroplanes, dirigible balloons and man-carrying war kites over and across the Hudson River during the progress of the great naval parade.

The Sign of the Times.

The West Penn Railways Company, of Connellsville, Pa., has erected a huge double electric sign on top of the Youghiogheny bridge. The sign reads: "West Penn, Light and Power, Cars Everywhere." The letters in "West Penn" are two feet high and the others eighteen inches. The sign can be read a long distance up or down stream. It will materially aid in lighting the bridge and adjoining territory.

The idea was originated by Superintendent J. W. Brown, and the work was designed by E. J. Mora of the illuminating department. The letters were manufactured and wired at the company's Greenwood shops. Nearly 600 electric bulbs are required to illuminate the seventy letters.

The Osiris Prize Award.

A despatch from Paris announces that the Osiris prize of $20,000, which is awarded once every three years by the Institute of France for the most remarkable achievement in sciences, arts, or industries, has been divided between Louis Bleriot and Gabriel Voisin for their remarkable efforts in aviation.

Projected Big Telephone Merger.

Upon the outcome of a conference held at Parkersburg, W. Va., on July 10 last, depends a gigantic consolidation of the independent telephone companies of the entire United States. Representatives of Pennsylvania, West Virginia, Ohio, Indiana and Illinois independent telephone concerns are in conference looking toward the incorporation of the National Telephone Corporation of New York, with a capitalization of $100,000,000.

The news that a consolidation of the independents was pending is not entirely new. For months past there have been rumors that the local and Pennsylvania companies would soon reach some sort of an agreement and work in conjunction.

The conference adjourned until possibly the 16th in order to clear up a number of minor details. Up to the time of going to press no definite steps had been taken, but it is expected that it will be consummated before the end of the month.

Definition of Head of Water.

In a recent paper Charles T. Main, mill engineer and architect, of Boston, gives the following definition of "head" as applied in waterpower development, as follows:

There is the "legal head," or the head to which the owner has a right to develop his power. This may or may not have been developed to its full extent. It may be that the expense involved would be too great to warrant further development. In some cases it may be economy to make the expenditure necessary to get the benefit of some unused portion of the head.

The "gross head" is the head actually used for producing power and getting the water to and away from the wheel.

The "net effective head" is the gross head minus the loss in head required to get the water to and away from the wheel. This loss will vary with the length of the waterways leading to and away from the wheels, the velocity of the flowing water, and the construction of such waterways.

In several manufacturing cities where the waterpower is controlled by a company which is separate from the mill owners, there is an allowance of one foot made from the gross head before charging for the water as used on the wheels.

The head should be measured with the wheels running. The only portion of the head which produces power is the difference in level directly above and below the wheel when the wheel is running.

Connecticut River Power.

The new plant and dam of the Connecticut River Power Company, at Hinsdale and Lemon, Vt., will be formally opened in August. Already current is being supplied from it to places fifty-three miles away, to Fitchburg, Worcester, North Adams, Pittsfield, Springfield, Clinton, Winchendon and Gardner, Mass., and Lewiston and Manchester, Vt., as well as many smaller places for lighting, traction and factory purposes. It is considered the largest engineering project of its kind east of Niagara, and the cost has been several millions.

A miniature Niagara Falls has been constructed between Hinsdale and Vernon by means of the massive barrier of concrete thrown across the river there, where it is 900 feet wide. When the ten floodgates are shut the backed water forms a lake sixteen miles long at several points over a mile wide. The height of the construction above the river bed is thirty-four feet.

The two capitalists most prominently connected with the project are Henry L. Harriman, of Hyde Park, and Malcolm G. Chase, of Providence, R. I.

Specifications for Hard-Drawn Copper Wire.

At the 1909 meeting of the American Society for Testing Materials, held at Atlantic City, N. J., June 28 to July 3, Committee W, headed by J. A. Capp, of the General Electric Company, Schenectady, N. Y., brought in a well-drawn specification for hard-drawn copper wire, including round wire, grooved trolley wire, and cable made of hard-drawn wire. Its distinctive feature is the omission of twist or wrap tests and of all requirements as to elastic limit. The only mechanical requirements are for a tensile strength of from 49,000 to 67,000 pounds per square inch, according to the diameter, and for an elongation of from 0.7 to 2.7 per cent in ten inches. The only other requirements are for accuracy of size and for a conductivity given by a weight of from 900.8 to 910.2 pounds per mile-ohm. Cable must have a strength of at least ninety per cent of the sum of the strengths of its wires.

For An International Wireless Law.

International regulation of wireless telegraphy will receive prominent consideration at the fourth Pan-American conference, to be held at Buenos Aires, Argentina, July 9, 1910, if the tentative programme is approved.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

ELECTRIC PROPERTIES COMPANY.

The Electric Properties Company has issued its report for the fiscal year ended April 30, 1909, which compares as follows:

	1909.	1908.
Earnings	$231,188	$280,671
Salaries, legal exp., taxes, etc.	55,327	87,200
Net	$175,861	$193,471
Preferred dividends	135,669	179,344
Surplus for year	$ 40,192	$ 14,127
Previous surplus	49,574	35,447
Surplus April 30	$ 89,766	$ 49,574

At the annual meeting of the Electric Properties Company the following directors were elected for three years: Charles H. Allen, N. W. Halsey, Walter C. Kerr, C. Sidney Sheppard, R. B. Van Cortlandt, and George Westinghouse. Other directors were re-elected. The directors re-elected the officers.

NEW ORLEANS RAILWAY AND LIGHT.

Stockholders of the New Orleans Railway and Light Company have authorized an issue of $50,000,000 five per cent forty-year mortgage bonds. Of this sum $20,000,000 will be used immediately to retire outstanding notes.

INTERBOROUGH-METROPOLITAN BONDS.

In connection with the action of the Public Service Commission in deciding that it was not necessary for the Interborough-Metropolitan Company to get the Commission's permission to issue bonds to refund notes given by the company in the hard times of 1907, it was announced at the office of President Shonts, of the transit company, that J. P. Morgan & Company had bought the entire $10,000,000 issue of five per cent bonds with which to take up a similar amount of six per cent notes issued March 1, 1907, and due June 1, 1910, but callable at any time after June 1, this year.

It was said at the office of the Interborough company that the transaction merely enabled the company to reduce its interest charges one per cent on $10,000,000 for a year, as money was now cheaper than it was in 1907.

TOLEDO COMPANY AGAIN DEFAULTS.

The bondholders' committee of Toledo Railways and Light Company has sent a letter to holders of the first-mortgage four per cent consolidated bonds, in which they say that the company will not be able to pay the principal or interest on the $4,866,000 bonds maturing July 1. This will make the third default on interest payments, but the committee asks that no summary or drastic action be taken against the company because of these defaults.

Practically all of these bonds are deposited with the committee, which has agreed not to institute foreclosure proceedings.

FORT WAYNE & WABASH TRACTION.

The report of the Fort Wayne & Wabash Valley Traction Company for the month of May and five months ended May 31 compares as follows:

	1909.	1908.
May gross	$111,702	$107,190
Expenses	66,890	63,337
May net	$ 44,812	$ 43,853
Five months gross	532,676	505,166
Expenses	320,147	295,152
Five months net	$212,528	$210,014

INTERBOROUGH RAPID-TRANSIT BONDS.

J. P. Morgan & Company and Lee, Higginson & Company have sold the $10,000,000 Interborough Rapid Transit five per cent bonds. The bonds are part of the authorized issue of $55,000,000 approved last year by the Public Service Commission, of which $11,590,000, including the present offering, are outstanding and $28,108,900 pledged as security for the company's six per cent notes.

It is announced that the company has paid the special tax under Section 14 of the New York state tax law making these bonds tax exempt. The bonds are secured by the only mortgage on the Interborough's property, subject only to the city's rental. The net income, the company's statement shows, amounted last year to three times the interest on these bonds.

SCRANTON ELECTRIC COMPANY.

The Scranton Electric Company reports for the year ended April 30, 1909, as follows:

	1909.	1908.
Gross income	$501,061	$421,559
Expenses	254,918	236,745
Net income	$246,143	$184,814
Interest on bonds	77,660	75,000
Preferred dividends	30,000	30,000
Surplus for year	$138,543	$ 79,814

MEXICAN TELEPHONE.

The Mexican Telephone and Telegraph Company has issued a statement of earnings and expenses for the three months ended May 31, 1909, compared as follows:

March 1-May 31:	1909.	1908.
Gross earnings	$109,864	$ 93,194
Expenses, operating	38,712	37,706
Maintenance	13,271	13,776
Total	$ 51,983	$ 51,482
Net	57,881	41,712
Construction	42,098	20,812

INTERBOROUGH RAPID TRANSIT.

The Interborough Rapid Transit Company has issued a statement of income for twelve months ended May 31, 1909, as follows:

Gross earnings	$25,594,439
Operating expenses	10,799,650
Net earnings	$14,794,789
Other income	1,404,769
Gross income	$16,199,558
Rentals of subway and Manhattan Ry.	8,021,281
Taxes	1,786,520
Total rental and taxes	$ 9,807,801
Balance	6,391,757
Interest, charges, Interurban R. T. Co.	1,996,370
Balance	$ 4,395,387
Discount, etc.	19,185
Surplus for dividends	$ 4,376,202

The total outstanding funded debt of the company, including notes, is $35,014,000, on which there is an annual interest amounting to $1,984,940. In the period of twelve months ended May 31, 1909, the company earned $6,391,757 in excess of operating expenses, taxes and rentals, which is more than three times the annual interest upon its total outstanding funded debt.

A comparison of the company's gross earnings from operation during the last five years, follows:

Year ended:	
June 30, 1905*	$16,837,371
June 3, 1906	19,695,594
June 30, 1907	22,363,802
June 30, 1908	24,059,299
May 31, 1909	25,594,439

*The Subway was opened for operation in October, 1904, so that earnings for the year ending June 30, 1905, include only eight months' operation of the subway division.

LONDON UNDERGROUND.

The Underground Electric Railways of London report earnings for the week ended June 19 and for twenty-four weeks ended June 19, 1909, compared as follows:

	1909.	1908.
Bakerloo	£ 3,325	£ 3,010
Piccadilly	5,855	5,440
Hampstead	3,920	3,240
District	10,954	9,401
Tramways	6,859	7,413
Total	£ 30,913	£ 28,504
Twenty-four weeks:		
Bakerloo	£ 80,215	£ 73,165
Piccadilly	139,090	129,990
Hampstead	93,260	77,840
District	237,294	214,536
Tramways	138,217	149,637
Total	£688,076	£645,168

CENTRAL & SOUTH AMERICAN TELEGRAPH.

In reviewing the report of the Central & South American Telegraph Company for the quarter ended June 30, 1909, it will be noticed that the ratio of expenses to gross earnings for 1909 and similar periods of the three preceding years, gradually increased from over thirty per cent to about 44.5 per cent, while the percentage of net and other income to outstanding capital stock decreased from 3.26 per cent in 1906 and 3.46 per cent in 1907, to 2.6 per cent in 1908, and 2.11 per cent in 1909. These conditions are partially

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due to the fact that expenses have been largely increased in the last four years by extensive alterations and repairs to the cables of the company and the laying of new lines. In addition, the company's "construction account," including the building of a transandine line in Argentina, has encroached heavily on the company's earnings.

The decrease in the percentage of net earnings to common stock for the company's second quarter may be accounted for in part by the reduction of through tolls to a uniform rate of $1 a word, between places on the west coast of South America and the United States and Europe. It is expected that the resulting natural increase in business will more than offset the loss in receipts.

The following table shows estimated earnings for the quarter ended June, 1909, compared with preceding years:

	1909.	1908.	1907.
Gross	$ 365,000	$ 408,000	$ 395,000
Expenses	163,000	162,000	132,000
Op. ratio, per cent	44.65	39.7	33.41
Net	$ 202,000	$ 246,000	$ 263,000
Other income	2,500	5,500	5,000
Total income	$ 204,500	$ 251,500	$ 268,000
Per cent on stock.	2.11	2.6	3.46
Dividends	143,565	143,565	144,855
Surplus	$ 60,935	$ 107,935	$ 123,145
Previous surplus.	1,495,492	1,172,712	2,024,181
Total surplus	$1,556,427	$1,280,647	$2,147,326

No new development work is planned, or under way, and in view of present conditions, dividend increases are hardly to be expected.

NORFOLK & PORTSMOUTH TRACTION.

The report of the Norfolk & Portsmouth Traction Company for the month of May and five months ended May 31 compares as follows:

	1909.	1908.
May gross	$151,599	*$152,175
Expenses	92,659	90,262
May net	$ 58,939	$ 61,913
Five months gross	759,016	*711,092
Expenses	450,221	448,912
Five months net	$308,795	$262,180

*Includes gross earnings of Norfolk County Ferries, which averaged about $17,000 per month. Ferry lease expired April 1, 1909, and assumed by other interests.

CUMBERLAND TELEPHONE AND TELEGRAPH.

The report of the Cumberland Telephone and Telegraph Company for the month of May and five months ended May 31 compares as follows:

	1909.	1908.
May gross	$ 524,954	$ 503,357
Expenses	268,557	292,790
May net	$ 256,397	$ 210,567
Charges and taxes	70,007	36,107
May surplus	$ 186,390	$ 174,460
Five months gross	2,643,848	2,552,614
Expenses	1,485,228	1,489,999
Five months net	$1,158,620	$1,062,615
Charges	243,179	187,635
Five months surplus	$ 915,441	$ 874,980

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of May and five months ended May 31, 1909, compares as follows:

	1909.	1908.
May gross	$ 569,217	$ 527,393
Expenses	260,970	254,577
May net	$ 308,248	$ 272,816
Chgs., taxes and pfd. divs.	140,251	126,972
May surplus	$ 167,996	$ 145,843
Five months gross	2,656,965	2,429,349
Expenses	1,361,601	1,265,571
Five months net	$1,295,364	$1,163,777
Chgs., taxes and pfd. divs.	687,507	621,178
Five months surplus	$ 607,857	$ 542,599

BOSTON ELEVATED.

The second installment of $30 per share on account of subscriptions to the $6,650,000 of new Boston Elevated stock has been paid. An additional five per cent of the stock was also paid in full at the same time, so that at present a fraction over twenty-five per cent of the entire issue has been paid in full. The next installment of $25 per share is payable October 18.

FRENCH WESTINGHOUSE.

The report of the Societe Anonyme Westinghouse for the year ended December 31, 1908, as read at the annual meeting held in Paris on June 15, shows profit and loss as follows:

	Francs.
Gross profit	1,686,254
Interest and proceeds from investments	94,510
Total	1,780,764
Administration expenses, taxes, etc.	290,221
Net profits	1,490,543
Interest on debentures and mortgage loan	683,642
Surplus	806,901
Brought forward from 1907	78,188
Total	885,089

The above surplus, frs. 885,089, was applied in the following manner:

Amortization on plants	530,955
Five per cent legal reserve	17,707
Dividend of 5 per cent on preferred shares	250,000
To carry forward	86,427
Total	885,089

The dividend is payable from September 1, subject to a reduction of four per cent for income tax and of transmissions tax upon bearer shares.

Since the close of the year under consideration the French Westinghouse Company has increased its capital from 15,000,000 francs to 20,000,000 francs. The proceeds of the issue of 5,000,000 francs of additional stock were used partly to pay off a mortgage loan of 4,000,000 francs.

Lexington Avenue Subway Plan Modified.

Acceding to the wishes of Lexington Avenue property owners, New York city, the New York Public Service Commission has modified the plan of construction for the Broadway-Lexington Avenue subway, so as to make under the avenue a double-deck instead of a single-deck tunnel.

The original plan adopted by the commission contemplated the placing of all four tracks on one level. Many property owners objected on account of the narrowness of the avenue and the resulting interference with abutting property. The commission therefore instructed its engineers to devise a better plan.

The engineers reported in favor of double-decking the road from Houston to One Hundred and Third Street, and from One Hundred and Thirteenth Street to the Harlem River. The commission has approved this modification, and so has the Board of Estimate.

The commission hopes that the property owners will now also consent, and has written asking them to do so. If consents are obtained from less than one-half, the consent of the Appellate Division must be sought, which will involve a long delay.

Cannot Tax Franchises.

Under a recent Supreme Court decision given in the state of Washington it was ruled that the counties in that state cannot tax a franchise given to the Western Union Telegraph Company. The treasurer of Pierce County had assessed the company's franchise at $15,000, and the company brought suit to prevent him from collecting a tax on this amount, with the result stated. The Supreme Court confirmed the ruling of the lower court from which the county had appealed.

Public Service Telephone Company.

Justice Blanchard, in the New York Supreme Court, denied the application made by counsel for the Public Service Telephone Company to vacate a stay granted on July 8 by Justice Blanchard in the suit of the Public Service Telephone Company for a writ of mandamus to compel the Empire City Subway Company to accord to it space in the ducts of the Empire City Subway Company for wires through Wall, William, Broad and New streets, New York city.

McCall Ferry Power Plan Extended.

The time for the deposit of stock and bonds of the McCall Ferry Power Company under the plan of reorganization announced to the security holders in May has been extended to July 21. It is announced that eighty per cent of the bonds and preferred stock have been deposited under the plan.

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REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

WOOD PRESERVATIVES.

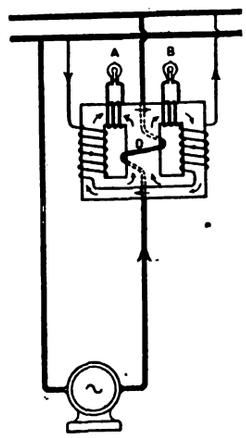
Preservatives of wood are always of topical interest to the electrical engineer, and consequently an account of some experiments on the subject, recently made in France, will be in order. The preservatives tested included carbonileum Avenarius, carbonileum Lyon, gas tar, microsol, lysol, antimony, antigermine, and hydrofluoric acid. It was found that for spruce, beech, poplar, oak, and Aleppo pine, exposed to the atmosphere, the best preservatives are certainly the carbonileums, gas tar, and microsol. The other substances examined produced absolutely no effect. These same preservatives (carbonileum, gas tar, and microsol) are also most efficacious for the preservation of wood in the confined hot air of mines. Antimony and hydrofluoric acid are less effective.—*Abstracted from the Scientific American, July 10.*

ELECTROLYTIC TINNING.

An electrolytic process, similar to galvanoplating, has recently been successfully introduced in Germany for depositing very heavy coatings of tin on articles of all sizes. The bath, which is kept at a temperature of between 120 and 140 degrees Fahrenheit, is heated by direct firing, by steam jets, or by a steam coil or double bottom, as desired. No stirring is necessary and the regeneration of the liquid is effected by anodes. For tinning small articles a perforated basketlike holder of sheet metal is most convenient. The bath is of enameled cast-iron, and may have a double bottom for steam heat if desired. The articles to be tinned are first to be cleaned from dirt, dust, scale, rust, soldering fluid, paint, etc. Those made of copper or of copper alloys are first cleaned with oxalic acid or its equivalent. Iron and steel articles, if rusty or covered with scale, are pickled in dilute sulphuric acid and scratch-brushed. Tumbling is recommended for such as will stand this process. If the articles are polished, turned, filed or stamped iron or steel, dull from long standing, or only slightly greasy, it is sufficient to tumble them in a five per cent soda solution for a considerable time. If they are very rusty or dirty it is well to wash them in ten per cent soda lye, then to pickle them in dilute sulphuric acid, then to rinse them in pure water, and finally to tumble them in weak lye and quartz sand. If a special polish is desired for iron or steel articles, they should be tumbled in a three per cent soda lye to which some soft soap has been added. After the cleaning process the articles should be rinsed in running water to remove any remaining pickle or other liquid. Articles of lead or zinc can be tinned at once after casting, without any special preparation. If, however, they have been exposed to the air for a considerable time they must be scratch-brushed. The articles are placed in a perfectly clean metal pan which is attached to the pole of the battery or dynamo. This pan, after being used two or three times, must be pickled in dilute nitric acid, and then thoroughly washed. The articles must not be piled on each other, as this would cause bare or thinly covered spots. Large ones should be turned from time to time. Those of very irregular form are best held in pans of specially adapted shape; sometimes it is well to have a metal coverplate which will lie on them and make better connection with the pole. The bottom of the bath gets gradually covered with sediment; and this should be removed from one to three times a week, in the morning, when the bath is cold. The clear bath liquid can be siphoned off by a clean rubber hose into a clean wooden tank, without disturbing the sediment; the bath tank is then to be scrubbed and rinsed with pure water.—*Abstracted from The Electrical Magazine (London), June 15.*

AN ENERGY DIRECTION INDICATOR.

The uncertainty of the working of reverse current relays on alternating-current circuits has been the subject of much recent discussion. In some cases, perhaps, failure in working is due to want of adjustment of the apparatus to meet the conditions, since most modern instruments provide for adjustment for phase displacement, surging, drop of pressure, etc. Although the conditions may not always admit of the use of relays, yet to couple generators direct to the busbars must be regarded as a practice involving a serious risk—a vital part of a system, which otherwise is protected throughout, being left without any protection of any kind. Even if the inductance of the machine prevents a disastrous rise of current, this partial protection does not apply to the cables between the machine and the busbars. Though a prompt indication at the beginning of the trouble is not so effective as automatic action, it is clearly better than nothing, and an instrument for indicating when an alternator is supplying energy to, or receiving energy from, the busbars has been in use for some time in America. It depends for its operation on a relay, which closes a switch and thereby causes a red lamp to



AN ENERGY-DIRECTION INDICATOR.

light up when the generator is receiving motoring current. This apparatus, however, has the disadvantage of depending upon a switch. An improved energy indicator (Andrews' patent), the action of which is purely inductive, as will be seen from the accompanying diagram, has recently been placed on the market by the firm of Cowans, Limited, of Salford, Manchester, Eng., and will doubtless be welcomed by many engineers. It is arranged to indicate by means of a green lamp when a generator is generating and by means of a red lamp when a generator is motoring. In the illustration, *A* and *B*, respectively, are red and green lamps connected across independent secondary windings. The combined effect of the series and shunt windings is to light the green lamp *B* when the series is in phase with the shunt—*i. e.*, when the generator is feeding energy into the busbars—and to extinguish the green lamp and light

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the red lamp on a reversal of the series current relatively to the electromotive-force. Among the uses of this energy direction indicator may be mentioned: (1) To indicate a faulty generator when several machines are connected in parallel; (2) to indicate when the load on a machine has fallen to zero in switching out a machine; (3) to indicate the direction of energy in a distributing network, an ammeter merely giving the amount. These indicators are designed for use on circuits up to 10,000 volts, and made for either high-tension or low-tension current. The high-tension apparatus is designed for connecting directly in series with the high-tension circuit, while the low-tension apparatus is arranged for connecting in series with the secondary circuit of current transformers. In either case the potential windings must be supplied with low-pressure current, and not directly from the high-tension busbars, as shown in the illustration, in order to simplify the connections.—*Abstracted from The Electrician (London), June 25.*

ELECTRIC STORAGE-BATTERY OMNIBUSES.

The city of Brighton, in England, has recently installed a unique omnibus service employing storage batteries for the propulsion of the vehicles, and remarkable for the methods used in the charging of the batteries. The electric omnibus has many obvious advantages for public-service work, if the cost of battery charging and maintenance can be brought to a reasonable figure, and the advances made in this direction of late appear to open up a considerable field of usefulness for them where gradients are not excessive and a sufficient number of vehicles can be employed to secure economical methods of working. For municipalities with their own electric supply, the electric omnibus offers several attractions. The whole problem of the financial success of the electric omnibus hinges on battery first cost and maintenance, and the cost of the electrical energy required for charging the batteries. The upkeep of an electric chassis is very small as compared with that of a gear-driven gasoline omnibus. Within the last two years the first cost and maintenance of traction batteries has been greatly reduced, and manufacturers are attacking the weight question with gratifying results. In appearance the new storage-battery omnibus is not unlike the Hallford gasoline-electric vehicle, which has now run 50,000 miles in the service of Thomas Tilling, Ltd., the well-known 'bus and cab proprietors of London. The new omnibuses are of the Hallford-Stevens pattern, manufactured jointly by J. and E. Hall, Ltd., of Dartford, and W. A. Stevens, Ltd., of Maidstone. In this purely electric omnibus, a storage battery takes the place of the engine and dynamo in supplying the current to the electric motors, which are accessibly mounted on the side frames, and drive by means of cardan shafts (enclosed in steel tubes, which also form torque rods), the worm gears in the axle. The bonnet is retained, and the radiator is replaced by a light aluminium frame which carries the starting resistance. The space under the bonnet is occupied by the Hallford-Stevens patent interlocking controller. In this position it is very accessible, and the increased smoothness of running obtained by the longer wheel base well justifies this arrangement. The battery used on these electric omnibuses has forty-seven cells of a capacity of 500 ampere-hours at the five-hour rate. The cells are arranged in the main battery box, in five lines of eight, and one line of seven cells, a vacant space being left at the end of the last row, for convenience of removing the cells from the box. The charging voltage of the batteries varies from 100 at the beginning of the charge to 130 when fully charged. A very economical method of dealing with this variation of voltage is employed, which entirely avoids the usual heavy waste in series resistances on each battery circuit, a loss in some cases amounting to as much as twelve per cent of the total. Speaking generally, the system is to take the supply at constant voltage, and to insert in circuit with each battery the armature of a motor-driven booster of the interpolar regenerative type. By means of a potentiometer rheostat in the booster fields, the booster can be made to absorb electrical energy in the earlier stages of the charge, running as a motor and causing the erstwhile motor to which it is direct-coupled to act as a generator, returning current to the line. As the voltage required by the battery rises, the resistance of the booster fields is progressively short-circuited by means of the potentiometer rheostat, until the average voltage is reached. At this point the shunt field windings of the booster are short-circuited, and the armature of the booster is inert, only serving as a conductor in series with the battery. By a further movement of the potentiometer resistance switch, the current in the shunt fields of the booster is reversed, and the voltage is gradually raised until the maximum value is reached, when the battery is fully charged; during the latter stage the booster armature is generating electrical energy and is driven by the machine to which it is direct-coupled. At Brighton, the supply is from the public mains, and the voltage is from 220 or 230 volts on either side of the middle wire. Until quite lately the batteries were charged in series with a motor-driven booster in series with each pair of batteries. With an increase in the number of electric vehicles, however, it became necessary to build new premises for their exclusive accommodation, and the directors of the omnibus company decided to adopt the Stevens regenerative battery-charging system for the new garage, the electrical energy being supplied from the Brighton Corporation mains. Already about 7,000 to 10,000 units are being taken weekly. As a middle wire of sufficient capacity was not available in the neighborhood, the outers only at a pressure of 460 volts were brought to the building, and a balancer was installed to create the middle point. The main supply is connected across the outer terminals of the balancers, which are direct-coupled by means of flexible couplings to a line of reversible booster armatures, four on each side, so that the system when complete will consist of ten machines running on the same axis. At the present time only two boosters are connected on each side of the balancers, but provision in the foundations is made to add additional boosters as required. The circuit from each booster is through a fuse, reverse-current circuit-breaker and ammeter to the terminals of a battery, the circuit being completed through the middle wire. A four-way double-pole voltmeter switch is provided on each panel, so that the voltmeter can read line volts, battery volts, or booster volts or can be connected across the circuit-breaker so that the circuit can be closed when the potential difference as shown on the voltmeter (which is graduated forty volts on one side of zero and 300 on the other) is nil. In the earlier conditions the boosters are running as motors, but when the charging of the batteries is more fully advanced they run as dynamos, and the energy required is small. The plant when completed will have a charging capacity of sixteen batteries at one time, and the total losses in conversion from 460 volts to the voltage required for individual batteries will not exceed five per cent.—*Abstracted from Electrical Engineering (London), June 24.*

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Continued Improvement of Westinghouse Business.

The condition of improvement which the Westinghouse companies find their business has undergone during the past month maintains the same steady rate of advance already noted during the previous months of the present year, assuring before the close of 1909 a repetition of the busy times of 1907. The Westinghouse Air Brake Company, Wilmerding, Pa., has received a large number of orders for brake apparatus and friction draft gear. As an index of the improved conditions at the Union Switch and Signal Company, Swissvale, Pa., this plant is now employing about twice the number of men of a year ago. In June, the Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa., enjoyed an improvement of twenty-five per cent over its business of May. A large order for railway motors secured from the New York Elevated Railroad Company is noteworthy. Switchboards and supplies, amounting approximately to $500,000, have also been ordered by the Pennsylvania Tunnel Terminal Company for the New York terminals and tunnels of the Pennsylvania Railroad. In line with the encouraging improvement noted by the Westinghouse Machine Company, the Philadelphia Rapid Transit Company has recently placed orders for two steam-turbine equipments, of 6,000 and 12,000 kilowatts capacity, respectively.

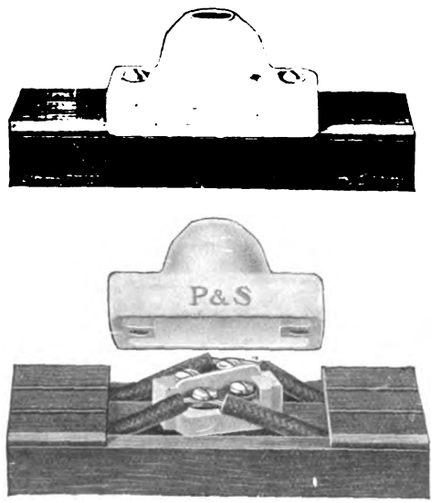
Popularizing the Electric Oven.

It is reported from Blackpool, Eng., that Charles Furness, the borough electrical and tramways engineer of that city, has formulated a scheme whereby electric ovens will be hired out at a rental of $0.75 to $1 a quarter. Experiments have shown that electricity at two cents a unit can compare with gas at sixty cents a thousand, for cooking purposes. If the proposed rental proves insufficient to cover interest and maintenance charges, Mr. Furness does not propose to raise the price, but to make up the difference from the charge for current. He figures on making no profit at all for eighteen months, as he considers it necessary to offer every inducement to give electric cooking a fair start.

Two-Piece Molding Rosettes.

In the two accompanying illustrations are shown a new two-piece fuseless molding rosette made by Pass & Seymour, Inc., of Solvay, N. Y. The upper view shows the device mounted with its cap in position. The lower view shows it with its cap slightly raised to show its interior construction.

It is to be noted that the small inside piece with the metal parts is mounted directly on top of the molding, which does not have to be cut to receive it. Nor is it necessary to cut the wire, since



TWO-PIECE MOLDING ROSETTES.

the latter simply loops up over the terminal plate at the extreme point and goes under the head of the upper contact screw.

Within the cap there is ample room for the knot of the lamp cord, which is fastened under the two inside screws on the terminal plates. The entire rosette is secured to the molding by means of two screws passing through the holes in the cap. This makes a neat and finished job, which can be completed in a very short time. The new rosette has been tested and approved at the Underwriters' Laboratories.

Orders for Allis-Chalmers Steam Turbines.

Allis-Chalmers Company has, of late, been shipping out a large number of steam turbines to fill recent contracts, among the number being machines of 500 to 3,500 kilowatts capacity for the Brush Electric Light and Power Company, Galveston, Texas; Oak Park Power Company, Flint, Mich.; Savannah Electric Company, Savannah, Ga.; Florida Mining Company, Mulberry, Fla.; Glenlyon Dye Works, Phillipsdale, R. I.; Willamette Valley Company, Springfield, Ore.; Pacific Mills, Lawrence, Mass.; Cia Electrica y de Ferrocarriles de Chihuahua, Mex., and Oshkosh Gas Light Company, Oshkosh, Wis.

Orders now in drafting room or shop comprise units as follows: Western United Gas and Electric Company, Aurora, Ill., 1,000 kilowatts; Neenah Paper Company, Neenah, Wis., 1,000 kilowatts; Cleveland Cliffs Iron Mining Company, Ishpeming, Mich., 2,000 kilowatts; Royal Weaving Company, Pawtucket, R. I., 1,500 kilowatts; North Adams Gas Light Company, North Adams, Mass., 1,000 kilowatts; Merchants' Heat and Light Company, Indianapolis, Ind., 2,000 kilowatts; Municipal light plant, Anderson, Ind., 500 kilowatts; Clinton Sugar Refining Company, Clinton, Iowa, 750 kilowatts; Anderson & Middleton Lbr. Company, Aberdeen, Wash., 300 kilowatts; Kenosha Electric Railway Company, Kenosha, Wis., 300 kilowatts; Fraser River Lbr. Company, Fraser Mills, B. C., 750 kilowatts; Northwestern Gas and Electric Company, Walla Walla, Wash., 1,000 kilowatts; Wilkesbarre Gas and Electric Company, Wilkesbarre, Pa., 1,500 kilowatts; Eastern Pennsylvania Railways Company, Pottsville, Pa., 1,000 kilowatts; Delaware, Lackawanna & Western Railroad Company, Scranton, Pa., 2,000 kilowatts; Colorado Springs Electric Company, Colorado Springs, Colo., 1,500 kilowatts; Aldrich Manufacturing Company, Moosup, Conn., 300 kilowatts, and Great Southern Lbr. Company, Bogalusa, La., 1,000 kilowatts.

Water Softening by Electricity.

A new water-softening process was described by J. L. Campbell in a recent paper before the American Railway Engineering and Maintenance of Way Association. Aluminum or iron plates were suspended in the water and an electric current passed through. The experiments proved highly successful.

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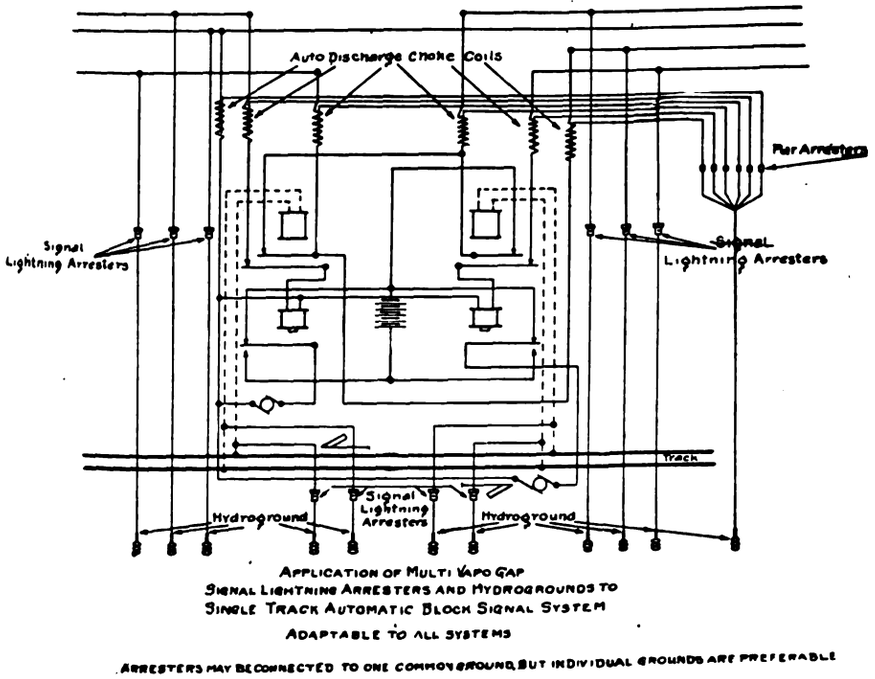
Lord Lightning Arresters and Grounding Devices.

The Lord Electric Company, of New York, has developed a new form of lightning arrester, making use of a discharge path akin to that found in nature. This device is designated as the "Multi-Vapo-Gap" lightning arrester. As its name implies, the arrester contains a hygroscopic medium forming a vapor cloud, through the numerous globules of which the lightning discharge finds multiple paths to ground. This cloud, however, is practically a non-conductor for the normal line current and forms an effective barrier to its leakage to ground. Therefore, no air gap is necessary. On tests this arrester has been shown to have a negligible equivalent spark gap, which is due to its insignificant impedance, since the multitude of moisture globules are very close together, though mechanically separated from each other. These features make the building up of static charges on the line impossible.

MULTI-VAPO-GAP LIGHTNING ARRESTER FOR SIGNAL CIRCUITS.

In construction, the Multi-Vapo-Gap arrester is a very simple and compact device. The body of the arrester is a highly hygroscopic mass which maintains mechanically and chemically a fixed and definite volume of moisture in suspension. Being hermetically sealed in a white or chocolate glazed porcelain housing, this moisture is maintained indefinitely. It contains no metal except the terminals, nor carborundum, graphite or any other form of carbon. There are no moving parts. There is provided a telltale, which indicates and records any discharge; this can also be used to open the circuit when testing. The arrester is built in three forms, suitable for high-tension circuits, circuits under 1,000 volts, and signal circuits of all kinds. In the accompanying illustration is shown the form of the arrester adapted to the latter service. It gives an excellent idea of its compactness as well as the clear designation of its terminals.

LORD ELECTRIC COMPANY'S HYDRO-GROUND.



APPLICATION OF LIGHTNING ARRESTER AND GROUNDING DEVICE.

The subject of effective grounding has interested electrical men for some years since it was found that the means formerly in vogue were very commonly unreliable. The Lord Electric Company, as the result of considerable experimenting in this line, has perfected a device termed by it the "Hydro-Ground," which is giving very satisfactory results. It consists, as shown in an accompanying view, of a number of ovoid disks mounted on a central metallic supporting rod. These units are of a substance which is highly hygroscopic and which retains indefinitely the moisture that it draws to it. This material is non-metallic, unaffected by acids or alkalies, and is not liable to electrolytic action. The installation of a Hydro-Ground is a simple matter, as it is necessary merely to dig a deep hole with a post-hole auger to bring it into the layer of damp earth. Ground wires are easily attached to its stem. After setting it on the ground strong brine is poured over the disks and salt is mixed with the earth used to fill in. This insures good earth contact, but does not corrode the Hydro-Ground as it would an iron pipe.

In the diagram herewith is shown the application of the Multi-Vapo-Gap lightning arresters and Hydro-Grounds to a single-track automatic block-signal system. It also shows a series of auto-discharge choke coils that have been devised by the company as an additional means to insure immunity from static disturbances. These devices have been proven to be adaptable to all systems and have been found to give excellent service.

Magnetos and the Automobile.

According to J. S. Bretz, president of the J. S. Bretz Manufacturing Company, New York, N. Y., importers of the Unterberg and Hehmle high-tension magnetos, the year 1910 will see the magneto in undisputed possession of the ignition field. Mr. Bretz avers that next year the magneto will be furnished as an integral part of the gasoline automobile and not offered as an extra or an option at an additional price.

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Western Electric's Half-Year.

While the first half of the fiscal year of the Western Electric Company, ended with May, shows an improvement in business and an increase in sales volume far ahead of expectations six months ago, the most satisfactory element of the situation and the one upon which the officers are felicitating themselves most, is the fact that the company is making money under present market conditions. An officer says:

"May 31 ended the first half of our fiscal year. Our business is running at the rate of approximately $46,000,000. This would compare with $33,000,000 for the fiscal year of 1908 and $53,000,000 for the fiscal year 1907, and the percentage relation is an improvement of forty per cent in the first case, and at the rate of eighty-seven per cent of the 1907 record. The present business outlook seems to us good but without anything to lead us to expect an unusual growth in our business. A sure and steady increase, however, may be confidently looked forward to if business conditions continue along the lines they are doing at present."

The increase in the machinery sales for the half-year was forty per cent over the same period a year ago and closely reflects the improvement in industrial conditions since a large part of the machinery orders were for additions and improvements.

Gross business for the first quarter of the fiscal year ran at the rate of $42,000,000 per annum, and for the last quarter at the rate of nearly $50,000,000 for the year, an increase of about nineteen per cent. While the business for May is usually ahead of the business of the preceding month, the increase of May, 1909, over May, 1908, showed approximately sixty per cent. The month of April, 1909, showed an improvement equivalent to fifty per cent over that of April, 1908, and if the ratio of improvement of the last two months continues the company will easily attain a $50,000,000 year.

The business with the farmers in the agricultural states has been satisfactory and with the good crop prospects that exist at present there is every prospect that this development will continue.

The volume of the company's orders for the six months increased about thirty per cent over the same period in 1908 and the average value per order increased approximately ten per cent. In certain lines the volume of orders increased more than fifty per cent.

The export business for the most part has not felt the impetus of the improvement in this country, running only slightly ahead of last year. The European business from the company's foreign plants, however, gained thirty per cent over a year ago and was twelve per cent greater than 1907, which previously held the high record. This remarkable gain is due to the fact that the company's trade with foreign countries is not so much dependent upon industrial conditions as the condition of the foreign governments' exchequers.

An Interesting Pole Yard View.

A panoramic view of the immense cedar pole stock of the Kellogg Switchboard and Supply Company, at Escanaba, Mich., was recently obtained and is produced herewith, which is interesting because of the difficulty in obtaining satisfactory views of this kind of a subject where a wide area must be covered, and yet bringing out clearly the important details. It shows quality stock, manner of piling, handling, wagon and train loading. This pole yard is economically laid out for quick shipments and low prices.

THE POLE YARD OF THE KELLOGG SWITCHBOARD COMPANY AT ESCANABA, MICH.

Induction Furnace for Brass Smelting.

An electric induction furnace has been suggested for brass smelting which possesses several good points. By covering in the furnace before the melting temperature is reached the oxidation of the zinc should be materially reduced. Brass and similar alloys at present are usually melted in crucibles in coke furnaces, a method which is wasteful with fuel and difficult to regulate, besides incurring a loss of zinc through oxidation. It is expected that the new process will meet with considerable success.

Western Electric Exhibit at Detroit.

An interesting feature of the convention of the Superintendents of Telegraph, held in Detroit, Mich., from June 22 to 25, was the Western Electric Company's exhibit of train-dispatching telephones. These attracted much attention and won favorable comment, as the systems were in actual operation and represented the latest development in telephone train-dispatching equipment.

Two types of selector equipment were shown: The Cummings-Wray standard, with a sender and four stations, and the Gill in two types, namely, the individual-call and the high-speed multiple-call, one sender and four stations of each.

The attention of visitors at the exhibit was directed to the many styles of apparatus developed especially for railway use. This included transmitters, receivers, desk stands, transmitter arms, head telephones, keys, loud-speaking receivers, portable sets, line poles, hand sets, foot switches, test panels, protectors, dry batteries, siding telephones, extension bells, and hand generators. Any of this equipment shown could be used with either the Gill or Cummings-Wray dispatching systems. Other pieces of equipment that were thought to be of general interest to railroad men, such as telegraph relays, emergency cable, cords, composite sets and howlers, were also shown.

The exhibit of transmitter arms was of special interest, including several distinct types, each having special features. Those shown were the Van Akin, the W. E. Special, the Flexiphone, the No. 1020 and the No. 20 desk stand.

The convention days fell in the midst of the late June hot wave. Western Electric fans were placed in the company's booth, and these rooms soon became popular. Similar fans were placed in the convention room and were much appreciated. The company also distributed trademark paperweights of unique design.

Representing the company at the convention were W. E. Harkness, R. F. Spamer and H. L. Burns, of New York, and C. L. Howk and J. H. Finley, of Chicago.

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A Supplementary Storage Battery for 24-Hour Service.

The generating equipment of the town lighting plant at Eddyville, Iowa, consists of a fifty-five-kilowatt, 220-volt, direct-current generator belted to a Corliss engine. During the year 1908, the load during peak hours reached, and, in fact, exceeded, the rated equipment of this set, thus necessitating increased capacity. It was felt that if a twenty-four-hour service could be maintained, the number of customers could be materially increased, the twenty-four-hour service being an additional inducement to use electric light and power. An attempt had been made to run a day circuit by operating the generating unit, but the expense of this method proved prohibitive.

A battery installation was therefore considered, and was placed in service in January, 1909, for the purpose of providing twenty-four-hour service, and supplying the excess peak load. This battery consisted of 130 cells of "Chloride Accumulator," manufactured by the Electric Storage Battery Company, of Philadelphia, with a capacity of twenty-five amperes for eight hours. It was found that the battery could be charged during the normal run of the steam generating plant, and would then have sufficient capacity to supply the demands for service after 11 p. m., when the plant was shut down. On occasions when the load during the peak is in excess of the generator capacity, the battery is also used to assist the generator. At infrequent intervals, a comparatively heavy demand is made on the plant by the Opera House, lodge halls and churches, and on such occasions the battery is available for supplying the excess demand.

Since the installation of this equipment a material increase has been noted in the number of customers, and since this is a municipal plant it is felt that the battery has been of manifold advantage, as it has not only increased the receipts, but has greatly improved the service.

Pure Wax Sheets for Condenser Dielectrics.

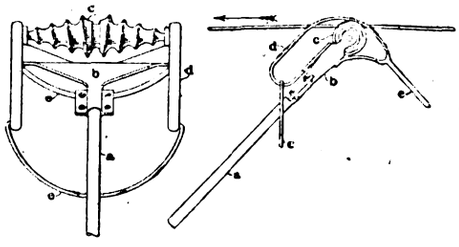
An interesting paper forming Memoir No. 18 of Vol. XLIV of the proceedings of the American Academy of Arts and Sciences, tells of the researches of C. L. B. Shuddemagen, of the Jefferson Physical Laboratory of Harvard University, on the residual charges of condensers with dielectrics of various materials.

Mr. Shuddemagen, in this paper, describes a new method of making condensers with pure paraffin wax. In preparing the thin wax sheets, he dips a thin, smooth board which has been soaked for a few days in water, and rinsed with water before use, into a bath of liquid paraffin wax. The sheet of wax on each side of the board is readily detached when the board is withdrawn from the bath. The thickness of the sheet is determined by the temperatures of the bath and the board, and also, of course, the time of immersion. Half a millimetre has been found a suitable thickness. Irregularities in the surface of the sheets are smoothed with the blade of a safety razor before the tin foil is placed on the sheets.

The condensers made in this way show no residual charge, and are thus likely to prove of great value in future electrical work.

A New Trolley Wheel.

A unique form of trolley wheel is described in a recent British patent granted to F. Kompe, of Berlin, and has already been tried out on the trolley system in Cologne, Germany. The idea of the invention is to prevent the trolley wheel



A NEW TROLLEY WHEEL.

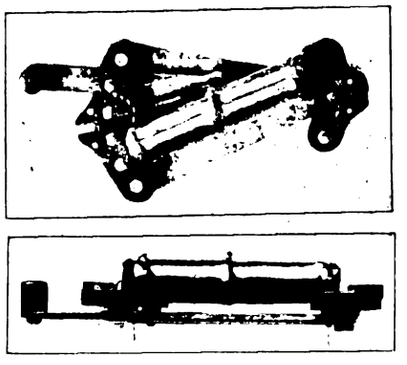
from leaving the wire, and, as will be seen from the accompanying illustrations, this is effected by means of a spiral device on each side of the trolley wheel proper, and integral with it, which tends to deflect the wire back into the central channel as the wheel is rotated by its running frictional contact with the wire.

In the illustration *c* is the double-conical spirally-grooved trolley wheel; *b* is a sheet-iron fork, provided with ball bearings, and fixed to the pole *a;* rigid side arms *d* connect with the fork, as shown. An extension is provided at each end to depress the roller if the wire leaves the central groove just before a span wire. The object of the arms is to prevent the wheel being thrown off the wire altogether, as when the wire is jerked out of its central position it strikes one of the two arms, and rebounds on to some portion of the spiral groove. In ordinary circumstances the arms do not come in contact with the span wires and other obstructions. When the car is running on a single-track section with the two trolley wires close together, the lower portions *e* prevent the second wire from being jerked under the arms *d*.

While the device is ingenious in design and construction it is doubtful whether in its present form it will supersede to any great extent the well-tried and efficient trolleys it is intended to replace.

Fan Controller.

The Ward Leonard Electric Company, Bronxville, N. Y., has placed on the market a complete three-speed and open step fan controller for desk fans, illustrations of which are shown herewith.



THREE-SPEED AND OPEN-STEP FAN CONTROLLER.

The resistance of these controllers consists of Ward Leonard enameled resistance units, the resistance wire being hermetically sealed from the disintegrating effects of the atmosphere. They are furnished complete ready for mounting in the base of eight-inch, twelve-inch and sixteen-inch desk fans.

Improvement in Nernst Lamps.

The instantaneous lighting Westinghouse Nernst lamps exhibited at the Atlantic City convention of the National Electric Light Association mark another important step in the development of the glower system.

The desirable feature of instantaneous lighting is accomplished by the substitution of a new form of heater for the old platinum heater. This heater becomes luminous immediately upon the passing of the current, and in addition to producing light instantaneously is so constructed that it causes the glower itself to light in ten seconds.

The Nernst company announces that on and after July 1, it will be prepared to deliver 88, 110 and 132-watt, 220-volt type alternating-current and direct-current lamps equipped with the instantaneous-lighting burners.

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The Roan Type Gathering Locomotive.

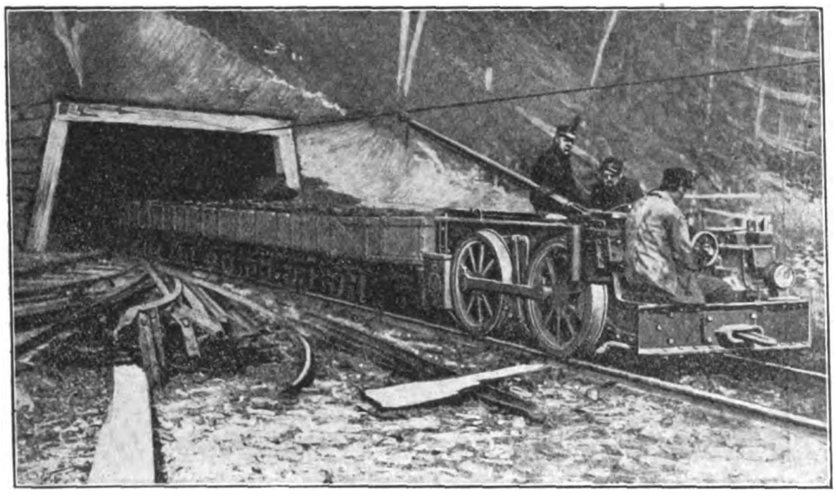
An improved electric mining locomotive of the "gathering" type, in which a single powerful motor performs the functions of both propulsion and operation of the gathering reel, has been brought out by the Westinghouse Electric and Manufacturing Company and the Baldwin Locomotive Works, under the patents of an invention of J. M. Roan. Mr. Roan, who is general manager of the Clinchfield Coal Corporation, is a practical mine operator, and on this account the gathering locomotive of his invention may be relied upon to meet exactly the requirements demanded by the practical mining man.

In the Roan gathering locomotive the single motor used to drive the wheels is arranged to be detached and connected to the wire-rope gathering reel. The wheels or the reel may thus be operated either independently or simultaneously, winding up the rope while the locomotive is moving.

The arrangement described secures advantages of flexibility, compactness and reduced amount and cost of electrical apparatus, attained in no other type. The provision of one powerful motor to perform the duties of both gathering and driving motors cuts in half the motor and controller expense, at the same time making the total power of the traction motor available for the gathering reel.

When loaded cars are to be hauled from the working face to the butt heading on which the locomotive stands, the rope is paid out and attached to the cars. The main driving motor is then unclutched from the axle and connected to the reel which winds up the rope, drawing the car toward the locomotive, which stands, with its brakes set, on the heading track. The provision for propelling the locomotive at the same time the reel is in operation enables the cars to be swung on to the heading without sawing the rope on the rib at the room neck. In service many applications have suggested themselves for the combined tractive and hauling-in actions secured from the motor. Derailed cars may be easily replaced on the track, timbers and rails recovered from under falls of rock, rails loaded on cars, and in fact the reel can be used for any kind of general hoisting work.

The motor transmits its power through a single spur gear directly to one axle. The two axles are connected together by side rods spaced ninety degrees apart, securing increased tractive effort beyond that of any single-motor or two-motor locomotive. As shown, the wheel base is extremely short, although the wheels are of full size, and the maximum amount of service is secured by the spring suspension of the frame and motor. The locomotive frame is made up of steel angles and plates, giving maximum strength for a given weight.

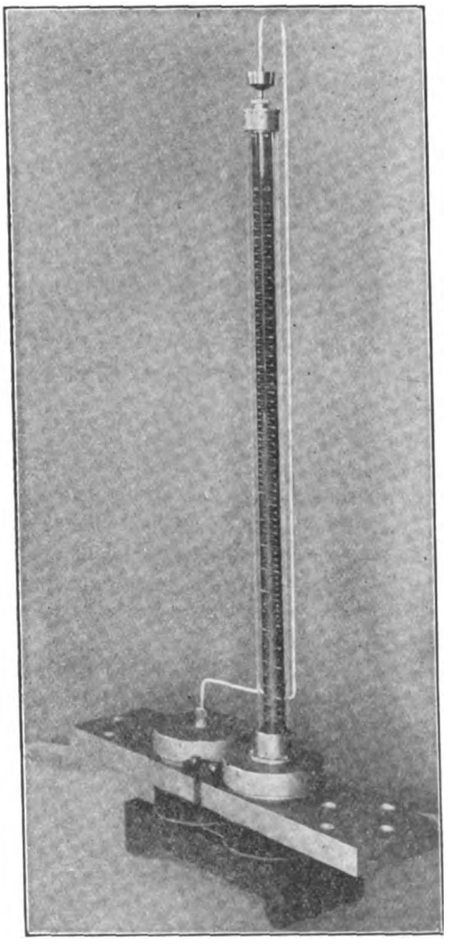


ROAN TYPE GATHERING LOCOMOTIVE.

The Leeds & Northrup Mercury Ammeter.

The problem of measuring large alternating currents with any degree of precision with any of the various types of instruments which have been on the market, is, from a technical standpoint, a difficult one. All who have had any experience in this class of work agree that there is need for a standardization instrument, which can be inserted directly into an alternating-current circuit carrying 500 amperes and over which will measure this current to the same degree of precision that small currents may be measured.

As a suggestion toward an instrument which would meet these conditions, in 1907, in a paper entitled "Some Newly Observed Manifestations of Forces in the Interior of an Electric Conductor," published in the *Physical Review*, June, 1907, Dr. E. F. Northrup proposed an alternating-current ammeter based on the forces he described. At that time a crude instrument was shown. Since that time, the Leeds & Northrup Company, of Philadelphia, has steadily perfected this instrument until it has reached a point where, practically speaking, it believes the only limit to accuracy of the instrument is the accuracy to which the ultimate unit of current is known. A paper descriptive of the developed instrument, its theory and tests of accuracy, was read by Doctor Northrup at the meeting of the American Electrochemical Society at Niagara Falls, Canada, May 6-8, 1909.



THE LEEDS & NORTHRUP MERCURY AMMETER FOR MEASURING LARGE CURRENTS.

The Leeds & Northrup Company states that its new instrument, which is designated the "mercury ammeter," is intended for use as a primary standard instrument for large currents, either alternating or

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direct. It is intended for the calibration of station instruments, and for use in the determination of series-transformer ratios.

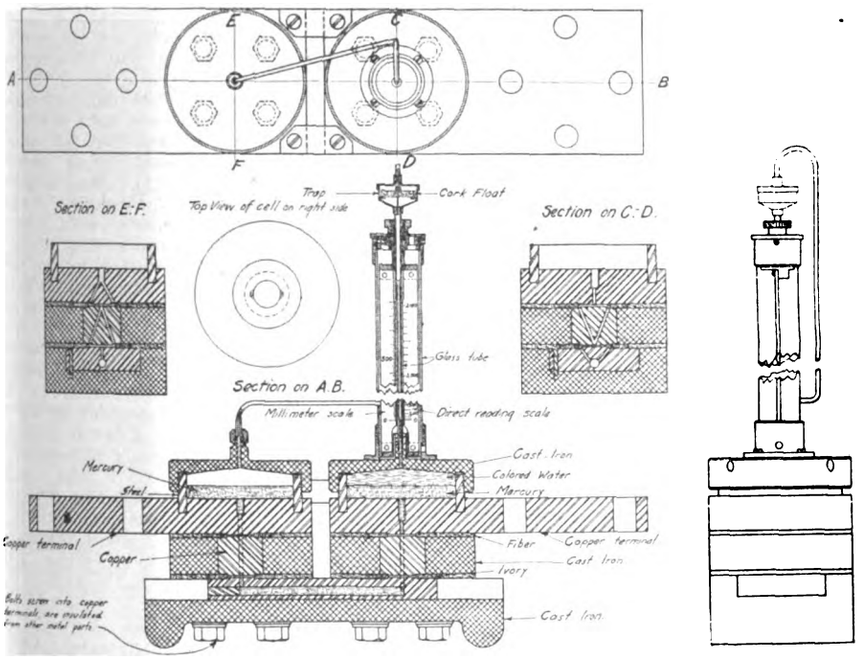
The mercury ammeter is intended for use in the measurement of currents of 200 amperes and over. The lowest practical range in the present type of instrument has a full scale corresponding to 500 amperes, and this instrument on 200 amperes may be read to one-fifth per cent accuracy. The standard length of the scale is about twenty-two inches.

Very exhaustive tests have been conducted on a number of these instruments using the potentiometer with direct current, and Kelvin balances with alternating current as calibrating instruments. In brief, it has been shown that this mercury ammeter may be read over three-quarters of the scale to an accuracy of 0.1 per cent, this accuracy being totally independent of the kind of current being measured; that is, the same instrument is equally accurate upon direct current and alternating currents of any wave form, and any frequency up to 133 cycles. The scale follows the square law, and the reading is in terms of the mean square value of the current. Also, the tests have shown that the temperature coefficient of the instrument is negligible when it is used as a standard.

A great deal of care was exercised in the determination of the effects of external currents upon the indications of the instrument. The results showed that appreciable errors resulted only when conductors, carrying heavy currents, were placed directly over or directly under the instrument in contact with the base. For instance, when a conductor carrying a current equal to the full scale reading of the meter (2,000 amperes) was placed over the base of the instrument parallel to its length, and in immediate contact with it, a 0.3 per cent error resulted. This was the maximum error observed, and when the distance between the conductor and the instrument was increased, the error rapidly diminished.

With regard to the constancy of the mercury ammeter, an instrument built in 1907, embodying all of the essentials of the present instrument, at the present date shows absolutely no perceptible change.

It has a period of about five seconds, that is, it will pass from zero to full-scale reading in five seconds. For facility of reading, the meter is built to be just short of "dead beat."



DETAILS OF MERCURY AMMETER FOR MEASURING LARGE CURRENTS.

The operation of the instrument is quite simple. The copper terminals of the instrument are bolted into the circuit without any regard for polarities. The zero of the instrument is roughly adjusted by leveling, and finally by turning the thumb nut at the top of the tube. The current is then thrown on, and the colored liquid will flow up to a point in the scale corresponding to the current flowing. The current is then read directly from the scale.

It is beyond the scope of the present article to go into the details of the theory of the mercury ammeter. However, a very simple analogy will serve to make clear the essential principle of the instrument. Wires, when carrying current, tend to attract each other so that were they fastened at the ends, they would swing together at their center. We can consider a liquid conductor as being made up of an infinite number of elemental conductors, parallel to the directions of flow of the current. With this in mind it is desirable to look at the cross-section views of the ammeter. The right-hand and left-hand sections will be seen to be very similar in construction, and to consist of copper plates alternating with insulating plates, having various holes drilled in each side, and closed reservoirs for mercury. Attention should be focused on the cross-sections on E F and C D.

The current, we will say, enters through the upper copper leaf. To get to the next copper leaf of the cell it must pass through the mercury-filled space within the ivory ring, shown dotted in the cut. In passing through the disk of mercury it causes the mercury to tend to flow away from the edges and bank up at the center. The force causing this action is exactly the same force that causes solid conductors, carrying current, to tend to attract each other. This attraction toward the center causes the mercury to flow through two diagonal tubes, which extend from the circumference of the disk of mercury to the center reservoir of mercury. Thus a force is set up which tends to make the mercury flow through the tubes and disks of sections C D and E F and through the connecting tube in the base of the instrument from C D to E F. It will be seen that in the meter in question there are four points at which the force is exerted, two being in section E F and two in C D. This force causes the mercury to flow until it is just balanced by the force due to the difference in hydrostatic head between the levels of the liquids in the two sides.

It is an interesting fact that the ammeter consumes about one watt per inch of scale reading, regardless of the amount of current to which one inch of scale corresponds.

The calibration of the instrument is dependent only upon the number and diameter of the disks or cells, the density of the liquid which serves as an indicator and the force of gravity. The liquid is not exposed to evaporation and, due to the fact that the instrument involves only hydrostatic heads, the effect of variations in the diameter of the index tube is eliminated, as is also the possibility of error due to drainage effects. Within wide limits the calibration is also independent of temperature changes.

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Current Electrical News

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, JULY 1.—The large network of power lines known as the South Electric, which extends over a large area in the Mediterranean region of France, is now being increased considerably, and the present project calls for a supply of 250 different communes in this region, representing a population of 600,000. A large turbine plant located on the Vis River is used to furnish a part of the current. At the locality of Sommieres is a substation which serves as a distributing center, and it receives the power line of twenty-seven miles length coming from the turbine plant, lowering the voltage from 50,000 to 13,000. About 5,000 kilowatts is utilized in this plant. Another source of supply is the Brillanne hydraulic plant, and a sixty-mile power line coming from it ends at St. Victor, near Arles, where there is a substation erected. The power line voltage of 50,000 is lowered to 13,500 volts at this point. It is intended to install a third substation in the Vaucluse department, which will receive current from the new turbine plant on the Ventavon River.

The trolley line which was erected along the Rue du 4 Septembre at Paris has finally been removed, to give place to the underground conduit system. The trolley system was only intended to be a temporary one and was installed during the subway work for the Metropolitan, when the conduit could not be put in place. However, it was allowed to remain for several years and was a subject of much discussion. Its removal adds much to the attractiveness of this quarter.

An international congress of radiology is to be held at Brussels in 1910. Information can be obtained from the secretary, at No. 1 Rue de la Prevoté.

The French Thomson-Houston firm has lately installed a tramway line which runs from Tunic to Carthage and the neighboring region.

At St. Leonhard, in the region of Salzburg, Austria, there has been installed a section of standard gauge electric railroad, which makes connection with the locality of Hallein. A. DE C.

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JULY 3.—The municipalities are taking up a somewhat anomalous position with regard to the much-debated "wiring" clause in the Electric Lighting Acts (Amendment) Bill, which is now before Parliament. This gives the municipalities authority to undertake the wiring of consumers' premises for electric lighting and also the hiring out of fittings, motors, etc. The House of Lords has amended the clause so that this class of work may be carried out by municipalities, but only through contractors. To this there is considerable opposition on the part of municipal electrical engineers, many of whom, however, state that although they do not believe in a municipality running a wiring department they do not wish to be tied down in this manner. This is a perfectly frank position to take up, but the somewhat curious wording of a resolution dealing with the matter passed at the recent annual convention of the Municipal Electrical Association rather prejudices the position of the municipalities when the Select Committee of Parliament comes to consider the point. The resolution in question was to the effect that if they cannot have the clause amended they will try and get it removed, but if this second alternative is unattainable then they will take the clause with the obnoxious restriction in it. This attitude will undoubtedly weaken the position of the municipalities and it would have been better to have taken a firm attitude either for or against the clause.

A good deal of discussion has been taking place of late on the question of how to deal with large consumers of electricity for power purposes. The real point under discussion is the method of charging such consumers; whether they shall bear a full share of the total capital charges upon the station in addition to the working costs or whether their share of the capital charges shall be confined to the newer plant from which they are supplied. The large majority of municipal stations, at any rate, were started many years ago as purely lighting undertakings and the capital expenditure upon the plant was naturally very high. Most of the recent extensions of plant have been for power supply and it is argued by many that the power supply should be treated as a separate business starting with the new plant. This is one aspect of the matter. Another point which is troubling many station engineers and managers is the question of discounts according to the time the supply is demanded. In some quarters there is an idea that the peaks can be leveled by giving sufficient encouragement to power users to make their demand at other times than the peak, and discounts of 80 per cent in regard to working costs are mentioned. Everyone seems to be working upon different bases, but the older stations with much out-of-date plant find the problem the most difficult to deal with. And the problem is not made the easier by the very cheap price of gas in many of our manufacturing cities in the provinces.

The first station relying solely upon British-made Diesel oil engines for giving a public supply of electricity has been opened at Chichester, a historic town in the south of England. Two 150-horsepower generating sets have been installed and the engines contain a number of features which are not common to those of continental build. Apart from the Diesel engines and the circumstances under which they have been installed, there is little of note in the station, which is quite a small one.

Great progress is being made with the formation of the Institution of Mining Electrical Engineers. It was felt that none of the existing scientific societies covered this field and a central organization has been formed with branches in every mining district. So far the details of formation are not quite complete, but no doubt a working session will be commenced next autumn.

The action by the British Westinghouse Company against Mr. Braulik for infringement of the Bremer arc-lamp patents has been completed, but the judge has not yet given his decision. Braulik claims that Bremer was anticipated in no less than thirteen patents in various parts of the world. Disconformity is also alleged between the provisional and the complete specification of the Bremer patent. The main patents relied upon are two American ones granted in 1882 and 1896, respectively, to Graham and Crosby. Some importance attaches to the result of this case, as it is the intention of the Westinghouse Company, if successful, to enter similar actions against a number of other makers and importers of arc lamps.

The popular seaside resort of Brighton has, by reason of the refusal of the Council to sanction patrol omnibuses, the distinction of being the second town in the country to adopt electrically-driven omnibuses, the local bus company having just put a number into service. These vehicles differ in their construction from those running in London, as the motors are accessibly mounted on the side frames and drive onto the rear wheels by means of cardan shafts. The batteries consist of forty-seven cells, and a special substation has been erected for charging the batteries off the mains of the Brighton Corporation. G.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, JULY 10.—The Montreal and Toronto stock exchanges, as well as many other Canadian financial concerns, have memorialized the Dominion government, praying for the disallowance of the act passed at the last session of the Ontario Legislature to validate certain contracts entered into by the Hydro-Electric Power Commission and the municipalities of the province.

A continuance has been granted of the injunction to restrain the city of Hamilton, Ont., from making application for power from the Hydro-Electric Commission until the trial of an action which has been instituted to quash the by-law that was recently adopted by the City Council, favoring an agreement with the commission.

The Porto Rico Railway Company has just decided to issue $500,000 preferred stock, and the shareholders are asked to meet, on July 28, in Montreal, to sanction the proposition. The money will be expended in extending the power lines to the eastern portion of the island. It is understood that a syndicate has agreed to take all the new stock, at par, not subscribed for by the stockholders.

The Erindale Power Company, which recently acquired from the liquidators of the Southern Light and Power Company the power station on Credit River, Ont., and land holdings at Port Credit harbor, is now arranging to proceed with the construction of the dam and the erection of buildings for the housing of machinery at the station with a view to delivering 1,000 horsepower to the distributors, the Stark Telephone, Light and Power Company, in Toronto, within six months. English capitalists are behind the power scheme. The capacity will be increased as the demand warrants.

The street railway company, Kingston, Ont., has notified the City Council that if no readjustment of the present condition of affairs can be made shortly, the company will discontinue its

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service to the city. The company declares that it will not take any bonus to run the line, neither will it accept power at less than cost of producing. The company says that if matters, even the purchase of the line, cannot be arranged, then the inevitable closing must follow and the stockholders take their loss to date. R. V. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, JULY 10.—At a meeting of the shareholders of the Alameda Rural Telephone Company, held at Alameda, Sask., it was decided to immediately proceed with the construction of a rural telephone company.

The British Columbia Electric Railway Company has made a proposition to the City Council of Victoria, B. C., to construct a power plant in the vicinity of that city at a cost of $2,000,000 to supply both the company and the city with electric current.

The Riverside Telephone Company has been incorporated, with head office at Bouleau, Sask., and the Wall Lake Telephone Company, with headquarters at Dundurn, Sask. Both companies have been formed to build rural systems.

The city of Fernie, B. C., has purchased a site on which to erect a new municipal light and power plant. Address Mayor Tuttle.

At Michel, B. C., the Michel Water, Light and Power Company has been incorporated to supply that town with the commodities named. R.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

MEXICAN IRRIGATION PROJECT—The Chapala Power and Irrigation Company, which has just been organized with a capital stock of $8,000,000 Mexican money, will construct a $2,000,000 hydroelectric plant for the purpose of providing water for irrigation. It is probable that two of these power plants will be built—one to be located on the Santiago River near Guadalajara and the other on a stream that empties into Lake Chapala. Transmission lines will be built to operate the pumps which will be located upon the shore of Lake Chapala, the water of which will be used to reclaim 75,000 acres of land. The government loan of $3,000,000, and an additional loan of $2,000,000 from the Loan Bank of Mexico City will be used to build about 110 miles of main irrigating canals and to establish three pumping stations. The plans, when completely rounded out, will involve the irrigation of more than 500,000 acres. The Pimintel interests of the city of Mexico, which own the street railway, light and power systems of Guadalajara, are associated with Manuel Cuesta in the enterprise.

ROYAL GORGE POWER COMPANY, COLORADO—George A. Taff, of Colorado Springs, Colo., formerly president of the Empire Water and Power Company, who has just incorporated the Royal Gorge Power Company, with a capitalization of $2,000,000, intends to build two enormous electric power stations at the mouth of the gorge, to be operated by the waters of the Arkansas River and Grape Creek, with a combined capacity of 40,000 horsepower, to reclaim hundreds of thousands of acres of arid land in eastern El Paso and Pueblo counties. Transmission lines will be extended as far north as Colorado Springs, with laterals running eastward fifty miles whenever necessary. The project is expected to be a boon to agriculturists in the enormous dry farming region to be made irrigable. Farmers in the Grand valley are pumping water at a cost of $5 per acre on surfaces from 40 to 100 feet above the Grand River, thus showing the feasibility of Taff's plan. Mr. Taff says arrangements have been made for the underwriting of the bonds to finance the proposition and that about $2,000,000 will be invested.

LIGHTING AND POWER.

(Special Correspondence.)

STORY CITY, IA.—The city is to put in a $9,000 electric-light plant.

MINNEOTA, MINN.—An electric-light plant is being considered by this city.

ELDORADO SPRINGS, MO.—B. F. Proctor will establish an electric-light plant here.

RYAN, TEX.—This city has voted $6,000 in bonds to establish an electric-light plant.

SAYRE, OKLA.—This city has voted bonds to the amount of $15,000 for an electric-light plant.

CORDELL, OKLA.—The city will vote on a $10,000 bond issue for establishment of electric lights.

TALALA, OKLA.—The Talala Telephone Company has been incorporated by A. W. Campbell and others.

HYDRO, OKLA.—A bond election will soon be held here to vote on a bond issue of $25,000 for waterworks and electric lights.

AMARILLO, TEX.—The Amarillo Water, Light and Power Company plans improvements to cost $100,000.

AINSWORTH, NEB.—The Electric Light and Power Company has been incorporated with a capital of $60,000.

MONETT, MO.—The citizens of this place have voted to issue $35,000 bonds to build a municipal lighting plant.

SINTON, TEX.—J. M. Greer and others are organizing a company to establish a $100,000 ice and electric-light plant.

MAYSVILLE, MO.—The De Kalb County Electric Light Company has been incorporated by E. A. Bunton and others.

TACOMA, WASH.—H. M. Byllesby & Company of Chicago, Ill., have acquired the Tacoma Gas Light property in this city.

CALLAWAY, NEB.—The Callaway Electric Light and Power Company has been incorporated with a capital stock of $15,000.

SAN MARCOS, TEX.—The San Marcos Electric Light Company has had an additional twenty-five-year franchise granted.

BARTLESVILLE, OKLA.—The Bartlesville Light and Power Company has been incorporated with a capital stock of $200,000.

SAN JUAN, CAL.—The Town Trustees have awarded an electric-lighting franchise in this place to the San Benito Light and Power Company.

McMINNVILLE, ORE.—This place has voted a bond issue of $30,000 for the completion of the new electric-lighting and power plant on Baker Creek.

BENSON, ARIZ.—Manager Frank Treat, of the Benson Water Company, says that the company proposes to install an electric-light plant in the near future.

CLOVIS, N. M.—The City Council has awarded a $55,000 contract for a municipal light and water plant to the Mathews Construction Company of this place.

ALBANY, N. Y.—The Oswego County Light and Power Company has certified to the Secretary of State that it has increased its capital stock from $100,000 to $1,000,000.

PIERZ, MINN.—A twenty-five-year contract has been made with the Little Falls Water Power Company, of Little Falls, Minn., for lighting the village by electricity. C.

WAYCROSS, GA.—Another election has been called to determine the question of issuing $35,000 municipal bonds for building a city lighting plant. The election will be held July 28. L.

ALBANY, N. Y.—The North Creek Electric Company, of Johnsburg, has been incorporated with a capital of $25,000. The incorporators are C. S. Wood, J. H. Wade and C. S. Wade, North Creek.

SEATTLE, WASH.—The municipality will appropriate $100,000 for the commencement of work on the extension to the power dam and on the extensions to the distributing system in this city.

SEATTLE, WASH.—Leslie H. Adams and William Mullholland have applied for an electric-lighting and power franchise in certain sections of this county. The matter will be acted on on July 29.

BELLINGHAM, WASH.—The Whatcom County Railway and Light Company will expend approximately $100,000 this summer in laying heavier steel on the local system and making street improvements.

SAN FRANCISCO, CAL.—The Pacific States Electric Company has been incorporated here, with a capital stock of $500,000, by W. L. Goodwin, F. Fowden, J. C. Gibson, H. V. Carter and J. S. Eells.

TOLEDO, OHIO—The citizens of Fayette, Ohio, have voted in favor of a bond issue to raise funds with which to install an electric-lighting plant. The proposition carried by a vote of nearly six to one. H.

ELLENBURG, WASH.—The City Council has adopted plans whereby the municipal lighting plant is to be doubled in capacity. Bids are to be received for a 250-horsepower engine and a 500-kilowatt generator.

COEUR D'ALENE, IDAHO—The Coeur d'Alene Current Motor Company has been incorporated here, with a capital stock of $250,000, by G. E. Nevers, J. R. Nevers, C. M. Butfhor, F. E. Wonnacott and Guy Searles.

HAWKINSVILLE, GA.—The city will soon install an electric-lighting plant and J. B. McCreary and Company of Atlanta are the engineers who are making specifications and plats of the system and the work proposed.

CHICAGO HEIGHTS, ILL.—An ordinance introduced in the Council creates "the department of electricity" of the city government, and provides for the appointment of a head thereof, who shall be an electrical engineer, or a practical electrician with five

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years' experience. A schedule of rates is fixed by the ordinance, and there are regulations concerning the issuing of permits, etc. On motion, the ordinance was held over to the next committee meeting.

KENDALLVILLE, IND.—The gas and light plant recently constructed by the Fort Wayne General Construction Company has passed into the hands of the Indiana Fuel and Light Company as the operating company. S.

VIRGINIA, MINN.—The Virginia Water and Light Company is erecting a fireproof brick power house and will install new fire pumps and electrical machinery. The total cost of the improvements will amount to $75,000. C.

LITTLETON, N. C.—The Panacea Springs Automobile and Electric Transfer Company has been chartered, with $125,000 authorized capital, to carry passengers and baggage from this town to Panacea Springs. Eugene Johnston is interested. L.

TOLEDO, OHIO—The Lake Shore Electric has made a proposition to the city of Fremont, Ohio, whereby it will expend $25,000 in improvements in consideration of an extension of its franchises. The proposition includes the paving of portions of State and Arch streets. H.

BELLINGHAM, WASH.—The North Coast Mining and Milling Company has appropriated 8,000 cubic feet of water per second from the Skagit River in Whatcom County. Water will be carried in flumes, pipe lines and tunnels to a point near Red Hill, where a power plant will be installed.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company is installing four 440-horsepower B. & W. boilers, with corresponding six-retort Taylor stokers, which they will operate at practically 900 horsepower normally. These boilers will, during a peak load, probably be run at about 1,200 horsepower.

HARTFORD CITY, IND.—The Hartford City Lighting Company announces that it will erect and equip a large central-station plant at this place and will generate light, heat and power for transmission to Upland, Eaton, Millgrove, Redkey and Ridgeville in addition to other towns and cities. Estimated cost of the plant is $75,000. S.

TOLEDO, OHIO—W. E. Richards has succeeded Charles R. McKay, resigned, as superintendent of light and power of the Toledo Railways and Light Company. Mr. Richards has been connected with the Toledo company for the past eighteen years, for the past several years holding the position of superintendent of the electrical department. H.

BERN, KAN.—The electric-lighting plant at Bern, Kan., owned by Ernest Gerber, was destroyed by fire and will be rebuilt at once. Mr. Gerber is in the market for an eight by ten or nine by ten high-speed, second-hand engine, and a twenty-kilowatt alternator, or an engine of the same size, direct-connected with a 110-220-volt three-wire unit.

BALTIMORE, MD.—Negotiations are pending between the Baltimore & Ohio and the United Railways Company, with the view of leasing the power house of the United, at Light and Heath streets. If the negotiations are successful, the Baltimore & Ohio will equip and use the power house as a supplemental station to its own power plant in Camden yards.

JOLIET, ILL.—The Economy Light and Power Company, which furnishes power for illumination throughout Joliet and is extending its lines in many directions, has just closed a contract with the village of Frankfort for supplying power to that town for lighting purposes. The line will pass through New Lenox and the work on its construction will be started at once.

FORT WAYNE, IND.—The City Council has been asked for an appropriation of $17,000 for electric-light betterments and extensions. The municipal lighting plant does not extend to the streets and residences on the outskirts of the city and there is a general complaint, as it is claimed the streets should be adequately lighted before experimenting with commercial lighting. S.

NEW YORK, N. Y.—The New York and Queens Electric Light and Power Company stockholders have failed to authorize the issue of $25,000,000 bonds proposed last April. They were to vote on the proposition by mail, but the company did not receive the required number of assets. At the annual meeting of the New York & Queens Electric Light and Power Company directors were re-elected.

KENNETT SQUARE, PA.—A receiver has been appointed for the Kennett Electric Light, Heat and Power Company. The company has been in financial straits for some time. Ralph Rhoads, the manager, issued a letter a few days ago charging gross criminal misrepresentation and mismanagement upon the part of those financing the company. He says there are $165,000 first-mortgage bonds, $300,000 of stock, $27,000 overdue notes, $3,000 unpaid bills and $1,000 in unpaid salaries against the company. The interest on the bonds was never earned, but paid out of receipts of stock sold, and that if the plant was put up at a forced sale today it would bring less than $50,000. The plant was built by local capitalists several years ago and has changed hands three or four times since then, being now said to be in control of the United Public Service Corporation, with headquarters in Philadelphia.

THOMASVILLE, N. C.—Mr. M. F. W. Bryant, Boston, Mass., has been elected superintendent and general manager of the Thomasville Light and Power Company for the ensuing year. The company is already finding a rapidly growing clientele, and is lighting the town and furnishing power for manufacturing plants. Mr. C. E. Leak, of Greensboro, was elected secretary and treasurer of this company. L.

SAN MARCOS, TEX.—The City Council of this city has agreed to grant an additional twenty-year franchise to the San Marcos Electric Light Company, their franchise having recently expired. This was done on an agreed basis between Victor M. Brooks of Austin and Will G. Barber of this city, attorneys for the light company, the attorneys agreeing to recommend same to the company to acceptance.

TOLEDO, OHIO—The Springfield Light, Heat and Power Company, of Springfield, Ohio, has submitted a proposition for a new franchise, although the old contract still has two years to run. In consideration of a ten-year agreement, it offers to make a reduction of fifty cents per lamp for each ten lights added to the 415 to be installed, including the 29 donated, until the rate has been lowered to fifty-eight dollars per year. H.

RALEIGH, N. C.—Following an act of the recent state Legislature requiring all steam-railroad engines to be fitted with electric lights, the representatives of the Norfolk & Southern Railroad recently appeared before the Corporation Commission, asking that their line be totally exempted from this rule. The road claimed that it made few runs at night, and that there was little need of headlights. The Commission reserved decision. L.

WASHINGTON, D. C.—The Rosslyn Electric and Gas Company, Rosslyn, Alexandria County, has been granted a charter by the state corporation commission, with a maximum capital stock of $50,000 and a minimum capital stock of $25,000. The objects are to operate a gas and electric-light plant. The following are named as officers: M. E. Church, president, Falls Church; G. H. Rucker, vice-president, Rosslyn; T. J. King, secretary, Georgetown, D. C.

GRAND JUNCTION, COLO.—A consolidation has been effected whereby the Grand Junction street railway and electric lighting plant, the gas plant and the Grand Junction Ice and Storage Company comes under one management. The cash consideration is $400,000. The purchasers are Charles McNeill, Thomas E. Curtin and other millionaires of Colorado Springs. It is understood that between $600,000 and $800,000 will be expended in the next year for improvements.

SAN FRANCISCO, CAL.—The final payment of approximately $1,000,000 was made this week by representatives of the California-Nevada Electric Company to the Fleishhacker interests for their Truckee River electric holdings. The property transferred includes two power plants and a distributing system carrying power into Reno, Carson, Virginia City and other towns. The new owner, under the management of W. P. Hammon, will extend the distributing system at a cost of about $1,000,000.

TOLEDO, OHIO—Plans are on foot for the lifting of the receivership of the Toledo Urban and Interurban line. A meeting will be held on August 6, with this end in view. Arrangements are also being made to increase the preferred stock of the company to $750,000. It is also probable that the matter of extending the Toledo, Bowling Green & Southern to Kenton and possibly to Columbus. The promise is made of a direct line from Toledo to Cincinnati, by way of Columbus, within eighteen months. H.

SAN FRANCISCO, CAL.—The directors of the Pacific Gas and Electric Company, at a meeting on July 29, decided to offer the preferred stockholders, in lieu of preferred dividends amounting to $2,000,000, common stock to the amount of $5,000,000. This will put out the common stock at forty per cent of the par value, the price on the local market having been forty-four in recent sales. It was announced at the directors' meeting that the unifying and refunding bond plan had resulted in the placing of $5,000,000 in bonds with a New York house.

RICHMOND, VA.—The application of the Virginia Railway and Power Company, successor to all the street-railway, lighting and power companies in this city, Petersburg, Manchester, and in Henrico, Hanover, Dinwiddie and Chesterfield counties, has been received by the Corporation Commission. The minimum capital is $9,000,000 and the maximum is $12,500,000, the new company to take charge July 1, with principal offices in this city. Frank Jay Gould, Tarrytown, N. Y., is named as president of the board, in the petition; president, William Northrop, of Richmond; vice-president and general manager, Henry Anderson, Richmond; secretary and treasurer, Guy Phillips, New York; the directors include the above-named officials and Messrs. C. S. Whelen, Phila-

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delphia; Edward Gould, Dobbs Ferry, N. Y.; Percy M. Chandler, Philadelphia; R. Lancaster Williams, Richmond; Fritz Sitterding, Richmond. This ends a long-drawn fight between the Fisher and Gould interests, and the transfer of the property is by order of the United States Court, which confirmed the auction sale to the new owners. C. B. Buchanan will be general manager of street railways, and Geo. M. Whitfield, general manager of the light and power departments. L.

TRENTON, N. J.—Articles of incorporation have been filed by the Union Railway, Gas and Electric Company, which has an authorized capital stock of $18,000,000. Of this $12,000,000 is cumulative stock bearing six per cent cumulative dividends, and $6,000,000 common stock. The company is to build and operate railroads, electric-light and power plants, gas plants and steam heating and supply plants. The charter was recorded in Camden by the Corporation Guarantee and Trust Company. The incorporators are F. H. Hansell, John A. MacPeak and Joseph F. Cotter.

ALEXANDRIA, VA.—Recent rumors that Baltimore and Washington capital was seeking to buy the Alexandria Electric Company franchise and rights have been confirmed, following a meeting in Philadelphia at which new officers were chosen. Thomas C. Coleman, of Cockeysville, Md., was made president; H. P. Lucas, of Baltimore, secretary and treasurer, and F. R. Weller, of Washington, D. C., general manager. Among the plans of the new holders is the doubling of the Alexandria plant's capacity, and the institution of a campaign for more business in house lighting, and power and heating service. L.

ATLANTA, GA.—The Council committee on electricity has voted favorably on the application of the Central Georgia Power Company for a franchise to sell power for lights and manufacturing purposes, etc., in this city. The application is copied from the franchise recently granted the Piedmont Power Company, and W. J. Massee, president of the Central Georgia company, states that the sum of $1,500,000 has already been expended in the work of construction, and a similar amount is in hand in cash for further prosecution of the work as needed. L.

HAZLETON, PA.—The Consumers' Electric Light and Power Company, the McAdoo Electric Company, Harwood Electric Power Company, Nescopeck Township Electric Power Company, Sugarloaf Township Electric Company, Black Creek Township Electric Company, Kline Township Electric Company, Union Township Electric Company, Rush Township Electric Company and Rahn Township Electric Company have all been merged under the name of the Harwood Electric Company, the power house of which is now nearly completed, and which will supply current throughout the territory of Hazleton and its vicinity.

SALISBURY, N. C.—Encouraging reports continue to emanate from here as to the likelihood of the old Whitney Reduction Company's mammoth electrical development being resumed soon, following a long shut-down due to litigation. Argument has been concluded in all remaining exceptions in the noted Whitney case, before Special Master A. H. Price, and final argument will be made before Federal Judge J. C. Pritchard at Asheville before the end of the month. It is also understood that arrangements are assured for the further financing of the project, on which many thousands have been expended already, for the development of one of the largest single electric plants in the southern country. L.

GRAND JUNCTION, COLO.—As the result of the consolidation effected recently in Colorado Springs of the Grand Junction Street Railway Company and the Grand Junction Electric, Gas and Manufacturing Company, twenty miles of interurban electric lines will be built in the Grand Valley during the next two years. The holding company is to be known as the Grand Junction & Grand River Valley Railway Company, and Thomas E. Curtin is to be president. The Grand Junction Electric, Gas and Manufacturing Company was taken into the new corporation at a valuation of $500,000, and will be at once enlarged to furnish adequate power both for lighting and operating the interurban system.

BROOKLINE, MASS.—A substantial cut in the price of electricity has been announced to the Brookline selectmen in a letter from the Boston Consolidated Gas Company. The cut is in accordance with an agreement made between the company and the committee appointed in 1907 to consider the need of a municipal lighting plant. An additional cut is promised in July of next year. Under the new terms the maximum rate is from sixteen to fourteen cents per kilowatt-hour. The contract rate is from eighteen, eight and five cents per kilowatt-hour to sixteen, seven-and-one-half and five cents per kilowatt-hour, under the rule of primary, secondary and tertiary charges. The cost per year for street arc lamps is to be $110 each, as against the old cost of $124.10. However, the communication states that the rate for arc lights is made only under consideration of a five-year contract. The town has 261 arc lights, of which seventeen are in parks. Little use is made of incandescent street lights; instead, the town has 918 Welsbach lights, of which 781 are gas and 137 naphtha lights. It is thought, however, that the new rate for electricity will offer such inducements that the gas lamps may be superseded by incandescents.

COLORADO SPRINGS, COLO.—The organization of the Automatic Light Company, composed mostly of Colorado Springs men, and incorporated for $1,000,000, has been completed, with the election of the following officers: President, C. S. Gambrill, of the El Paso Ice and Coal Company; vice-president, W. B. Dempster, president of Dempster & Place, glove manufacturers, of Gloversville, N. Y.; secretary and general manager, Taylor J. Downer, Colorado Springs; treasurer, E. G. Davis, of the Elite Laundry Company. These officers, with E. F. Downer, of this city, form the board of directors. T. J. Downer is the inventor and patentee of the signal light for electric cars, which has been tested on the street cars in this city, and will be installed on several of the electric cars in Denver.

RICHMOND, VA.—The proposed municipal lighting plant, for which large appropriations have been made, will, in all probability, require considerably more money than was first anticipated, before the system is fully provided for. The first additional matter comes in the form of a request for the number of lights that will be required to light all of the alleyways of the city, and cost of the same. The city will be compelled to build a complete system of street electric lines to replace the old system, which has been used under lease from the old Virginia Passenger and Power Company. The city has declined to purchase these lines, poles, wires, etc., desiring to put in a new system. To date the money available by bond issues is, $250,000 for construction purposes and $100,000 for machinery in the lighting power plant. L.

CHARLOTTE, N. C.—A ten-year contract has just been agreed upon by the city executive board and the Southern Power Company for the furnishing of not less than 300 arc lights for the period named. The first 250 lights will be paid for at the rate of $56 per annum per light, and all lights over 250 to be supplied at $50 per annum. This is claimed to be the cheapest lighting that any city of the population of Charlotte enjoys in the south. The annual light bill for approximately 350 lights is $19,000. The city has the privilege of buying the lights at the end of five years, and there are other clauses in the contract to protect the interests of both city and company. In the event that the city should desire to purchase the system at the end of five years, the company reserves the right to charge $60 instead of $56 for the first 250 lights and $54 instead of $50 for all over 250 lights. L.

PHILADELPHIA, PA.—The Philadelphia Electric Company intends greatly to extend its field, and has contracted to furnish current to the recently organized Delaware County Electric Company, which supplies electricity to most of the towns in Delaware County. According to the arrangement made, the Philadelphia Electric will furnish current for the territory between Philadelphia and Media, including the towns of Swarthmore, Morton and Wallingford. The distribution will be made by the Delaware County Electric Company. The latter corporation is the result of the amalgamation of three separate Delaware County plants, which will now be closed. The Delaware County Company will now purchase all its power from Philadelphia Electric. The latter company has agreed not to sell its power to any other consumer in the territory served to the Delaware County Company, assuring the new corporation a monopoly.

BOONE, IOWA—The City Council recently passed, by unanimous consent, to the people for popular vote, a franchise which will mean the rejuvenation of the public utilities of the city. This franchise, which is termed the Hughes-McBride franchise, would mean, it is rumored, further interurban extensions and low rates for light and power. The power rate, which compares favorably with the rate in any city in Iowa, and which should be a boost for manufacturing concerns, is as follows: Forty kilowatt-hours per month, nine cents per kilowatt-hour; forty to fifty kilowatt-hours per month, eight cents per kilowatt-hour; fifty to 100 kilowatt-hours per month, seven cents per kilowatt-hour; 100 to 200 kilowatt-hours per month, six cents per kilowatt-hour; 200 to 300 kilowatt-hours per month, five cents per kilowatt-hour; 300 to 400 kilowatt-hours per month, four cents per kilowatt-hour, and over 400 per month, for three cents per kilowatt-hour.

PROVIDENCE, R. I.—Another big steam turbine is to be placed in the power house of the Narragansett Electric Lighting Company. It is stated that all the Narragansett steam engines as fast as worn out will be replaced with turbines and that the Westinghouse-LeBlanc condenser, which was applied to the first turbine, has proved to be reliable and will be used with the turbine just ordered. Turbines of the Parsons type also have been recently selected in preference to reciprocating engines by the Atlantic Mills, the Sea View Railroad, the Manville Company, the Hamlet Textile Company, the North Scituate Cotton Mills, the Royal Weaving Company, Glenlyon Dye Works, the Lowland Worsted Mill, the Aldrich Manufacturing Company, and by F. P. Sheldon & Sons for the Lyman Mills, Holyoke, and the Erwin Mills, Durham, N. C., and by Knight C. Richmond as consulting engineer for the Dartmouth Mill, New Bedford.

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ELECTRIC RAILWAYS.

(Special Correspondence.)

MINNEAPOLIS, MINN.—Work has been started on the survey for the electric line to Anoka, Minn. C.

MOSCOW, IDAHO—A franchise has been granted for a street railway to the Spokane & Inland Empire Railroad Company.

MISSOULA, MONT.—A. H. Withey announces that the Clark company will shortly commence construction work on the electric line to the fort. C.

HELENA, MONT.—Former Governor Hauser states that funds have been obtained for the construction of the Butte and Helena electric line. C.

SALINAS, CAL.—The Board of Supervisors has granted to H. R. O'Bryan the electric-railway franchise in this county, recently applied for by him. A.

SANTA BARBARA, CAL.—The City Council has adopted a resolution awarding a franchise for a trackless trolley line to the Pacific Improvement Company. A.

BUTTE, MONT.—Manager Wharton of the local street-car company announces that his road will make extensive improvements and extensions to its system this year. U.

MACON, MO.—Articles incorporating the Hannibal & Northern Missouri Railroad Company, capitalized at $2,000,000, have been filed. The line is to be operated by electricity.

HOUSTON, TEX.—The Marshall Traction Company of Marshall, capital stock $25,000, has been incorporated. Incorporators: M. Turney, F. H. Prendergast, F. A. Austin and others.

BELLINGHAM, WASH.—The Whatcom Railway and Light Company will extend its line a distance of 5,980 feet. The improvement is known as the Happy Valley extension and will cost $12,000. U.

MICHIGAN CITY, IND.—The Chicago South Shore Electric Railroad Company is settling claims growing out of the Chesterton wreck. It estimates that the aggregate will reach from $80,000 to $100,000. S.

CHARLOTTE, N. C.—The Piedmont Carolina Railway Company has secured a franchise for the construction of an interurban electric line from Salisbury to Concord and an urban system for the latter city.

BOONE, IOWA—The coal mines near Ogden have been sold to the Fort Dodge, Des Moines & Southern Interurban, being the biggest coal deal in years here. The company will construct a track to the new property.

INDIANAPOLIS, IND.—The Indianapolis & Beech Grove Electric Railway Company is preparing to let the contract to construct eight miles of road, to connect Beech Grove, where the Big Four shops are located, with the city. S.

WAUSAU, WIS.—The Wisconsin River Traction and Power Company has commenced the construction of a dam across the Wisconsin River at Trappe, which is taken as an indication that the electric road to Merrill will be built. C.

AUGUSTA, ME.—The Lewiston, Augusta & Waterville Street Railway Company plans to run a line of freight cars on its lines in the rural districts, which will give the farmers better facilities for transporting their products to market.

MOUNT VERNON, IND.—Plans have been formulated for the construction of an interurban line from this city to Burt Prairie, Fairfield and Cormill, Ill. George W. Burnes, president of the Burt Prairie Bank, is at the head of the project. S.

BLUFFTON, IND.—The Bluffton, Geneva and Celina Traction Company has been granted a fifty-year franchise right to enter the city, by the City Council. The officials of the company agree to have the road in operation within one year. S.

EVANSVILLE, IND.—The City Council has granted the Evansville & Newburg Electric Railway Company a franchise to haul freight through the streets. This privilege was withheld until the business interests of the city demanded that the right be granted. S.

LAPORTE, IND.—Interest has been revived in the construction of an electric line between this city and Logansport, passing through Knox, Bass Lake and Winamac—connecting three county seats. A meeting was held in this city July 2, and eastern capital was represented. It is proposed to construct the road next year. S.

SPRINGFIELD, ILL.—The Belleville and Mascoutah Traction Company has been licensed to incorporate. The capital stock is nominally $150,000, and the principal office is Mascoutah. The road is to be constructed from Belleville to Mascoutah. The incorporators and first board of directors are: Emil J. Kohl and Adolph Knobeloch, both of Belleville, and Gust. J. Sheve, E. E. Hagist and Peter W. Lill, all of Mascoutah.

MARSHFIELD, ORE.—J. M. Blake, who, it is understood, is representing eastern capitalists, has applied for a franchise to construct and operate an electric railroad running on certain streets here, and has also applied for a franchise to operate in North Bend. U.

EVANSVILLE, IND.—The Indiana Railroad Commission has issued an order requiring two interurban lines, the Evansville & Newburg and the Evansville Terminal Railroad companies, to construct a physical connection at Newburg in order that an interchange of freight may be maintained. S.

MINERAL WELLS, TEX.—It is stated that Little Rock capitalists, headed by the Kempner brothers, have acquired the Mineral Wells electric system and its appertaining properties from the Jones-Bomar interests of Fort Worth. This is regarded as meaning early re-operation of the line.

MILES, WASH.—The Big Bend Transit Company, which holds the power site at the narrows below Fort Spokane, proposes to build an electric line along the Spokane River from Spokane to the Columbia River steamboat landing, above the mouth of the Spokane River, and use the narrows for a power site. U.

KOKOMO, IND.—C. C. McFann, a local capitalist, is at the head of a company seeking the right-of-way for a traction line from this city to Young America—a distance of sixteen miles. The road will be constructed through fertile farm lands, hitherto void of railroads, and connect a number of prosperops villages. S.

EUGENE, ORE.—Vice-President and Manager A. Welch of the Portland, Eugene & Eastern Railway Company, which operates the electric lines in Eugene as well as the interurban lines out of this place, announces that the company will erect this year a large power house at Martin's Rapids, thirty miles from Eugene. A.

LA CROSSE, WIS.—The La Crosse Water Power Company has secured an option on all the properties of the La Crosse Cty Railway Company. The latter company has recently issued $400,000 bonds, which have been taken up by the National Bank of La Crosse, to retire present bonds and make improvements in the service. C.

MILES, WASH.—The Big Bend Transit Company, which is to build an electric railway from Spokane, Wash., to the Columbia River steamboat landing, above the mouth of the Spokane River, is preparing to put in a sixty-foot dam and a power house at the Narrows. Engineer L. F. McCoy has just completed a survey of the river at the dam site. A.

KINGSTON, N. Y.—A thirty-mile trolley line will be built in Rockland. It will begin at Tappen and go as far north as Stony Point. It will do much to develop Rockland County. The cost will be $2,500,000. It is proposed to extend a trolley line along the west bank of the Hudson until it reaches the state capital by way of Kingston, Saugerties and Catskill.

DES MOINES, IA.—Incorporation papers for the Iowa & Omaha Short Line, giving the capital stock at $100,000,000, have been filed in the office of the secretary of state. The line will be operated electrically and will be 140 miles in length, terminating in Douglas County, Nebraska. John A. Holmes of Pierre will be in charge of the home office, which will be in Pierre.

LOGANSPORT, IND.—The Fort Wayne & Toledo Electric Company has announced that the actual construction of a line from Fort Wayne to Toledo will be commenced as soon as the requisite amount of stock has been subscribed for. The line, when completed, will be the connecting link between this city and Toledo, and will traverse a prosperous and growing country.

PONCE DE LEON, PORTO RICO—At a special meeting of the shareholders of the Porto Rico Railway Company, held in New York July 8, the shareholders authorized an increase in the capital stock from $3,000,000 to $3,500,000 by the issue of $500,000 preferred stock at par. The company states that this capital is necessary to take advantage of the satisfactory franchises secured by the company for double-tracking and for the extension of its lighting lines to cities and towns in the eastern part of the island.

WINSTON, N. C.—An announcement of more than ordinary interest is made to the effect that an interurban electric line will be built from this city to Salisbury, forty miles southwest, and to High Point, on the Southern Railway, and along a very heavily traveled part of the steam railway. The chief promoter is T. H. Vanderford, of Salisbury. It is said that the principal rights-of-way were secured already. A supplemental line, that from Salisbury to High Point, thirty-six miles in length, paralleling the route of the main line of the Southern Railway, which has been under consideration for some years, is likewise receiving a good deal of attention, while the Salisbury-Winston cross-country line is being promoted. The fact that this line is now materializing follows the announcement of the building of the "Southbound" steam railway from Winston, crossing the above-mentioned line from Salisbury, to High Point and continuing through the center of the

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state, is perhaps of some significance relative to the electric-railway announcement. Furthermore, Mr. Vanderford has sought an extension of time from the town of Concord, thirty-four miles southwest of Salisbury, and has put up $1,000 forfeiture with the Concord officials to begin work inside of sixty days on a local electric system. Mr. Vanderford declares that work will be begun immediately in Concord. It is stipulated in the franchise that three miles of track are to be completed and in use within two years. L.

ST. JOSEPH, MO.—The Engineering Construction and Securities Company, Chicago, Ill., was recently given a contract for the engineering and construction of an interurban road from Creston, Ia., to Des Moines, Ia., running through Macksburg and Winterset. The engineering corps will be put in the field to make the survey at once. Any information desired in regard to this proposition may be secured by addressing C. B. Judd, chief engineer, at Creston, Ia., or C. A. Ross, president, Engineering and Securities Company, Chicago.

SAN JOSE, CAL.—The Peninsula Railroad Company, one of the Harriman Southern Pacific properties, recently incorporated in San Francisco, has filed its articles of incorporation here preliminary to the taking up of active work in Santa Clara County. The roads already owned and in operation by the company include the San Jose and Los Gatos electric line, the old Peninsular electric line and the San Jose and Santa Clara line. New lines and extensions to old ones are planned which will bring the total mileage up to 220 miles. A.

AUSTIN, TEX.—The governor has requested the Attorney General's Department to prepare the form for the state railway bonds, as they will be issued under act of the last legislature. The outstanding bonds, aggregating $125,000, are to be refunded and $50,000 additional bonds are to be issued to complete and equip the state railway, to be operated from Rusk to Palestine. The original $150,000 of State Railway bonds provide for one bond of $7,500 to mature each year, and one has matured and been taken up. The next will mature on December 1, 1909. The bonds will be refunded and the school fund secure the entire issue.

McKEESPORT, PA.—A company has been organized to build a trolley line from Dravosburg to Duquesne. The distance will be about three miles and will cut the present route in half. Business men in Duquesne, together with a few outside capitalists, are financing the company, which will be known as the Duquesne and Dravosburg Street Railway Company. The officers of the company are: President, Fred W. Scott, of Duquesne; vice-president, J. C. Cato, of Aliquippa; secretary, T. F. Vankirk, of Coraopolis; treasurer, A. J. Krill, of Aliquippa; board of directors, William J. Leader, J. W. Speering and M. G. Conlin, of Duquesne, H. C. Purdy, of Coraopolis, and Charles McGinley, of Indiana.

JOLIET, ILL.—The Chicago, Ottawa & Peoria Railway Company is about to increase the capacity of its power plant at La Salle, and if terms can be made with the commissioners of the I. & M. Canal the power line may be built along the canal from Split Rock to Joliet. At the present time the company's pole line between La Salle and Split Rock is constructed along the towpath, and if arrangements can be made the line will be extended to Joliet. This arrangement will enable the company to compete with the W. D. Boyce Company, which has a pole line on the other side of the canal. This line is completed from Morris to Ottawa and the effort is being made to extend it to La Salle.

CHARLOTTE, N. C.—The Charlotte Electric Railway Company has completed the third public park, within three miles of the center of the city, since its organization fifteen years ago. The newest pleasure resort is Lakewood Park, where large sums have been expended on an artificial lake, boating facilities, pavilion, dance halls, etc. The company has established an up-to-date service with double tracks to the new park, and has proven of great value to the city in furnishing the only suburban parks which the city possesses. It is only a question of time, perhaps less than two years, before lines are built to the Catawba River, twelve miles to the west, where another pleasure park and resort will be constructed on liberal and expensive lines by this progressive concern. L.

PHILADELPHIA, PA.—George H. Earle Jr.'s plan to finance the Interstate Railways Company has been approved by the board of directors. The plan, in a word, proposes that the four per cent bonds of the corporation shall be deposited in trust, the income to be used for betterment, and if any money is left it shall go toward paying the interest. What then is lacking is to be obtained by issuing six per cent scrip. Bondholders who prefer cash will receive it. The scrip they refuse will be sold and the receipts placed in the company's treasury. Bondholders are asked to signify their assent to the plan and to deposit their bonds. The plan is signed by John C. Bell, James F. Sullivan, Richard Y. Cook, F. W. Roebling, William R. McIlvain, Holstein DeHaven, Richmond L. Jones and George H. Earle, Jr., chairman.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

LAKE CITY, ARK.—The People's Telephone Company has been incorporated with a capital of $10,000.

WINNSBORO, LA.—The Winnsboro Telephone Company has been incorporated with a capital stock of $25,000.

TWO RIVERS, WIS.—The West Shore Telephone Company has been incorporated with a capital stock of $6,000.

LYONS, NEB.—The Lyons Independent Telephone Company has been incorporated with a capital stock of $25,000.

PHILADELPHIA, PA.—The Citizens' Telephone Company, of Kent County, has been incorporated with $30,000 capital.

ANADARKO, OKLA.—The Anadarko-Southern Telephone Company has been incorporated by J. E. Stalder and others.

LAKE CITY, ARK.—The People's Telephone Company has been incorporated in Lake City with a capital stock of $10,000.

SPIRIT LAKE, IOWA—The Midland Telephone Company has completed arrangements for the erection of an exchange building. C.

READOUT, OKLA.—The Stockholm and Southwestern Telephone Company has been incorporated by J. W. Williams and others.

BELLINGHAM, WASH.—The American District Telegraph Company is preparing to put in a burglar-alarm and messenger-call system in this city.

SAN FRANCISCO, CAL.—The Pacific States Telephone and Telegraph Company will expend $11,000 in the improvement of its system at Watsonville.

GRAFTON, N. D.—Farmers who reside in Grafton and Fertile townships have organized a co-operative telephone company, with the following officers: A. Midgarden, president; Thomas Thorson, secretary. C.

MARTINSVILLE, IND.—The Martinsville Telephone Company announces that it will install an automatic system in its new exchange building when completed, and also modernize and extend the entire plant. S.

WATERLOO, IOWA—The announcement is made that a deal has been consummated whereby the Corn Belt, Cedar Rapids and Marion and Johnson County telephone companies will pass into the hands of the Bell people. C.

OMAHA, NEB.—The Nebraska Securities Company has been incorporated by Albert E. Wilson, Charles P. Flynn, F. M. Phipps and others, with a capital of $750,000, to take over the Independent Telephone Company. C.

DEFIANCE, OHIO—The Northwestern Telephone Company has increased its capital stock from $60,000 to $100,000. H. B. Tenzer is president of the company and W. G. Lehman, secretary. A highly prosperous condition is reported. H.

COUNCIL BLUFFS, IOWA—A paid-up capitalization of $14,500,000 and an authorized capital stock of more than $20,000,000 is represented in the functionary consolidation of the five western Bell telephone companies to be operated from Omaha.

BALTIMORE, MD.—The Maryland Telephone and Telegraph Company has given notice that it will on September 1 redeem all general mortgage bonds outstanding against the company. They will be paid at the office of the Central Trust Company, of Baltimore.

OMAHA, NEB.—The Nebraska Securities Company, a corporation to take over the Independent Telephone Company, has filed articles of incorporation. The new company is to have a capital stock of $750,000, which the articles say shall be paid up on issuance.

TOLEDO, OHIO—The Arcade Mutual Telephone Company, of Findlay, Ohio, has been incorporated, with an authorized capital stock of $10,000. The incorporators are Sherman Huffman, Wm. H. Dilley, E. E. Bish, G. W. Dick, A. L. Anderson, E. T. Dailey and H. J. Harkness. H.

DES MOINES, IOWA—The Bell Telephone Company has strengthened its hold in Iowa. Minneapolis brokers acting for the company have purchased control of the Cedar Rapids and Marion Telephone companies, the Marion Telephone Company, the Corn Belt Telephone Company, of Waterloo, and the Johnson County Telephone Company. The Bell Company is making rapid strides in Iowa and is forming a great state telephone service.

WINSTON, N. C.—The Southern Bell Telephone Company has authorized and begun work on a toll line from this point to Elkin; also a long-distance line from Morganton to Black Mountain, and thence to Asheville, thus completing a continuous stretch of long-distance lines from Charlotte, via Statesville, to Asheville, 150 miles in length. The two lines mentioned place in direct communication with all southern cities and the cities of the north scores of lumber, mining and other industries of the western part

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of the state. Some seven of eight mountain counties and probably forty mountain towns and villages will be affected by the various extensions and sub-leases, whereby long-distance service is given, or made available, for subscribers to local exchanges or to those located on the trunk lines of the long-distance service. L.

CORYDON, IND.—At the annual meeting of the directors of the Eureka Telephone Company it was decided to extend the lines and enlarge the capacity of the plant. The following officers were elected: President, Alonzo Cunningham; vice-president, Elias Shields; secretary, H. P. Beanblossom; treasurer, D. C. Davis. S.

NEW YORK, N. Y.—The New York Telephone Company, which operates in Yonkers, has taken over the Westchester division of the Hudson River Telephone Company, which embraces towns from Peekskill to Croton, and from Briarcliff to Brewster. Several towns on the west side of the river, including Haverstraw, Nyack, Tappan and Spring Valley, also supplied by the Hudson River company, are absorbed. There are about 5,000 instruments.

HOUSTON, TEX.—Plans for the new South End exchange to be erected by the Southwestern Telegraph and Telephone Company have been perfected. The South End exchange will cost in the neighborhood of $50,000 or $60,000 when it is fully equipped and it is stated that work will be started on it as soon as the detailed specifications can be worked out and bids secured. It will be a fireproof building and the equipment alone will cost approximately $30,000.

MINNEAPOLIS, MINN.—The Northwestern Telephone Company will spend $1,000,000 for improvements in the territory which it covers within the next year. This includes the Minneapolis, St. Paul and Duluth systems, together with the network of toll lines and stations connected with these principal exchanges. The announcement has been made by Casper E. Yost, of Omaha, president of the company and head of the five middle western Bell concerns.

ORANGE, TEX.—The Orange Telephone Company exchange has been sold by Receiver P. M. Shingle to a committee of bondholders, represented by George D. Crane of Kenton, Ohio. The sale will have to be confirmed by the federal court and after sixty days' time there will be a reorganization of the company and improvements can be made. The company has been short a large number of phones for several months and nothing could be done, because the business was in the hands of a receiver.

WEBSTER CITY, IA.—E. H. Martin, well-known telephone man and capitalist, has announced his intention of leaving Webster City. He will move to Minneapolis. The Martin telephone plant here, which is capitalized at $200,000, will be sold. A plan is now on foot to reorganize the company and dispose of it to a number of prominent independent Iowa telephone men. C. P. Holdeegle, of Rockwell City, of the Iowa Telephone Clearing House directorate, has been in the city looking over the plant and it is likely that the reorganization will take place under his supervision.

NEW PUBLICATIONS.

UNIVERSITY OF ILLINOIS BULLETIN—The University of Illinois has issued its 1909-1910 circular of information of the College of Engineering, a 101-page book containing the University Calendar, particulars of the College of Engineering, courses of study, engineering experiment station, etc. The work is provided with a copious index.

ANNUAL REPORT OF THE COMMISSIONER OF PATENTS—The Annual Report of the Commissioner of Patents for 1908 has just been issued. It shows total receipts, from all sources, of $1,896,847.67, total expenditures of $1,712,303.42, leaving a surplus of $184,544.25 for the year. Of the 61,475 applications for patents, 33,682 were granted. There were 12,208 applications for trade-marks, labels and prints, 6,029 of which were granted.

MAY BULLETIN OF THE BUREAU OF STANDARDS—The *Bulletin of the Bureau of Standards* for May contains quite a number of articles of much interest to electrical men. Among these are: "The Testing of Transformer Steel," by M. G. Lloyd and J. V. S. Fisher (this paper is the one recently presented before the annual convention of the American Institute of Electrical Engineers at Frontenac); "A New Method for the Absolute Measurement of Resistance," by Edward B. Rosa; "The Theory of Coupled Circuits" and "The Coefficient of Reflection of Electrical Waves at a Transition Point," by Louis Cohen; "A Volt Scale for a Watts-per-Candle Meter," by Herbert E. Ives; "A Tungsten Comparison Lamp in the Photometry of Carbon Lamps," by Dr. Ives and L. R. Woodhull.

GROUNDED CIRCUITS AND ELECTROLYSIS—A reprint of an interesting article entitled "Grounded Electric Transmission and Electrolytic Corrosion," by J. Stanley Richmond, has been published by the *Canadian Engineer*, of Toronto, Canada. In this pamphlet of sixty-nine pages the author reviews at first the history and literature of the subject. With the aid of numerous diagrams several methods of testing grounded circuits are described, particularly the author's system of making elaborate measurements of track drops from a central point of a railway system. There is also a discussion of voltage contour lines and of rail bonding. The author concludes with a description of several methods for lowering the track drop. Throughout, this little booklet contains much valuable information on the subject of ground-return circuits and should prove interesting reading for electric-railway managers and engineers.

SUPERVISION OF STREET RAILWAYS IN ENGLAND AND PRUSSIA—This is a reprint from the annual report of the Public Service Commission for the First District of the State of New York for the year ending December 31, 1908. It opens with a summary of state prevention and franchise procedure in the two countries, an account of "prevention versus correction," a law-court review, and an article on metropolitan problems. Following the summary are two lengthy articles, both by Robert H. Whitten, the first on "Supervision of Street Railways in England" and the second on "Supervision of Street Railways in Prussia." The book concludes with "exhibits" containing a model form of regulations issued by the English Board of Trade for the equipment and operation of electric railways, a Board of Trade memorandum regarding details of construction and equipment of tramways and light railways laid on public roads (July, 1908), Prussian regulations for the construction and operation of street railroads with mechanical traction, regulations for the Berlin District (September 3, 1907), supplementing the latter, and lastly a model form of concession from the state for street railroads in Prussia.

BRIQUETTING TESTS—The Technologic Branch of the United States Geological Survey has issued Bulletin 385, on Briquetting Tests at the United States Fuel-Testing Plant, Norfolk, Va., 1907-1908, edited by Charles L. Wright (Washington, D. C., Government Printing Office, 1909). An official definition of briquetted or "agglomerated" fuel is given in this bulletin as "fuel made by pressing in molds a mixture of coal dust and small-sized pieces of coal or other fuel material and a binding substance which holds the particles together." It further goes on to say that the most common binder at present commercially available is a pitch made either from coal tar or water-gas tar, but other substances, such as starch, lime, sulphite liquor, etc., have been used with more or less success. The tests described are combustion, drop, tumbler, weathering, absorption and density tests. A detailed description is given of the English and American types of briquetting machines. A very complete bibliography pertaining to the subject is appended, and the bulletin is well supplied with illustrations. This is a most timely publication and will be heartily welcomed by all interested in this important subject, which is now attracting a great deal of attention in the United States, as it has already developed to a considerable degree in European countries.

PROPOSALS.

POST OFFICE, GONZALES, TEX.—The office of the Supervising Architect, Washington, will receive sealed proposals until 3 o'clock p. m. on August 5, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Gonzales, Texas, in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Gonzales, Texas, or at the Supervising Architect's office.

NEW MANUFACTURING COMPANIES.

SIOUX FALLS, S. D.—The Northwestern Electric Company has been incorporated, with a capital of $25,000, to handle electrical supplies.

NEW ALBANY, IND.—The W. J. Miles Casting Company has secured a site in this city and will erect and equip a plant to manufacture steel gears for electric cars, machine tool gears and high-grade iron castings.

HARTFORD, CONN.—The Lionell Manufacturing Company, of New Haven, has been incorporated with a capital stock of $50,000, to manufacture electrical toys. The incorporators, all of New York city, are Gustave K. Hartung, Joshua L. Cohen and Victor Scharps.

NEW YORK, N. Y.—The Electric Cigar Advertising Company has been incorporated to manufacture advertising devices and novelties, with a capital of $50,000, and the following incorporators: G. H. Schuler, Belleville, N. J.; S. I. Knight, and G. F. McKay, New York city.

INDIANAPOLIS, IND.—The National Creosoting Company has filed articles of incorporation, with a capital stock of $200,000. The company proposes to build, equip and operate a plant for the treating of railroad ties and timbers of all kinds. Alvin T. Hert, R. V. Look and H. W. Griffith, directors. S.

ALBANY, N. Y.—The Westinghouse Storage Battery Company, of New York, has been incorporated with the Secretary of State; capital, $1,750,000, $100 shares, of which $250,000 is six per cent preferred. The directors are: H. H. Westinghouse, Samuel B. Dusinberre, George C. Smith, H. Cool and John G. Greenburgh, of New York.

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PERSONAL MENTION.

DR. E. P. ADAMS, assistant professor of physics at Princeton, has been made a full professor in that subject.

DR. JOHN C. SHEDD, of Westminster College, Denver, has been made professor and head of the department of physics at the University of Pittsburg.

PROF. E. F. NICHOLS, president-elect of Dartmouth College, has been made a doctor of laws by Colgate University, of which institution he was professor of physics from 1892 to 1898.

H. ALMERT, an engineer of long practice in Chicago, has been appointed manager of the department of examinations and reports of H. M. Byllesby & Company, with headquarters at Chicago.

CYRUS OSBORNE BAKER, the platinum importer, is in London, convalescing from a severe illness. He is accompanied by Mrs. Baker, and they will spend several weeks in Carlsbad before returning to New York.

E. M. BASSETT, of the New York Public Service Commission, is making a tour of inspection of the public service corporations in various cities, including Buffalo, Chicago, Milwaukee and St. Paul. He will be gone a month.

C. E. GROESBACK, of San Diego, Cal., has been elected a vice-president of H. M. Byllesby & Company, with headquarters at Tacoma, Wash., in charge of their interests on the Pacific Coast and in the states of Idaho and Montana.

CHARLES E. BURGOON, late assistant inspector of electric-light plants, United States Treasury Department, has been appointed assistant to W. A. E. Doying, inspecting engineer to the Isthmian Canal Commission, Washington, D. C.

W. R. THOMPSON, late of the Public Service Commission of New York state, and formerly with Westinghouse, Church, Kerr & Company, has been appointed assistant to the chief engineer of H. M. Byllesby & Company, with headquarters at Chicago.

R. F. SCHUCHARDT, of the Commonwealth Edison Company, and editor of the *Round Table*, the N. E. L. A.'s branch organ, is on a holiday trip through the East with Mrs. Schuchardt. After leaving Atlantic City, Mr. Schuchardt journeyed to Montreal, Que., and back again to Schenectady, then down the Hudson to New York, and will return home by way of Baltimore and Washington.

A. R. HALL, of the Capital Electric Company, of Denver, Colo., on returning from the convention of the American Institute of Electrical Engineers, at Frontenac, N. Y., stopped in Chicago last week to mingle with the local electrical men. He reports excellent business in the West. Denver's new "White City" is now illuminated entirely by Hall lamps, over 100,000 lamps being used.

H. B. MARSHALL, who has been for many years connected with the Chicago sales office of the Electric Storage Battery Company in the Marquette Building, has recently been appointed contract agent, in charge of that company's office at St. Louis in the Wainwright Building. Taliaferro Milton, formerly contract agent of the St. Louis office, has been appointed engineer of the Chicago sales office of the Electric Storage Battery Company.

F. W. WILLIS, formerly of the Commonwealth Edison Company's engineering department, has for five years been in India, where he is an operating engineer with the Canvery Power Scheme, Champion Reef, Mysore, India. He has splendid bachelor quarters and a retinue of servants to wait on him. Two years ago Mr. Willis enjoyed an accumulated vacation and visited his old friends in Chicago, traveling by way of Burma, China, Japan and Hawaii.

WILLIAM RUSSELL WILLCOX, chairman of the New York Public Service Commission, First District, sailed on the Mauretania last Wednesday and will be absent for about six weeks. During his absence Commissioner McCarroll will most of the time act as chairman. Mr. Willcox made the following statement: "The subway situation is now well in hand. We have increased the staff of engineers, so that plans for the proposed new routes may be drawn as quickly as possible, and the legal department is already at work on the forms of contract. The working out of these matters is now merely a matter of detail. They will proceed just as promptly with me in Europe as if I were here. When I return I expect to find them practically completed, so that we may advertise for bids in the fall, as arranged."

WALTER P. PHILLIPS, who is probably one of the best known old-time telegraphers today and who is now manager of the printing department of the Columbia Phonograph Company at Bridgeport, Conn., has written a stirring appeal to the chivalrous spirit of those engaged in the telegraphic, journalistic and related fields of activity concerning Robert W. Martin, an old-time telegraph man and a familiar with many of those who had an active part in the upbuilding of the industry in the early days, who has been ill and unable to help himself for some time. Mr. Martin was with Mr. Phillips in the service of the United Press (No. 1) and is one of the surviving members of the United States Military Telegraph Corps. Communications addressed to the care of the *Telegraph Age*, New York, N. Y., will be forwarded to Mr. Martin.

EDWARD G. DEWALD, heretofore manager of the water-wheel department of the Platt Iron Works Company, Dayton, Ohio, has become identified with the hydraulic turbine department of the Allis-Chalmers Company, as special representative for the Pacific Coast, with headquarters at 599 Mission Street, San Francisco. Mr. Dewald has been with the Platt company for the past twenty years, during five of which he served as manager of its San Francisco office; and he has been identified with many of the largest hydraulic power installations in the country, including the majority of those on the coast. Mr. Dewald's prominence in this field, coupled with the important position the Allis-Chalmers Company has taken in this field in recent years, makes his new connection noteworthy.

DANIEL E. MANSON, who has resigned as manager of the Boston office of the Westinghouse Electric and Manufacturing Company, to engage in engineering work with a corporation of which he will be vice-president and manager, was tendered a farewell dinner in Boston, July 13, by the officers and associates of the Westinghouse Company. During Mr. Manson's twelve years with the Westinghouse forces he has rendered services of a high order that merited his promotion through various positions, to the head of the Boston office, a post he has held for a number of years. The severance of Mr. Manson's relation with the company is viewed with genuine regret by its officers and the many friends he has made, but for his new work all unite in good wishes, a sentiment which the farewell dinner fittingly expressed. George E. Bates, of the Boston office, will succeed Mr. Manson as head of the Westinghouse sales force for the New England district.

EDWARD FOLGER PECK, general manager of the Schenectady (N. Y.) electric-railway system, was elected president of the New York State Street Railway Association at the annual convention of that body at Bluff Point, N. Y., on June 29 and 30 last. Mr. Peck in 1880 became connected with the American Electrical Company, of New Britain, Conn., which company subsequently became the Thomson-Houston Company. He was in charge of the exhibit of this company at the Philadelphia Exhibition in 1884, and was afterward in charge of the Thomson-Houston exhibit at the New Orleans World's Fair in 1884-1885. In 1885 he became general manager of the Citizens' Electric Illuminating Company, Brooklyn, N. Y., where he remained until 1897, in which year he organized the Peck Electrical Company, which did an engineering and supply business in New York city. He was appointed general manager, in 1899, of the Kings County Electric Light and Power Company, of Brooklyn, from which position he resigned in 1902 to become general manager of the Schenectady Railway. Mr. Peck is also president of the Electric Express Company, of Schenectady, N. Y. He is a member of the American Institute of Electrical Engineers and also of the Engineers' Club, of New York. He is well known in the electrical industry and is very popular both among his associates and in the profession at large.

OBITUARY.

ELWYN G. HOVEY, forty-two years old, died on July 9 at his home in Montclair, N. J., of pneumonia. Mr. Hovey was an electrical engineer for the Weston Electrical Instrument Company, having been connected with the company for over twenty years. He leaves a widow and three sons.

GEORGE FREDERICK DEACON, a well-known English engineer, died suddenly at his offices in London on June 17 last. Mr. Deacon was an assistant to Lord Kelvin on the SS. Great Eastern during the laying of the Atlantic cable in 1865. Since that time he became famous as the engineer in charge of the great Vyrnwy waterworks construction for the city of Liverpool

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in 1877. He was the recipient of the Telford, Watt, and George Stevenson medals of the Institution of Civil Engineers. Mr. Deacon was a member of the council of the Institution of Civil Engineers, and president of the engineering section of the British Association in 1897.

ROBERT CLARK died at his home in Chicago, the first of this week, at the advanced age of eighty years. Mr. Clark came to Chicago in June, 1849, and was one of the pioneers of Chicago and Cook County. Up to fifteen years ago, when he retired from active business, he was head of the Ætna Iron Company, of Chicago. Mr. Clark was active in political life in the city of Chicago and held many important offices. He leaves one daughter, Mrs. Edwin D. Welch.

SIMON NEWCOMB, astronomer, mathematician and retired rear admiral of the United States Navy, died at the age of seventy-four at his home in Washington, D. C., on Sunday, July 11 last, and was buried last Wednesday with military honors in Arlington Cemetery. The body laid in state on Monday and Tuesday. The distinguished astronomer is survived by his widow, a daughter of the late Dr. Charles A. Hassler of the United States Navy, and three daughters—Dr. Anita Newcomb McGee, of Washington; Mrs. Francis Wilson and Mrs. Edward Whitney, both of New York. Simon Newcomb was born in Wallace, Nova Scotia, March 12, 1835. He received his early education from his father, John Burton Newcomb, and emigrated to the United States in 1853. He taught school for two years in Maryland, and afterward secured an appointment as computer of the United States nautical almanac, then published in Cambridge. While in Cambridge he undertook some of the most advanced astronomical work ever attempted in this country up to that time, his great work which brought his immediate international recognition being a mathematical theory on the orbits of the asteroids. In 1861 he was appointed professor of mathematics at the United States Naval Academy; later he was also assigned to duty at the United States Naval Observatory, in the course of which he negotiated the contract for, and supervised the construction of, the great twenty-six-inch equatorial telescope at that institution. He was secretary of the United States Transit-of-Venus Commission, 1871-1874, and observed the transit of Venus at the Cape of Good Hope in 1882. He was made director of the Nautical Almanac office in 1877, retiring at the age of sixty-two in 1897. He was professor of mathematics and astronomy at Johns Hopkins University, 1884-1894, and was also editor of the American Journal of Mathematics. Simon Newcomb received an enormous number of honors and distinctions. He was made a graduate of American, British and continental universities, receiving in all no less than nineteen degrees, of which only two were below the rank of doctor. He has received medals and prizes from the Royal Astronomical Society, the Dutch Society of Sciences, the Royal Society of London, the Astronomical Society of the Pacific, etc. He was an honorary or corresponding member of almost every important European scientific society in his line of work, besides his activity in similar lines in his own country. In 1874 he was made correspondent, and in 1893 one of the eight foreign associates, of the Institute of France, being the first native American since Benjamin Franklin to be so honored. He was made officer of the Legion of Honor of France in 1893, and commander in 1907; Knight of the Prussian Order of Merit for Science and Art, in 1906 (receiving special authority from Congress to accept these honors). Professor Newcomb was a prolific writer and besides a list of over three hundred papers on his researches he has written textbooks on astronomy, mathematics and economics, besides magazine articles, etc. He published tables of the motion of the stars, the planets and the moon, now used by astronomers in their computations and as the basis of present-day navigation. By the death of Professor Newcomb the United States has lost one of her foremost scientists of the century, and one whom it will not be easy to replace.

LEGAL NOTES.

PROPRIETY AND LOGIC OF "READINESS TO SERVE" CHARGE—In an opinion rendered on June 14, 1909, in the case of the Little Rock Railway and Electric Company vs. Newman, the Supreme Court of Arkansas decided that the company was not violating an act of the General Assembly, in stipulating a "readiness to serve" charge in making a contract with the plaintiff, prior to connecting his residence with the lighting plant. An analysis of the act did not reveal any attempt to regulate charges further than to require uniformity and publicity, nor to compel the company to hold itself in readiness to supply electricity to those who use none, and it does not specify that a minimum charge is forbidden. The court ruled that a readiness to serve charge amounts to the same as a minimum rate charge, which does not violate the act.

LIABILITY IN TELEPHONE BOOTHS THAT CANNOT BE OPENED FROM INSIDE—Under the rule that an employer is not an insurer, but is required to use ordinary care to make his premises reasonably safe for the use of his employes, the Court of Appeals of Kentucky holds, in Georgetown Water, Gas, Electric and Power Company vs. Forwood, 113 Southwestern Reporter, 112, that a telephone booth should not be so constructed that it cannot be opened from the inside. It holds that if an employe was locked up in such a booth he had a right to try to get out; he had a right to use reasonable effort to get out of the box, exercising such care as might be reasonably expected of an ordinarily prudent person. If he used ordinary care, and was injured in his effort to escape, his employer would be liable for any injury resulting from its negligence.

LIABILITY FOR INJURY OF TRIMMER FROM BREAKING OF DEFECTIVE PIN—A trimmer of electric lamps was injured by the giving way of one of the pins in the cross-arms on which the wires were strung. The supreme judicial court of Massachusetts says, Jennison vs. Waltham Gaslight Company, that he was required to climb the pole, and upon reaching the last iron step being obliged to go higher to reach the lamp, the jury could find, on his evidence, that not only the feasible and customary way was to grasp one of the pins to assist him in making the ascent, but in so doing he was following the instructions given him by the company. If the company knew that he must perform his work in that way, then by neglecting to provide a properly adjusted pin, or to see that as inserted it remained sound, it failed at common law, as well as under the Massachusetts statute, to discharge its duty to the trimmer.

VALIDITY OF RULES AND REQUIREMENTS OF RURAL TELEPHONE COMPANIES—In the case of Buffalo County Telephone Company vs. Turner, 118 Northwestern Reporter, 1064, the Supreme Court of Nebraska holds that a rule of a rural telephone company that telephone rent must be paid six months in advance is reasonable; and a subscriber, refusing to comply therewith, is not entitled to service from the company. Nor will the existence of a counterclaim or set-off asserted by the subscriber, a large part of which is exorbitant and illegal, justify him in demanding that he be given service without prepayment of charges as other subscribers pay. A telephone subscriber is presumed to know that his telephone is liable to get out of order, and, if it is situated in the country, that some time may elapse before it can be repaired, and such subscriber is only entitled to a deduction from his bill subsequent to the expiration of a reasonable time after the company had notice of the trouble and failed to repair it.

CONTRACTS FOR A CERTAIN NUMBER OF LIGHTS IN SIGNS MUST BE LITERALLY MET—To an action brought to recover the contract price of a specially-built electric sign one of the defenses was that the sign was to have a border consisting of rows of electric lights, containing 296 lamps so arranged that by a system of intermittent lights the border produced the effect of two snakes chasing each other, whereas a less number of bulbs were used. To permit the jury to find that the plaintiff might recover upon the theory of substantial compliance with his contract, the Court of Civil Appeals of Texas holds, on appeal of Ellison Furniture and Carpet Company vs. Langever, 113 Southwestern Reporter, 178, was in error. It says that if the parties to the contract specifically stipulated that the border should contain 296 lights, the courts would have no power to set aside such stipulation; but the plaintiff would be bound by it, even though a less number of lights might be more desirable, either from the standpoint of beauty or utility.

EXTENT OF SERVICE REQUIRED OF TELEPHONE EXCHANGES—That telephone exchanges are impressed with a public use as common carriers of news, the Supreme Court of Indiana says, in the case of State vs. Cadwallader, is settled in that state. That they must furnish impartial service without discrimination to all persons in the same or similar classes is, the court believes, everywhere the rule. There is, however, as the court conceives, a marked difference between furnishing initial, independent service, through or by means of an independent exchange, and secondary service by an interchange of business, or by means of connecting two or more plants, so that for all practical purposes of the users they constitute but one system, for that in effect, in the absence of contract, would amount to practical confiscation of private property. Patrons of the corporation or individual contracted with are bound to know that, in the absence of an undertaking so to do, another corporation or individual is not bound to subject its or his property to their use by direct or unrestricted use of their lines.

TELEPHONE CONVERSATIONS OVERHEARD AT THIRD INSTRUMENT—Where a witness offered in a case gained his information by listening to a conversation by the use of another telephone at the defendants' place of business, the Supreme Court of New York, appellate term, says, Rimes vs. Carpenter, 114 New York Supplement, 96, that unquestionably a conversation overheard between parties whose voices are recognized by the witness may be proven, and there is no ground for distinction, in principle, between such a case and that of a conversation by telephone, which the witness overhears, where the actual connection between the instruments is shown in such wise as to identify the very conversation, and the persons holding the conversation are known. From the proceedings upon the trial it appeared that the defendants could probably have shown that

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three instruments on the same wire, being those used by the principals in the conversation and by the person who overheard it, would serve as a medium of transmission, whereby what was heard by one listener must have been heard by the other and have been the actual words of the speaker. In this situation the conversation overheard by a witness would clearly be the proper subject of his testimony, where the conversation itself, as between the parties, was competent and relevant to the issues.

CONTRACT FOR TELEPHONE SERVICE AT GREATER THAN PRESCRIBED RATES UPHELD—As it has been held that a telephone company may, by entering into a voluntary agreement with the city fixing maximum rates, be estopped from questioning the authority of the city to enter into such agreement, so the Supreme Court of New York, special term, Erie County, holds that a citizen may, by entering into a contract with the telephone company, be estopped from questioning the authority of the company to make such a contract with him.

ELECTRICAL SECURITIES.

It was expected that following the short holiday week there would be an opening up both as to activity and prices in the stock market. While the negotiations on the first sessions were encouraging, the market slipped back into the rut, and, although news of an adverse character was lacking, there has been very little animation.

Electric Bond and Share Company; the regular quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable August 1; books closed July 16 and reopen August 2.

Manhattan Electrical Supply Company; the regular semi-annual dividends of three per cent on the preferred and three per cent on the common stock, both payable August 2 to stock of record July 10. Books closed July 10 and reopen August 3.

Milwaukee Electric Railway and Light Company; the regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable July 31 to stock of record July 20.

National Carbon Company; the regular quarterly dividend of one per cent on the common stock, payable July 15.

New Hampshire Electric Railways; regular semi-annual dividend of one per cent on preferred stock, payable July 31 to stock of record July 20. Books close July 20; reopen August 2.

New York and Queens Electric Light and Power Company; the regular semi-annual dividend of two-and-one-half per cent on the preferred stock, payable August 10 to stock of record July 31.

J. G. White & Company; the regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable August 1 to stock of record July 24.

NEW YORK.

	July 12.	July 5.
Allis-Chalmers common	15	15⅛
Allis-Chalmers preferred	51⅝	51¾
Amalgamated Copper	81¼	82⅝
American Tel. & Cable	80*	80*
American Tel. & Tel	140½	140¾
Brooklyn Rapid Transit	78	79½
General Electric	163½	164
Interborough-Metropolitan common	11	16½
Interborough-Metropolitan preferred	30⅛	49⅜
Kings County Electric	130	130
Mackay Companies (Postal Telegraph and Cables) common	..	79½
Mackay Companies (Postal Telegraph and Cables) preferred	..	73½
Manhattan Elevated	145	143
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	125	124
U. S. Steel common	68⅞	69⅛
U. S. Steel preferred	125⅜	125⅛
Western Union	71¾	72
Westinghouse common	84	84
Westinghouse preferred	121	..

*Last price quoted.

BOSTON.

	July 12.	July 5.
American Tel. & Tel	140½	140¾
Edison Elec. Illuminating	248	250
General Electric	163½	164
Massachusetts Electric common	13¼	13¼
Massachusetts Electric preferred	71½	71
New England Telephone	134	134½
Western Tel. & Tel. common	10	9¾
Western Tel. & Tel. preferred	37	87

PHILADELPHIA.

	July 12.	July 5.
American Railways	44¾	45¼
Electric Company of America	12⅝	12½
Electric Storage Battery common	52	52
Electric Storage Battery preferred	52	52
Philadelphia Electric	11¾	11¾
Philadelphia Rapid Transit	28¾	28⅝
Philadelphia Traction	91	90¾
Union Traction	53	53

CHICAGO.

	July 12.	July 5.
Chicago Railways, Series 1	112	112¾
Chicago Railways, Series 2	41	40½
Chicago Subway	21	22
Chicago Telephone	132	132
Commonwealth Edison	120½	120
Metropolitan Elevated common	15	15½
Metropolitan Elevated preferred	47	49
National Carbon common	91	91
National Carbon preferred	115	117½

INDUSTRIAL ITEMS.

PASS AND SEYMOUR, SOLVAY, N. Y., manufacturers of electrical specialties, are distributing a catalogue showing a few of their porcelain receptacles.

THE NEW YORK INSULATED WIRE COMPANY, NEW YORK CITY, is distributing a useful innovation in the form of advertising blotters. On one of these is a calendar for the current month.

THE PNEUMELECTRIC MACHINE COMPANY, Syracuse, N. Y., is now equipping its coal puncher with an alternating-current motor of two or three-phase for any voltage or frequency. The complete machine weighs only about eight hundred pounds.

THE SAFETY ELECTRIC COMPANY, of Chicago, is meeting with considerable success in putting out a two-candlepower refilled sign lamp. These lamps are made for any voltage from 100 to 130. A circular, entitled "S. S. 14 Sign Globe," describes these lamps and can be had upon request.

THE ELECTRIC CONTROLLER AND MANUFACTURING COMPANY, Cleveland, O., has issued a very attractive and instructive booklet containing a series of five articles on electric-motor control, written by the president of the company, A. C. Eastwood, copies of which may be had on request.

THE AMERICAN SEWER PIPE COMPANY, Pittsburg, Pa., has received, through A. L. Waterbury, manager of its Chicago office, an order from the Commonwealth Edison Company, of Chicago, for 1,000,000 duct feet of vitrified clay conduit. Shipments on this order have already begun, and will continue for three months before the order is filled.

THE HOYT ELECTRICAL INSTRUMENT COMPANY, Penacook, N. H., publishes a monthly bulletin containing some very interesting information concerning the Hoyt electrical instruments, and in addition to this sufficient material in a lighter vein to render a perusal worth while. Copies of this bulletin will be furnished to those interested upon request.

THE KIMBLE ELECTRIC COMPANY, Chicago, Ill., has found it necessary to enlarge its facilities for handling its business, owing to the increased demand for the Kimble variable-speed, single-phase, alternating-current motors. James K. Bass, who recently came from New York to fill the office of treasurer and manager of the above company, is an old Chicagoan and has a large acquaintance in the electrical field. It is the purpose of the company to improve its product wherever possible.

THE NEW YORK INSULATED WIRE COMPANY, of New York, in order to take care of the increased local demand for their rubber-covered wire and insulating tapes, have been obliged to secure a new and larger New York stock-room. The new location, 80 Murray Street, is an admirable one, being right in the midst of the largest New York jobbing and supply houses, and the increased stock which they are now carrying enables them to fill more promptly than ever orders from their out-of-town and local friends.

THE CARLYLE JOHNSON MACHINE COMPANY, Manchester, Conn., announces in a folder containing a halftone of the new factory, that increased business has compelled it to seek larger and better quarters. The new plant is located at Manchester, Conn., nine miles east of Hartford, on the Willimantic Division of the New York, New Haven & Hartford Railroad, where the facilities of the company will be much improved so as to permit of an even better and prompter attention to orders than in the past.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., manufacturing the well-known Exide Battery, Chloride Accumulator and Tudor Accumulator, has issued an instructive and timely booklet, entitled "The Exide Battery," which will be welcomed by all interested in the storage battery. An introduction gives a brief history of the commercial development of the storage battery, and this is followed by a clear and concise account of the design, manufacture and care of the Exide Battery, with illustrations and many practical hints.

THE TRIUMPH ELECTRIC COMPANY, of Cincinnati, Ohio, has prepared a very useful chart giving in compact form directions and formulas for testing polyphase induction motors. The tests referred to are: Determination of primary resistance, no-load test, short-circuit test, determination of motor characteristics, service test, resistance and puncture tests of insulation, and heat tests. The chart, which is eight by ten-and-one-half inches, is made for mounting in a convenient manner so that its information is readily ascertainable.

THE ELECTRICAL ALLOY COMPANY, Morristown, N. J., draws attention in a recent leaflet to its special electrical resistance wires sold under the specific guarantee that they have been submitted to the most exhaustive tests of the Electrical Testing Laboratories of New York city. The best-known products and those which are in the greatest demand are the ideal wire, for use in making electrical instruments, shunts, resistance standards, rheostats, etc., Phenix wire, with the highest specific

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resistance of any wire on the market, for use in the manufacture of electrically heated appliances, and German silver wire, with any percentage of nickel required. A new catalogue with revised prices is being distributed and samples and the fullest particulars will be sent on request.

THE GARWOOD ELECTRIC COMPANY, Garwood, N. J., announces that it has appointed the International Supply and Export Company, Bank of Commerce Building, St. Louis, Mo., as its sales agent. The International Supply and Export Company is a well-known manufacturers' agent in the Middle West, and keeps a number of salesmen on the road.

THE I. P. FRINK COMPANY, 551 Pearl Street, New York, N. Y., installed its system of special reflectors for lighting the squash court of the University Club, Chicago, a few months ago. These proved so satisfactory that the company has just finished putting in these reflectors for illuminating the tennis courts also. Bronze reflectors for lighting the desks and screens have been placed in the National Bank of Commerce, St. Louis, Mo., and the fixtures for illuminating the art gallery of the Alaska-Yukon Pacific Exposition were made by this company.

THE ROCKINGHAM POWER COMPANY, Rockingham, N. C., has been experimenting with a new device called the "reflectorlier," the invention of William H. Browne, who is president, general manager and one of the receivers of the company. This appliance combines in a new method, fixtures, reflecting surfaces and lamps in such a way as to produce without shadows the most widespread and uniform distribution of the light. The results of the experiments were decidedly encouraging, and we expect to hear more of this new device, for which letters patent have been applied.

THE CROUSE-HINDS COMPANY, Syracuse, N. Y., has issued No. 106 of its "Condulet Talks," which are published weekly. Type "Q K L" is described as strong and waterproof, protecting the outside switch and wiring from the weather and the water from window washing. It is proof against tampering by unauthorized persons, and is for the man with a key. An illustration of a drug-store window is given, the advantage of having a suitable switch conveniently located in an inconspicuous place outside the building being clearly demonstrated. Condulets are sold by the Western Electric Company of Chicago.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a new circular and price list descriptive of electric-light supplies. This list embodies some thirty pages and should be of general interest to the electrical fraternity. The company is also sending out a new bulletin descriptive of high-voltage transformers for use in serving consumers directly from high-tension lines. A considerable amount of data is given as to construction of these transformers and attention is particularly called to the special bushings which are claimed to give an insulation strength much greater than has heretofore been secured.

THE GREEN FUEL ECONOMIZER COMPANY, Matteawan, N. Y., has published a booklet, entitled "How to Save Coal," discussing this from the point of view of recovering waste heat in the chimney flue gases. The booklet further describes the construction of the Green economizer, illustrating the new extended top header, the new bottom header specially designed to avoid choking from soot, the new sectional covering and other improved features. There are several illustrations of large plants, such as the Delaware, Lackawanna & Western terminal power plant, which have recently been equipped with Green economizers and Green mechanical draft fans.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., has prepared an attractive little booklet, "Electric Power for Domestic Purposes," which offers many valuable suggestions for the use of small motors in the home. Among the labor-saving applications of electric power noted are the sewing machine, vacuum cleaner, washing machine, ice-cream freezer, coffee grinder, meat chopper, ironing machine, silver polisher, dish washer, and the motor-driven pump. A novel electric-driven household utility illustrated in the folder, is the combination of a coffee grinder and meat chopper compactly attached to a small motor. The booklet will be sent upon request to the Pittsburg office of the company.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., announces that it has purchased the plant, business and patents of the J. L. Schureman Company, of Chicago. The manufacture of the well-known types of Schureman controlling apparatus will be continued and all agreements and contracts made by the J. L. Schureman Company will be faithfully carried out by its successor. The services of S. M. McFedries, general manager of the Schureman Company, have been retained by the Cutler-Hammer Manufacturing Company and he will remain in active charge of the manufacture and sale of Schureman apparatus. J. L. Schureman retires from the business. Until further notice customers of the Schureman company should direct orders and inquiries to the old address, J. L. Schureman Company, 70 West Jackson Boulevard, Chicago. Communications addressed to any of the offices of the Cutler-Hammer Manufacturing Company will also receive prompt and careful attention.

THE JARVIS ENGINE AND MACHINE WORKS, Lansing, Mich., manufacturers of "Jarvis" safety water columns, contractors' hoists, automatic switches, power pumps, "Monitor" feed-water purifiers, oil extractors, etc., also make a specialty of motor-driven pumps, some of which are described in Bulletin 101, which is now ready for distribution. The type E pump, operated by a one-eighth-horsepower alternating-current motor, has a capacity of seventy gallons per hour, working pressure seventy-five pounds, speed 100 strokes a minute. Type K pump, operated by a one-half-horsepower motor, or other desirable power, has a capacity of 300 gallons per hour, and is suitable for any working pressure up to 250 pounds, with proper power.

THE NATIONAL ELECTRIC LAMP ASSOCIATION, in bulletin No. 6E, issued by the engineering department, treats of tungsten sign lamps. A general description is given by way of introduction, followed by particulars as to frosting, cost of operation, uses, quality of light equipment and operation, alternating-current system, flashers and typical installation. Useful tables and instructions as to ordering complete a very handsome pamphlet. It may be noted that everything put out by this association is always most thoroughly and clearly arranged. This bulletin covering as it does the performance, economy, equipment and general uses of the Tungsten sign lamp should be carefully perused by everyone interested in the latest development of electric lighting.

B. S. BARNARD AND COMPANY, New York city, manufacturers of clay material and in particular vitrified, salt-glazed electrical clay conduit for underground installation, draws attention in a four-page circular to various of its products, such as single butt joints, two, four, six and nine-inch multiples of various sizes; also to the "Lyle" mandrel, and metal wrappers and plugs. The last are described as being made for both permanent and temporary use. The permanent one is of perforated metal and when applied with a covering of cement it forms a complete air and water tight stopper at the end of the duct. The temporary plug is made with a rubber gasket perfectly air and water tight, and can be inserted or drawn with little effort. Prices are furnished on request.

DATES AHEAD.

Ohio Electric Light Association. Annual convention, Toledo, July 13-15.

National Electrical Contractors' Association. Annual convention, Toledo, Ohio, July 21-23.

Maine Electric Association. Annual convention, Portland, Me., July 29-30.

Society of Automobile Engineers. Annual convention, Chicago, August 5-7.

Michigan Electric Association. Annual convention, Detroit, Mich., August 17-19.

International Association of Municipal Electricians. Convention, Atlantic City, N. J., September 14-16.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8, 9 and 10.

Northwest Electric Light Association. Annual convention and joint session with Seattle branch, A. I. E. E., Seattle, September 7, 8 and 9.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired July 12, 1909:

478,565. DESK ATTACHMENT FOR TELEPHONES. Lewis C. Butler, West Bay City, Mich.

478,664. ELECTRODE. Armand Vanden-Kerckhove, Brussels, Belgium.

478,692. TELEPHONE. Paul M. D'Unger, Chicago, Ill.

478,722. DISTRIBUTION OF ELECTRIC CURRENTS. Elihu Thomson, Swampscott, Mass.

478,743. TELEPHONE-REPEATER. Thomas A. Edison, Menlo Park, N. J.

478,788. ELECTRICAL THERMOSTAT. William L. Denio, Rochester, N. Y.

478,789. ELECTRIC SIGNALING APPARATUS. William L. Denio, Rochester, N. Y.

478,816. ELECTRO-MECHANICAL APPARATUS FOR STARTING OR REVERSING MACHINERY. Albert Piat, Paris, France.

478,821. ELECTRIC ELEVATOR. Alonzo B. See and Walter L. Tyler, Brooklyn, N. Y.

478,865. ELECTRIC TIME-ALARM. John Jacobi, Brooklyn, N. Y.

478,956. CONDUIT SYSTEM FOR ELECTRIC RAILWAYS. William H. Ford, St. Louis, Mo.

478,968. ELECTRIC MOTOR. Harlon F. Ong, Newberg, Ore.

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CONTENTS.

EDITORIAL:
Central Stations in Small Communities..... 141
Electrification of the Southern Pacific..... 142
A Hydroelectric Problem..... 142
Ohio Electric Light Association's Convention..... 143
National Electrical Contractors' Association's Annual Convention—Report of the Proceedings..... 144
The Philadelphia Electrical Exposition..... 144
Southern Pacific Electrification..... 144
The Tariff and Its Relation to the Electrical Industry..... 145
Electric Power in the New England Mills..... 147
California Electrical Supply Companies Unite..... 147
Ohio Electric Light Association's Annual Convention—Complete Report of the Proceedings..... 148
An Accident and a Quick Recovery..... 154
The Manufacture of Artificial Nitrates from Air in Norway..... 155
Central Stations in Towns of Less Than 4,000 Inhabitants..... 160
Colorado Electric Light, Power and Railway Association..... 163
The Faraday Society..... 164
Discriminates Between Bulk and Retail Service..... 165
Chicago Electric Club..... 166
Annual Convention of the American Society of Civil Engineers..... 166
Electrification Shows in Germany..... 166
Briquette Making..... 166
The Preservation of Poles..... 167
Rockingham Power Company Sold..... 168
New Copyright Law..... 168
American Exposition in Berlin..... 168
Navy Department Supplies..... 168
Financial Reports of Electrical Companies..... 169
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE..... 170
INDUSTRIAL SECTION:
New Line of Motor Starters..... 172
Low-Pressure Turbine in Textile-Mill Service..... 173
A Prompt Delivery..... 173
The Rothchild Engine..... 173-174
Nernst-Lamp Improvements..... 174
Rail Handling at Gary, Ind..... 174-175
Central Electric High-Tension Disconnecting Switches..... 176
The High-Voltage Pittsburgh Transformer..... 176
CURRENT ELECTRICAL NEWS..... 177
RECORD OF ELECTRICAL PATENTS..... 184

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CENTRAL STATIONS IN SMALL COMMUNITIES.

There is no class of central stations that is more deserving of encouragement and help than the stations in the small communities scattered throughout the country. Started by local interests, as they generally and rightfully are, they are handicapped from the beginning by lack of technical and administrative knowledge of central-station principles. This has its unfortunate effects not only on the operation of the plant and the conduct of the commercial side of the business, but primarily is the cause of much poor design in equipment and ill-judged choice of policies, from which poor economy and low or no profits only can result. The outcome of this has been in altogether too many instances poor and unsatisfactory service, which has accounted for the erection of many municipal plants, that likewise have been doomed to financial failure from the start. There is no reason why these conditions must prevail, however, as is shown by the excellent success of a considerable number of small central stations that are yielding as good returns on their investment as many of the large and prosperous electric plants.

An excellent summary of the conditions that make for the financial success of the small station and for satisfactory service to the community is given in the paper by Mr. James S. Knowlson, on "Central Stations in Towns of Less Than 4,000 Population," that was presented at the recent convention of the National Electric Light Association, and which is abstracted at length on other pages of this issue. While this paper does not contain much that is radically new, it does give, from a broad point of view, a great many valuable suggestions on the design and operation of the physical plant, as well as on some of the methods that have been found successful in building up the business. For these points the paper is to be especially commended to the managers of small stations. One of the most important features of Mr. Knowlson's paper is that relating to continuous twenty-four-hour service, and he says rightly that almost every community that can support electric service of any kind will support all-day service, to the decided profit of the central-station company. Along the same lines are the advocacy of extensions to outlying communities and of broadening the scope of the plant to include all public utilities that can be economically supplied from a central station. At any rate there is no reason why such a station cannot supply electrical energy at all times for all kinds of service for which electricity is adapted.

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ELECTRIFICATION ON THE SOUTHERN PACIFIC.

The daily papers a week or so ago gave wide publicity to an announcement coming from E. H. Harriman that he was in favor of the immediate electrification of the mountain division of the Southern Pacific, lying between Ogden and Sacramento. The editorial note which was published in a recent issue of the Boston *Evening Transcript* is pertinent and worth reproduction:

"When the construction of a transcontinental railroad was looked on as an exceedingly formidable undertaking great operating obstacles were anticipated in the scarcity of fuel and water. Even oil-burning locomotives were suggested in the fifties as possible means out of the difficulty. Nor were the troubles unreal. The fuel supply on the Pacific Coast remained decidedly deficient until the oil deposits of the Bakersfield region came into use. But the solution of the problem which Mr. Harriman has just ordered from Europe, by the electrification of the mountain division of the Southern Pacific, lying between Ogden and Sacramento, is one that never occurred to the apprehensive founders. Few stretches of railroad track in the country offer larger invitation to electrification than this; many miles of its course lie through tunnels and snow sheds, where the smoke is a very distinct nuisance. The snows on the mountains will afford the waterpower that can be turned into electricity. This should be much cheaper than hauling coal to these high levels and over long distances from its source. Every application of electricity is to be welcomed. The more places to which that camel can get his nose under the railroad tent, the greater the chances of his eventually finding habitation there."

SUBDIVIDING BETTERMENT EXPENSES BY MUNICIPALITIES.

Progressive and equitable regulation of central-station rates in cases of appeal to state commissions requires that a close approximation should be reached by the reviewing tribunal as to the cost of giving service in the territory concerned. Unquestionably, one of the most difficult problems in the administration of a public-utility corporation is to determine what the actual cost of service is on a given section of a railway, in a given municipality, in a telephone system, in a certain central-station district, or to specific classes of customers. To a considerable extent it is necessary for a commission analyzing a rate situation to take general cognizance of the earnings and expenses, including fixed charges, of a company as a whole; but where specific appeals come before such a board as to charges in one special location, the case cannot, as a rule, be decided fairly without going far into detailed figures as to the cost of rendering the service on a smaller or larger part of the system.

In this connection it is important for operating companies to separate their betterment expenses sufficiently so that the investment made in different sections of their territory can be readily ascertained. When a central station, for example, operates in several municipalities, it is of much importance that the approximate expenditures in each city and town shall be available in case of a rate dispute, since it may be necessary for a commission to consider the operations of the company outside the particular municipality where the complaint originates, as well as its doings in the particular territory in hand. The tax list will show the total valuation of the property in a given municipality, but this is not the cost of the work undertaken, by any means, and besides, it is generally of great importance in rate cases to be able to show that in a definite period the company has expended this or that amount of money in the territory at issue. With the almost continual expansion of physical equipment and facilities which is taking place in electrical properties, expenditures are bound to be widely distributed, and often the public does not realize at all the cost of improvements which have been made; in fact, it could not be expected to appreciate them from the money side unless the figures are brought out publicly before the commission or some other tribunal having jurisdiction. Neither is a commission certain to appreciate localized expenditures unless care is taken to present them in proper form and early in the case. The returns made by central stations to state boards usually show the cost and quantity of new work done each year by the individual companies, but they seldom subdivide the investment sufficiently to enable the proper deductions to be made. This is because the great majority of appeals to state boards in rate cases are complex questions involving both financial and technical points in engineering and traffic problems. New inquiries almost always come to the front in such cases, since novel combinations of facts and tendencies have to be made in responding to these appeals.

Obviously, it is out of the question for any company to subdivide all its operations so minutely that it can foresee the character of the rate appeals that may be made by its customers. What is needed, however, is sufficient subdivision in the company's files to enable all sorts of combined statistics to be made up, as occasion requires. In a case that was taken up some time since before a state board, the commission held that the complete operations and earnings, with the expenses also, of the company outside the disputed territory must be considered, as well as the business in the city where the complaint originated. As the outside territory was a poor one for revenue and a relatively high one for operating cost, it was to the company's advantage to have the commission call for figures external to the city proper. The longer one studies rate problems the more important it appears to be possessed of complete data, or the means of assembling it before the adjudicating tribunal.

A HYDROELECTRIC PROBLEM.

At Vernon, Vt., five miles north of the Massachusetts line, are the new dam across the Connecticut River and the hydroelectric plant designed for a capacity of 16,000 kilowatts,

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as mentioned in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of February 13, 1909.

It is now possible to point out certain hydraulic and electric problems involved in the construction and operation of this dam and power plant that may have application in other cases.

To fully understand the situation, the profile of the river and the nature of the industries above and below the Vernon dam should be held in mind. From the dam at Turners Falls, Mass., to the foot of Bellows Falls, Vt., the distance by the Connecticut River is fifty miles, and as the new Vernon dam is twenty-two miles above that at Turners Falls, it is twenty-eight miles below Bellows Falls.

At the foot of Bellows Falls the elevation of the river is sixty-one feet above the top of the dam at Turners Falls, and it is this fall of sixty-one feet along fifty miles of the river, mostly in a rocky gorge, that the company engaged in the construction of the plant at Vernon is to utilize in part. In Massachusetts, at or near the French King rapids, which are four miles above the dam at Turners Falls and eighteen miles below the new Vernon dam, a company that is understood to be in accord with the one at Vernon is also authorized to build a dam.

Without going into a discussion of the law on the subject, it may be assumed that a plant built to utilize any part of the sixty-one feet of descent in the river from Bellows Falls to Turners Falls would be required to leave undiminished the head of water at the former and the volume of water during each hour of the day at the latter. The volume of water available during the night is important as well as that during the day at Turners Falls, because a large part of the flow there is used by paper mills, that operate during the entire twenty-four hours. It was, of course, desirable to create as much storage area as possible behind the new dam, but still the back water must not reach Bellows Falls.

On the other hand, it is expected that the electric plant at the Vernon dam will be devoted largely to the development of energy for sale in bulk for manufacturing purposes, the greater part of which may be expected to operate only during the day. It will therefore be very desirable to store large amounts of water behind the new Vernon dam during the night for use during the following day, at times when the run of the river is low.

If the use of this storage in times of low flow is not to affect the regularity of the discharge at the Turners Falls dam twenty-two miles downstream, some system of compensation appears to be necessary, and it is understood that this is to be provided by means of a dam at the French King rapids.

The pool below the Vernon dam is nearly fourteen feet above the top of the dam at Turners Falls and about eleven feet above the foot of the French King rapids. A dam at these rapids will thus create a pond in which water may be stored during the day, when the electric plant is operating at the greatest load, and then released during the night, when the river is held back by the Vernon dam, so as to produce the normal flow at Turners Falls.

Such a method of regulation may be of value at other hydroelectric plants.

THE OHIO ELECTRIC LIGHT ASSOCIATION'S CONVENTION.

The Ohio Electric Light Association prides itself on being one of the strongest and most influential state electrical organizations of the country. To anyone that attended its fifteenth annual convention, held at Toledo last week, the justice of this claim was easily manifested. There are a number of elements contributing to this strength that are worthy of mention. Among these are: The personnel of the organization, the active interest of the officers and members in its work, the custom of holding the conventions in midsummer and the lavish manner in which the association entertains its members and guests on these occasions. Of special value to the association is its recent custom of retaining a permanent secretary and compensating him for some of the time and effort required to look after its routine affairs.

This year's convention, a detailed report of which is given in this issue, was an exceptionally successful one in nearly every particular. On account of the increased financial strength of the association, it was possible to arrange the entertainment features on a much more elaborate scale even than has been customary in the past. The convention sessions, while not attended as well as might be expected from the total registrations, brought out a number of good discussions to the leading papers presented.

Among these papers probably the most significant, as indicating a marked trend of the times, were those by O. H. Hutchings and Claude Smith on "The Supply of Electric Current to Other Towns from a Centrally Located Station." In two other papers the same tendency was alluded to. One of the speakers aptly expressed the theory of this new policy for the small community by advising "if your town is too small to support a well-built plant, it were better to 'hitch your wagon to a star' of greater magnitude by running a transmission line to a larger plant." At the last Atlantic City convention of the National Electric Light Association and at a recent meeting of its Brooklyn company branch, the same sentiments found expression by some of the ablest electrical men in the country. The day of the small, poorly equipped and uneconomically operated electric plant is rapidly passing and its poor service is bound to be replaced by the far-reaching, continuous and cheaper service from a network of transmission lines, radiating in all directions from a highly efficient central station, worthy of the name. The Ohio Electric Light Association can do no better service to the small communities in its state, and by its example to those in other states, than to foster this plan of extending the blessings of electric power, light and heat to the small, yet widely scattered, centers of our rural population, and even to the farms along the lines.

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NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.

(*By Telegraph to the* ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.)

TOLEDO, O., July 21.—The ninth annual convention of the National Electrical Contractors' Association opened this morning shortly after 10 o'clock with over two hundred contractors and guests in attendance. The opening session was marked by much enthusiasm and a fine spirit of cordiality. Marvin W. Hansen, of Toledo, national director for Ohio, made a brief address introducing the Hon. Brand Whitlock, mayor of Toledo, who felicitated the Contractors' Association upon this fine gathering and upon the importance of its work. He said that Toledo welcomed the convention with open arms and open hearts, that there were no keys, nor bars, nor walls, and that the freedom of the city was theirs entirely.

The first paper entitled "The National Electrical Code and the Relation of the Contractor to the Central Station" was read by W. H. Blood, Jr. Mr. Blood is president of the National Conference on Standard Electrical Rules and the official representative of the National Electric Light Association. He said that similarly to the rule of the triumvirate of early Roman days, the triumvirate of today in the electrical industry is formed by the code, the contractor and the central-station company; no one can rule alone, but the co-ordinated effort of all controls the situation. If a lighting company's rates are too high, its customer turns to gas or oil. If the contractor attempts to make undue profit or insists upon costly construction, the prospective customer again refuses to use electricity and as a result the contractor's business is curtailed. If the code rules are unnecessarily severe, this has the same result of decreasing the use of electricity. The code, contractor and company are like three large links in a chain, bonded together by smaller links of confidence. The latter are really the weaker and have many times been strained, but mutual tolerance and co-operation are removing the stress and welding the elements into a more substantial body. The Underwriters are making effectual efforts to bring about uniform interpretation of code rules, and through the broadening influence of attendance at various meetings for the discussion of these rules, at which the Underwriters are very glad to have the counsel of the contractors, order is being brought out of chaos and the recodified rules which will be issued shortly will bring about substantial relief. As regards competition of lighting companies in doing inside wiring, there are few companies which would not gladly turn this over to honest contractors, but where the contractor is not conscientious the lighting company is forced to do its own wiring in order to avoid permanent injury.

This paper was followed by an address by George C. Nimmons, of Chicago, who took for his topic "The Relation Existing Between the Contractor and the Architect." This was a most interesting and inspiring analysis of the fallacies of present-day contracting methods, and an intelligent discussion of the remedies which might be applied.

There was a brief discussion of this paper and a vote of thanks was tendered to Messrs. Blood and Nimmons. In the afternoon a business meeting was held. This evening the "Sons of Jove" conducted an enthusiastic rejuvenation. Exhibits of apparatus and supplies are being made by the Westinghouse Electric and Manufacturing Company, the Nernst Lamp Company, the Western Electric Company, the Charles L. Kiewert Company and the Crouse-Hinds Company. There is a large representation of manufacturers and supply men in attendance.

A. A. G.

The Philadelphia Electrical Exhibition.

A great electrical exhibition is announced to take place at the First Regiment Armory, Broad and Callowhill streets, Philadelphia, Pa., from February 15 to 27, 1910, inclusive, under the auspices of the Electrical Exhibition Compay of America, whose offices are located at 211 and 212 Baker Building, 1522 Chestnut Street, Philadelphia.

This preliminary announcement is contained in a handsome booklet which is being distributed by the company promoting the show, and with which is included a large floor plan showing the arrangement of spaces for exhibitors.

The object of the exhibition is for the avowed purpose of stimulating the electrical industries in Philadelphia and the surrounding territory. The importance of the third largest city in the country as a great manufacturing center is too well known to be enlarged upon here, but that Philadelphia contains more individual houses than any other city in the United States may not be so well known. These facts show the tremendous field for electrical activity in this territory, which is probably not equaled by any similar area in the country.

The First Regiment Armory is an ideal building for the purpose of the exhibition. It is within easy walking distance of the principal railroad stations, office buildings, department stores, and theatres, and can be easily reached by the excellent street-car system from every residential section of the city. The main auditorium has a high-vaulted ceiling, free from all obstructions, and numerous committee and retiring rooms will be available for the accommodation of exhibitors and visitors. The building will be tastefully decorated, inside and out, by experts who are originating some unique and artistic effects.

Broad Street will be specially decorated and illuminated from the City Hall to the Armory, and a well-known band will be in attendance every day of the show. Each day will be featured—as Students' Day, Municipal Day, Naval Day, State Day, etc.

A liberal policy will be followed in the distribution of free complimentary tickets to exhibitors, manufacturers, electrical and scientific societies, and others who are interested.

A Good Example.

In connection with the International and Universal Exhibition, to be held at Brussels in 1910, the Royal Commission appointed by the British Government is making extraordinary efforts to make the British machinery exhibits unrivaled among those of the various countries to be represented.

Not content with securing for British exhibitors what is probably the most favorable location for the display of their wares at the Exposition, the Royal Commission has announced that it will defray fifty per cent of the charges made by the Belgian administration for the supply of steam, gas, and electricity to British firms, when these are to be used for showing machinery producing finished articles, or for illustrating manufacturing processes. The Royal Commission is also prepared to furnish expert advice and superintendence for the erection of foundations, shafting, etc., by Belgian contractors for British exhibitors.

Southern Pacific Electrification.

Permits for the construction of power houses along the Rubicon River have recently been obtained from the government in the execution of the plan for the electrification of the mountain division of the Southern Pacific between Auburn and Truckee, Cal., on the Ogden route.

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The Tariff and Its Relation to the Electrical Industry.

Washington, D. C.—Now that the fight has narrowed down to the work of the conference committee on the tariff bill, it is of considerable interest to run over the various changes that have taken place during its progress from the Ways and Means Committee hearings, as the result of which the Payne bill was presented to the House, then went to the Senate, by whom it was handed to the Finance Committee, and in time—three months—was amended and returned to the House, whence it has been placed in the tender care of the conference committee.

ALUMINUM.

The Act of 1897 provides a duty of 8 cents per pound on "Aluminum, and alloys of any kind in which aluminum is the component material of chief value, in crude form," and of 13 cents per pound on plates, sheets, bars, and rods.

Under the Act of 1890 the duty on the crude was 15 cents per pound, and in manufactured form, 45 per cent ad valorem. In 1894 this was reduced to 10 cents and 35 per cent, respectively, and, as shown above, was made specific in 1897. This was reduced by the bill as reported by the House, which reads as follows:

170. Aluminum, *aluminum scrap,* and alloys of any kind in which aluminum is the component material of chief value, in crude form, 7 cents per pound; in plates, sheets, bars, and rods, 11 cents per pound; *barium, calcium, magnesium, sodium* and *potassium, and alloys of which said metals are the component materials of chief value, 3 cents per pound and 25 per cent ad valorem.*

The items which were added to the present act are in italics. Under the present law magnesium is not dutiable, coming in free under paragraph 606, while sodium and potassium are dutiable at 20 per cent ad valorem under paragraph 183 of the Dingley Act.

The imports of aluminum in 1907 were, in crude form, 1,292,307 pounds, at a value of $258,601.40, and the duty collected amounted to $103,384.56, or an average ad valorem rate of 39.98 per cent. Of aluminum in plates and sheets we imported 10,961.06 pounds, at $7,333. On this the duty amounted to $1,424.94, or an average ad valorem rate of 19.43 per cent. Our exports amounted to $442,987. It is estimated that under the House Bill the minimum rate on the crude article will average just what it is now, although in figuring it out in the Senate it shows a reduction to 34.98 per cent ad valorem, or of 12.50 per cent. It is estimated that on the manufactured forms there will be a reduction to 16.44 per cent or of 15.38 per cent.

Sec. 3 of the House Bill would mean an increase on the crude from 7 cents minimum to 8.4 cents maximum, or 1.4 cents per pound, and on the manufactured forms from 11 cents to 13.2 cents, or 2.2 cents per pound.

Aluminum in leaf in 1890 was assessed at 8 cents per package of 100 leaves. Under the tariff of 1904 this was changed to 40 per cent ad valorem, and under the present law was switched back again to a specific rate of 6 cents per 100 leaves, at which rate it is left under both Senate and House bills. The maximum clause of the House bill would run it up to 7.2 cents per 100 leaves.

As a revenue producer this is a negligible item, as our imports in 1907 were only valued at $492, on which $261 was paid in duty, or an average ad valorem of 53.05 per cent.

Wares of aluminum are still left dutiable at 45 per cent ad valorem. The imports only amounted to $1,026.50 in 1907. The maximum rate under the House bill would be 54 per cent, or an increase of 9 per cent.

CARBON.

Under the tariff of 1890 manufactures of carbon, if undecorated, were dutiable at 55 per cent ad valorem and at 60 per cent if decorated. Under the Act of 1894 they were placed at 30 per cent and 40 per cent, respectively; but it was not until the present act that carbon was specifically named as such and increased to 35 per cent and 45 per cent, respectively, under paragraph 97. In the preparation of the bill before it entered the House, attention was called to the fact that, in the case of Dingelstedt vs. United States (91 Fed. Rep., 112), the rule was laid down by the circuit court of appeals for the second circuit that the act of 1894 should only apply to articles of this nature when decorated, and by a decision of the United States Supreme Court this was made applicable to the law of 1897, and extended it to articles of carbon, for which, as I have already stated, there was no specific provision in 1894. This ruling is said to have caused a tremendous loss of revenue to the Government, for the articles which would have paid 35 per cent have been coming in at 20 per cent. It was suggested that the remedy would be to amend the paragraph so as to provide that such articles of earthy or mineral substances as would otherwise fall within the terms of the paragraph should not be excluded because they are not susceptible of decoration, but should be dutiable under a provision for such articles not decorated. With this end in view, the House passed to the Senate this provision:

93. Articles or wares composed wholly or in chief value of earthy or mineral substances, or carbon, not specially provided for in this section, whether susceptible of decoration or not, if not decorated in any manner, 35 per cent ad valorem; if decorated, 45 per cent ad valorem.

This was materially changed while the bill was in the Senate, so that, as sent back to the House, the bill provides for:

93. Articles or wares composed wholly or in chief value of earthy or mineral substances, not specially provided for in this section, whether susceptible of decoration or not, if not decorated in any manner, 35 per cent ad valorem; if decorated, 45 per cent ad valorem; carbon, 20 per cent ad valorem; electrodes, brushes, plates, and disks, all the foregoing composed wholly or in chief value of carbon, 30 per cent ad valorem.

Under the Act of 1890 carbons and carbon pots were dutiable at 55 per cent ad valorem; and under the Act of 1894 at 30 per cent; in both instances this was in the undecorated state. The present act is as follows:

98. Gas retorts, $3 each; lava tips for burners, 10 cents per gross and 15 per cent ad valorem; carbons for electric lighting, 90 cents per hundred; filter tubes, 45 per cent ad valorem; porous pots for electric batteries, without metallic connections, 20 per cent ad valorem.

Carbons for electric lighting were originally made of wood charcoal, quenched in water or mercury. They burned with brilliancy and regularity, but too rapidly. The carbon which is deposited in gas retorts was next employed, but the chief fault with this was lack of homogeneity and purity, and they are so hard that it is too expensive to cut them into pencils of the required sizes. These difficulties were overcome by purifying the gas-retort carbons, while experiments were conducted that resulted in the production of suitable carbons from other sources. In some of these processes the gas-retort carbon is used as a base, while in others lampblack is employed. In Europe the coarser fibers of manila hemp have been carbonized and successfully employed as carbons.

The number of carbons imported in 1907 was 81,792.90 hundreds, at $157,311; the duty collected amounted to $73,613.61, or an average ad valorem rate of 46.79 per cent. The imports of carbon pots during the same year were valued at $9,149, and the duty at 20 per cent, to $1,829.80.

The bill as reported to the House was as follows:

94. Gas retorts, $3 each; lava tips for burners, 10 cents per gross and 15 per cent ad valorem; carbons for electric lighting, 35 per cent ad valorem; filter tubes, 35 per cent ad valorem; porous carbon pots for electric batteries, without metallic connections, 20 per cent ad valorem.

The bill as reported to the Senate reported:

94. Gas retorts, 30 per cent ad valorem; lava tips for burners, 10 cents per gross and 15 per cent ad valorem; carbons for electric lighting, 70 cents per 100 feet; filter tubes, 35 per cent ad valorem; porous carbon pots for electric batteries, without metallic connections, 20 per cent ad valorem.

As passed by the Senate it was again changed.

94. Gas retorts, 30 per cent ad valorem; lava tips for burners, 10 cents per gross and 15 per cent ad valorem; carbons for electric lighting, made entirely from petroleum coke, 35 cents per hundred feet; if composed chiefly of lampblack or retort carbon, 65 cents per hundred feet; filter tubes, 35 per cent ad valorem; porous carbon pots for electric batteries, without metallic connections, 20 per cent ad valorem.

It is estimated that under the present bill the average ad valorem rate on carbons is 46.79 per cent and that the proposed changes will reduce this to 36.39 per cent.

As I have shown, Senate comparisons of the two bills with present rates, show that the rates which they propose on electric-light carbons will really be lower than those at present in force, despite the contention of the House conferees that the rates have been raised.

COPPER.

The wording of the copper paragraph—174—has not, and is not now changed from what it was in 1890. Only the rate is changed. In 1890 it was assessed at 35 per cent ad valorem, in 1894 it was lowered to 20 per cent ad valorem, whereas in 1894 divisions were made which made "copper in rolled plates, called brazier's copper, sheets, rods, pipes, and copper bottoms" dutiable at 2.5 cents per pound, and "sheathing, or yellow metal of which copper is the component material of chief value, and not composed wholly or in part of iron ungalvanized,"

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at 2 cents per pound. This remains unchanged in both the House and Senate bills.

Two paragraphs of the present bill, 534 and 532, have been combined to make 536 of the pending bills, but its terms are unchanged.

536—"Copper ore: regulus of, and block or coarse copper, and copper cement; old copper, fit only for remanufacture, clippings from new copper, and copper in plates, bars, ingots, or pigs, not manufactured or specially provided for in this section," Free. The provision for old copper is slightly changed. In the present act it is—

533. Old copper, fit only for remanufacture, clipping from new copper, and all composition metal of which copper is a component material of chief value not specially provided for in this act. Free.

It is proposed to change this to the following:

537. Composition metal, of which copper is the component material of chief value, not specially provided for in this section, Free.

To the iron and steel plate paragraph the House added the following clause:

Sheets or plates composed of iron, steel, copper, nickel, with layers of other metal or metals imposed thereon by forging, hammering, rolling, or welding, 45 per cent ad valorem.

The Senate has reduced this rate to 40 per cent. This clause was added because there has been a great deal of litigation on this point, and because, as it stands in the present law, the term is restricted to coatings produced by galvanizing, dipping, electrolysis, or similar processes. An appeal from that decision is now pending, and it is thought that the introduction of the clause mentioned will do away with this difficulty for the future.

A new paragraph has been inserted to provide for an assessment of duty at the rate of 45 per cent ad valorem on phonographs, gramophones, graphophones, and similar articles and their parts.

WIRE.

Telegraph and telephone wire has up to the present time been dutiable under paragraph 137, which is wholly inadequate, and reads as follows:

137. Round iron or steel wire, not smaller than No. 13 wire gauge, 1.25 cents per pound; smaller than No. 13 and not smaller than No. 16 wire gauge, 1.5 cents per pound; smaller than No. 16 wire gauge, 2 cents per pound: Provided, that all the foregoing valued at more than four cents per pound shall pay 40 per cent ad valorem. Iron or steel or other wire not specially provided for in this Act, including sheet steel in strips, 0.0025 of an inch thick or thinner, any of the foregoing, whether uncovered or covered with cotton, silk, metal, or other material, valued at more than four cents per pound, 45 per cent ad valorem: Provided, That articles manufactured from iron, steel, brass, or copper wire, shall pay the rate of duty imposed upon the wire used in the manufacture of such articles, and in addition thereto 1.25 cents per pound, except that wire rope and wire strand shall pay the maximum rate of duty which would be imposed upon any wire used in the manufacture thereof, and in addition thereto, 1 cent per pound; and on iron or steel wire coated with zinc, tin or any other metal, 0.2 cent per pound in addition to the rate imposed upon the wire from which it is made.

The House bill provided the following rates:

134. Round iron or steel wire not smaller than No. 13 wire gauge, 1 cent per pound; smaller than No. 13 and not smaller than No. 16 wire gauge, 1.25 cents per pound; smaller than No. 16 wire gauge, 1.5 cents per pound: Provided, That all the foregoing valued at more than 4 cents per pound shall pay duty at the rate of 40 per cent ad valorem; all iron or steel wire covered with cotton, silk, or other material, * * * and all flat wires and steel strips, strip steel, or steel in strips 0.0025 of one inch thick, or thinner, whether in long or short lengths, in coils or otherwise, and whether drawn through dies or rolls, and all other wire not specially provided for in section 1 or 2 of this act, shall pay a duty of not less than 45 per cent ad valorem; or iron or steel wire coated by dipping, galvanizing or similar process with zinc, tin, or other metal, there shall be paid 0.2 cent per pound in addition to the rate imposed upon the wire of which it is made: Provided further, That articles manufactured wholly or in chief value of any wire or wires provided for in this paragraph shall pay the maximum rate of duty imposed in this section upon any wire used in the manufacture of such articles, and in addition thereto 1.25 cents per pound, except that wire rope or wire strand shall pay the maximum rate of duty imposed in this section upon any wire used in the manufacture thereof and in addition thereto, 1 cent per pound: And provided further, That no article composed of wire shall pay a less rate of duty than 40 per cent ad valorem.

This the Senate first changed so that the duty on "smaller than No. 16" was increased from 1.5 cents to 1.75 cents per pound. Then the provision for "all iron or steel wire" was changed so as to include "all wire composed of iron, steel, or other metal, except gold or silver, covered, etc." The 0.0025 of one inch provision was changed to "not exceeding ten inches in width," and the duty reduced from 45 per cent to 40 per cent ad valorem. "Wire cable" was added to the wire rope and strand, and the additional duty in that clause was reduced from 1 cent to 0.75 cent per pound. Then was added this provision:

Telegraph, telephone, and other wires and cables composed of metal and rubber, or of metal, rubber, and other materials, 45 per cent ad valorem.

Still further minor changes were made and, as it has gone back to the House, the paragraph reads as follows:

134. Round iron or steel wire, not smaller than No. 13 wire gauge, 1 cent per pound; smaller than No. 13 and not smaller than No. 16 wire gauge, 1.25 cents per pound; smaller than No. 16 wire gauge, 0.75 cent per pound: Provided, That all the foregoing shall pay duty at not less than 35 per cent ad valorem; all wire composed of iron, steel, or other metal, except gold or silver, covered with cotton, silk, or other material, * * * and all flat wires, and steel in strips, not thicker than No. 15 wire gauge and not exceeding five inches in width, whether in long or short lengths, in coils or otherwise, and whether rolled or drawn through dies or rolls or otherwise produced, and all other wire not specially provided for in this section, shall pay a duty of not less than 35 per cent ad valorem, on iron or steel wire coated by dipping, galvanizing or similar process with zinc, tin, or other metal, there shall be paid 0.2 cent per pound in addition to the rate imposed on the wire of which it is made: Provided further, that articles manufactured wholly or in chief value of any wire or wires provided for in this paragraph shall pay the maximum rate of duty imposed in this section upon any wire used in the manufacture of such articles and in addition thereto, 1 cent per pound: And provided further, that no article made from or composed of wire shall pay a less rate of duty than 40 per cent ad valorem; telegraph, telephone, and other wires and cables composed of metal and rubber, and other materials, 45 per cent ad valorem * * * wire heralds 25 cents per thousand, and in addition thereto 40 per cent ad valorem.

KIESERITE is free under paragraph 599.

PLUMBAGO is free under paragraph 651.

POLES.

Paragraph 200 takes the place of paragraph 196 of the present act and reads:

"200—Paving posts, railroad ties, and telephones, trolley, electric-light, and telegraph poles of cedar or other woods," the duty being 10 per cent, as against the present rate of 20 per cent.

Many conflicting decisions have been rendered under this paragraph. Sometimes it has been held that when imported in a rough state they should come in free of duty under paragraph 699 as round unmanufactured timber, and in others that they should be dutiable. The contemplated reduction in the duty was made, primarily, for the purpose of admitting foreign poles, as it is claimed this will conserve our own forests. In bringing the matter to the attention of the committee it was stated that the white cedar from the North can no longer supply the demand for telegraph poles; it has been found that the cedar timber of Idaho furnishes a satisfactory substitute where heavy timbers are not required, and cypress from the Southern States has also become an important factor in the pole business. The last-named wood has been neglected as a substitute for white cedar, but that of northern Louisiana and eastern Alabama is found to be entirely satisfactory as a substitute, and the value of the timber may be expected to increase in connection with this newly found use. The same reason that is causing the railroads to look for a substitute for wooden ties—the increasing scarcity of wood—is turning attention to a substitute for telephone, telegraph and electric-light poles. Europe is now beginning to use glass telegraph poles, and patents have been granted in Germany and the United States for a machine to manufacture them.

The importations in 1907 were valued at $570,323.41, and the duty, at 20 per cent, amounted to $114,064.64.

Manufactures of VULCANIZED OR HARD RUBBER are dutiable at thirty-five per cent ad valorem under paragraph 456.

ELECTRICAL MACHINERY and APPARATUS, including telephone and other instruments, will come under the provisions of paragraph 195 by assimilation, which is exactly the same as paragraph 193 of the present act, providing for

Articles or wares not specially provided for in this section, composed wholly or in part of iron, steel, lead, copper, nickel, pewter, zinc, gold, silver, platinum, aluminum, or other metal, and whether wholly or partly manufactured, 45 per cent ad valorem.

An effort was made both in the House and Senate bill to include electrical machinery and apparatus under paragraph 194 at thirty-five per cent ad valorem, but this was stricken out by the Finance Committee.

MICA.

Under the law of 1890 mica was dutiable at 35 per cent ad valorem. In the Act of 1894 this was reduced to 20 per

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cent ad valorem. Under the present act the rates are as follows:

184. Mica, unmanufactured or rough trimmed only, 6 cents per pound and 20 per cent ad valorem; mica, cut or trimmed, 12 cents per pound and 20 per cent ad valorem.

The paragraph which has been introduced by the House is:

89. Mica, 30 per cent ad valorem; mica plates or built-up mica, and all manufactures of which mica is the component material of chief value, 35 per cent ad valorem.

The paragraph underwent considerable change while in the hands of the Finance Committee and was reported as follows:

89. Mica, unmanufactured or thumb-trimmed only, 5 cents per pound and 20 per cent ad valorem; mica, cut or trimmed, mica plates or built-up mica, and all manufactures of mica or of which mica is the component material of chief value, 10 cents per pound and 20 per cent ad valorem.

This was afterward changed so that the first clause, as it went back to the House, reads "mica, unmanufactured, or rough-trimmed only."

Mica has been a subject of considerable dispute. In Myers vs. United States it was held that small pieces of mica which fell off in the process of thumb-trimming mica, varying in size from one to two inches in width and from two to three-and-one-half inches in length, were still mica, susceptible of use as mica, and were properly dutiable as mica under paragraph 184, against the contention of the importers that the merchandise was entitled to entry at ten per cent as waste. In another case, Shallus vs. United States, where a decision was handed down by the Board of General Appraisers, an assessment made by the collector was reversed solely on the ground that the small value of the disks made the assessed rate of duty prohibitive. The suggestion was made to the Ways and Means Committee that a provision should be made for manufactures of mica, or of which mica is the chief value; also that, inasmuch as mica is a non-metallic substance it should not be placed in the metal schedule. Both these suggestions have been acted upon.

The use of mica for stove doors is rapidly falling off, but as an insulator and for other purposes in connection with the electrical industry there is an ever-increasing demand. There is an extensive use for mica cut into small disks for electrical purposes, and the waste is used for a variety of purposes where formerly it was thrown away. The value of sheet or plate mica varies with the size of the sheet from two cents to three dollars per pound. The very lowest values, from two cents to five cents, are for small disks that are cut by machinery. Larger sheets are cut by hand, and considerable skill is required to cut the largest pattern possible from a crude block of mica. The commercial value of scrap mica before it is ground is from $8 to $10 per ton. After it is ground it is valued at from $40 to $60 per ton according to its fineness.

In 1907 we imported 3,110,029½ pounds of unmanufactured or rough-trimmed mica at a value of $1,116,320.25; duty amounted to $409,865.81, or an average ad valorem rate of 36.72 per cent. We also imported during that year 99,335 pounds of cut or trimmed at $73,364; duty paid was $26,593.01, or 36.25 per cent. The great bulk of our importations comes from Canada, other principal sources of supply being China, the United Kingdom and Germany.

A. F. TENNILLE.

Washington, July 17.

Electric Power in the New England Mills.

Within the last four or five years there has been a quiet movement among New England textile mills, which, in its natural working out, means the very general substitution of electricity for steam. At the present time there are no less than forty New England cotton mills which are either using or have orders for installing steam turbines for the generation of motive power to operate their plants. The aggregate steam-turbine capacity of these forty mills is nearly 100,000 horsepower, or exactly 98,150. A year ago there were but twenty-two mills, with a total of 41,000 steam-turbine horsepower capacity. Five years ago the mechanical operation of New England cotton mills was almost entirely dependent upon steam or waterpower.

Numbered among these mills are some of the very largest and most important in the country, such as the Amoskeag (which is using 3,000 horsepower, generated by turbines, with provision for an ultimate enlargement to 10,000 horsepower), the Arlington mills, the Nashua mills, Pacific, and Tremont & Suffolk.

The following table will show how the business of electrifying the power plants of New England cotton mills has been divided among the three largest steam-turbine producers of the country:

Company.	No. Mills Equipped.	Total Capacity in H. P.
General Electric	16	49,500
Westinghouse	13	15,000
Allis-Chalmers	11	23,450
Total	40	98,150

In still another way are the cotton mills of New England making use of electrical apparatus for power purposes. In many cases, where power is generated by water or steam, electric motors are used for the delivery of the power. At present fully 175,000 horsepower is delivered by motors in New England mills alone, and in the entire country there is some 350,000 horsepower so delivered.

The increase in the use of motors has shown a yearly average gain during the last three years of thirty per cent, better than a 100 per cent increase in the three years. Among the large centers using motors are New Bedford, with 10,000 horsepower; Lawrence, with 35,000 horsepower, including the American Woolen Company, the Pacific mills and the Arlington mills. The Amoskeag mills alone will have 13,000 horsepower of this description when additions at present contemplated are completed.

California Electric Companies Combine.

Four of the big electrical supply houses of San Francisco, Oakland and Los Angeles have consolidated and will hereafter do business under one management. These firms are named as having mutually agreed to consolidate: Pacific Electric, Los Angeles; Crescent Electric, Oakland; Brooks-Follis Electric Corporation, San Francisco; and Sterling Electric, San Francisco.

It is the intention of the new organization eventually to open offices in all of the larger western cities. Plans will be formulated at an early date to include Portland, Seattle, Spokane and Salt Lake City in the list of cities where a broad field presents itself. It is stated that here, also, the new organization will combat the strong eastern houses, which have already secured a solid footing in these places.

The provisional directors named in the organization of the new company are H. V. Carter, Pacific Electric Company, Los Angeles; William L. Goodwin, Sterling Electric Company, San Francisco; C. L. Gilson, Crescent Electric Company, Oakland, and Frank Fowden, Brooks-Follis Electric Company, San Francisco.

Service Board's Decision Reversed.

Justice Ingraham, in the Appellate Division of the New York Supreme Court, handed down a decision on July 13 upholding the New York city Board of Estimate in granting a franchise to the South Shore Traction Company to build and operate a street-railway line over the Queensborough Bridge.

The decision is a reversal of the refusal by the Public Service Commission to confirm the franchise granted to the South Shore company by the Board of Estimate.

The Commission was directed to grant the application and pay $50 costs and disbursements to the traction company.

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Ohio Electric Light Association.

Fifteenth Annual Convention at Toledo, Ohio, July 13, 14 and 15, 1909.

The fifteenth annual convention of the Ohio Electric Light Association, that was held at Toledo on Tuesday, Wednesday and Thursday, July 13 to 15, was one of the best in practically every detail that this association has ever held. The convention headquarters were at the Boody House, the scene of many of its former notable gatherings. The unavoidable absence of the president and, for part of the time, of the vice-president was regrettable. Notwithstanding this, the programme of meetings and entertainments was carried out in an excellent manner. The entertainment features were particularly pleasing, and on a much larger scale than is customary for meetings of this kind. The attendance at the convention was exceptionally good, the total registration being 263. All who attended agreed that they had received much of value from the business standpoint and incidentally had had a very pleasant midsummer outing.

TUESDAY MORNING SESSION.

The first session of the convention assembled at 10 o'clock Tuesday morning, with W. P. Engel, past-president of the association and one of the active members of the executive committee, in the chair. President C. R. McKay has just a few weeks ago removed to South Covington, Ky., where he has become general manager of the local central-station company. Secretary D. L. Gaskill read a communication from him, from which the following are extracts:

"I greatly regret that my absence from the convention this year has been necessitated by change of residence. . . . . The officers and committees of the association have worked most conscientiously to provide a programme and entertainment for the members and their guests superior to those of any previous convention of the Ohio Electric Light Association, and I take this opportunity of thanking them for their cordial support and assistance. It is gratifying that this year's convention, which sets the high-water mark in membership and well being of the association, should occur coincidentally with the improved conditions in the industry which it represents. Although there are disturbing questions of corporate regulation and legislation which are as yet unsettled, the electric-light and power industry as a whole is too firmly established and too honestly conducted to fear any permanent setback from such causes. Please convey to the association my hitherto unexpressed thanks for the honor conferred upon me in my past election as president and my hope that the convention now in session will justify all the efforts made toward its success."

Albion E. Lang, president of the Toledo Railways and Light Company, delivered a pleasing address of welcome to the association on behalf of his company and the electrical and business interests of Toledo in general. In emphasizing the importance of the association's work, he called attention to the great development of the electrical industries, particularly electric railways and electric lighting, in the past twenty-five years, and to the necessity of co-operation by these industries in pushing this progress still further.

The Hon. Brand Whitlock, mayor of Toledo, also welcomed the association to the city of Toledo in a most cordial manner. He called attention to the fact that about one-half of the population of this country is urban, and that this percentage is rapidly increasing. The problems of city life are therefore steadily multiplying, and the application of electricity to the solution of many of these problems has become and will continue to be of the most potent character.

The report of the executive committee recommending the admission of fifteen new members to the association was presented by W. F. Hubbell. This report was accepted and the members duly admitted. The report of Secretary-Treasurer Gaskill was presented by him. It related chiefly to the financial condition of the association, which is now on a much better footing than ever before. There was a net balance of some $237 preceding the last convention. At the beginning of July, 1909, this was more than doubled to $490. Besides this the association has this year undertaken itself the publication of the souvenir convention programme, from the advertising in which there has netted to the association clear profits of about $1,715.

The first paper read was that entitled "Residence Lighting in Detroit," by F. T. Mather, of the Detroit Edison Illuminating Company.

This paper, which is largely quoted from a paper presented at the last annual convention of the Association of Edison Illuminating Companies, describes the conditions met with in the residence lighting in Detroit. In this city, having a population of about 360,000, there are 13,000 homes lighted electrically. There is practically no competition with other illuminants in the high-class residences, comparatively little in the moderate homes, and considerable business is done among the owners of small cottages. The majority of homes of any pretensions are invariably wired for electric service and seldom piped for illuminating gas. The Detroit residence rate is a differential one and has the peculiarity that the amount to be charged monthly at the primary rate of fourteen cents per kilowatt-hour is based entirely upon the number of living rooms in the house. Attics, store rooms, laundries, closets, bath rooms and spare rooms are not counted in determining the demand charge. The secondary rate is four cents per unit. This enables very liberal use to be made of household utensils of all kinds. As an illustration of this it was stated that one concern selling electric washing machines has placed over 450 of them in Detroit residences, particularly where the laundry work is done by members of the family. From 7,000 to 8,000 electric flatirons are used. From these the average monthly revenue is estimated to be about fifty cents. A great deal of the business is obtained without any particular effort, but active solicitation is also employed by the company, especially in filling up lines that have been extended into new territory. The residence business is considered to be very desirable. It has been found that the ratio of connected load to the district demand is more than four to one and is steadily increasing, due to the placing of convenient lights in halls, closets, etc. The hour of the maximum residence demand does not seem to vary appreciably. It comes about fifteen minutes previous to the time of the evening meal and continues until about 8 p. m., from which it falls slowly until about 10:30 p. m. The residence-district demand comes later than the business-district demand, and is falling at the time that the demand due to theatres and other places of amusement is rising. A schedule of the average monthly sales of the residence business shows that these decrease from 10 per cent in January to 4.2 per cent in June, then rise again to 13.2 per cent of the annual sales in December. The average price per unit varies from nine cents in June to 5.7 cents in December. Residence business has been found to be very stable. In hard times customers economize a little, but do not order the lights discontinued. Collections from these customers are regular and bad debts are unusual. The business is to a large extent self-propagating, as the satisfaction of one housewife is quite instrumental in inciting the interest of the neighbors in the electric service. The extensions of the lines are made into any territory that gives promise of a reasonable return.

Chairman W. P. Engel opened the discussion of this paper by pointing out that Mr. Mather has shown that residence lighting in large cities can be made very profitable, even at such extremely low rates. Most small companies have considered that residence lighting is not a very profitable branch of the business because of the large investment required for long lines and transformers.

In reply to several questions Mr. Mather said that the number of rooms in a house is the only basis upon which the

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differential rates are based, and that the character and number of lamps is not taken into consideration. In regard to the meters used, a ten-ampere Fort Wayne meter is generally installed in every residence.

F. S. Duncan, of Lisbon, Ohio, said he had not found that a forty-watt tungsten lamp starts this type of meter. His company has therefore used five-ampere, and even three-ampere, meters in the smaller residences.

John Gilmartin, of Toledo, said he does not believe it advisable to use so small a meter as a five or three-ampere instrument, because its cost is almost the same as that of a ten-ampere meter. The small-capacity meter, moreover, is not good for use with flatirons and other domestic utensils.

Mr. Mather declared that in Detroit they have found the meter department the most expensive part of the business. All meters are tested twice a year in position. In regard to the residence rates he added that the minimum charge is fifty cents per month, and a ten per cent discount is given for prompt payment of bills up to $50 a month. The service is almost entirely from overhead lines, which are extended free to the outside of the building only. The company owns the meter and the lamps only inside of the building. A deposit of $5 for the meter is required from tenants; on this bank interest is allowed. Landlords of premises must give a guarantee.

Mr. Mather also spoke of the extension of electric service to the town of Royal Oak, some distance from Detroit. In this community of about 600 population the company has 189 customers out of about 200 residences and fifty business houses. In Birmingham, another village near by, within the last six months 110 customers have been obtained. The average monthly bill of the maximum residence customers in these towns is not over $2. Most of this business has been secured by personal solicitation, which scheme has been found most successful, although all other methods of business-getting have been made use of. No houses had been wired in these towns, which are small communities of people in rather moderate circumstances. Carbon lamps are furnished by the company originally and renewed. The company has not handled tungsten and other special lamps. The town of Royal Oak is about ten miles from Detroit and Birmingham some five miles farther on the same line. A voltage of 4,600 is now used on this line, although it was built for the ultimate use of 22,000 volts.

Others who discussed this question were F. M. Tait, of Dayton; F. H. Krauss, of Bellefontaine; O. B. Welch, of Dennison, and P. Barnhard, of New Philadelphia, Ohio.

Chairman Engel, in closing the discussion, predicted that the smaller companies must adopt solicitation and follow the general methods of the large companies in getting the maximum amount of new business, otherwise they must give in to the large companies.

TUESDAY AFTERNOON SESSION.

The second session was called shortly after 2 p. m. Two papers, entitled "The Supply of Electric Current to Other Towns from a Centrally Located Station," were read by Secretary Gaskill. The first paper was written by O. H. Hutchings, of the Dayton Lighting Company, and the second by Claude Smith, of the Bradford Electric Light and Power Company.

In Mr. Hutchings' paper it was pointed out that the small central station usually works under the following conditions: Limited hours of operation and no day service; simple, non-condensing engines; moonlight schedule for street lighting. The actual cost of each unit of output from such a station is necessarily high on account of the excessive coal consumption per unit output and the extremely low load factor. The investment in the generating equipment, compared with an equivalent equipment of static transformers and substation apparatus, is about in the ratio of five to one. Important advantages of purchasing the power from a larger central station are: The complete elimination of the labor costs of operating the generating station; complete elimination of the steam maintenance charges and reduction of those on the electrical equipment; the possibility of giving twenty-four-hour service and thus getting a considerable day load without additional expense other than the purchase price of the additional power. These factors bring about a decided reduction in the total running expense of a small station, and the last factor is probably the most important. The requirements for a central station distributing power to adjacent communities are: That it be equipped and operated in as perfect a manner mechanically and electrically as engineering skill and capital make possible; interruption of the service must be made next to impossible. Transmission voltages from 6,600 to 60,000 volts, or higher, may be used, depending upon the load and length of line. The station should be so located as to secure the greatest economy of operation and diversification of service.

The paper by Claude Smith described the formation of the Bradford & Gettysburg (Ohio) Electric Light and Power Company, and the installation of its transmission and distributing system. The power is purchased from the Greenville (Ohio) Electric Light and Power Company. The transmission line has a total length of twelve miles, with Bradford at the end and Gettysburg about four miles from the end. The former town has a population of about 1,600 and the latter about 350. In Gettysburg eighteen seventy-five-watt series tungsten lamps are used for street lighting. In Bradford a capacity for 150 such lamps has been provided. A minimum charge of $1 is imposed and the rates vary from twelve cents to six cents per kilowatt-hour. Practically all the wiring has been done by the company. The use of flatirons and other household conveniences is becoming quite common on account of the all-day service. There has been very little effort necessary in order to extend the service. Although in the business only a comparatively short time there are considerably over one hundred meters now connected and fifty applications on file. An effort is being made to develop power load. On the whole, the installation is extremely successful.

The discussion of this subject was opened by D. L. Gaskill, who told how the Bradford company had made its arrangements to secure its supply from his company. The rate made was three-and-one-half cents per kilowatt-hour at the border of Greenville. The Greenville company at first did not care to take on this load, but later reluctantly agreed to do so. The company now realizes what an excellent class of business it is. A small town cannot afford to put in a generating plant and to maintain it in a high state of efficiency, nor to give twenty-four-hour service. The distribution of current to small towns from a well-kept central plant is bound to increase, since it is the most economical way to reach such communities.

Claude Smith told briefly the history of the Bradford plant, which was started in 1893 by Mr. Pennington, with a very poor gasoline-engine equipment. After working for several years along unprofitable lines the plant was shut down for some five years, after which the municipality took possession of it, and likewise made a failure of its operation. The plant finally burned down. After another seven years he came back to the town and started up the present scheme, which has met with exceptional success. About ninety per cent of the lighting is by means of tungsten lamps. The transmission from Greenville is at 6,600 volts and the local distribution is on the three-wire, 220-110-volt system. Bonds for $25,000 were issued, and the company is now in shape to retire them early.

In reply to a question as to the effect of this load on the running costs of the Greenville plant, Mr. Gaskill said that it had entailed substantially no increased cost of operation.

F. M. Tait, of Dayton, pointed out that evidently, therefore, the cost of production per unit at the Greenville plant must have been reduced by this added load. He believed these two papers to be the best and most important papers presented before this convention. This matter is of great interest because in this way only can a small town get twenty-four-hour electric service at a successful price.

W. C. Anderson, of Canton, Ohio, spoke of an installation of this kind that was also very successful. E. A. Geaugue, of Edgerton, said he had just completed an eight-and-one-half-mile transmission system of this kind, from which he expected very good results. F. D. Elwell, of Sidney, spoke of a plant of this kind that took its power from a traction line. This plant has now been taken over by the city and reports from it are very favorable. He wished to know whether voltage regulators have been found necessary on such transmission systems. Mr. Smith said he had not found any need for them. He uses a sixteen-horsepower induction motor as a regulator, and has reduced his line fluctuations from maximum to minimum to only four volts.

W. S. Culver, of the General Electric Company, said as to the need of voltage regulators on lines getting power from traction systems, that this depends on

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local conditions. In general, when installed they must be at the generating station. It should be noted that they can control for only one distributing center. If a number of towns are located along the transmission line it would be necessary to install induction potential regulators at each center of distribution. Where the regulator is installed at the generating end it should be at the joint expense of the traction and the transmission companies.

Mr. Smith stated in reply to questions that the maximum load on his line was now twenty-five kilowatts. The transmission line was put up complete at a cost of about $800 per mile; five-inch glass insulators were used, and had been found satisfactory up to 13,200 volts. Much trouble from trees had been met with. He advises companies to secure their own right-of-way and to have it freed of all trees. There are several farmers on his line who pay for the transformer equipment and fifty cents per month for the core losses. They take stock in the company to pay for the building of the branch lines to their farms.

A paper entitled "Engine-Room Management" was then read by F. R. Brosius, of the Columbus Railway and Light Company, Columbus, Ohio.

This paper begins with a clear statement of the qualifications of the operating engineer. The best way to get the most work out of a steam plant with the least expenditure is to find first in what particular the plant is lacking, and then to bring that part up to the highest standard. One of the most important money-making requisites of a power station is the periodic testing of the equipment. It is absolutely necessary to know what is being done by each of the elements, boilers, engines, generators and auxiliaries. The value of making flue-gas analyses was strongly emphasized. A good system of making and keeping close record of repairs is necessary. The author showed a number of typical record forms that were both compact and complete. These provided for keeping an individual record of each unit for a year and were shown to be much preferable to the old system of keeping random notes in a diary. One of the chief problems of the engineer in charge is the proper organization of the power-station force. A system of keeping a personal record of each employe is regarded as being highly desirable. Forms of such records were shown. Time checks should be made out by each employe at the end of each day's work. The clerical work in connection with the power station should be entrusted to a particular individual, if possible, who should keep record of the ordering of all material, the consumption of the fuel, oil and other supplies, the record of repairs, and also be a timekeeper for the operating force. Definite rules and regulations should be displayed conspicuously and enforced impartially.

A number of topics from the Question Box were then considered. The first related to what policy should be followed in changing the frequency of a system from 125 to sixty cycles. F. M. Tait said that it is only fair to the consumer that the company allow the cost of any changes in motors necessitated by such a change in frequency, either by making the necessary changes in the apparatus or by exchanging sixty-cyle equipment for it. The policy in this regard should be very liberal and the consumer should not be burdened on account of any changes of this character for which he is not responsible.

The second question was in regard to the type of generation and distribution in a town of 10,000. This was generally conceded to be best on the three-phase system because of the favorable opportunity this gives for power development.

Another question had to do with the policy to be followed in a power station of about 400-kilowatt capacity in order to increase the interest of the employes in the plant. Premium systems or profit sharing by virtue of increased economy of operation were advocated. In one case as the result of experience a certain amount of coal per kilowatt is set apart; thirty per cent of any actual saving in coal below this amount is allowed the employes.

The last question, in regard to lightning arresters, was set for answer by Prof. E. E. F. Creighton the next morning.

WEDNESDAY MORNING SESSION.

The first session on Wednesday was opened at 9:45 a. m. by Chairman Engel. The first number on the programme was an illustrated lecture and demonstration by Prof. E. E. F. Creighton, of Union University, Schenectady, N. Y., and consulting engineer of the General Electric Company. Professor Creighton took for his subject "Lightning Protection." He spoke first of the various types of conduction by means of slight leakage through air, brush discharge, sparks, arcs, metals, electrolytes and a type of solid conductor which does not obey the ordinary laws of resistance. For the demonstrations he had a large induction coil, to the secondary terminals of which two condensers were connected, and between these was placed the object to be tested and an adjustable needle gap. A number of determinations of equivalent needle gap were made. The lecturer estimated that he was using about 60,000 volts and a frequency of about 2,000,000 cycles in the test circuit.

The first test was of a resistance rod of the material used in conjunction with multi-gap lightning arresters. This rod, having a resistance of 100,000 ohms, had an equivalent needle gap of two inches. A choke coil of a small number of turns was found to give one-and-one-half inches for the equivalent needle gap. With a choke coil of commercial dimensions this figure rose to over two inches. In the fourth test, which was intended to show the accumulation of potential upon the end turns of transformers, a small choke coil of cotton-covered wire was used; the discharge was found to jump from turn to turn instead of passing through the coil itself. A single loop of about four feet of wire gave a needle-gap test of about one-half inch. When this loop was closed by bringing the wires together and twisting them, the equivalent gap was reduced to 0.35 inch. A multi-gap arrester having twenty-three gaps, each of about one-thirty-second inch, gave an equivalent needle gap of one-and-one-half inches; by putting a high resistance in parallel with it the equivalent gap was reduced to three-fourths inch. In the seventh and last test two aluminum-cell arresters designed for 600-volt direct-current circuits were found to give a needle gap of only a few thousandths of an inch.

From the results of these tests the lecturer argued that the use of resistance and of inductance in connection with a lightning arrester is not desirable. This was shown by the fact that each of these gave a considerable equivalent needle gap in the test, and this proved that lightning discharges or excess potentials on the line would not find a free path to ground. The multi-gap arrester he regarded as being quite good for high frequency discharges, but not for low frequencies nor for very heavy surges, although the use of shunt resistances helps in the latter particular. The aluminum-cell arrester, however, is adapted for taking care of all excess potentials, regardless of their frequency. In conclusion, Professor Creighton recommended the use of lightning arresters for the protection of apparatus and for dense distributing lines, but not generally for transmission lines.

In reply to questions, Professor Creighton said that the best protection for a building is doubtless by the use of a large number of small lightning rods instead of one only. These should be interconnected so as to form a sort of network over the house. A metallic roof grounded in several points is the best form of lightning protection for a building. The occurrence of fire on the top of a house that is provided with a lightning rod is usually caused by the fact that the rod does not extend high enough over the house to keep the arc around its extremity from striking the roof. He also said of the horn-gap arrester that, in order to make it satisfactory, it is necessary to use a resistance of such large carrying capacity, so that the bulk of the lightning discharges may pass freely, that its cost is in excess of that necessary for the provision of several alumium-cell arresters. The small air gap that is placed in series with the latter does not detract from their performance, since it takes but a comparatively small potential to cause an arc to jump across this gap.

Two papers on "The Commercial Organization of Electric Lighting Companies and Their Relation to the Public," by C. C. Custer, of the Miami Heat and Power Company, Piqua, Ohio, and by W. E. Richards, of the Toledo Railways and Light Company, were read by their respective authors. A paper by N. B. Ayers, of the Dayton Lighting Company, was then read on the subject of "Boiler-Room Economy." Mr. Ayers added a caution on what he regarded as the excessive importance now being given to the commercial end of the business at the risk that the operating end is being neglected.

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Mr. Custer's paper shows that the relation between company and public should be of mutual benefit, under which the consumer enjoys the service at a reasonable rate and the company secures a remunerative and permanent investment. The generating station must be well equipped and of a character to secure very low generating cost per unit of output and extreme reliability of service. If the town is too small to support a well-built plant it is better to build a transmission line to a neighboring larger plant. It is well that a considerable portion of the stock and bonds of the company be placed locally in order to strengthen the local standing of the company. In developing its business the company must advertise, advise, solicit, demonstrate, and educate the people to electric service. All methods must be made use of to build up the maximum possible load. By liberal co-operation between the company and the customer, as, for instance, by showing him how to secure the same illumination at less cost, or more illumination for the same cost, a friendly consumer is secured and the best results are obtained. The character of load that should be most eagerly sought is the daylight or off-peak load, in order that the load factor of the station may be as high as possible. Thus, by securing a good day load, the only cost that is increased is the fuel cost, as practically all other expenses remain the same and the income is materially increased. Small factories very commonly operate with steam machinery that is very inefficient, and it should not be difficult to secure them as power consumers. The light and power plant that is most progressive in business-getting methods and most active in developing its own local field generally enjoys the most prestige with its patrons and is least harassed by the bugaboo of municipal ownership.

In Mr. Richards' paper the author gives some pithy suggestions on the co-operation between the individual departments of the company organization. Electric-lighting companies succeed best when the capabilities of each employe are most fully utilized. The resultant effect upon the company's business is the algebraic sum of all the individual efforts properly directed and combined. They should assist each other for the common good. If ignored or misdirected they retard each other. It is a mistaken policy to rely upon only two or three per cent of the company's total forces, that happen to be in the selling department, instead of making every member of the force do his utmost in promoting friendship, satisfying the consumers, explaining the system, extolling its virtues and minimizing its faults. This means that there is need of the most friendly co-operation of the entire organization. Soliciting and operating forces should know of each others' doings and work in harmony. The company's policy should be known in all its departments. Each member of the organization impresses his personality, ability and character upon the composite picture which forms public opinion regarding the company. Therefore, each member, from president to coal passer, is really a part of the commercial organization. The company should make every effort to instruct its employes on matters, whether physical, commercial or political, which enhance or hinder the prosperity of its business. The attitude of the personnel to the community must be frank, accommodating, as well as intelligent and active in the company's interest. In this way a favorable public sentiment is readily built up. Misapprehensions and misinformation which are the cause of much injustice to the company are eliminated most effectively by the policies advocated above.

Mr. Ayers' paper states that since the bulk of the cost of generating electricity is spent in the boiler room, it is a fruitful field for the display of experience and training in boiler-room practice and knowledge of the art of combustion and the generation of steam. Great ignorance of these requirements is altogether too prevalent. This is shown by the great number of stokers, forced and induced draft systems, shaking grates, improved furnaces, and boiler compounds, which in four out of five cases make good their claims for increasing the boiler efficiency from ten to fifteen per cent. The first step toward economy is perfect condition of the apparatus. It is very common to cover the steam lines to prevent the transmission of heat through the walls of the pipe, but it is equally common to allow the boiler tubes to be covered with scale on one side and soot on the other and to expect to maintain perfect transmission. Leakage of air through the boiler setting is generally neglected. In the matter of operating conditions the purchase of good coal is given too little attention. The guaranteed heat-unit basis has in small plants been found somewhat unsatisfactory on account of the cost, time and labor of properly sampling and analyzing the coal. However, it is the ideal system. Economy in combustion is a matter entirely of the man in charge. A large amount of loss is occasioned by the admission of an improper amount of air to the furnace. Flue-gas analyses are of the highest value in checking this feature. A study should be made of the amount of forcing that a boiler can stand. Frequently boilers can be operated at or near twice their rating, with gain over the cost of firing up another boiler. There is no reason, on the whole, why the generation of steam has not kept pace with the generation of electricity.

A general discussion on these three papers was then taken up. D. L. Gaskill, in speaking of public relations, said the rights of the public must be taken account of by the company, and the latter must cater to public wishes. If this is not done the company will find considerable trouble in pushing its commercial campaign. In nine out of ten cases of trouble he has found that the company has been the cause by neglecting to cater to the public whim in even trivial matters. These public rights, or whims as they sometimes are, vary in different communities. The company should find out the public sentiment and prepare its service in accordance with it before any considerable agitation develops.

F. M. Tait advised that the company select some stranger to investigate what public opinion is being held among the business men of the community in regard to the public utility company. It is very difficult to get such information directly and the scheme he has found effective is to have some such disinterested investigator ascertain the standing of the company in the community. Mr. Gaskill added that he had often found that local friends of his can get from others more freely the opinion held about the company or its service than he himself could directly.

J. C. Martin, of Wilmington, says he makes use of both these plans. In his town there had formerly been a municipal plant. He believes the most successful way to get new business is to give the best kind of service. He now gives all-night and all-day service, and in five years has increased his customers from 159 to 700. He has found it effective to place the power consumers on a separate circuit, which he cuts off at 5:30 p. m. because he gives them a preferential rate for off-peak load.

In taking up the discussion on boiler-room economy, F. S. Duncan advised the use of slack coal for the sake of economy in fuel cost.

J. C. Martin had had much trouble from very hard feed-water, which was partly eliminated by digging a well about 200 feet deep. When the scale reappeared he had built a water-softening plant, which has not only removed the scale that was in the boilers, but prevented its further formation and thereby greatly reduced his fuel consumption. He is now putting in a recording apparatus for keeping accurate track of his coal and water.

Mr. Gaskill also narrated the excellent results that had followed from the installation of a water-softening system that had been constructed by his own men. His maintenance costs on the boilers have been kept down to a very low figure. A. A. Pointer, of Antwerp, Ohio, said that in his opinion the best coal was the cheapest.

At this point the executive committee, in accordance with the provisions of the constitution, selected a nominating committee to be composed of the following: William J. Hanley, E. A. Beckstein, and S. M. Rust. A motion was passed that Secretary Gaskill be reimbursed $150 for extra expenses that he had incurred in connection with the association's souvenir programme. Another motion was passed that his salary for the ensuing year be made $750 instead of $600, as formerly.

WEDNESDAY AFTERNOON SESSION.

The fourth session of the convention was called shortly after 2 p. m. on Wednesday. The paper by J. C. Rothery, of the East Liverpool Traction and Light Company, entitled "Plans to Be Followed in Supplying Lamps to Consumers," was read by Douglas A. Brown in the author's absence. Another paper on the same subject, that was announced for T. D. Buckwell, of the Toledo Railways and Light Company, was not ready for presentation, and was therefore passed; it will, however, be printed in the official proceedings.

Mr. Rothery's paper reported on the results of a study of the subject made by communicating with companies throughout the country as to the policies they adopt in the matter of renewals. The replies from about twenty companies are summarized. In these replies there was considerable difference of opinion, as some companies have very liberal renewal policies and others find it impossible to carry out this plan on such a large scale. With regard to the tungsten lamps, it seems to be the general practice to supply them at substantially cost price. Some companies have even furnished and maintained arc lamps and Nernst lamps. In general, while a few of the station managers hold the view that the central station should furnish current only, the greater majority assert that the company should supply illumination, which

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means that it must undertake the maintenance of the lighting units at a high efficiency, and aid the consumer in getting the best light at the least cost.

The discussion of this paper was opened by W. P. Engel, who thought that the plan of free lamp renewals is not a good policy, particularly for the smaller companies. He has never followed it, but believes that it is the function of the central-station company to supply current at the lowest reasonable rate and to leave it to the consumer to use whatever type of lamp he chooses. W. C. Anderson, of Canton, Ohio, said he had always given free renewals of incandescent lamps, and also free maintenance of arc and Nernst lamps. He believes it a highly desirable plan. For lamps consuming over fifty watts he supplies Gem lamps.

A paper entitled "Factors Which Should Be Considered in Making Contracts for Street Lighting" was then read by S. M. Rust, of the Greenville Electric Light and Power Company, Greenville, Ohio.

In Ohio there are 143 private corporations engaged in the business of supplying electricity to the public. Of this number more than three-fourths depend upon the street lighting of their communities for financial success. The prices that should be made for the street-lighting contract depend very largely upon local conditions; each party to the contract should be thoroughly familiar with these conditions. The author groups into the following heads the factors that should be taken into consideration in fixing the price in the contract: Length of contract, kind and number of lights, changes in position of lamps, outages, schedule of burning, time of payment, costs of service, and manner of contract. As to the duration of contracts, by the Ohio statutes these are limited to ten years. Considering the requirements for this service, the contracts should not be for any period less than this. Each contract should provide that the company has the right to change its system to a newer or better one of equal or better intensity during the life of the contract. In dealing with outages it is suggested that two-thirds of the price received for lighting the lamp be allowed. The kind of lamp selected depends largely upon the size of the municipality. While arc lamps have been used almost exclusively and are in general superior, yet the introduction of the series tungsten lamps has enabled a very excellent lighting system for residence districts, where there are an abundance of trees and where the illumination does not have to be of so high an order as that on the business streets. The reports from the systems using the series tungsten lamps have all been very favorable. The author thinks that in towns of less than 5,000 inhabitants the all-night service is not justified and that a moonlight schedule is preferable. Cities above 10,000 inhabitants usually require all-night service. Bills for the street lighting should preferably be paid monthly. The letting of contracts after competitive bidding is not desirable from the standpoint of the central station having a permanent investment. The writer is of the opinion that many street-lighting contracts are made below actual cost, and he concludes his paper with an estimate of the average cost for a plant having capacity for one hundred arc lamps. The total cost thus estimated is $63.62 per year per lamp.

D. L. Gaskill emphasized the points in Mr. Rust's paper. If city councils would realize what it costs to run an arc lamp, they would be more liberal in their contracts and lighting appropriations.

Chairman Engel said he has a plant in a Michigan town in which there had been considerable municipal ownership agitation. He had an opportunity, however, to clearly and frankly state his case at a public meeting shortly before the election, at which everyone thought the municipal ownership advocates would win out by a great majority. As a result of his statement the majority went the other way. He advocated street lighting without contract. This can be done by keeping the public confidence in regard to costs and details of the work. For fifteen years he has operated a street-lighting system without contract, at $72 per open arc lamp per year.

F. M. Tait, of Dayton, said there should be a more uniform price on arc lights

J. C. ROTHERY.

J. C. Rothery, president-elect of the Ohio Electric Light Association, was born in Scotland about fifty-two years ago. He received a good academic education. In response to a roving disposition in his early youth he went to sea and rose to the mastership of a vessel. Returning to land occupations he went into railroad engineering work with the Michigan Central Railroad. He was superintendent of the cantilever bridge at Niagara Falls. In 1894 he became superintendent of the electric railway built on the Canadian side of the Falls, and retained this position after it was absorbed by the International Railway Company. January 1, 1906, he came to East Liverpool, Ohio, and assisted in rebuilding the lines of the East Liverpool Traction and Light Company and in connecting them with Steubenville, Ohio, and Rochester, Pa. His position with the company is general manager. This company forms the central link of the Ohio Valley Scenic Route, which also comprises the Ohio River Passenger Railway Company and the Steubenville & East Liverpool Railway and Light Company. He has for several years been actively associated in the affairs of the Ohio Electric Light Association and for the past year was its vice-president.

than now prevails in different communities. At present there is so much variety in these prices in various cities that the low rates granted to some communities become very quickly and generally known, and these have an important bearing upon the claims of other cities for equally low prices when contracts are to be made, regardless of the conditions prevailing locally.

Secretary Gaskill said he had prepared a list of street-lighting prices throughout Ohio and many other places in this country and abroad. This list has been supplied to the members of the Association. He is now preparing a revised and enlarged edition of the same, which will be shortly submitted to the membership.

P. Barnhard, of New Philadelphia, Ohio, said that it costs him less than $60 per year per lamp. He has had considerable difficulty, however, in making clear the actual costs to the residents of the adjoining town of Canal Dover, where the contract is about to expire and where the rates for the service have been extremely low. This community had been promised by a former company that it would have the street lights free at the expiration of the contract.

A general discussion of the conditions in New Philadelphia, Canal Dover and Bellefontaine, Ohio, was then indulged in. Secretary Gaskill thinks that the trouble at Canal Dover is due to a municipal ownership agitation started for political purposes.

George C. Osborne, of the General Electric Company, quoting from Mr. Gaskill's data, pointed out that the prices received for the street lighting varied from three to 16.6 cents per kilowatt-hour, and he called attention to the fact that each of these figures was beyond what the proper price should be. F. M. Tait added that in his opinion as little profit from the city should be made as possible in the matter of street lighting in order to keep in good favor with the municipality. Claude Smith, of Bradford, said he gets $48 per year for each seventy-five-watt series tungsten lamp, and that it was necessary to get this figure on a ten-year contract in lieu of a bonus from the town for extending the electric service to it.

THURSDAY MORNING SESSION.

The concluding session of the convention was called at 10 a. m. Thursday by Vice-President J. C. Rothery. The first business was the report of the nominating committee. Its report was accepted and the secretary instructed to cast a joint ballot for the following-named, as the officers of the Association, who were therefore declared elected for the ensuing year:

President—J. C. Rothery, general manager of the East Liverpool Traction and Light Company, East Liverpool, Ohio.

Vice-President—E. H. Beil, superintendent Youngstown Consolidated Gas and Electric Company, Youngstown, Ohio.

Secretary-treasurer—D. L. Gaskill, president Greenville Electric Light and Power Company, Greenville, Ohio.

Executive committee—F. M. Tait, of Dayton, Ohio, chairman; E. A. Beckstein, Sandusky; W. H. Hubbell, Wauseon; W. P. Engel, Defiance; Sheldon Roberts, Columbus.

Advisory committee—Samuel Scovil, of Cleveland, chairman; F. M. Tait, Dayton; D. L. Gaskill, Greenville.

Finance committee—J. T. Kermode, of Cleveland, chairman; T. D. Buckwell, Toledo; W. C. Anderson, Canton.

Publicity committee—T. H. Jungk, of Fremont, chairman; E. L. Booth, Bellaire; J. C. Martin, Wilmington.

Membership committee—W. J. Hanley,

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of Cleveland, chairman; E. Van Winkle, Cincinnati; P. J. Williams, Columbus; F. C. Caldwell, Cincinnati; F. F. Rassman and I. M. Cassell, Cleveland; H. B. Rogers, Columbus.

The secretary-treasurer's financial report was again read and approved on the recommendation of the finance committee. A further report of the executive committee was submitted, recommending four additional names to the membership roll; these were duly accepted.

An amendment to the constitution relating to the selection of the nominating committee was presented by M. E. Turner, of Cleveland. It sought to have this committee composed of five members, two to be elected in open convention, two selected by the executive committee and one chosen by the retiring president, the idea being to prevent control by any clique. Its adoption was deferred until a special committee of three (Messrs. Tait, Turner and Hard) reports on this matter at the opening of the next convention.

A vote of thanks was tendered the Toledo Railways and Light Company, the Hotel Boody and to others of the local committee that had contributed to the success of the convention.

The paper on "The Titanium Carbide Arc Lamp" by C. R. McKay, late of the Toledo Railways and Light Company, was read by W. E. Richards, of that company.

Within the past ten years the street-lighting industry has passed from the direct-current, open-arc lamp to the magnetite, titanium carbide, and the flaming arc lamps. Of these the latter, while highly efficient and possessing the possibility of controlling the color of the light, is regarded by the author as objectionable on account of its frequent trimming, obnoxious fumes and undesirable distribution. The metallic oxide, or magnetite, lamp is at the present time, in his opinion, the best lamp for street lighting, since it combines high efficiency, pure white color, excellent distribution, long life and low maintenance cost. These lamps are rapidly replacing the series alternating enclosed lamps. After describing the magnetite lamp somewhat in detail, the further advantage it possesses is stated to be its adaptability for operation from alternating-current generators of any frequency through a simple rectifying system. To eliminate the necessity for this rectification, a lamp is now being developed which is capable of being used directly on series alternating-current circuits. This is the titanium carbide lamp. Its characteristics are: High luminous efficiency, approaching one-third of a watt per mean horizontal candlepower; the cost of electrodes is at present high, about twenty cents per trim, and constitutes the principal item in the operating cost of the system; the light possesses a yellow tinge, which is objectionable; the arc is unsteady and the slag condensed from the vapor of the arc may become fused into the globe; the power-factor of the circuit of these lamps is seldom higher than fifty-five per cent because of the reactance necessary to steady the arc. At the present time three tentative installations of these lamps are in operation—at Rochester and Schenectady, N. Y., and Haverhill, Mass. The lamp is a plain series lamp, without shunt winding or regulating device. There is an oil switch in series with the circuit, which is automatically opened and closed by a clock-controlled relay at definite feeding intervals. There are two series magnets which raise the upper electrode to the proper arc length, at which it is held until the station relay momentarily interrupts the current through the entire circuit and allows the upper electrode to drop. The oil switch then closes and the current through the lamp magnets again draws the arc. The upper electrode is a round stick, chiefly of titanium carbide. There are two lower carbon electrodes inclined to form an inverted V. Ventilating arrangements are necessary to keep the fumes and condensed vapor from depositing on the globe or lamp mechanism. The efficiency of the system is given as ninety-five to ninety-seven per cent and the power-factor from fifty to sixty per cent at full load on sixty cycles. A constant-current transformer is included in the circuit, a 100-light unit being arranged for two series circuits. This type of lamp has been developed not with the idea of displacing the magnetic lamp, but to supplement it and to enable the use of alternating current in the lamp circuit itself. Until it shall be commercially practicable to produce satisfactory arc lighting from unrectified alternating current at twenty-five cycles, the magnetite system will remain the preferable and most efficient means of arc lighting from low-frequency systems. At the conclusion of the paper are given a number of distribution curves, circuit diagrams, and sketches of the titanium carbide lamp and its mechanism.

At this point there was a general discussion on tungsten lamp experiences. This was participated in by E. L. Booth, of Bellaire, Ohio; W. E. Richards, Toledo; E. H. Beil, Youngstown; W. C. Anderson, Canton; M. E. Turner, Cleveland; J. C. Rothery, East Liverpool; L. A. Pettit, Jr., Middletown; O. H. Hutchings and F. M. Tait, Dayton; G. C. Osborne and H. Schroeder, Harrison, N. J.

In this discussion there was no dissent from the general opinion that the tungsten lamp had been a boon to the electric lighting industry. Excellent results have been achieved with it in every class of illuminating service where it has been used. Exceptionally successful was the use of the series tungsten lamp in street lighting. Mr. Schroeder, of the General Electric Company, said that about ninety per cent of the carbon lamps lately used in series incandescent lighting were now replaced by tungsten lamps. The use of tungsten sign lamps is rapidly increasing. Mr. Tait spoke of the ornamental posts now being installed in Dayton for the special tungsten street lighting.

President-elect Rothery made a brief address, expressing his gratitude for his election to preside over the affairs of the Association for the coming year, which he hoped would continue to extend its benefits and influence to a still greater degree.

A vote of thanks was tendered to W. P. Engel for presiding over the earlier sessions, and to the retiring president, C. R. McKay, for the important part he had taken in arranging for the success of this convention. The convention was then adjourned.

ENTERTAINMENTS.

The Ohio Electric Light Association has become famous, among other things, for the liberal scale in which it entertains its members and guests at the annual conventions. The entertainments this year were carried out in a more elaborate manner than has been customary even for this association.

During the day while the convention sessions were in progress entertainment was afforded for the ladies in the nature of an automobile ride to points of interest around Toledo on Tuesday afternoon and a trip by launches on the Maumee River to Fort Meigs and return on Wednesday morning.

At 5:30 p. m. Tuesday special cars were provided which carried the members and guests to the Casino at Lake Erie Park, where a dinner was enjoyed in the pavilion over the lake. In the evening the party went into the theatre to witness a performance of "The Girl from Rector's."

Wednesday at 4 p. m. a trip was made to Toledo Beach, on the Michigan shore of Lake Erie, via special electric cars. On reaching the beach a majority of the party went in bathing and at half-past six partook of an excellent frog-leg and chicken dinner in the open air on the lawn. Later in the evening there was dancing at the pavilion, interspersed with a variety of amusements afforded by the improvised "Order of Turkey Buzzards," who furnished much merriment on this and other occasions by their eager search for candidates, as well as by the band music, songs and other stunts that they indulged in.

On Thursday at 2:30 in the afternoon a special train on the Lake Shore & Michigan Southern Railroad was provided for taking the convention party to Sandusky, Ohio. On arriving there at the main boat landing boats were taken across the bay to Cedar Point. Headquarters were established at the Hotel Breakers, where, at 6:30 p. m., a banquet was given in honor of the Association. Later in the evening there was a tour of the amusements, particularly the picturesque lagoons on the Point, followed by dancing in the ballroom. After this the convention broke up and the members departed in various directions to their homes. The excursion to Cedar Point was marred considerably by a long and very heavy downpour of rain.

EXHIBITS.

The associate member companies, as usual, made exhibits of their latest electrical appliances in various rooms of the parlor floor of the hotel, and also in its main corridor. These were visited by all the members and examined with great interest.

The General Electric Company had an exhibit comprising toasters, flatirons, percolators, chafing-dishes, cigar-lighters, tungsten lamps of all kinds, including the new sign lamps, oscillating fans, the new intensified arc lamp, and a new vibrating rectifier panel for charging small storage batteries, and Professor Creighton's outfit for the demonstration of lightning phenomena. Among those rep-

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resenting the company were F. H. Gale, H. Schroeder, G. C. Osborne, W. S. Culver, F. T. Benson, W. J. Hanley, E. E. F. Creighton.

The Westinghouse Electric and Manufacturing Company had on display an "Electric Favorite" range, disk stoves, flatirons, and various other heating devices, fans, a variety of tungsten lamps, including the new Westinghouse series lamp and the five-watt lamp for sign lighting, motor-driven devices of various kinds, including the new utility motor, various integrating wattmeters, and other portable instruments, multiple and metallic arc lamps, transformers and other apparatus. Among the company's representatives were J. C. McQuiston, S. A. Fletcher, W. B. Wilkinson, A. E. Rickards, J. W. Schrantz, E. W. McAdams, A. B. Fishel and R. W. Beebe.

The Nernst Lamp Company had an extensive display of single and multiple-glower units of various sizes in both inexpensive and highly ornate fixtures. The new instantaneous lighting units, which have a special carbon filament for the heater, attracted particular attention. The company was represented by Max Harris, H. M. Brown, J. J. Sorber, J. L. Anderson and S. P. Wilbur.

The Adams-Bagnall Electric Company had one of its new regenerative flaming-arc lamps hung at the entrance to the hotel. J. H. Worbs represented the company.

The Allis-Chalmers Company showed the following apparatus in the main lobby of the hotel: A portable air-compressor set, direct-current motor, a polyphase induction motor, a transformer, and a steam-turbine section. Among the company's representatives were C. B. Cook, F. C. Colwell, G. P. Fairbanks, and L. Gugenheim.

The Pittsburgh Transformer Company showed two types of its transformers in the exhibition room. In charge of the exhibit was P. H. Butler.

The Wagner Electric Manufacturing Company had an exhibit of its single-phase and polyphase induction motors. The company's interests were looked after by Dean Emerson, A. B. Hoffman and Arthur B. Shepard.

The Weinman Manufacturing Company, of Columbus, Ohio, had an exhibit of electrically driven pumps in charge of William A. Wolls.

The Fort Wayne Electric Works showed an extensive line of Fort Wayne fans. The company was represented by G. B. Edgar and Mr. Ryan.

The Tungstolier Company had an exhibit of its folding tungstolier fixtures, in charge of T. M. Roche and W. S. Reynolds.

The Holophane Company had an exhibit of various examples of its glassware, and also of the new line of D'Olier metallic shades, in charge of C. S. Davidson.

The Pacific Electric Heating Company had a display of its toasters and "hot point" electric flatirons, in charge of Henry F. Holland, manager of the Chicago office.

The Manhattan Electrical Supply Company, of Chicago, had a large line of supplies on display. Norman S. Richmond represented the company.

The Electric Suction Sweeper Company, of New Berlin, Ohio, made a demonstration of the Hoover electric suction sweepers by its representative, A. W. Wasey.

The Charles L. Kiewert Company displayed an Alba and an Aurola flaming-arc lamp in the main lobby of the hotel. M. W. Hansen looked after the company's interests.

The F. Bissell Company, Toledo, was strongly represented at the convention, among its representatives being F. Bissell, W. J. Bissell, H. E. Allen, A. O. Clingman, L. C. Crabbs, C. M. Hamilton.

The National Carbon Company was represented by N. C. Cotabish, A. G. Summerell and A. B. Pike.

The Shelby Electric Company, Shelby, Ohio, was represented by George Loring, W. H. Myers and J. Feighner.

H. H. and F. M. Cudmore represented the Brilliant Electric Company, of Cleveland.

M. A. Watterson looked after the interests of the Erner Electric Company, of Cleveland.

The Bryan-Marsh Company, Chicago, had among its representatives J. S. Corby and G. E. Arboquist.

The Cleveland Electrical Supply Company was represented by H. F. Ackerman and C. L. Bogner.

The Electric Appliance Company, Chicago, was represented by F. J. Alderson.

J. W. Brooks represented John A. Roebling's Sons Company.

The H. W. Johns-Manville Company had R. R. Braggins to look after its interests.

The Electric Storage Battery Company was represented by A. N. Bentley.

The Standard Underground Cable Company, Pittsburg, Pa., had Ralph B. Wilcox as its representative.

The National Metal Molding Company, of Pittsburg, Pa., was represented by J. A. Campbell.

The ELECTRICAL REVIEW AND WESTERN ELECTRICIAN was represented by P. S. Dodd, F. H. Bernhard and F. R. Schalck.

The General Incandescent Lamp Company was represented by H. C. Rice.

W. Reynolds represented the Doubleday-Hill Electric Company, of Pittsburg.

The Triumph Electric Company, Cincinnati, was represented by W. H. Jacob.

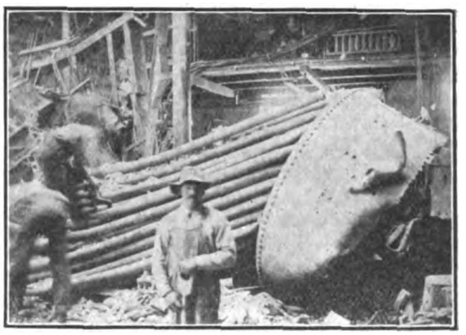
Second Avenue Railroad.

Judge Lacombe, in an order signed last week, in the United States Circuit Court at New York, extends the time for all parties to take testimony in the foreclosure proceedings instituted by the Guaranty Trust Company against the Second Avenue Railroad Company, of New York city, until October 9.

An Accident and a Quick Recovery.

On June 15 last, at the West Station of the Denver Gas and Electric Company, a 400-horsepower boiler exploded, shot upward and backward, clearing a row of eight smokestacks, each 125 feet in height, descending through the roof of the building into the engine room. In its downward flight, the exploded boiler tore through the switchboard-gallery floor, landing upon two generators below. The latter were practically demolished. The engine operating these generators was considerably damaged, but not irretrievably so.

In the switchboard gallery havoc was wrought. All of the leads from the generators to the switchboard were cut off, which interrupted service in nearly the entire city. Many of the boosters were injured and five went down to the floor below with the boiler. Most of the gen-



BOILER AFTER THE ACCIDENT.

erator switches and rheostats were more or less seriously injured.

The end of the boiler room was blown away, and where the boiler descended through the roof a large hole was made. Thunder showers for several days following gave considerable trouble and hindered the repair work.

However, the entire incandescent lighting service was restored four hours after the accident, and the direct-current service resumed within twenty-four hours. Within four days, the entire service was in operation.

As a result of this accident, four men are dead and four others seriously injured. The latter will recover, however.

The cause of the explosion is not determined.

Electrolytic Sewage Disposal.

The electrolytic plant for the treatment of sewage at Santa Monica, Cal., has given the utmost satisfaction after being in operation for a year. The average monthly cost was $400, of which about $150 was for electric current.

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The Manufacture of Artificial Nitrates from the Air in Norway.*

BY JOHN B. C. KERSHAW.

One of the most important and pressing problems of our modern civilization is how to increase the yield of the world's food crops without impoverishing the soil upon which they are grown. Three chemical substances, nitrogen, potassium and phosphoric acid, are essential for the healthy development of all plants, and are being constantly extracted from the soil by the crops grown upon it. It is therefore necessary that these substances should be supplied to the soil in some form in which they can be assimilated by the growing plant. The frequent application and digging into the ground of natural or artificial manures is thus an essential condition for the continuance of good yields of cereals from the soil. Of the three substances named, the nitrogen is probably the most important.

The nitrogen required by the soil in the early days of agriculture, and down to comparatively recent times, was entirely supplied by farmyard manure. This is still largely used, though supplemented by combined nitrogen from two other sources, viz., the deposits of nitrate of soda in South America, and the nitrogen contained in the coal measures, which is recovered as sulphate of ammonia when the coal is gasified. Coal contains on an average 1.3 per cent of nitrogen, and of this amount about seventy per cent can be recovered as ammonia when the coal is converted into gas. The growth of the production of nitrate of soda and sulphate of ammonia is most striking, and is largely due to the demand for agricultural purposes. The output of nitrate of soda (or Chili saltpeter, as it is called) is now at the rate of 1,500,000 tons per annum, and the consumption has doubled during the last fifteen years. As regards sulphate of ammonia, the output is growing rapidly, owing to the increased number of works in which coal is gasified and the by-products recovered, and is probably now over 500,000 tons per annum. But both these sources of combined nitrogen must ultimately fail, for the nitrate grounds of South America and the coal measures of the earth are themselves limited in extent, and at some future date they will be exhausted, or will become economically inaccessible.

It is therefore satisfactory to know that two distinct electrical processes have been invented, and are now working upon an industrial scale, for tapping the immense reserves of nitrogen existing in the atmosphere, and for converting this nitrogen into a combined form available for the needs of agriculture. The first of these is the Birkeland and Eyde process, in which an electric arc flame is employed to raise the air to a temperature of 3,000 degrees centigrade. At this temperature nitrogen and oxygen combine, with formation of nitric oxide gas, although the reaction is not purely thermal in character as the earlier investigators thought. The nitric oxide obtained in this way is cooled, then oxidized to a higher state and is finally passed through absorption towers containing water and milk of lime. The end product of the process is basic nitrate of lime, and this is either sold as such, or is mixed with forty per cent of ammonium sulphate to give a stronger and less hygroscopic artificial manure.

The second process for fixing the nitrogen of the air in combined form is known as the Frank and Caro process. The product in this case is a compound known to chemists as calcium cyanamide, but known to the trade as "kalkstickstoff" or "lime nitrogen." The process is based upon the fact that calcium carbide when heated to a temperature of 1,100 degrees centigrade in an atmosphere of nitrogen, absorbs this gas with great avidity, and yields a compound of the cyanide type of which the chemical formula is $Ca(CN)_2$. The process, therefore, requires calcium carbide and nitrogen as raw materials, and apparatus for bringing these two into contact at a high temperature. The calcium carbide required for the manufacture is produced in the usual manner by heating lime and coke in an electric furnace of the resistance type, to a temperature of 2,500 degrees centigrade. The nitrogen is obtained by the fractional distillation of liquid air, this latter being produced by the Linde apparatus, in which the air is first compressed and is then cooled to 194 degrees centigrade below freezing point. The absorption is carried out in retorts of special design, filled with the finely crushed carbide and connected with the nitrogen supply.

The present article will be confined to a description of the large developments now occurring in Norway in connection with the Birkeland and Eyde process. This process has been worked upon an industrial scale at Notodden in Norway since May, 1905. The plant at this place at first consisted of three 700-horsepower furnaces, each producing nitrates equivalent to 325 tons of nitrate of lime per annum. Three months after starting, the electrical generators were destroyed by fire, and much delay occurred before the special construction and financial difficulties caused by this disaster were surmounted. Herr S. Eyde in February of the present year, gave a detailed history of the financial side of the development of the undertaking before a meeting of engineers in Christiania.[1] In the course of this address Herr Eyde emphasized the fact that without the ready support of Swedish and German financiers, the process and works would have been a failure. The few friends who financed the first experimental installation of plant at Notodden drew back when further support was required, and had it not been for this outside help, the history of the undertaking would have been very different from that recorded today. Nearly $300,000, in fact, was expended upon experimental work before the process became an assured success, and capable of earning the profits named by Herr Eyde in his statement. It is unnecessary in this article to repeat the details of the successive stages in the financial development of the great undertaking. After several intermediate companies had been formed and absorbed by still larger companies, the decision was made to create one company which should take over the two power development schemes, and another which would deal with the utilization of this power for nitric acid and nitrate production—an amalgamation with the Badische Anilin und Soda Fabrik—being part of the latter scheme. The title of the first company is the Norsk-Kraftaktieselskabet and its capital is 16,000,000 kroner (equivalent to $4,275,000). This company takes over the present power station at the Svelgfos Falls, where a plant of 47,000 horsepower is already installed, and is also charged with the still larger power development scheme at the Rjukan Falls, where a total of 250,000 horsepower is

* Since this article was written two important papers on "Nitrate Production from the Air," have appeared—the one by Sam Eyde was read before the Society of Arts, London, on May 26, and the other by Director Bernthsen, of the Badische Anilin und Soda Fabrik, was read before the International Chemical Congress, on May 29.

[1] "*Zeitschrift für Electrochemie*," No. 5, 1909, p. 146.

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available for industrial use, and only awaits development.

The second company is named the Aktieselskabet der Norske Salpeterverket and possesses a capital of 18,000,000 kroner (equivalent to $4,810,000). This company is to control the utilization of the power for the fixation of atmospheric nitrogen, under the Birkeland and Eyde and Badische Anilin und Soda Fabrik patents, and will extend the nitrate works at Notodden and at Vanna, as rapidly as required by the developments of the power. At the date of Herr Eyde's address a total of 22,000,000 kroner ($5,880,000) had been expended upon the developments at Notodden, Svelgfos, Rjukan and Vanna; of this total eighty per cent had been spent within the country and had benefited Norwegian works and workers.

It is expected that all the development work will be completed by the end of 1910, and by then an outlay of 54,000,000 kroner, or $14,430,000, will have been made.

As regards the financial prospects of the undertaking Herr Eyde is naturally sanguine. Even supposing that 500,000 horsepower in Norway were harnessed and applied to the new manufacture, this would only produce 300,000 tons of nitrates annually, and the necessary engineering works and plant could not be completed under ten years. According to Herr Eyde, however, Chili is now exporting 1,800,000 tons of nitrate annually, and by 1920, will probably be producing 2,500,000 tons per annum. The Norwegian output in 1920, even supposing this enormous extension of the industry has occurred, will only be one-eighth of the Chilian production, and with such disproportion between the two sources of supply, it is unlikely that any marked fall in value can occur. The financial results of the manufacture at Notodden so far have been satisfactory. In the year 1908, a net profit of 500,000 kroner ($133,600) was made, while the total receipts were 2,000,000 kroner ($535,000). The balance of 1,500,000 kroner ($401,400) was accounted for by the costs of running the plant, and general expenditure and depreciation charges. The average power used during the year was only 13,000 kilowatts, in place of 22,000 kilowatts, for which the plant is designed when in full working order.

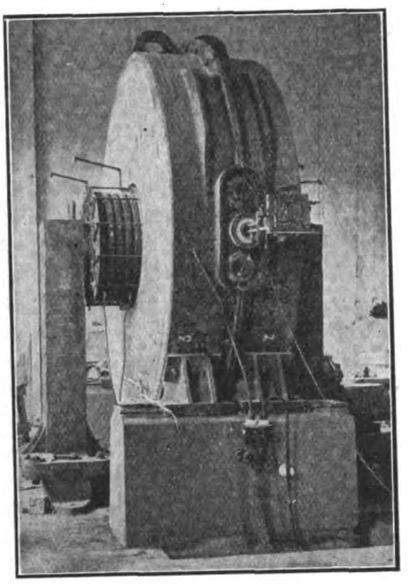

FIG 2.—EXTERNAL VIEW OF BIRKELAND AND EYDE FURNACE.

During the latter six months of 1908 the Notodden works have been running on an average with 15,000 kilowatts, and for this shorter period the sales receipts have been $400,500, while the running costs and other charges have totaled $258,990, leaving a net profit of $141,510, or $283,020, calculated upon twelve months. This profit has been really earned upon a capital outlay of $2,837,000, and represents 9.6 per cent on the investment. When the plant for manufacturing ammonium and potassium nitrates is completed, still better results are expected.

The original portion of the plant at Notodden comprises three 700-horsepower furnaces, capable of dealing with 75,000 litres of air per minute. Fig. 1 shows a sectional elevation of the furnace, Fig. 2 an external view, and Fig. 3 a view of the three furnaces in the furnace room. The electrodes of these furnaces are formed by water-cooled copper tubes, and the air from which the nitrogen oxides are formed is forced through channels AAA into the chamber B, where it is brought into intimate contact with the electrodes and the arc, before escaping by the passages marked C C.

The spark discharge, when passed between the poles, is caused to spread out into a disk of flame by means of a magnetic field, formed at right angles to the path of discharge. The water-cooled electrodes approach one another within one-third of an inch, and the diameter of the electric disk flame produced is over six feet. The fire chambers of the furnaces are only from two to six inches in width, and they are lined with fire brick. The hot gases which issue from the furnace pass through a steam boiler, where a portion of the heat is utilized for steam generation. In this way the temperature is reduced to 200 degrees centigrade, and by passing through another cooling apparatus it is reduced to fifty degrees centigrade. At this temperature the gases enter two large oxidation chambers with

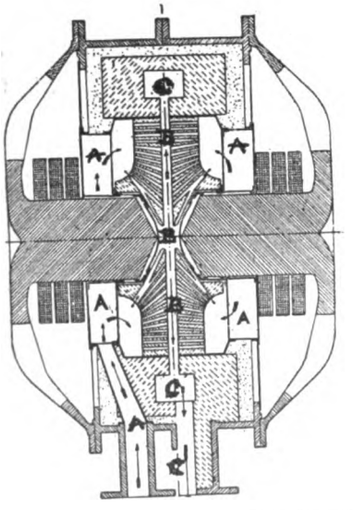

FIG. 1.—SECTIONAL ELEVATION OF BIRKELAND AND EYDE FURNACE.

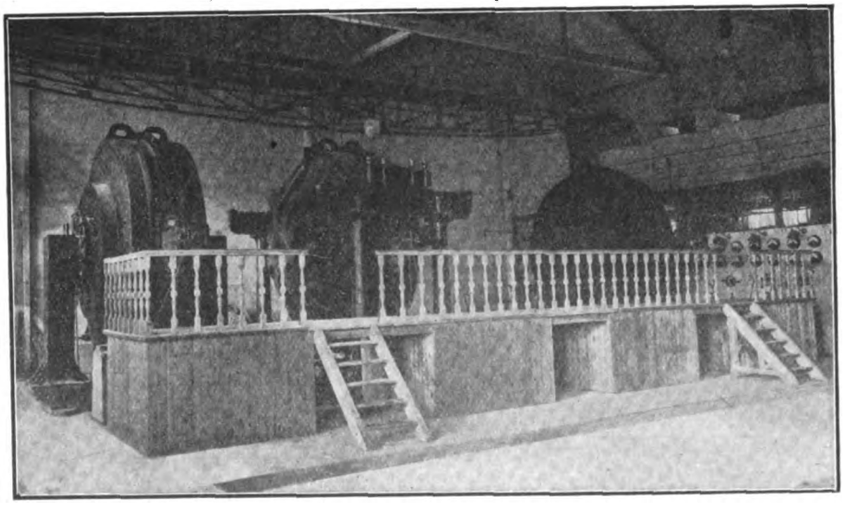

FIG. 3.—ELECTRIC FURNACE ROOM AT THE NOTODDEN NITRATE WORKS.

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acid-proof linings, and finally pass to the absorption towers shown in Fig. 4.

These are fifty to eighty feet in height, are built of granite slabs, and are filled with lumps of quartz, over which water trickles. No. 1 tower produces fifty per cent nitric acid, No. 2 tower twenty-five per cent acid, No. 3 fifteen per cent acid and No. 4 five per cent acid. When working under normal conditions, the liquid from Nos. 4, 3 and 2 towers is pumped back through the series by means of a pressure chamber and air pump, as in the sulphuric acid manufacture, Fig. 5. The gases finally pass through a similar tower, down which milk of lime flows, and then through a wooden vessel or chamber filled with beds of quicklime, before they pass into the atmosphere. Fig. 6 shows the method of feeding the absorption towers with acid or water.

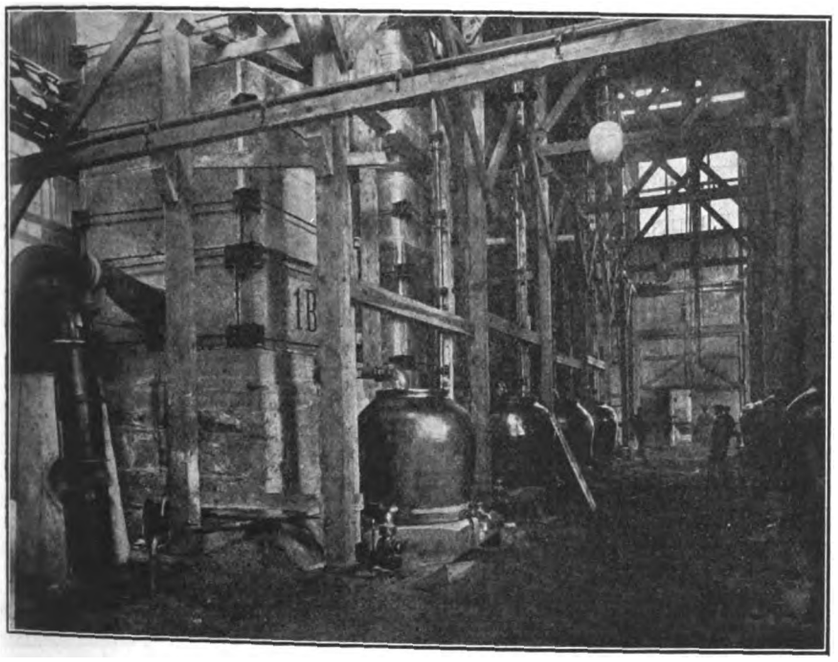

FIG. 4.—ABSORPTION TOWERS AT THE NOTODDEN WORKS.

The fifty per cent acid obtained from No. 1 tower is added to limestone, and the solution is concentrated until the residue is anhydrous nitrate of lime, containing thirteen per cent nitrogen. While in the molten state this salt is poured into iron drums of the form and size shown in Fig. 7, and is then ready for shipment.

The enlarged works at Notodden consists of thirty-six 1,500-horsepower furnaces and nine absorption towers; the annual capacity is 20,000 tons of nitrate of lime per annum, valued at $1,000,000.

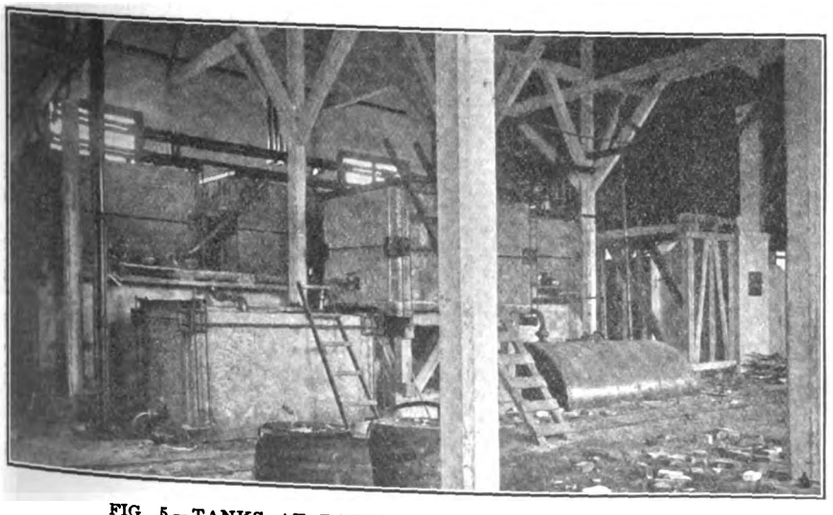

FIG. 5.—TANKS AT BOTTOM OF ABSORPTION TOWERS.

It was estimated that the original plant at Notodden would produce 500 to 600 kilogrammes of 100 per cent nitric acid per kilowatt-year (equivalent to 1,000 kilogrammes basic nitrate of lime) and that the cost would be about $7.20 per metric ton, with power costing about $4 per kilowatt-year. In the early experiments from seventy-five to 200 kilowatts were employed for each arc, alternating current at 500 volts and fifty cycles per second being employed.

As already stated, the generators in this early plant were burned out three months after starting the same. A commission of experts was appointed to examine the generators and report upon the special difficulties of the work. Alterations in their design were made, and the delay consequent upon the construction and installation of this new plant stopped production in 1906 and reduced the output for the year 1907. It is, in fact, only since the middle of 1908 that the manufacture has been run upon the large scale which is estimated to produce the best results.

The hydraulic engineering works at Notodden comprise an embankment which increases a natural fall of the Svelgfos from thirty-two to 140 feet. A conduit 1,130 feet in length conveys the water to the penstock chamber—the volume of water available is 16,500 gallons per second. The turbine house is built in a narrow defile, close against the foot of the precipice, and in place of pipe lines four perpendicular galleries have been driven through the rock down to the tunnel connecting with the turbines. There are four turbines, each unit being 11,750 horsepower; the vertical shafts of these are directly coupled to the dynamos. These machines have been supplied by the firm of Voith of Heidenheim, and they are among the largest yet constructed in Europe.

The generating station when completed will yield 47,000 horsepower, and the whole of this power is to be utilized in the nitrate factory at Notodden, which is five kilometres distant from the power station. A second factory at Christiansland is equipped partly with the Birkeland and Eyde type of furnace, already described, and partly with the improved furnace patented by the Badische Anilin und Soda Fabrik. In this furnace arcs of great power are produced by use of an iron tube three feet or more in length, at the end of which an insulated electrode is placed, while a single electrode connected electrically to the tube, is inserted at the opposite end. On passing the current through this tube, an arc is established between the insulated electrode and the wall of the inner tube, and when air is blown into the tube with a whirling motion, this arc travels along the interior of the tube to the opposite electrode, burning all the time with great steadiness. This

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form of furnace has several advantages, since the tube can be jacketed and the heat of the gases at the upper end utilized on the counter current principle, to heat the incoming air. The heat still contained in the gases after the reaction can also be applied to evaporate the solution obtained in the latter stages of the process. It is stated that this tube type of furnace is more efficient than the original Birkeland and Eyde furnace, and that two per cent of nitric oxide is obtained in the gases passing away from the furnace.

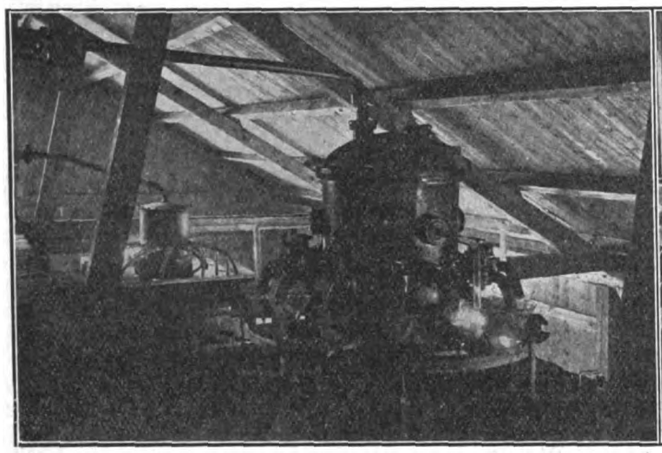

FIG. 6.—DISTRIBUTING APPARATUS ON TOP OF ABSORPTION TOWERS.

FIG. 7.—PACKING NITRATE OF LIME IN DRUMS.

As already stated, this improved type of furnace has been installed in one portion of the extended works at Christiansland, while for the still larger nitrate factory at Vanna for utilization of the power developed from the Rjukan waterpower, the Badische Anilin und Soda Fabrik furnace is to be employed exclusively. The power station at this place is to be built in two sections, as the head of water is too great to be safely utilized in one station. It is hoped that the first portion of 25,000 kilowatt capacity will be ready for operation in 1910. Few details of the engineering work on this scheme have yet been published, but there is said to be a water flow of 1,589 cubic feet per second and a head of 1,830 feet, which is equivalent to a power development of 220,000 horsepower. According to H. D. Pierce, the American minister at Christiania, the concessions for the utilization of these two large waterpowers (Svelgfos and the Rjukanfos) were obtained some years ago, and the Norwegian government is now much more strict with regard to the development of Norwegian waterpower resources by the aid of foreign capital.

Haber and Koenig have recently published results of investigations into the theory of the oxidation of nitrogen in the electric arc, which appear to prove that the reaction is not purely thermal in character, and that a higher yield of nitric oxide can be obtained by operating the process at a much lower temperature than has been customary. Working with temperatures much below 3,000 degrees centigrade, they obtained yields of ten per cent of nitric acid when air was employed and of 14.5 per cent when mixtures of oxygen and nitrogen in equal parts were used, as compared with five per cent in the Birkeland and Eyde process. According to Haber and Koenig the reaction is partly ionic in character, and an increase in the yield can be obtained by improving the ionizing action of the arc. If this theory is correct, and if Haber and Koenig's improved efficiency can be maintained in experiments on a large scale, it would apear that finality has not by any means been reached in the design of electric furnaces for the production of nitric oxide from the air, and that the new Badische furnaces now installed at Notodden may soon give place to yet another type of furnace.

In conclusion, the author must place on record his thanks to the manager of the Notodden Salpeterfabrik Company for the photographs of the Notodden works illustrating this article. The papers by Professor Frankland and by Professor Birkeland, referred to below,[1] have been drawn upon for some of the facts and figures, while an article contributed by the author to the *Manchester Guardian*, in 1908, has also been similarly utilized.

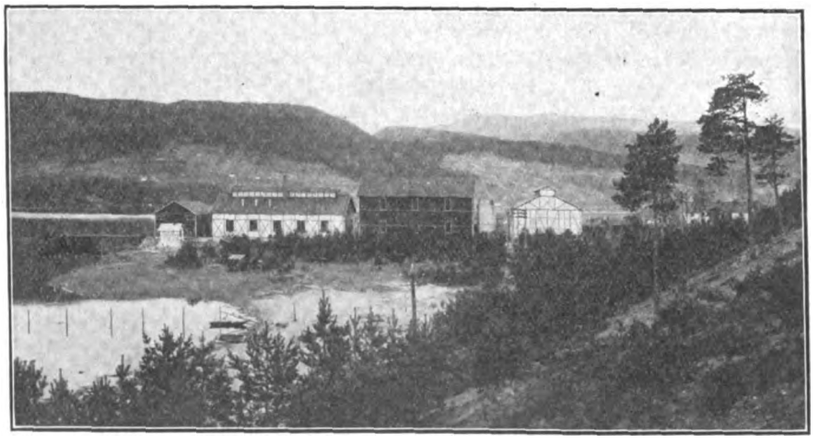

FIG. 8.—GENERAL VIEW OF NOTODDEN WORKS.

Big Storage Battery Company.

Articles of incorporation have been filed at Albany for the Westinghouse Storage Battery Company of New York, with an authorized capital of $1,750,000, $100 shares, of which $250,000 is six per cent preferred. The directors are: H. H. Westinghouse, Samuel B. Dusinberre, George C. Smith, H. Cool and John G. Greenburgh. They will assume the business of the storage battery department of the Westinghouse Machine Company.

[1] "On the Oxidation of Atmospheric Nitrogen in Electric Arcs," by Kr. Birkeland. Transactions of the Faraday Society. Vol. II, December, 1906.—"The Utilization of Atmospheric Nitrogen," by Professor Frankland.—Journal of the Society of Chemical Industry, March 15, 1907.

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Association of Iron and Steel Electrical Engineers.

The second annual convention of the Association of Iron and Steel Electrical Engineers was held at Buffalo, N. Y., from June 23 to 25.

On June 23, which was designated as "Members' Day," the president, John C. Reed, gave his annual address, and the reports of the treasurer and the secretary were presented. The standardizing committee and the safety committee presented reports which were read and discussed. E. W. Yearsley and P. McN. Bennie each delivered a lecture on the electric furnace.

On June 24, which was designated as "Visitors' Day," the following papers were read and discussed: "Some Important Phases of Electrical Power for Steel Mills," by C. F. Scott, of the Westinghouse Electric and Manufacturing Company; "Motor and Control Apparatus for Steel Mills," by B. Wiley, of the same company; "A Steel-Mill Starter for Direct-Current Motors," by C. Pirtle, of the Electric Controller and Manufacing Company; "Allen-Bradley Controllers and Starters," by Lynde Bradley, of the American Fuse Company; "New Developments in Electric Apparatus," by Messrs. Rushmore, Pauly, and Whiting; "Leblanc Condenser," by Edwin Yawger, of the Westinghouse Machine Company.

June 25 was given up to visiting various large iron and steel works in Buffalo and vicinity, and the electric power plants at Niagara Falls. A brief meeting was also held on this day.

The next convention will be held at Pittsburg at a date to be selected later.

Rome Telephone Company Sold.

The property of the Rome Home Telephone Company was sold by the bondholders on July 14 at foreclosure sale. The plant was built in 1900 from the proceeds of the sale of $150,000 of five per cent mortgage bonds.

The Cleveland Trust Company, of Cleveland, Ohio, was the trustee named in the mortgage for the bondholders. On the first of last October the telephone company failed to meet its interest payments, and after waiting three months, as the mortgage provides, the bondholders notified the trust company to proceed with the foreclosure of the mortgage.

At the sale the property was bid in by James S. Brailey, of Toledo, Ohio, acting for the bondholders, for $20,100. The plant will be rebuilt and the automatic system installed.

National District Heating Association.

Directly after the close of the Ohio Electric Light Association's convention a meeting was held at the Hotel Boody, Toledo, Ohio, July 15, for the purpose of forming an organization of central-station managers interested in district heating.

On motion of Mr. Gwynn, A. C. Rogers was elected temporary chairman and W. A. Wolls temporary secretary. Mr. Rogers, on taking the chair, stated the general objects of the meeting to be the formation of an organization of central-station men interested in district heating.

After general discussion whether the organization should be a state or national one, it was decided to form a national organization, under the name of the National District Heating Association, to be composed of active and associate members, the associate members to embrace members of all supply or material concerns that cater to the heating business.

The following officers were duly elected: President, A. C. Rogers, Cleveland, Ohio; vice-president, A. N. Cope, Springfield, Ohio, and secretary-treasurer, W. A. Wolls, Columbus, Ohio.

Committees were constituted as follows: Executive committee, E. F. Gwynn, chairman; membership committee, W. A. Wolls, chairman; finance committee, A. N. Cope, chairman, and programme committee, D. J. Hard, chairman.

The executive committee was instructed to prepare a constitution and by-laws, effective as of this date. The committee on programme was authorized to select suitable papers and topics to come up at the first annual meeting. The membership committee was authorized to obtain lists of all central stations now doing district heating and to solicit their membership. The annual dues were fixed at $5 for active members and $10 for associate members.

The place of the first annual meeting was fixed at Columbus, Ohio, to cover two days, upon dates in November, 1909, to be fixed hereafter by the executive committee and due notice thereof promulgated.

Iowa Court on Telephone Service.

A telephone decision denying arbitrary or even punitary powers to the company comes from the Iowa Supreme Court. The case was one where the company had taken out a telephone because of the too emphatic way a subscriber had expressed his opinion of "central's" attentiveness and because he had a habit of listening to conversations on the line.

An Anglo-American Student Exchange.

A scheme is on foot in England to provide an interchange of college students between Great Britain, Canada and the United States. Lord Strathcona is the president of the movement, and the list of vice-presidents includes the heads of many British universities, as well as the prime minister and many other distinguished people. One of the objects of the movement is to establish certain traveling scholarships for practical observation in other countries under suitable guidance, the selection to be made along the lines of the Rhodes scholarships. It is hoped to afford technical and industrial students facilities to examine into questions of particular interest to them in manufactures, etc., by observation in other countries and by providing them with introductions to leaders in industrial activity. It is proposed to establish two students' traveling bureaus, one in New York and one in London; to appoint an American secretary (resident in New York) and a British secretary (resident in London), to afford every facility to any graduate who wishes to visit the United States, Canada or Great Britain for the purpose of obtaining an insight into the life of those countries. It is hoped to provide twenty-eight traveling scholarships, fourteen of these being available for universities in the United Kingdom, ten for universities in America and four for universities in Canada. The total cost of the scheme, inclusive of the maintenance of traveling bureaus and the provision of twenty-eight scholarships per annum, is estimated at $67,500 for a period of three years, equivalent to an annual expenditure of $22,500, the relative annual expenditure being estimated at $12,000 in the United Kingdom, $3,000 in Canada and $7,500 in the United States.

Government Wireless Station on a Private Estate.

The United States government has obtained permission from Catholina Lambert, the silk manufacturer, to establish a wireless station on the observatory above his picturesque home on Garret Mountain, New Jersey. This will be the highest of a number of stations to be established near the Atlantic coast.

It is about 1,000 feet above sea level, and in a direct line about fourteen miles from the ocean. The War Department has always realized the value of Garret Mountain as a vantage point for a wireless station in case of war.

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CENTRAL STATIONS IN TOWNS OF LESS THAN 4,000 POPULATION.[1]

BY JAMES S. KNOWLSON.

As a class, the central stations in towns of less than 4,000 people, while representing over sixty-five per cent of the total number of central stations in the country, receive but scant attention from the engineering fraternity. The problems which they must solve in order to prove a financial success are not discussed with anywhere near the same fullness of detail as are those of the large stations.

The primary object of a paper on such a subject must be to voice the need of co-operation among small-station managers for a broader and more analytical discussion of their problems, and its secondary object should be to outline briefly the factors that must be given weight in the design of such stations, to touch on those policies that have helped to make some of them good financial propositions and, perhaps, in passing, to suggest some methods of increasing business.

The smaller central station rarely owes its inception to outside capital. It is usually a direct answer to the demands of the people for those conveniences which modern existence has placed in the category of necessities. The central station may be considered in the same class with the police and fire departments; not primarily a commercial enterprise, but a local institution.

The ideal organization for a central-station company in such a community is one with a wide distribution of stock, with practically every consumer owning one or more shares, and with the best business men of the town as its executive officers. Such an organization gives all the advantages of a municipal plant, makes the company a matter of local pride and almost a public institution, and at the same time guarantees that it will receive the hearty co-operation of the people as a whole, and the attention which the best business men can give it.

Turning from the subject of company organization, the problems of location and equipment demand first consideration.[1] In all discussions as to the requirements of such stations two facts must be kept constantly in mind. First, that the amount of available capital is always very limited; that $100 frequently means one per cent of the entire first cost of the plant. Second, that the equipment must be extremely simple; that it must not be such as to demand expert care, and while many refinements may, on paper, show a fuel economy sufficient to warrant their use, the additional apparatus necessary so complicates the operation of the plant as to raise materially the standard of attendance necessary and adds to the maintenance cost and chances of trouble.

Location.—The station should be situated as near to the railroad or local point of fuel supply as possible. It should also, if possible, have available a water supply free from lime or other solid material in suspension or solution, and of such quantity as to make condensing feasible. For even though the station will probably start non-condensing, the natural growth will in time raise it to a size where it will pay to condense. Enough ground should be obtained to provide space for extensions, for storeroom and for stables.

Layout.—Fortunately, or unfortunately, the small-station engineer seldom has to worry about limited floor space. Land is cheap. The result has been in such stations that we find very little consideration given to compact arrangement, and buildings, as a rule, are far larger than is necessary and often extremely inconvenient.

The power-house arrangement for such a station should combine three qualities: simplicity, convenience for operating purposes, and susceptibility to economic extension; which last means a parallel boiler and engine room. Fig. 1 shows an ideal layout for a small central station of 100 kilowatts capacity, using simple non-condensing high-speed engines belted to fifty-kilowatt generators.

In such a station the engineer will have as a fireman a rather unreliable helper, and at times he will probably act as fireman himself. With an arrangement as shown here, the engineer may stand in front of his switchboard, and from that position be in full view of the gauges on the end of the boiler, and from the boiler room he may still be in full view of his switchboard. Ample space is allowed on all sides of the generating apparatus, rendering it easily accessibile. The steam piping is of the most economical length and interconnected, permitting the utmost flexibility, and the auxiliary apparatus, heater and boiler-feed pump are conveniently located.

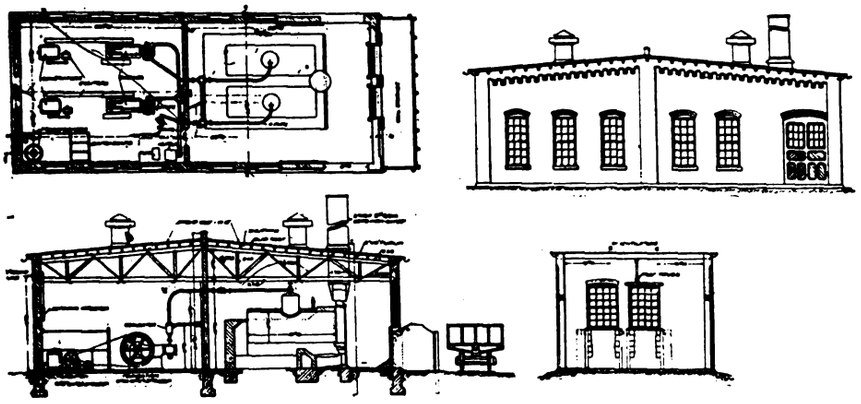

FIG. 1.—ARRANGEMENT OF 100-KILOWATT, 2,300-VOLT, 3-PHASE, 60-CYCLE, ALTERNATING-CURRENT GENERATING STATION.

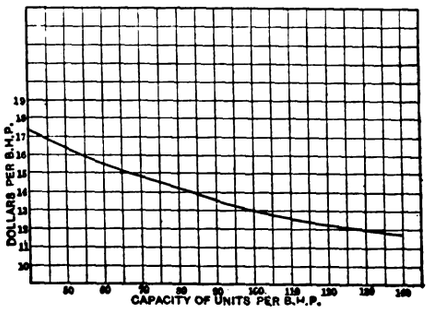

FIG. 2.—AVERAGE COST PER BRAKE-HORSEPOWER OF HORIZONTAL RETURN-TUBE BOILERS, INCLUDING SETTINGS.

In the boiler room sufficient space is allowed for cleaning boilers, and coal storage is taken care of in a most simple manner. The coal is unloaded from cars into a bin at the end of the boiler room, and is fed automatically to the firing floor through an opening in the base of the building, or may be wheeled in through the large doors at either end, which also permit a ready exit for ashes. With such an arrangement the natural extension will cause the boiler and engine room to grow side by side.

Apparatus.—In stations of the capacity under consideration, return-tubular boilers are generally installed; for, while water-tube boilers are capable of better economies, the efficiency of a boiler plant

[1] Abstract of a paper read before the technical session of the National Electric Light Association at the annual convention, Atlantic City, N. J., on June 3, 1909.

[1] This paper deals only with the station using steam boilers and engines.

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rests heavily upon the methods of firing, and higher first cost of water-tube boilers seldom pays for their use in such stations. Fig. 2 shows the average first cost of horizontal return-tubular boilers in dollars per boiler-horsepower. This figure includes settings, but does not include stack or auxiliary apparatus. The price of water-tube boilers varies so radically that no general figures can be given, but their first cost is always materially higher than that of the return-tubular type. While the first cost of an iron stack is materially less than that of a brick stack, the upkeep is much greater. What this upkeep will be, and what length of life may be expected with an iron stack, are factors largely governed by local conditions, the humidity of the atmosphere, and the like. But even with a comparatively short life and high maintenance charge, the iron stack commends itself in the case of the small plant, because it

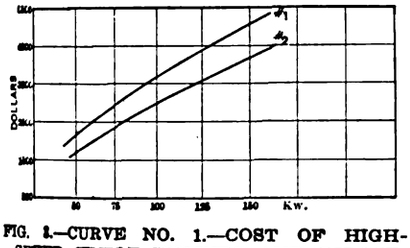

FIG. 2.—CURVE NO. 1.—COST OF HIGH-SPEED SIMPLE ENGINES AND DIRECT-CONNECTED GENERATORS. CURVE NO. 2.—COST OF HIGH-SPEED SIMPLE ENGINES AND BELTED GENERATORS.

may be so cheaply replaced by a larger stack to take care of increased station capacity.

In the engine room, the problem of whether the station shall be operated condensing or non-condensing must first be

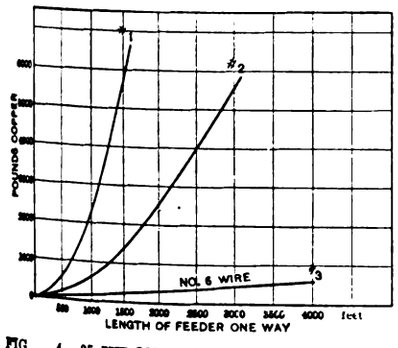

FIG. 4.—25-KILOWATT CAPACITY OF FEEDER, 10 PER CENT VOLTAGE DROP. CURVE NO. 1.—DIRECT CURRENT, 110 VOLTS. CURVE NO. 2.—DIRECT CURRENT, 220 VOLTS. CURVE NO. 3.—ALTERNATING CURRENT, 2,300 VOLTS.

discussed. The decision rests largely on the capacity of the station, nature of the load, price of fuel, and the availability of water; all these are local conditions, but it is generally true that in small stations it seldom pays to condense on account of the increased complications in operation.

Assuming that the plant will operate non-condensing, turbines or simple high-

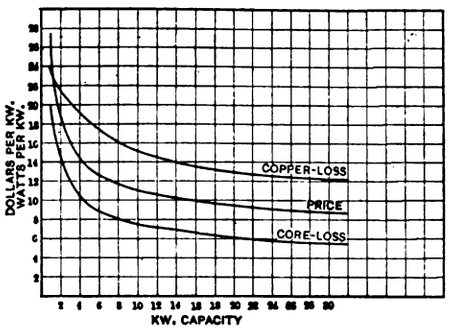

FIG. 5.—COMPARISON OF TRANSFORMER PRICES, CORE AND COPPER LOSSES PER KILOWATT FOR DIFFERENT CAPACITY UNITS OF 60 CYCLES, 2,300/220/110 VOLTS, OIL-COOLED POLE-TYPE TRANSFORMERS.

speed engines, either direct-connected or belted to generators, are to be recommended. A simple Corliss type engine, while showing much better economies at full load, is seldom as efficient on light loads as a high-speed engine, and, further, its first cost with the necessary foundations and jack shafting is far greater than that of the high-speed engine.

From an engineering standpoint, direct-connected apparatus should always be used; but it must be remembered that floor space is not an item, that in small-capacity units belt troubles and belt losses are not such serious factors as in larger sets, and that the item of first cost favors belted apparatus. Fig. 3 shows the relative first cost between direct and belted sets, using high-speed simple engines. Turbines, comparing favorably with direct-connected sets, are to be recommended on the score of better continued efficiency, and also on account of the fact that the exhaust is free from oil and may be used directly for other purposes.

It hardly seems necessary to say that the generators for such a plant should be alternating-current, sixty-cycle, polyphase machines. The average small station is located in a community loosely knit, with residences straggling out for a considerable distance, and a glance at Fig. 4 shows the large amount of copper which it is necessary to use in a twenty-five-kilowatt feeder circuit, in order to obtain a satisfactory distribution for 220 or 110-volt direct current, as compared with the amount necessary for 2,300-volt alternating current. However, if the greater portion of the load is in the immediate vicinity of the central station, alternating current may be generated at 220 volts and distributed on a three-wire system with 125 volts between the outer and neutral, and transformers may be used for stepping up this voltage in order to serve outlying districts economically.

The switchboard in such a station must be of the simplest type. Cheap boards are always poor economy, but complicated arrangements are unnecessary. The design of the board and its equipment depend entirely upon the kind of service rendered. For example, a station with a single generator carrying a street and commercial lighting load requires a single panel, carrying on its upper section instruments for commercial and street-lighting circuits and switches for the control of the series street lighting. On the lower section it carries a field rheostat and an oil switch that throws the generator directly on the commercial lines, this switch being made automatic as a protection to the generating apparatus. Such a panel combines all the functions required in such stations with low first cost. Any increase in the size of the station necessitates a corresponding increase in the equipment of the switchboard.

TABLE I.—POLE-LINE COSTS PER MILE FOR THREE-PHASE, 2,300 OR 6,000 VOLT.

No.	Item.	Omaha.	Kansas City.	Montana.	Minnesota.	Texas.	Tennessee.	Average.
50	30-foot poles	$275.00	$287.50	$200.00	$200.00	$171.00	$180.00	$218.90
50	Pole hardware	10.00	7.10	16.00	12.50	8.30	7.40	10.25
50	Cross-arms, 2-pin	17.50	7.25	11.50	15.00	17.00	16.00	14.00
150	Insulators	16.50	6.00	11.20	6.00	6.75	7.00	9.00
	Labor setting	80.00	90.00	200.00	125.00	55.00	100.00	109.00
	Labor stringing wire	25.00	15.00	40.00	50.00	30.00	40.00	35.00
	Incidentals	25.00	41.00	50.00	30.00	10.00	20.00	30.00
	Total	$449.00	$453.85	$528.70	$438.50	$297.05	$370.40	$426.15

These figures do not include painting and are exclusive of bookkeeping, overhead charges and the like.

Distribution.—Outside the central station, the largest single item of first cost is the pole line. This item depends so largely on local conditions, such as price of labor, quality of soil, and cost of poles, that it is difficult to make any general estimate as to the first cost. Table I, however, shows estimates for such pole lines in six different localities. Painting is not included in these estimates, but will range from twenty-five cents to $1 per pole, depending, of course, upon the locality.

It will seldom be necessary to use poles of more than thirty feet in length, and

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as often twenty-five-foot poles may be used to advantage.

In arranging the secondary distribution every attempt should be made to install transformers in as large capacity units as possible. The saving per kilowatt in price, core and copper losses, which may be effected by using a single unit in place of several small ones, is shown in Fig. 5.

Street Lighting.—Until recently, street lighting has meant arc lighting. Today, however, while arc lamps unquestionably provide the best illumination in business districts and wherever they may be hung so as to allow for the proper distribution of their light, the series tungsten lamp is to be recommended for residential and suburban lighting where shade trees prevent the proper hanging of arc lamps, or where a large quantity of light is neither wanted nor required. Table II shows the first cost and operating expense of magnetite arc lamps and series tungsten lamps in various capacity units. It also shows the number of incandescent units necessary to provide the same street illumination as one arc. Arcs and series tungsten lamps may be operated on the same circuit, and the combination of a few arcs with a relatively large number of incandescents will probably provide the most satisfactory street illumination in the average small town.

Passing from the construction and design of the new central station, we approach the questions of operation and the methods whereby the greatest possible returns may be obtained on the invested capital. The consideration of this question naturally divides itself under four heads: Economies and improvements in operating conditions; addition of new business; broadening the scope of the plant; and the extension of service to outlying communities.

Economies and Improvements in Operating Conditions.—There are two points which are to be strongly emphasized. First, the necessity of keeping records that will show the cost of production; not complicated records, but adequate records. To the progressive central-station manager such a statement seems trite, but there are many plants that possess but the sketchiest sort of books. There is no station so small that it should not possess means of telling exactly how much its power costs. Every station should possess a recording wattmeter, measuring the total output; should record the fuel, water, supplies, labor and incidentals, month by month, and should keep this record in such form that it may be easily compared. The second point to be emphasized is that in attempting to improve operating conditions a definite programme should be followed. The station manager should experiment, by all means, but his experiments should follow along predetermined lines.

Briefly, then, regular inspections should be a part of the day's work. In the boiler room, the repairing of boiler settings and improvements in methods of firing will often bring phenomenal results. Dirty boilers and defective settings are among the greatest sources of loss and inefficiency possible. Boilers should always be operated at full or overload, if possible, and experiments should be carried on varying the number of boiler units for various portions of the load. Experiments should also be made with various qualities and types of fuels, and the results tabulated. In almost every community there are industries such as saw-mills, jute mills, cotton gins, and the like, having a by-product that may be utilized as fuel to the mutual advantage of the manufacturer and the central station. In the engine room the engine should be frequently indicated, the valves set, belts and piping kept tight. In the distributing system, the rearrangement of transformers and the substitution of a single unit for several small ones will often show marked improvements. If a series incandescent system is used, the substitution of tungsten for carbon lamps should be made.

Addition of New Business.—There is a vast difference between getting business and taking business, and the live manager will go out and get it. If no electrical contractor or supply man is available, the central station must go into the wiring and supply business itself, wiring customers' houses and every new building that is put up in the town. Concessions should be made on the first cost of wiring, the total cost being spread over a number of months, perhaps a year. On such a basis practically every house in the town can be wired. But in approaching the prospective customer with such a proposition, a concrete estimate of the cost should always be made. General terms should be avoided, and he should always be talked to in dollars and cents.

Simple advertising by one or more methods is well worth while. Manufacturing companies are always glad to supply pamphlets and interesting reading matter on electrical devices, free of charge, to the central station for distribution among its customers. The windows of the company's office should always be illuminated, even if everything else on the street is dark; and it is perhaps a good plan to make the walls and woodwork of the office a light color in order that they may show up brilliantly. In newspaper advertising, one of the best plans is to let the printed matter take the form of frank talks with the customers as to the cost of electricity, showing what a kilowatt-hour will do; how many lamps it will burn, what it will cook, and the like. One manager of a progressive central station in a town of 2,700 people prints a list of the average monthly bills of all of his customers once a year, so that others may see how cheaply their friends receive light. Probably the best advertisement is a continuous service to satisfied customers, but, if for any reason, service is interrupted, the management should take the earliest possible opportunity to explain the cause to the public without waiting for someone else to tell the story.

Twenty-four-Hour Service. — Within the last year the statement has been frequently made that any place which could support electric service of any kind will support a twenty-four-hour service. This is unquestionably true in almost every community. The operation of a plant

TABLE II.—COST OF STREET LIGHTING IN VARIOUS UNITS.

Unit.	Arc. Magnetite 4-Ampere.	Tungsten 40-Watt.	Tungsten 60-Watt.	Tungsten 100-Watt.	Tungsten 200-Watt.
No. of units giving street illumination equivalent to one arc	1	4	3.21	2.48	1.76
First cost per unit, including brackets, transformers, etc., on a basis of equipment necessary for illumination equivalent to 100 4-ampere magnetite arcs	$54.00	$10.96	$12.00	$11.60	$15.70

OPERATING COST, BASED ON 4,000 HOURS' BURNING PER YEAR.

Unit.	Magnetite 4-Ampere Arc.	Tungsten 40-Watt.	Tungsten 60-Watt.	Tungsten 100-Watt.	Tungsten 200-Watt.
Maintenance and renewals	$ 6.00	$ 3.60	$ 3.80	$ 4.20	$ 4.67
Interest, 5 per cent	2.70	.55	.68	.58	.80
Depreciation, 5 per cent	2.70	*.49	*.57	*.52	*.73
Current at 2 cents per kw.-h	27.50	4.00	6.00	10.00	20.00
Total per annum	$38.90	$ 8.64	$11.05	$15.30	$26.20

*Exclusive of cost of lamps.

These figures are exclusive of repairs on overhead equipment, inspection cost, clerical, storeroom costs and the like.

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for twenty-four hours a day, while increasing the fuel and labor charges, does not materially increase the maintenance and overhead charges on the plant, or demand the investment of additional capital.

The general use of electricity is increasing so rapidly that arguments for using electric power, rather than small steam or gas-engine units, are constantly growing in number and strength. From figures obtained in five or six towns with a day circuit, it appears that for each horsepower of motor load carried on the lines the central station may expect the sale of approximately 750 kilowatt-hours per annum. This is, of course, a general figure based upon the average of small motors used in many different lines.

In soliciting a motor load, the same general injunction may be given as in the case of lighting. A concrete proposition in dollars and cents should always be made to the prospective customer. His present engine should be indicated and he should be shown how much his losses in belts and friction amount to, and a definite estimate made of what electric service would cost him to do the same work. It is often necessary to install the wiring and motors on a thirty or sixty-day free trial, to be purchased at the end of that period, if satisfactory.

The pumping of water, particularly if a tank or reservoir system is used, is always a very advantageous load and may be taken at low rates, as the water may be pumped at almost any time of the day or night when the load is light. Beyond the motor load, there is an ever-increasing demand for electrical conveniences in the home, and these, in themselves, form a day load generally paid for at lighting rates, which should not be overlooked. Motors for driving sewing machines, washing machines and pneumatic cleaning outfits, toasters, coffee pots, milk warmers, chafing-dishes, heating pads, electric flatirons, and the like, are each rather insignificant when considered individually, but together form a considerable total. Many stations have estimated that flatirons alone will bring a revenue of $7 to $10 each annually.

Broadening the Scope of the Plant.—To broaden the scope of the central station and incorporate under the same management all the public utilities of the community is, or should be, the ideal of every central-station manager. The station should provide light and power and, added to these, water, heat and ice. Water and ice are both desirable additions, particularly in the southern and southwestern sections, the greatest demand for these coming in the summer when the lighting load is smallest.

The advantage of adding an ice plant to the central-station equipment is only beginning to be thoroughly appreciated.

TABLE III.—REVENUE CHART OF TYPICAL SMALL CENTRAL STATIONS.

Location.	Population.	Capital.	Revenue—Ice.	Revenue—Water.	Revenue—Electricity and Supplies.	Total per Capita.
New Jersey	4,000	$39,000 stock	.....	.....	$10,909.42	$2.60
Illinois	1,000	$12,000	.....	.....	2,900.00	2.90
Kentucky	1,800	$7,500 stock, $5,500 bonds	.....	.....	6,145.72	3.41
New York	1,300	$12,000 stock	.....	.....	5,504.16	4.25
Ohio	1,800	$20,000 stock	.....	.....	8,300.00	4.60
Illinois	2,000	$10,000	.....	.....	7,563.98	3.78
Illinois	2,700	$25,000 stock, $12,500 bonds	.....	$ 720	8,353.80	3.36
Indiana	860	$10,000	.....	320	3,952.00	5.00
Ohio	1,900	$40,000	.....	3,745	7,235.20	6.10
Kentucky	1,900	$40,000	$4,945.52	1,270	7,933.00	7.85
Iowa	4,000	.....	12,000.00	$5,600 steam heating	38,300.00	14.00

The existing boiler capacity is in almost every case adequate. The engine-room and boiler-room force, if the plant offers a twenty-four-hour service, need not be increased, except for one extra man as an ice-maker during the summer.

Extension of Service to Outlying Communities.—Another method by which a central station may increase its load is along the lines of extending its service to outlying communities. For years the larger companies have been pushing out their lines to greater distances from the central station, profitably serving communities which in themselves are too small to support a central station. Outlying from almost every central station are communities that likewise might be served, which should be carefully investigated by the station manager.[1]

Conclusion.—The general impression, that a small central station cannot possibly be a sound financial proposition, is unquestionably erroneous. Table III shows the gross revenue per capita in a number of typical central stations, ranging from stations supplying electric light alone to those furnishing light, water, and ice. They are all prosperous, and their owners are well satisfied; but the rank and file of successful small stations do not advertise their success, and it is hard to persuade them that what they are doing can possibly be of interest to others. The failures, though comparatively few in number, are much better known, but investigations of the reasons that caused these failures show that there were generally two factors that mitigated against success: First, overcapitalization; and second, inefficient machinery.

It has been said that the hardest lesson which the station manager has to learn is the value of the scrap heap, and the small-station manager has perhaps been slower to learn this than the managers of larger plants. Machinery today is much cheaper, more efficient and more rugged than in the past. Its operation is far simpler and requires less expert care. The costs of production and maintenance are being lessened each day, and at the same time the demands for central-station service are constantly increasing.

[1] This subject was treated by the author in a separate paper read before the Northwestern Electrical Association. It was abstracted at length in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of June 5, 1909, page 1046.

The Colorado Electric Light, Power and Railway Association.

The seventh annual convention of the Colorado Electric Light, Power and Railway Association will be held at Denver, Colo., October 7, 8 and 9, the same week as will be held the convention of the American Street and Interurban Railway Association, which is announced for October 4 to 8, inclusive, also at Denver. Thus those desirous of attending the two conventions can do so at the expense of a single trip to Denver.

The entertainment features of the two associations will be undertaken conjointly as far as possible. In this connection the Colorado association announces that no collection will be made this year from associate members to pay for the entertainments.

The following papers are to be read at the Colorado association's convention: "The Commercial Field," "Meters and Testing," "Lamps and Illumination."

During the week of October 4 to 8 there will be, so the announcement runs, "one gorgeous, stupendous, astounding meeting of the Rejuvenated Sons of Jove."

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The Faraday Society.

The forty-fifth ordinary meeting of the Faraday Society was held on June 15, at the Institution of Electrical Engineers, London, England. Dr. N. T. M. Wilsmore occupied the chair.

E. R. Taylor, chairman of the conservation committee of the American Electrochemical Society, delivered an address, which was profusely illustrated with lantern slides, on "The National and International Conservation of Water for Power." The author pointed out that the waterpower capacity of the United States, with proper conservation, is not less than 150 million horsepower, without considering the storage capacity of brooks. Of the annual stream-flow, less than one per cent is restrained and utilized for municipal supply and such purposes, less than two per cent is used for irrigation, five per cent for navigation, and less than five per cent for the production of power. From eighty-five to ninety-five per cent is wasted in floods. This illustrates the kind of waste that is going on all over the world, and typical examples of such wasted resources were described and illustrated by the author, who strongly advocates the impounding of flood-waters in the uplands with its accompanying afforestation of the hills, and the simultaneous conservation of sources of power, which are vast in the aggregate, and which at present are almost entirely uncontrolled and untapped. The electrochemical industries in particular would benefit by the creation of cheap and abundant sources of power, on which their very existence depends. The lecturer strongly urged the necessity for this problem being considered internationally by all the civilized peoples of the world. A beginning will be made in 1910, when an international conference will be held at The Hague.

Walter Reid pointed out that the conservation of waterpower over large areas might be very difficult of accomplishment in England, where the value of land was so high, and where there was a large number of cities very close together. Others who discussed this subject were W. Murray Morrison, Dr. H. Borns and the chairman.

W. Fielding contributed a paper entitled "The Formation of Silicon Sulphide in the Desulphurization of Iron." In the refining of steel in the electric furnace a very complete desulphurization of the metal can be effected, and this action is facilitated by the addition of a charge of ferro silicon. Several explanations have been put forward to account for this influence on the removal of sulphur. The object of the author was to investigate the conditions under which ferro silicon can react with ferrous sulphide, and liberate a sulphide of silicon, and the reaction of the two compounds was investigated by heating intimate mixtures of them in a vacuum at known temperatures. The heating was effected in a crucible in the form of a hollow graphite rod, heated electrically. When the commercial variety of iron sulphide was used, the mass fused at a temperature of about 930 degrees centigrade, and a vigorous reaction set in with rise of temperature. Using pure iron sulphide (free from oxide) no reaction was observed up to about 1,300 degrees centigrade, hence the reaction noted in the first case was probably due to reduction of oxide of iron present by the ferro silicon. This explains the sudden rise of temperature noted. In all the experiments a yellow sublimate began to appear on the walls of the tube at a temperature of 1,500 degrees centigrade. This was found to consist of approximately fifty per cent silicon sulphide, the remainder being iron sulphide, which had volatilized, silica, and a small amount of ferric oxide in a finely divided state.

Prof. A. K. Huntington, F. E. Pollard and the chairman discussed the paper briefly.

"A Contribution to the Study of Electric Furnaces as Applied to the Manufacture of Iron and Steel" was communicated by Charles A. Keller. The author states as his opinion that the electrical production of steel in electrode furnaces necessitates their being fitted with hearths of a conducting material that will not carbonize the metal produced. Conducting hearths at present in use are mostly made of a layer of agglomerate carbon or of a bundle of electrodes. The upper electrode, being kept in the slag, will not operate as a carbonizing agent. The author described the various classes of conducting hearths, classifying them as follows: (a) Those made entirely of metal, water-cooled. These have no industrial value. (b) Those consisting of one or more metallic poles (or graphite protected by metal) embedded in non-carbonizing masonry. The original furnace of Siemens and furnaces by Borchers and Girod are of this type. (c) Those consisting of a hearth of refractory material, such as magnesia or silica, rendered conducting by a carboniferous substance. (d) Furnaces with a hearth made up of a mixed conducting material; this is the type devised by the author. The hearth consists of "reinforced clay," made up of iron bars, placed vertically and packed solid with magnesia. When cold, only the bars are conducting, but when in operation the hearth is conductive over its whole section, and the electrical resistance is very small. The author states that the bottom of the furnace is absolutely indeformable. The hearth of a 1,500-kilogramme furnace, examined after many months' service, was in exactly the same condition as when it started. The author has made a comparative study of the more usual type of furnace, with vertical electrodes in series, serving as entrance and exit for the current, and the furnace with conducting hearth, and he concludes that the latter has metallurgical advantages over the former for furnaces of moderate size, since the current traverses the whole mass of metal, and thus renders it more homogeneous. Moreover, the furnace is very simple mechanically. On the other hand, the series electrode furnace is of simpler construction, and only half the current density is necessary for the same output, thus economizing electrical connections. The furnace with conducting hearth will need careful design to minimize the self-induction and increase the power-factor, and a low frequency, say, about twenty, should be employed. With this frequency, a power-factor of 0.9 should be attained with a 1,000-kilowatt furnace. The remainder of the paper describes in detail the construction and performance of the various furnaces the author has erected. These furnaces are furnished with vertical electrodes both for the entry and exit of the current, and they are characterized by the separate regulation of the two fires created by each electrode. The most important example is the eight to ten furnace in operation at the Holtzer Steel Works at Unieux. This is in reality two superimposed electric furnaces, of which the upper is used for melting and oxidizing the billets of iron and steel, and the second for purifying the molten steel. The Holtzer furnace has four movable electrodes, each pole consisting of two electrodes, which can be regulated so as to alter the voltage or current by displacing either or both pairs. This method of central distribution of current results in very small self-induction; the power-factor is 0.97 when 12,000 amperes are passing. A detailed account is given of the performances of this furnace, which can purify the steel until the phosphorus and sul-

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phur together only total 0.01 per cent. A brief consideration of a three-phase furnace, with electrodes connected either in mesh or star, concludes the paper. The author is of opinion that a twenty-ton three-phase furnace, of about 1,800 kilowatts, could now be constructed. Such a furnace could purify 250 to 300 tons of steel per day, obtained from a Thomas converter, at an operating cost of fifteen to twenty francs per ton, with electricity at 0.15d. a unit, such as would be obtainable by utilizing blast-furnace gas.

J. Harden considered a water-cooled electrode beneath a furnace hearth far too dangerous an arrangement to be generally adopted. He thought electrode furnaces would be of limited application on account of the difficulty of procuring electrodes. The variations of power, thirty to thirty-five per cent, in these furnaces were very great. E. Ristori, W. Murray Morrison and Mr. Cobb, all agreed with the last speaker in his criticism of the water-cooled bottom electrode.

Gustave Gin communicated a paper entitled "Automatically Circulating Furnaces of the Gin Type for the Electrical Production of Steel." The paper describes induction furnaces in which the molten material is in continual circulation, such as described in his article in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of June 26, 1909, page 1183.

The forty-sixth ordinary meeting of the Faraday Society was held on Tuesday, June 29, 1909, at the Institution of Electrical Engineers, 92 Victoria Street, London, S. W., Eng. Dr. N. T. M. Wilsmore occupied the chair.

Dr. Henry J. S. Sand read a paper entitled "Apparatus for the Rapid Electro-Analytical Separation of Metals."

The paper contains a description of some developments made in the apparatus, first described by the author about two years ago, for the rapid electro-analytical deposition and separation of metals.[1] This apparatus for the first time combined in a practical manner the use of an auxiliary electrode and very rapid stirring of the electrolyte, and made it possible, as has been shown so far, to deposit and separate from each other for purposes of chemical analysis the metals silver, mercury, copper, bismuth, lead, cadmium, zinc, antimony, and tin. The times required for these depositions varied in the majority of cases between five and fifteen minutes. Apart from the very high stirring efficiency of the electrodes, the apparatus is believed to be superior to others of similar type in the exceedingly great simplicity of the method of making and undoing the electrical connections on a single stand, in the fact that the electrodes may be used with ordinary beakers, and in the simple manner in which the electrodes may be washed and dried. No alterations in principle have therefore been made to the apparatus, but the following additions and simplifications are described:

As hitherto, a mercury contact has been employed in the electrolytic stand to make the connection between the stationary and the moving parts; a special screw cap has, however, now been provided, which may be screwed down when the apparatus is not in use, making it possible to transport it without taking out the mercury.

A clutch arrangement has been added which enables the operator to start or stop the rotation of the anode without stopping the motor. Such an arrangement will be found of advantage if it is desired to actuate several sets of apparatus from one shaft driven by a single motor; or if the current is obtained from a small motor-generator which is also employed for rotating the electrode, the clutch making it possible to stop or start the stirrer without stopping the current; or, lastly, if a hot-air or water motor is employed which cannot be stopped instantly during the washing of the electrodes.

A very considerable simplification has been obtained by fitting all the apparatus required for the measurement of the potential of the electrode in a single box. The arrangement has been designed so that by depressing a key it will also allow the potential difference between the anode and the cathode to be read directly. It was thought very desirable to retain the capillary electrometer as a zero instrument, but it became necessary to design a new portable form suitable for the purpose in view. It may be described as a closed evacuated form developed from the Ostwald capillary electrometer. It is provided with an enclosed scale, and if observed by a lens of small magnification, it will readily indicate one millivolt.

Dr. B. Beckett Denison communicated a paper entitled "Researches on the Relative Rates of Migration of Ions in Aqueous Solution."

The author has determined, by the method of direct observation of moving ionic boundaries, the transport numbers of the halide salts of the metals of the alkalies and alkaline earths. The concentrations of the solutions were 0.1 to 0.02 normal. It is pointed out that the study of transport numbers by the direct and indirect methods has been shown to afford a means of determining the degree of hydration of the ions, although in the present paper none was calculated.

S. Field read in abstract a paper on "The Conditions which Determine the Composition of Electrodeposited Alloys. Part I. Copper-Zinc Alloys."

As the result of a large number of experiments on the electrolytic deposition of brass, the author has, by the analysis of the deposits, shown the regular manner in which the composition changes with such varying conditions as (1) proportion of copper and zinc compounds in the solution; (2) strength of the solution; (3) temperature; (4) current density, and (5) the presence of free cyanide. It is thus shown that the proportion of zinc is increased (a) at lower temperatures; (b) with more dilute solutions; (c) with increased current density, and (d) by the absence of free cyanide. With a large proportion of zinc compound copper is still freely deposited. The author incidentally draws attention to a number of important conditions which primarily affect the composition of the solution and ultimately the character and composition of the deposit.

[1] Chemical Society Transactions, Vol. 91, p. 373 (1907); Vol. 93, p. 1572 (1908).

Discriminates Between Bulk and Retail Service.

The report of the Massachusetts State Gas and Electric Light Commission with its decision on the appeal of the Fitchburg Gas and Electric Light Company, from the orders of the board of mayor and aldermen granting the Connecticut River Transmission Company the right to erect and maintain poles and wires for the transmission of electricity in Fitchburg, has been filed and confines the new company to customers using 300 or more electrical horsepower.

The decision gives the Connecticut company the right to sell electricity to the Fitchburg Gas and Electric Light Company and the Fitchburg & Leominster Street Railway Company but does not allow it to sell to any other company or individual to be resold, and declares that the Connecticut company and the local company are not natural competitors and expresses doubt over the ability of the latter company to supply large users and equal doubt over the ability of the former to profitably supply large and small consumers on the same terms.

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Chicago Electric Club.

Following the regular Wednesday noon luncheon of the Chicago Electric Club, on July 14, in the grill room of the Chicago Automobile Club, the members were entertained by an excellent address on the "Ethics of Salesmanship," by H. P. Albaugh, of the mail-order house of Albaugh-Dover Company, Chicago. In the course of his address, Mr. Albaugh commented on the light in which the profession of salesmanship is being looked at today, which was by no means complimentary. This, to a great extent, according to Mr. Albaugh, is due to the salesman who is after a swollen record of orders, and the speaker used an amusing story to describe his opinion of the "near salesman," who, by misrepresentation, bluffing, etc., attempted to attain that end. In concluding, Mr. Albaugh mentioned the three essential qualifications which, in his opinion, were necessary in every salesman, namely, originality, enthusiasm and the power to control other people's minds.

The chairman of the entertainment committee, John J. Schayer, after giving a brief review of the programme for the picnic on July 17, announced that the delay in distributing the tickets was due to the final arrangements with the Casino, at Michigan City, over the serving of dinner. A large attendance was expected.

The first annual outing of the Chicago Electric Club, which was held at Michigan City, Ind., on Saturday, July 17, was a success from every viewpoint. Nearly two hundred members and guests left the Clark Street bridge at 10 a. m. on the steamer Theodore Roosevelt. Dinner was served at Michigan City at 12:30, and shortly after dinner there was an exciting baseball game. This was followed by a race for fat men, which was won by the jovial and agile Porter. The thin man's event went to Phil Fisher. The swimming race was the event of the day, and was cleverly won by J. F. Holland.

A delightful supper was served early in the evening and the party embarked at 7:45, occupying the greater portion of the upper forward deck, where all the old songs were rendered by a fine chorus made up of members and friends. During the return trip three times three cheers and a tiger were given for J. J. Schayer, chairman of the entertainment committee, and for C. A. S. Howlett, president of the club, with whom the idea of the picnic originated.

Annual Convention of the American Society of Civil Engineers.

The American Society of Civil Engineers held its forty-first annual convention at the Mount Washington Hotel, Bretton Woods, N. H., July 6 to 9.

The Tuesday session was opened by Onward Bates, who delivered his presidential address on "The Status of the Civil Engineer's Profession in the United States." President Bates accepted Thomas Tredgold's historic definition of a civil engineer as the best that could be offered, although, he said, the civil engineer's duties had, since Tredgold's time, become so enlarged, diversified and multiplied that it would seem impossible to state in words what may be reasonably expected of a civil engineer at the present time. An analysis of the 2,380 members of the society (February, 1909) showed that about twenty per cent were in government service, fifteen per cent employed on railroads, eighteen per cent in manufacturing or contracting, five per cent consisted of architects, professors, etc., and twenty-one per cent were unclassified. He deprecated strongly the civil engineer's professional narrowness which often made him the servant where he should be the organizer or director, and suggested as a remedy that the civil engineer should become more of a mixer and assume the initiative where he was wont to be a follower. It was not unprofessional for an engineer to be a capitalist, and at any rate he should tend to create a sentiment for an equitable remuneration of his services. Finally, an engineer's rating of competency should be established by the opinions of his fellow engineers, and to this end all civil engineers should strive to increase their acquaintance in the profession, and should desire the honor and responsibility of membership in the society.

Among the reports and topics which were presented for discussion were the following: "The Status of the Metric System;" "Report of the Special Committee on Concrete and Reinforced Concrete," which gave rise to a lively discussion; "Fire Resistant Construction in Buildings;" "Impurities in Sand for Concrete;" "Road Watering as Compared with Oiling for Laying Dust."

The convention proved thoroughly enjoyable in every respect, except perhaps in the paucity of the technical proceedings, which possibly accounted for the regrettably small attendance.

The date and place of the next meeting were left to the board of directors. The Isthmus of Panama was mentioned in this connection, although it was proposed by F. P. Stearns to delay such a trip until 1911, when the canal work would be in full swing.

Electrification Plans in Germany.

It would seem that the Germans are planning some big projects for the electrification of their railroads in the near future. Herr Wilhelm Wechmann, chief electrical and mechanical engineer of the Prussian Royal Railways, has been for several weeks past inspecting the latest types of single-phase roads on the Pacific coast. In a recent interview he stated that the Prussian government intends to electrify 280 miles of steam railroads, and that it has practically decided on 10,000-volt, fifteen-cycle, single-phase, alternating current, with catenary overhead construction. The tentative plans, according to Herr Wechmann, call for an outlay of about $40,000,000.

Briquette Making.

In connection with the announcement in our last issue of the publication of Bulletin 385 of the Technologic Branch of the United States Geologic Survey, on "Briquetting Tests," a short abstract of a paper on "Briquette Making," recently read before the South Wales Institute of Engineers, by Prof. W. Galloway, will prove of interest as showing the progress of this industry in Europe.

The burning of small coal under boilers is made much more economical when the coal is used in the form of briquettes. It is advisable, in briquetting anthracite, to mix with this coal a certain proportion of bituminous coal to accelerate the rate of burning. The most satisfactory agglomerating material tried up to the present is pitch or resin, or a mixture of these, the best results being given by a mixture of slack coal with a binder of four per cent of pitch and one-and-one-half per cent of resin.

The total output of briquettes in the United Kingdom in 1906 amounted to 1,513,220 long tons, and in Germany to 14,500,851 long tons in the same year.

The paper contains full descriptions and drawings of the mixing and drying machinery and presses required for briquette making, together with estimates of labor required and costs. For example, at an English works making a little over 100 tons of briquettes per day of ten hours, the total cost, including labor, materials, fuel and stores, interest and depreciation, works out to $2.32 per long ton.

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The Preservation of Poles.[1]

There are about 40,000,000 poles in use in the United States, by telegraph, telephone and other companies, valued at $5 to $7 each on an average, or a total of $200,000,000 to $280,000,000. It requires about 3,800,000 poles each year to replace those that have become useless from decay. The average life of white cedar and chestnut poles in the United States, other than the Gulf States, is about twelve years. Hence, the depreciation is about eight-and-one-half per cent per year, or $17,000,000.

The subject of the preservation of timber has engaged the attention of scientists and engineers for over a hundred years.

In 1884, Mr. Boulton, an eminent engineer of England, read a paper before the Royal Society, in which he reviewed all the known methods of treating timber antiseptically. All the different chemicals now in use to preserve poles were well known then. This paper of Mr. Boulton, together with the discussions, was printed in book form. It constitutes today a classic on the antiseptic treatment of timber. Yet, at that time the real cause of the decay of timber, fungi, was known to probably not more than a dozen in the convention.

It is now a well-established fact that the cause of the decay of poles at the ground line is a fungous growth. Furthermore, it is known that this growth attacks the pole from the outside and not the inside, except, of course, in cases of butt rot.

Although various methods of impregnating timber with chemicals have been known and used with some variations, for sixty years, it is estimated that less than ten per cent of the poles in use in the United States have been treated by any method.

Mr. Boulton in his paper established that a material used to preserve poles by any of the methods then used must have two properties: (1) It must be a germicide; (2) it must be a germ excluder.

The great effort of all experimenters and scientists from that day to this has been to get some chemical, or combination of chemicals, which, when injected in the form of a solution, would become immediately insoluble; one that would not wash, leach, or soak out, but would remain in the timber indefinitely and kill the germs therein, and prevent other germs from entering. Science has so far failed to find this substance.

It is a popular notion that deep penetration of germicides is necessary effectively to preserve timber or poles. This is not true. The wood-destroying germs begin their ravages on the outside and work toward the center of the pole. It follows, then, that if the germs on and near the surface of the pole at the ground line can be destroyed, and the myriads of germs in the air and in the soil surrounding the pole can be excluded, the pole will be preserved. The only advantage there is in deep penetration when using the old methods is that it requires a longer time for the germicides to be leached or washed out.

The practical requirements of any succesful method of preserving poles must have the following advantages: (1) It must be a method that can be used by large or small companies having a large or small number of poles to treat. (2) It must be capable of being applied to new, or partially destroyed, poles in the ground. (3) It must not require a large or expensive plant. (4) It must not require highly skilled labor. (5) It must not require the transportation of poles to and from the plant. (6) It must not require more than one treatment, and must be positive and effective, and relatively inexpensive.

When the company[1] with which the author is connected began experimenting over nine years ago with its present method, the following facts had been established by scientists and experimenters: That poles commence to decay at, or about, the ground line; that the cause of this decay is a fungous growth, or living germ; that when this germ is killed the decay ceases; that many chemicals will kill these wood-destroying germs. It was also known that germicides in solution held in contact with wood, will be taken up into the pores of the wood by capillary attraction and the osmotic forces.

The aim of the experimentation was not to secure a chemical that was both a germicide and a germ excluder, but to use one or more of the well-known germicides and endeavor to exclude the germs in the air and soil, mechanically.

As most germicides which are cheap enough and powerful enough to be used in preserving poles are soluble, the mechanical device must serve the following purposes: It must exclude the germ after the pole is treated and at the same time retain and protect the chemicals in constant contact with the pole at the ground line; it must also prevent the chemicals from being taken up and absorbed by the surrounding soil.

The method adopted is first to dig down around the pole a distance of about fourteen inches from the ground line, and clean off any decayed wood from the surface of the pole. A layer of Portland cement mixed with sand is then placed around the pole at the bottom of the excavation. Next, a "hydrobestos" jacket is placed around the pole and one to two inches therefrom, imbedding the lower edge of it in the cement. The two edges of the jacket are lapped from one to two inches and fastened with a specially prepared cement and tacked upon a lath inside the jacket. The space between the pole and the jacket is filled with germicides in a dry state, mixed with sand. Around the top of the jacket is formed a reinforced cap or collar of Portland cement, imbedded in which are one or more wires around the pole. The collar protects the chemicals and jacket from the action of the rain and snow, and, if along steam railroads, protects the pole against the numerous grass fires. The chemicals are slowly dissolved by the natural moisture in the pole, and they pass into the same by capillary attraction. As they cannot pass out into the surrounding ground they go into the pole, thus destroying all fungi and wood-destroying insects. Thus there is a continuous absorption of chemicals and a mechanical exclusion of germs.

The hydrobestos jacket used around the pole is a pure mineral, composed of specially prepared and purified asbestos and asphaltum. This material is subjected to a pressure of about 27,000 pounds per square inch in its manufacture and is a very important factor in the method. There is no animal or vegetable fiber in it and it is practically indestructible in the situation used. In some special locations the jacket may be made of cement.

The reinforced Portland cement cap is an important part of the protective device. It prevents the rain and snow from entering the receptacle, holds the germicides, and gives a stability and attractiveness to the pole.

The germicide used consists of hydrated lime and chloride of sodium, mixed with coarse sand and one-fourth to one pound of sulphate of copper (per pole), according to size and condition of the pole. These proportions may be varied

[1] Abstract of a paper by H. P. Folsom, presented before the twenty-eighth annual convention of the Association of Railway Telegraph Superintendents, at Detroit, June 23, 24 and 25.

[1] The Universal Post and Pole Preserving Company, Circleville, Ohio.

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somewhat in the case of partially decayed poles, according to condition.

On small jobs the men work in gangs of three. One goes ahead and digs around and cleans the poles and the other two follow with a one-horse wagon or hand truck containing the chemicals (if the line of poles is along the road or on the streets of a city), and finish the treatment. Or the material may be distributed in small sacks to each pole from a hand car, if along a railroad.

One gang of men can treat from twenty to thirty twenty-five-foot poles per day. A much larger number of new poles can be treated in a day. The cost depends upon the accessibility of the poles and whether the materials are purchased in carload lots or not, and also the price of labor; but it may be said that the cost would be from seventy-five cents to a dollar per pole, including royalty for the patent on the process. Some very large poles worth from $50 to $75 have been treated at a cost of $1.50 up to as high as $2.50. Even this will pay, when the cost of removal and renewal of the pole is taken into consideration. These figures may be reduced on large contracts.

According to the Government experts, the open-tank treatment costs sixty-seven cents per pole, not including hauling.

So little attention has been paid by pole users in the past, to the question of the depreciation of their poles and their preservation, that many have not stopped to think or figure what the cost of treatment should be in order to be practicable.

Poles which were partially decayed when treated, after over nine years show no increase in the decay, and the protecting device is in good condition.

Electrification in Japan.

All railroads in Japan will be operated by electricity within a few years, according to S. Kondo, chief of the electrical department of the Japanese Department of Communication, who is en route home from a tour of Europe and the United States to study electric railways. He is quoted as saying:

"It will be a matter of a short time until all the railroads in Japan are operated by electricity, although the conversion of the main lines from steam to electricity is not immediately contemplated. The element of economy is the greatest consideration, and so far as it is possible to utilize waterpower in the operation of branch lines construction of plants for the operation of the roads will be begun immediately."

New Copyright Law.

A new copyright law, which went into effect on July 1 last, repeals the act approved June 18, 1874, under section 3 of which labels and prints have been registered in the United States Patent Office. The registration of labels and prints in the United States Patent Office, therefore, ceased with the issue of June 29, 1909. Applications for the registration of labels and prints will not be filed in the Patent Office after June 25, 1909, and any received after that date will be forwarded to the Register of Copyrights, Library of Congress.

Work Starts on New Westchester Road.

Work was begun on July 12 on the new electric line between New York and Port Chester, which will cost about $21,000,000. The start was made at New Rochelle by the Ferguson Contracting Company. The new line will be completed first from New Rochelle into New York, and will take two years to build. It is being built by the New York, Westchester & Boston Railroad, and will serve as a suburban passenger entrance to the subway and elevated lines.

Rockingham Power Company Sold.

Properties of the Rockingham Power Company, including hydroelectric power plant, railroads, machinery, etc., were sold by Commissioners W. H. Brown and W. A. Leland under order of the United States Court at Wadesboro, N. C., on July 14 and bought in by D. H. Thomas, representing bondholders of the company, who was the only bidder. The purchase price was $1,000,000, sale subject to confirmation of court. This concern controls one of the largest electric-development plants in the South, located at Blewett Falls, near Wadesboro. The company had issued $1,500,000 in bonds, and this amount has already been spent in development of power plant, and liens were filed in court at Wadesboro aggregating $150,000 for unpaid claims against the company. The trouble in this enterprise dates back to the failure two years ago of the Knickerbocker Trust Company, of New York, which was financing the enterprise. Later differences arose between Hugh McRae and the company of Wilmington, N. C., and other stockholders, which resulted in litigation, which culminated in the sale today. It is understood the next step will be completion of big plant by purchasers. The power generated will be used in Wadesboro and elsewhere in different industrial lines.

American Exposition in Berlin.

An exposition of American products will be held in Berlin, Germany, during the months of April, May and June, 1910. This American Exposition will be given in the well-known Exposition Palace, near the Zoological Garden, in the best and most frequented part of the German capital.

The exposition is intended to educate Europeans, and especially the German people, to the importance and excellence of American manufactured products, to strengthen the existing cordial relations and to stimulate trade between the two countries.

The exhibitors will be freed from the annoying incidentals usually attending an exhibition of this kind. The decorations for the exhibition booths, water, heat, light and janitor service, will be furnished by the exposition management. Exhibitors will be protected from loss of fire or theft by insurance. Exhibits will be entered into Germany free of customs duty. The Hamburg-American Line and the North German Lloyd have granted a reduction of twenty per cent in the freight charges on exhibits both ways. The rental for space is $4 per square foot, which includes the features referred to above, as well as storage for the packing of the material.

The Exposition Palace is a massive stone and steel structure erected in 1907 at a cost of $1,500,000. It has two connected buildings, of about equal size, and the combined floor space available for exhibits is about 110,000 square feet, or nearly twice that of Madison Square Garden, New York city.

The American headquarters for the exposition are in the Hudson Terminal Building, 50 Church Street, New York city. Max Vieweger is the American manager.

Navy Department Supplies.

The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on July 27 for 5,000 feet cable, for delivery at Brooklyn, N. Y.; 5,000 feet lamp cord, for delivery at Portsmouth, N. H., and for 5,000 feet wire, for delivery at Norfolk, Va.

Bids will be opened on August 3 for miscellaneous push and foot buttons and other electrical supplies, and for miscellaneous weatherproof wire and cables, for delivery at Annapolis, Md.; also for seventy-two porcelain insulators and miscellaneous magnet wire, for delivery at Brooklyn, N. Y.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

DENVER GAS AND ELECTRIC.

The Denver Gas and Electric Company reports earnings for the month of June, 1909, and twelve months ended June 30, 1909, which compare as follows:

June:	1909.	1908.
Net earnings	$72,836	$59,473
Interest, coupons, etc.	34,841	32,001
Surplus	$37,995	$27,472
Twelve months ended June 30:	1909.	1908.
Gross earnings	$2,299,182	$2,062,326
Expenses	1,300,623	1,210,171
Net earnings	$ 998,559	$ 852,155
Interest, coupons, etc.	392,147	378,601
Surplus	$ 606,412	$ 473,554

An analysis of the gross earnings for the twelve months ended June 30, 1909, indicates the following percentages of revenues from the various departments: Gas, 36.3 per cent; electricity, 62.3 per cent, and Pintsch, etc., 1.4 per cent.

SYRACUSE LIGHTING COMPANY.

Authorization has been given by the New York Public Service Commission, Second District, to the Syracuse Lighting Company, to execute its mortgage or trust deed for $2,500,000, and to issue at once $143,000 par value bonds. The bonds are to be sold at not less than ninety-five.

The company asked permission to issue $207,000 bonds, but it appeared at the hearing that there remained unexpended $70,388, applicable to additions and betterments under the $1,000,000 debenture issues of May 27, 1907. This amount will now be used in addition to the $143,000, just authorized.

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways of St. Louis for the month of June and six months ended June 30 compares as follows:

	1909.	1908.
June gross	$ 964,024	$ 915,339
Expenses	600,617	572,259
June net	$ 380,407	$ 343,080
Charges	232,322	230,883
June surplus	$ 131,085	$ 112,247
Six months gross	5,391,575	5,163,555
Expenses	3,431,199	3,367,509
Six months net	$1,960,376	$1,796,046
Charges	1,404,630	1,385,547
Six months surplus	$ 555,746	$ 410,499

CHICAGO RAILWAYS COMPANY.

The report of the Chicago Railways Company for the month of May, 1909, compares with that for the same period of last year as follows:

	May, 1909.	May, 1908.
Gross earnings	$1,055,160	$902,482
Expenses:		
Maintenance of way and struc.	$ 55,180	$ 41,015
Maintenance of equipment	59,500	67,677
Operation power plants	110,832	78,073
Operation cars	325,010	290,219
General expenses	124,619	103,959
Exp. inv. real estate	3,446	2,798
Taxes (estimated)	31,155	16,608
Total	$ 709,744	$600,352
Balance (actual)	345,416	302,129
Balance based 70% operation	316,548	270,744
Deduct int. 5% on valuation	176,437	137,625
Net income	$ 140,110	$133,118
City of Chicago, 55%	77,060	73,215
Chicago Railways Co., 45%	63,049	59,903

PENNSYLVANIA BELL TELEPHONE.

The Bell Telephone Company, of Pennsylvania, announces that the American Telephone and Telegraph Company will exchange one share of its stock for one-and-one-seventh shares of the stock of the Bell Telephone Company of Pennsylvania. The exchange is to be made on or before August 1.

Directors of the Bell Telephone of Pennsylvania have approved the proposed exchange and have recommended to stockholders that they accept the proposal.

The exchange is on a basis of seven shares of American Telephone and Telegraph Company stock for eight shares of Bell Telephone Company of Pennsylvania stock.

MASSACHUSETTS ELECTRIC SUBSIDIARIES TO INCREASE CAPITAL STOCK.

The Old Colony Street Railway has petitioned the Massachusetts Railroad Commission for authority to issue 4,042 shares of preferred stock at $115 per share. The Boston & Northern Street Railway has asked authority to issue 5,883 shares of preferred at $115 per share.

These applications are for the purpose of increasing working capital under the new law permitting the company to fix prices of new stock, subject to approval by the Commission.

AMERICAN LIGHT AND TRACTION COMPANY.

The American Light and Traction Company reports earnings for the month of June and for six and twelve months ended June 30, 1909, as follows:

	1909.	1908.
Earnings	$ 238,171	$ 189,835
Expenses	9,649	4,000
Net earnings	$ 228,522	$ 185,835
Six months ended June 30:		
Earnings	$1,546,979	$1,217,426
Expenses	53,787	24,000
Net earnings	$1,493,192	$1,193,426
Twelve months ended June 30:		
Earnings	$3,052,616	$2,535,819
Expenses	74,787	36,562
Net earnings	$2,977,829	$2,499,257

NEW YORK & NEW JERSEY TELEPHONE COMPANY.

The American Telephone and Telegraph Company is offering shareholders of the New York & New Jersey Telephone Company the privilege of exchanging their stock, share for share, for American Telephone stock. The right of exchange holds good until August 31, 1909. The negotiable receipts given in exchange for New York & New Jersey shares are convertible into Telephone stock on or before December 31, 1909.

The New York & New Jersey Telephone Company has always been ranked as a Bell subsidiary, although the American Telephone Company owns directly but eight-and-three-fourths per cent of the entire capital stock. It is understood that the New York Telephone Company is a large stockholder, so that control undoubtedly lies within the American Telephone system.

Public Utility Corporations Pay Enormous Sums to the City of Chicago.

During the past few days the Chicago Telephone Company and the Commonwealth Edison Company have both paid over to the city of Chicago its share of their gross receipts, in the case of the former company for the six months ended June 30, and of the latter for the year ended May 31, 1909.

The amount paid by the Chicago Telephone Company was $119,930.58. This represents three per cent of the gross receipts of the company for the period named, and was accompanied by a statement of the earnings of the company, signed by Angus S. Hibbard, second vice-president, and Charles E. Mosley, secretary, as follows:

Exchange earnings	$3,730,438.08
Toll earnings	274,540.59
Private line earnings	6,238.95
Miscellaneous revenue	9,862.87
Total	$4,021,080.49
Less uncollectable total bad debts charged off	27,077.02
Less amounts charged off subsequently paid	3,682.49
	$ 23,394.53
Total gross receipts	3,997,685.96
Three per cent of gross receipts	119,930.58

The payment made by the Commonwealth Edison Company amounted to $360,752.15. This amount is the share of the city in the gross receipts of the company for the period mentioned, and a comparison of these figures with last year's shows an enormous increase in the light and power business in the city during the past twelve months. As a matter of fact, the city at this time only gets $269,752.15 in cash because the Commonwealth Edison Company advanced it $100,000 the first of the year to help over a tight financial situation. Both companies report splendid development in their respective fields and consider the outlook for the future as good as could be desired.

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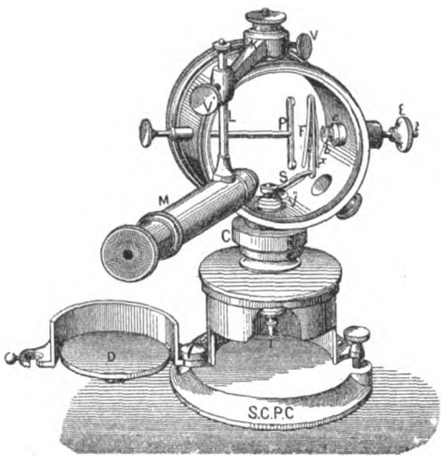
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

AN ENGINEERING SLIDE RULE.

A new slide-rule of special interest to engineers has been designed by James Lusk, of the firm of David Colville and Sons, Motherwell, Scotland, and is being marketed by D. Robertson & Company, of Glasgow. The rule differs from an ordinary slide-rule in that its logarithmic scales are arranged and graduated to suit engineering practice. The form of the piece of metal, the weight of which is to be calculated, may be rectangular, circular, or segmental, and may be of steel, wrought-iron, cast-iron, brass, copper, or any other metal. The only setting required for rectangular pieces is that of bringing the length and width opposite each other, and for circular pieces that of bringing the diameter on one scale opposite the diameter on another scale. For segmental pieces a scale is provided on which the distances are proportional to the logarithms of the areas of circular segments having certain ratios of height of segment to radius. Any desired percentage over and under the net weight in steel can be read as simply as the net weight, and this should prove especially useful to steelmakers, for example, in estimating the weight of slab required to roll a plate of given finished dimensions. The length of the rule, which is made in boxwood, faced with celluloid, is such as to give accuracy of the order of one-fifth of one per cent with a range of weights from 100 pounds up to twenty-five (long) tons.—*Abstracted from The Times (London), Engineering Supplement, July 7.*

APPARATUS FOR MEASURING RADIOACTIVITY BY THE ELECTROSCOPE METHOD.

C. Chaveneux and D. Laborde recently exhibited before the French Physical Society a very interesting apparatus, by means of which the radioactivity of any body—solid, gaseous or liquid—may be easily measured. When such bodies are in the field of a charged electroscope, the latter will be discharged on account of the conductivity imparted to the air by the radiations of the radioactive substance. The electroscope consists of a cylindrical metal case closed by glass plates, as shown in the accompanying illustration. It is screwed on a metal neck *C*, in which the resin insulator and holder *S* of the aluminum foil *F* are fastened. At the bottom the holder ends in a screw, to which points for the dispersion of the electrical charge may be attached. The aluminum foil is connected to the outside only by the insulated holder. It may be electrically charged by means of the rod *t*, which passes through the wall of the case and is insulated from the same by ebonite. The rod is movable in the direction of its axis and carries inside of the case a small eccentric metal plate *b*, which may be brought in contact with the foil in order to charge the same, and also with a projection *e* of the case, after the charge is completed. Influence phenomena induced by the charging arrangement are



ELECTROSCOPE FOR MEASURING RADIOACTIVITY.

thus avoided. The movements of the foil are observed through a microscope with ocular micrometer, which may be set in any position with respect to the electroscope, and provisions are made for fixing such position for the purpose of comparative measurements. During transport the aluminum foil is held firm by a metal piece *P* fastened to a rod movable from the outside. For the examination of solid bodies the electroscope is placed on a metal case and the rather short dispersion rod *T* projects into this case, on the bottom, *D*, of which the substances to be examined may be placed. For the examination of radioactive gases the electroscope is fastened to a closed copper cylinder containing the gases. In order to calibrate the apparatus a known quantity of emanation is introduced into the cylinder, and the loss of the charge measured three hours after the beginning of the emanation. The measurements of the apparatus are such that with a charge of about 300 volts, the saturation current is obtained within one to two per cent with the strongest practically measurable currents. The apparatus is, of course, also suitable for measuring induced radioactivity.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), June 6.*

TURBO-TANDEM ALTERNATOR GROUP OF 11,200 HORSEPOWER FOR THE BUENOS AIRES CENTRAL STATION.

In November, last year, Brown, Boveri and Company, of Mannheim, delivered to the central station of Buenos Aires the most powerful turbo-alternator group so far constructed. The turbine is to furnish normally 11,200 effective horsepower at 750 revolutions per minute. It is provided with a battery of surface condensers and is operated with steam superheated to 300 degrees centigrade under an effective pressure of twelve kilogrammes per square centimetre. For two hours it will carry a load of 14,200 horsepower. The normal steam consumption, with cooling water at fifteen degrees centigrade, and a load of 7,500 kilowatts, is guaranteed at 6.3 kilogrammes per kilowatt-hour. The turbine is directly coupled to two three-phase alternators in tandem, of a capacity of 7,500 kilowatts each. One of them furnishes a current of twenty-five periods and a combined tension of 12,000 to 13,000 volts, the other fifty periods per second and a combined tension of 12,500 volts. The directly connected exciter generates 100 kilowatts at 220 volts. The total surface of the condenser is 1,300 square metres. When fed by water at fifteen degrees centigrade it can condense 50,000 kilogrammes of steam per hour with a vacuum of ninety-five per cent; if the water is at a temperature of twenty-five degrees centigrade, a vacuum of ninety-one per cent can still be reached. The weight of the entire group, including the condenser, is 475 tons. On account of its great power and also in order to keep the steam consumption as low as possible, the turbine is divided into two cylinders

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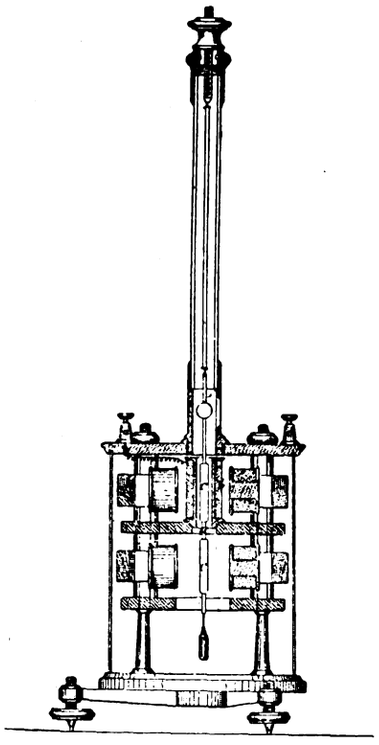
with an intermediate bearing. The dynamos are of the usual type of turbo-alternators manufactured by Brown, Boveri and Company, with rotating inductor and stationary secondary. They can easily withstand an overload of twenty-five per cent for half an hour. The maximum temperature after a continuous run of ten hours is not to be more than forty-five to fifty degrees centigrade above that of the surrounding atmosphere. The six alternators of this type intended for the Grand Central Station of Buenos Aires are all to be supplied by Brown, Boveri and Company, as well as three of the turbines, the remaining three being built by Franco Tosi, Lignano.—*Translated and abstracted from La Revue Electrique (Paris), June 15.*

ELECTROLYTIC IRON.

A new process of making iron plates and tubes direct from the ore has been invented by Sherard Cowper-Coles, the well-known English electrometallurgist, which appears to open up new possibilities in metallurgy. Ordinary cast-iron or iron ore, or material unfitted by certain ingredients for ordinary making of high-grade iron or steel, is put into an acid bath, and connected to the positive pole of a dynamo. For tubes the negative electrode is a wooden core covered with a sheet of lead, a similar flat surface being provided for plates. When the tube deposited by electrolysis has reached the desired thickness, it is taken from the bath, and is then heated to melt the lead and remove the core. The tubes and plates cost much less than those obtained by melting and rolling. The iron produced is superior in quality, and it is believed to be possible not only to utilize iron waste and inferior ore, but to apply the process direct to ore in its bed, thus making unnecessary much of the labor at present connected with the mining and cleaning of ore.—*Abstracted from The Engineer and Iron Trades Advertiser (Glasgow), June 29.*

THE MEASUREMENT OF TELEPHONE CURRENTS BY THE ARNO GALVANOMETER.

The ever-increasing use of the telephone and the adoption of telephonic receivers in wireless telegraphy have created a need for an instrument capable of measuring telephonic currents. In 1906 Duddell invented a thermo-galvanometer which is particularly suitable for measuring such currents. Quite recently Riccardo Arno has designed a much more sensitive galvanometer based on an entirely different principle. He had observed that when an iron or steel disk or cylinder is placed in a rotary magnetic field and subjected at the same time to the action of periodic currents, even of feeble intensity, a considerable variation in the hysteresis is produced. This action is the greater the higher the frequency of the currents, other conditions being equal. Therefore, with the high-frequency telephone currents or those produced by Hertzian waves the variation is still noticeable, even though the currents be very feeble. In order to utilize this phenomenon, Arno employs two magnetic fields rotating in opposite directions, of the same intensity and frequency, each



THE ARNO GALVANOMETER.

acting on a hollow steel cylinder. The two cylinders are mounted on a common vertical axis, constituting the movable part of the apparatus. One of the two cylinders may be subjected at the same time to the action of a secondary magnetic field produced by the telephone currents traversing a coil surrounding the cylinder, and having the same axis as the latter. Under these conditions the hysteresis of the cylinder undergoes a certain variation, and the movable portion, which is normally in equilibrium, begins to deflect. In his first apparatus Arno produced the rotating fields by a system of three coils with iron cores operated by three-phase currents. With equal frequency of the rotating fields and definite frequency and intensity of the secondary magnetic field, the intensity of the rotating fields is of considerable importance. If its value is increased, the result will be a corresponding increase in the deflection of the movable portion up to a certain limit, depending upon the mechanical sensitiveness of the apparatus. As three-phase currents are not generally available, the latest type of instrument has been adapted for single-phase current, and in order to make the mechanism lighter and more sensitive, the two cylinders are replaced by a wire, a small tube, or a spiral of magnetic material. The coil traversed by the telephone currents to be measured has a resistance approximately equal to that of a telephone receiver. If the currents of Hertzian waves employed in wireless telegraphy are to be measured, a coil is employed with a sufficient number of turns to present an impedance such that the entire system and apparatus at the receiving station are in resonance with those at the generating station. The apparatus is so sensitive that a considerable deflection will be produced by speaking into a telephone, even if a resistance of 100,000 ohms is connected in the circuit.—*Translated and abstracted from L'Industrie Electrique (Paris), June 25.*

A NEW ELECTRIC CLOCK.

A new self-contained electric clock, operated by a single dry battery, has been invented by a Mr. Kutnow, and will shortly be put on the market by the Eureka Clock Company, Limited, of London, Eng. The clock has no pendulum, is noiseless in operation, and will go in any position, and it is announced moreover that the price will compare favorably with that of a spring-operated clock of equal quality. The balance wheel is controlled by an isochronous spring and is given an impulse every three seconds by means of an electromagnet on the wheel. The movement is transmitted direct to the seconds hand.—*Abstracted from Electrical Engineering (London), June 17.*

Erie Tests the Hudson Tube.

An experimental train was run in the Hudson Tunnel last week from the Erie station in Jersey City to the New York terminal, at 50 Church Street, in five-and-a-half minutes. As six minutes will be the regular schedule, the Erie officials believe that commuters using the new tube will save about fifteen minutes from Jersey City to Church and Fulton streets when the trains are running regularly, beginning August 2.

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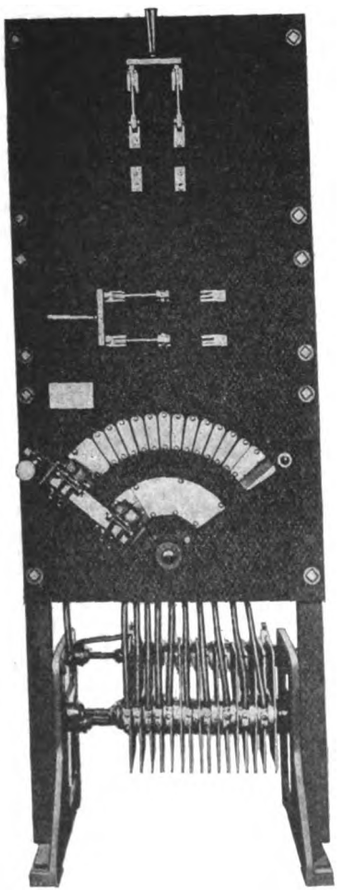
INDUSTRIAL SECTION

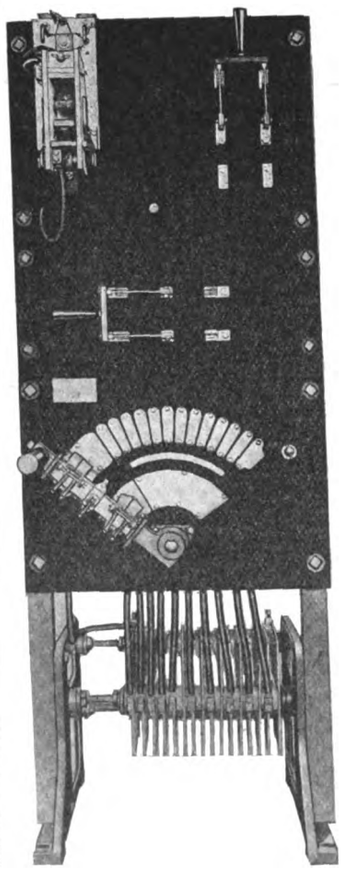
ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

New Line of Motor Starters.

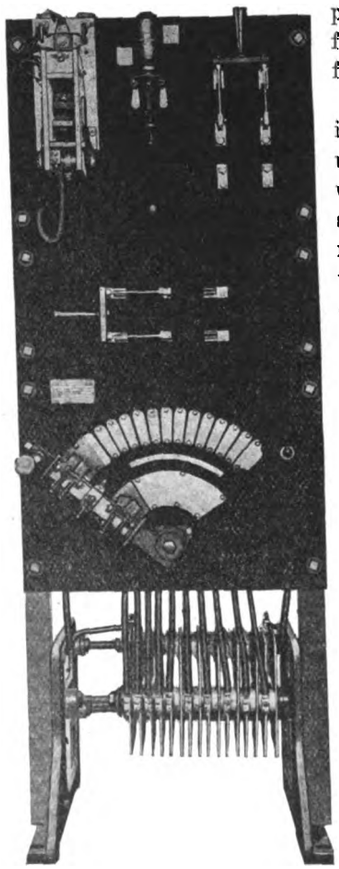
Recognizing that there is a demand for a motor starter of rugged construction, the Electric Controller and Manufacturing Company, of Cleveland, Ohio, has developed and placed on the market a new line of starters which are essentially of mill-type design.



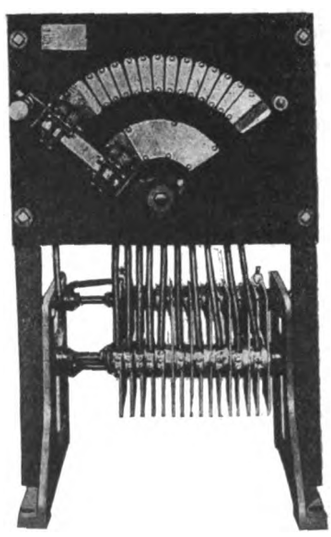
MILL TYPE MOTOR STARTER —FORM A-1.



MILL TYPE MOTOR STARTER —FORM A-2.



MILL TYPE MOTOR STARTER —FORM A-4.



MILL TYPE MOTOR STARTER —FORM F-1

In designing these mill-type motor starters, the Electric Controller and Manufacturing Company has attempted to interpret severe operating conditions, and this has necessarily led to the use of some new features. Mill-type motor starters are made in panels, have supporting feet, and are completely self-contained. The dimensions of the different forms vary only in height. In width, nothing projects beyond the slates, so that adjacent starters may be placed side by side, forming a continuous control board. The starters are furnished in several forms, beginning with a very simple form, and elaborated on to embrace such features as no-voltage release, overload protection for running, and separate and different overload protection for accelerating. In explanation of the last-named feature, this design allows more current to flow through the motor during starting than during running. If a motor be connected to a load having large inertia—such as a hot saw or a press with a heavy flywheel—the mere accelerating of the load demands a very considerable expenditure of energy. Since this starting is relatively infrequent, the motor will not be injured by employing a starting current in excess of the running current. Yet the starting time will be materially reduced. There are, in fact, numerous instances where it is desirable to allow an accelerating current larger than the running current.

Experience has shown that no-voltage protection which is secured by a spring return arm, is open to the following serious objections: First, the spring is likely to be either broken or weakened so that upon voltage failure the arm does not return to the off position. Second, the contacts may become so roughened that the spring is not powerful enough to move the arm. Third, an ignorant operator may block the arm in the off position, so that it is impossible for the spring properly to perform its function.

If, through any cause, the arm is not returned to the off position upon voltage failure, the motor will necessarily be subjected to a damaging overload upon the return of voltage. In the mill-type motor starters, the danger of a broken or weakened arm spring is absent, because no such spring is used.

The no-voltage protection is secured entirely by means of a magnetic switch, which opens upon failure of voltage. This same magnetic switch in connection with an overload coil, is used for securing overload protection. Since the overload feature must stand the abuse and have the characteristics of a circuit-breaker, the Electric Controller and Manufacturing Company believes that it should possess the advantages and arc-breaking ability of a circuit-breaker.

The following valuable features sum-

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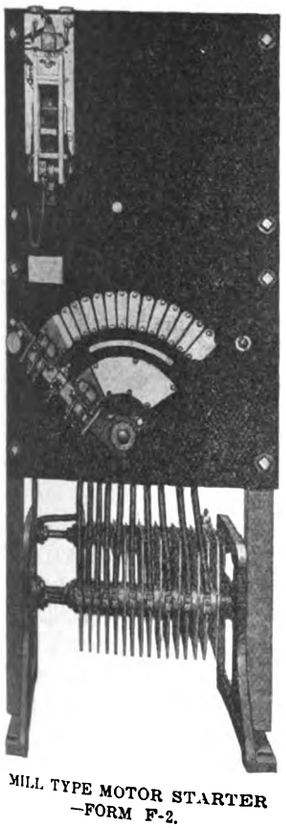
marize the operation of this type of motor starter:

(1) The magnetic switch can be closed only by bringing the arm to the off position, preventing injurious overloads to the motor upon the return of voltage after voltage failure.

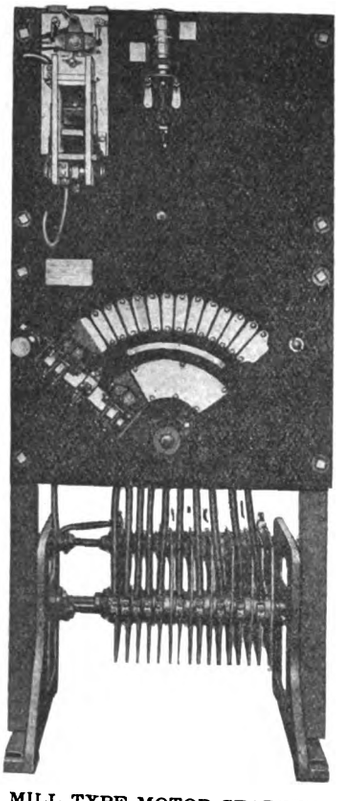
(2) The magnetic switch can be held closed to the arm on any accelerating step only by holding in a push-button. This prevents leaving any of the starting resistance permanently in circuit, and thereby burning out this resistance.

(3) The magnetic switch will maintain itself closed only when the arm is at the full-on position.

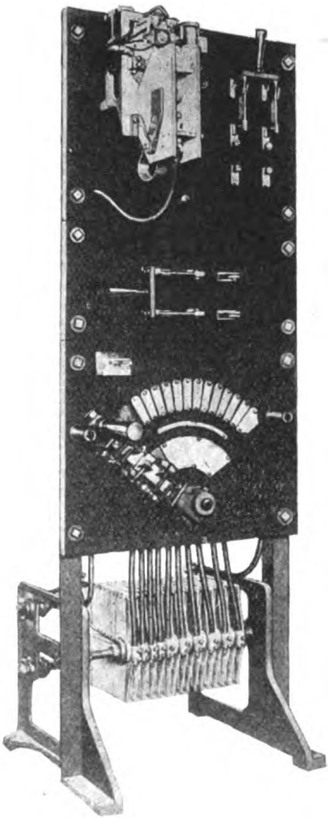
The resistance fingers, contacts, etc., used in the mill-type motor starters are of the same design and kind of material that the Electric Controller and Manufacturing Company uses in controllers for heavy service. It states, therefore, that this starter can be rightly called of mill-type design, and is well able to stand the abuse and severe service which the most ruggedly constructed mill-type motor can be expected to encounter.



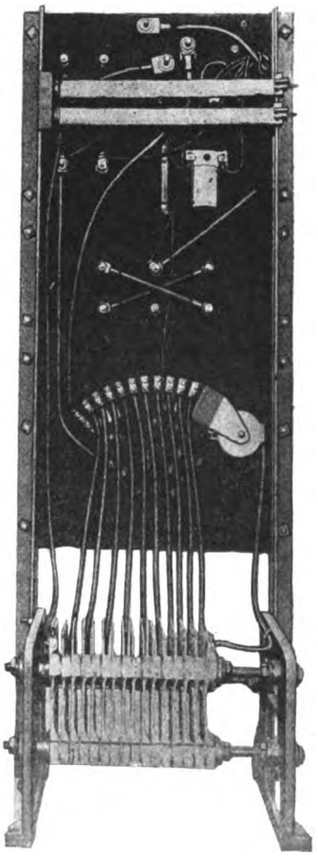
MILL TYPE MOTOR STARTER —FORM F-2.



MILL TYPE MOTOR STARTER —FORM F-4.



MILL TYPE MOTOR STARTER— FORM F-4 (Three-quarter View).



MILL TYPE MOTOR STARTER— FORM F-4 (Rear View).

Low-Pressure Turbine in Textile-Mill Service.

At the Bernon Mills of the Manville Company, Georgiaville, R. I., a 300-kilowatt Westinghouse low-pressure turbine is being installed to take steam at atmospheric pressure from the exhaust of a Corliss engine, driving a three-phase, sixty-cycle, 600-volt alternator to supply additional power and lighting for the mills. The turbine is operated without superheating and exhausts into a condenser maintaining a vacuum of twenty-seven inches. Besides the lighting service for the mills, the distribution system supplies a synchronous motor direct-connected to mill line shaft.

A Prompt Delivery.

The International Acheson Graphite Company, of Niagara Falls, N. Y., reports a recent demonstration of its facilities for prompt shipments of orders. Between 1 and 2 o'clock on the afternoon of Friday, July 2, a telegraphic order, calling for the shipment of a carload of electrodes eight inches by forty-eight inches by express, was received. The works and an express company were immediately notified. At 5 p. m. an express car was delivered on the track in front of the products building. At 5:30 p. m. a locomotive on the Niagara Junction Railroad was pulling away with the loaded car for delivery to the Michigan Central Railway. It left Niagara Falls about 6 p. m., Buffalo about 8 p. m., and very early on Saturday morning the electrodes were delivered to the consignees in Chicago, Ill. The regular shipments of the day were not interrupted.

The value of the service to the customer is more apparent when it is known that if the business judgment of the Acheson Graphite Company had not been such as to have these very large electrodes in stock, a delay of from ten to twelve weeks would have resulted in filling the order.

The Rothchild Engine.

The object of the engine illustrated herewith is to furnish an engine that shall have the economy of the most perfect type of present stationary engine, simpler in construction, and more convenient to operate than any engine of the reversible kind now in use. It is economical, simple and reversible at the same time.

The valves of this engine differ from all others both as to location and movement. They are located in the cylinder heads and driven by a continuous rotary motion taken from the main shaft, the latter making three revolutions to one revolution of the valve. The valve is cylindrical in shape, and has three ports at equal distance on its circumference, thereby employing one port for each revolution of the main shaft. The port in the valve casing is equal in width to the blank space between any two ports on the

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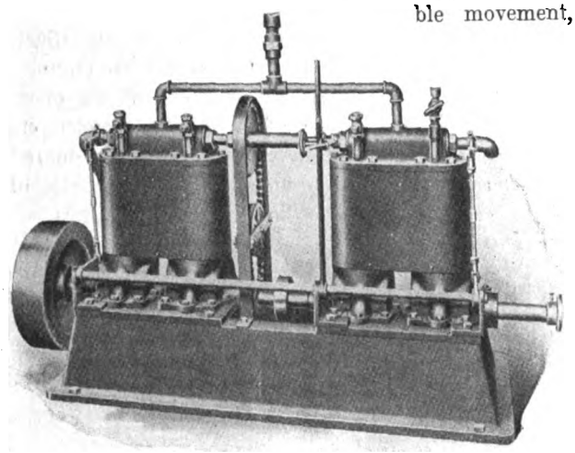
cylindrical valve. It will be seen from this that the engine can obtain steam by moving in either direction. The forward and backward movement of the engine is controlled by the cut-off within the cylinder valve. The cut-off separates the live steam from the exhaust, and its port arrangements are such that they control, in the most economical way, both the admission and exhaust of steam, according to the load or speed required. The cut-off extends beyond the valve casing far enough to permit the attachment of the controlling lever. The cut-off may be moved or changed at pleasure—without detriment to the exhaust—to expose the port either for a forward or backward movement of the engine, depending upon which way the cut-off is tilted. The position of the cut-off also controls the amount of steam to be admitted to the piston. By this construction it will be observed that there is a continuous rotary valve moment between a stationary case and a cut-off which may be varied to suit the occasion or circumstances. This enables the valve to enter unimpaired steam at a positive point for the piston to receive the same.



ROTHCHILD ENGINE.

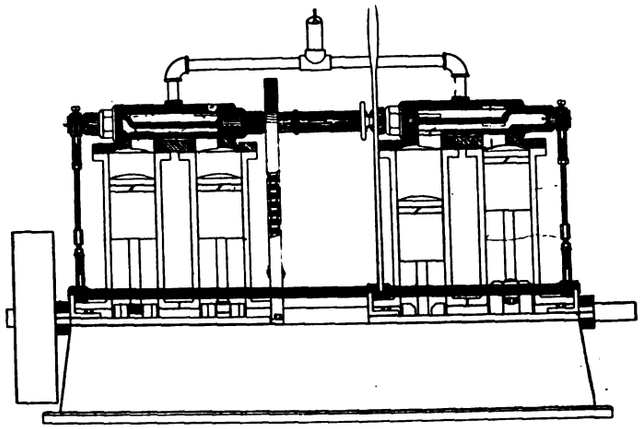
The variable cut-off inside of the cylindrical valve cuts off the supply of steam at any desired point of the stroke to suit the occasion, and may be operated by hand or governor. The seating contacts of movements contained in the valve are self-sealing and arranged so as to take up their own wear by differential pressure.

This engine differs radically from all other cut-off engines in consequence of the continuous rotary movement of the valve, giving the latter a movement in one direction so that it can be met and regulated as to its steam admission with very slight movement of the cutoff, and this is necessary only when there is a change of load requiring a different amount of steam, or a change of direction requiring the reversing of the engine; otherwise the cut-off remains stationary.

The entire control of the engine as to starting, stopping, regulating, or reversing is done by one simple lever located conveniently to the operator.

All joints and connections along the line of movements of the valve are of the toggle type, permitting an easy and flexible movement, also providing a thrust endways to make steam joints in place of stuffing boxes, and permitting the valve to seat without being interfered with by the motion of the stem.

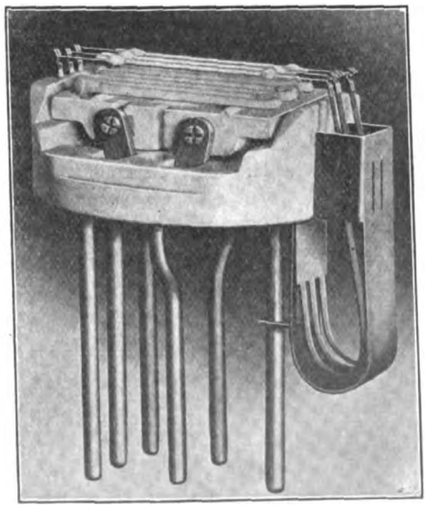
This unique engine is manufactured by the Rothchild Engine Company, whose offices are at 102 Centre Street, New York, N. Y.



SECTIONAL VIEW, ROTHCHILD ENGINE.

Nernst-Lamp Improvements.

Another marked improvement in the Westinghouse Nernst system is the new spring holder. This holder consists of a one-piece porcelain base, same as the old holder, and receives the wafer heater in the same manner, but is provided with an entirely new device for holding the glowers. On one side there is attached a metal stamping consisting of a series of springs, one for each glower, covered by a metal guard. A corresponding number of rigid upright supports fit into slots in the opposite side of the porcelain. Small platinum jaws to receive the glowers are welded to the tips of the springs and to the tips of the upright supports.



NEW SPRING HOLDER FOR NERNST LAMPS.

The glowers are provided with fused beads at the ends of their platinum leads which prevent them from slipping through the jaws of the holder. Replacement consists of the simple operation of inserting the bead of the glower in the jaw on the spring side of the holder and then drawing the spring forward sufficiently to allow the other bead to drop into the corresponding slot on the opposite side of the holder.

The spring tension is sufficient to draw the glower into place, which is done automatically without further attention on the part of the operator. Contact is made automatically. The pressure of the spring keeps the glowers in their correct position and does not permit them to assume any other position due to expansion and contraction.

This device makes the replacement of glowers so simple an operation that it can be done by anyone, without having had electrical experience. It greatly reduces the trimmer's time and makes it impossible for him to replace the glowers in any but the proper way.

Rail-Handling Magnets at Gary.

During the past few years the saving that can be accomplished by the use of lifting magnets has been generally recognized, and many new applications of magnets have been made. The Electric Controller and Manufacturing Company of Cleveland, Ohio, a pioneer in this field,

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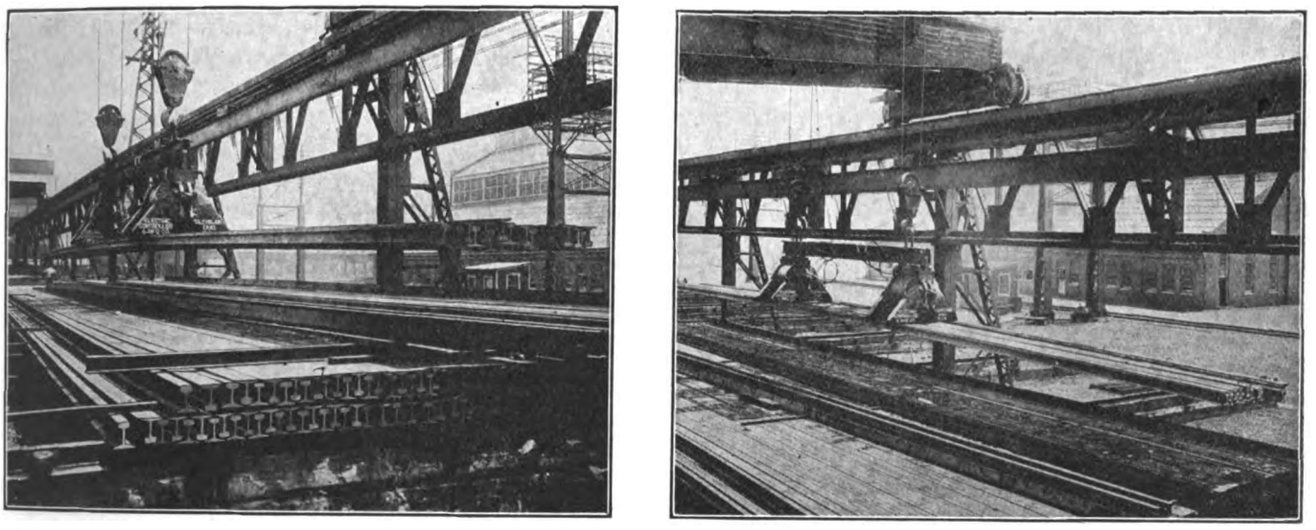
has not only introduced improvements in design, but has designed and applied new types of magnets to new kinds of service.

Such an application requiring a new design of magnet, is the handling of the entire output at the immense rail mill of the United States Steel Corporation's plant at Gary, Ind. This mill is of the most modern design in every respect, and electric power has been used throughout, even to the driving of the rolls, by 6,000-horsepower motors. The handling of the finished rail by electric power, through the use of lifting magnets, was therefore a logical conclusion, providing a successful magnet could be made. The handling of the rail output by means of magnets was particularly desirable from the following considerations. (1) Sufficient labor alone could be dispensed with to make the application commercially attractive. (2) A large saving in time of handling would be effected. (3) Very much less timber-spacing material was necessary in loading.



E. C. AND M. MAGNET HANDLING A LOCKED SECTION OF 60-FOOT RAILS AT THE RAIL MILL OF THE INDIANA STEEL COMPANY, GARY, IND. LIFTS ARE FROM 12 TO 15 TONS.

E. C. AND M. MAGNET HANDLING A LOCKED SECTION OF 33-FOOT RAILS AT THE RAIL MILL OF THE INDIANA STEEL COMPANY, GARY, IND. LIFTS ARE FROM 10 TO 12 TONS.

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(4) There being no possibility of bending the rail when loading by magnets, loss on this score would be eliminated.

While it is desirable, from the standpoint of the rail mills and railroads, to ship rails in locked sections, yet this is an arrangement of rails which is particularly difficult to handle with a magnet.

The difficulty arises from the fact that the top layer of the rails practically short-circuits the magnetic field and none but a very powerful and carefully designed magnet would have sufficient strength to penetrate the top layer of rails and lift the bottom layer.

The magnets, which were furnished by the Electric Controller and Manufacturing Company, have been very successful and have lifted not only locked sections of thirty-three-foot rails, but have also lifted locked sections of sixty-foot rails with an aggregate load of fifteen tons.

Central Electric High-Tension Disconnecting Switches.

The increasing use of high voltages in electric transmission systems has created demands for many special devices, among which are the so-called high-tension disconnecting switches, of which many types have been developed and are extensively

HIGH-TENSION DISCONNECTING SWITCH.

employed for sectionalizing lines or disconnecting lightning arresters, oil switches, etc., from live circuits.

When oil switches or circuit-breakers are tied in on busbar sets, it is essential that disconnecting switches be provided whenever possible, as the installation of these switches will permit the oil circuit-breakers to be cut out of service for inspection or adjustment.

To meet the demands for disconnecting or sectionalizing switches, the Central Electric Company, Chicago, Ill., is marketing a number of different types, embracing both indoor and outdoor forms, and adapted for use on circuits ranging from 300 to 2,000 amperes at pressures of 2,200 to 110,000 volts.

The indoor forms for use on switchboards have the contacts and conducting elements mounted on corrugated porcelain pillars, in turn mounted on marble bases or adapted to be directly mounted on the switchboard panels.

The blades are made of the highest conductivity copper, accurately machined and fitted into the contact clips, which are provided with suitable connection lugs.

When desired, the switches are provided with automatic safety locking devices, which not only secures the contact blade in a closed position, but also holds it in a predetermined open position, thus preventing accidental closing.

These switches are made in both front and back-connected types, or in a combination of the above, in some cases several switches being mounted on the same panel, and conveniently arranged to be used as busbar transfer switches.

All the various types are intended to be operated by means of insulated hook handles, as has become common practice.

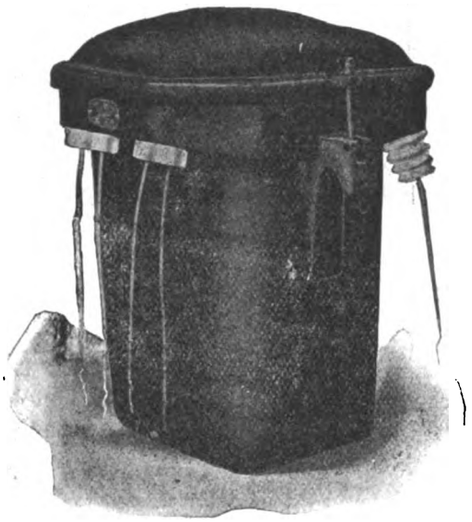
The High-Voltage Pittsburgh Transformer.

Companies operating high-voltage transmissions frequently meet with demands for power at various points along their lines. Usually the consumer requires only a small amount of power, but if his field is systematically developed it will be found that a considerable revenue may be derived from such consumers. A matter of utmost importance in this work is choice of a transformer which will operate with safety to the consumer and which is free from expense and trouble on account of the high line potential.

The illustration shows the new Pittsburgh transformer for supplying consumers directly from high-potential lines. The features of this new transformer are its substantial mechanical construction and its high insulation. The importance of insulation strength will be realized when it is considered that a breakdown in a transformer of this kind is much more costly to remedy than a similar failure with 1,100 or 2,200-volt distributing transformers, and the property or safety of the consumer is subject to greater risks.

These transformers are made in the Pittsburgh standard core-type design, which is the most reliable construction for this work. The cases are cast-iron, and are provided with hangers for cross-arm suspension. The high-tension leads issue through very large porcelain bushings which are set in the case at an angle of thirty degrees away from the casing. These bushings are deeply fluted to secure large leakage surface, and the hole through which the lead passes is enlarged at the lower end to produce a dry-petticoat effect. The bushing projects well above the cement within the case, thus providing dry glazed porcelain insulation, which prevents leakage through the cement. This substantial bushing construction at once does away with the usual lead troubles of small transformers for this class of service.

The insulation of these transformers has been most carefully developed. Pittsburgh coils being of the core-type construction, present only smoothly curved surfaces for the application of insulating materials—that is to say, that insulating material being wound on surfaces which are practically cylindrical, is not injured in the process of winding, and is therefore used in its full effective strength. The absence of sharp corners or edges greatly simplifies the insulation of Pittsburgh transformers. Between the high-voltage primary and low-voltage secondary is a heavy shield of built-up mica



HIGH-VOLTAGE PITTSBURGH TRANSFORMER.

reinforced with specially treated material, the breakdown strength of which is in excess of the A. I. E. E. specifications. This shield extends beyond the high-tension winding at each end of the coil.

These transformers are designed to secure high operating efficiency, combined with substantial construction and perfect insulation. The windings are thoroughly ventilated by means of oil passages between the core and the windings and between the various sections of the windings themselves, so that the windings are constantly cooled with currents of flowing oil. This results in a small temperature rise and also maintains the windings at a uniform temperature. Uniform transformer temperature rise is very important on account of the fact that unequal heating produces uneven expansions and contractions, which in time destroy the insulation, and lead to burn-out.

These transformers are manufactured by the Pittsburgh Transformer Company, Pittsburgh, Pa.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, July 10.—Probably the most famous Local Government Board inquiry into a loan for electrical purposes has just concluded at West Ham, a district just over the London border, and one which has, during the past three years, attracted a very large number of factories by the cheap rates at which electric power has been offered and supplied. At West Ham, the Electricity Committee has entered into a number of contracts to supply electric power for long terms of years, at prices down as low as one-third of a penny per unit, and this has formed a peg upon which a great deal of opposition to an application for sanction to borrow further capital to meet extensions has been hung. The West Ham electrical engineer has worked upon the principle that in arranging tariffs for large power supplies, the whole of the capital expenditure upon the original plant in the electricity works should not be taken into account, but only that upon the newer plant which most large works here have put in during the past two or three years to meet this new class of demand. Obviously, the capital charges per kilowatt upon this plant are very low compared with the original plant, and in this way very low charges can be offered.

A 200-volt, sixteen-candlepower metal-filament lamp has made its appearance upon the market here. At present there is considerable difference of opinion on the part of supply station engineers as to whether the public is really being educated up to using larger units of light, experience on this point seeming to differ in different towns. There is quite a strong body of feeling that consumers prefer to maintain their illumination at the old standard and to reduce their bills by the use of metal-filament lamps, rather than to improve the standard of illumination for the same money.

The Salford corporation has followed the Manchester corporation and installed an exceptionally large storage battery in order to assist the "peaks." An order has just been placed for such a battery running into some $40,000.

As a result of the recent daily newspaper campaign against the use of surface-contact tramways in London, the owners of the G. B. surface-contact system have served writs upon three newspapers for alleged libel. An action for breach of contract is also to be expected as against the London County Council.

It is a curious fact that the only two aluminum companies which Great Britain possesses are in a very bad financial position, and applications for compulsory winding-up orders have been made in respect of both. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, JULY 10.—A new company has been formed by the consolidation of the wireless departments of the well-known Carpentier and Gaiffe firms of Paris, with W. O. Rochefort acting as chief engineer. Besides many naval posts which the new company has installed for the government, we may mention that it is about to equip a wireless post in Brazil for the government, which will rank among the largest in South America. It is to be located on the island of Fernando Noronha, and is expected to have a range of 1,000 marine miles, at least. At night, it may be able to signal across the Atlantic to the African posts. The new plant will have four 230-foot iron towers, placed at the corners of a 530-foot square, with the station building in the middle, and the power used will be about sixty horsepower. A large storage battery will be used in connection with the generating group.

I note the following French projects: At Vire, the municipality is arranging with one of the leading companies for the electric lighting of the town. It is expected that the Energie Electrique Company will secure the rights for electric light and power in various communes in the region of Grasse. At Montelimar, the Municipal Council is to grant the rights for electric lighting. A gas and electric system is being considered in the town of St. Etienne, and it was decided to give the concession to the French Edison Company. The localities of Granville, Dinard and Longueville are considering electric-lighting projects.

Prof. Mercadier is now able to operate his vibratory system of multiplex telegraphy upon a single wire, and has been making some very satisfactory tests between Lyons and Paris. Heretofore he was obliged to use a double line, so that he secures a great advantage in being able to work with a single wire.

The Swedish firm known as "Stora Kappelbergs" is making experiments in electric steel manufacture on a large scale, using the new Grönwall method, which has been lately patented. They are now running a 750-horsepower furnace on this principle, having ten tons' capacity.

In the Tyrol there is a new electric railroad line in operation in the neighborhood of Mendel. The first section of the road uses trains made up of motor cars and trailers, while the second section is on a steep grade and runs up to the elevated point of Mendel, so that a cable incline operated by electric motor drive is employed here, with special cars. The change from one system to the other is made at the midway point. On the first section there is used a 200-horsepower motor car carrying two motors, working on a 500-volt overhead trolley system. A. DE C.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

MEXICAN POWER PROJECT—A Mexican syndicate, it is announced, is planning to divert the Santiago River for a drop of 1,800 feet, thereby developing 90,000 horsepower, to be used to supply cities and mining camps in Aguascalientes and Zacatecas.

CHATTANOOGA RAILWAYS AND CHATTANOOGA ELECTRIC MERGER—By a deal just consummated, the Chattanooga Railways Company and the Chattanooga Electric Company have been merged into a single corporation, under the management of W. E. Boilleau, formerly manager of the Chattanooga Electric Company. Extensive improvements, entailing the expenditure of several hundred thousand dollars, are contemplated by the combined companies.

POWER DEVELOPMENT IN OREGON.—A mortgage for $15,000,000, given by the Wasco County Electric and Water Power Company to the Carnegie Trust Company of New York, to secure a bond issue to that amount, has been filed here. By the terms of the instrument, the power company is authorized to sell, for a period of 200 years, to the Portland, Bake City & Butte Railroad Company, one-half of all the power produced, the minimum amount of which is to be 60,000 horsepower. The first work undertaken as a result of the financing of the power company will be the erection of a 12,000-horsepower steam auxiliary plant on the Willamette River at Portland, and the building of 117 miles of railroad from Portland to the proposed site of the 60,000-horsepower hydroelectric plant on the Deschutes River. Work is to begin on both of these pieces of work on August 1. When the road and the auxiliary plant are completed work will begin on the hydroelectric plant. The main office of the Wasco County Electric and Water Power Company is at Condon. The company has a capitalization of $3,000,000, while the Portland, Baker City & Butte Railroad Company is incorporated for $2,000,000. A.

UNITED STATES LIGHTING AND HEATING COMPANY—The United States Lighting and Heating Company, capitalized in the state of Maine for $17,500,000, will, it is semi-officially reported, build its mammoth plant at Niagara Falls. The company is now negotiating for the necessary amount of power and for a site upon which to erect its plant. It is said that as soon as the contract for power is closed and the title of the land upon which the plant will be erected is transferred, ground will be broken. The power contract involves a delivery to the company of 1,000 horsepower at once, this amount to be increased to 3,000 horsepower when the plant reaches its full capacity. The United States Light and Heating Company contains in its directorate Edwin Hawley, chairman of the board of directors of the Chesapeake & Ohio Railroad; Newman Erb, of the Wisconsin Central; W. H. Silvertown, president of the Railway Steel Spring Company; J. E. French, chairman of the board of directors of the Railway Steel Spring Company; Mr. Starbuck, president of the New York Air Brake Company; Mr. Crandall, of New York, of Crandall Brothers, bankers and brokers, and Theodore Shonts, president of the Metropolitan Traction Company. The company has recently acquired the systems of the Moskowitz Lighting Company, of New York, and the Bliss Electric Car Lighting Company, of Milwaukee, Wis. The purpose of the company is to manufacture storage batteries and a system of electric lighting for installation on railroad trains. J. A. Smith, of New York, has been conducting the negotiations in behalf of the $17,500,000 concern, and these have reached a point so near to consummation that the above statements are authorized.

LIGHTING AND POWER.

(Special Correspondence.)

ALBANY, N. Y.—The New York Public Service Commission, Second District, has authorized the Buffalo General Electric Company to issue $242,000 first refunding five per cent gold bonds, for

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extensions and improvements. The bonds must be sold at not less than ninety-seven.

PRESCOTT, WIS.—A twenty-five-year franchise has been granted to the Prescott Light and Power Company. C.

LEAVENWORTH, KAN.—It is reported that the Great Northern Railway Company will build another power plant here.

MILBANK, S. D.—Oscar Clausen, of St. Paul, Minn., has been granted a franchise to install and operate an electric-light plant. C.

SEATTLE, WASH.—The City Council has passed a bill appropriating $100,000 for building a new power dam at Cedar River. A.

LOS ANGELES, CAL.—The Board of Public Works will receive bids here until July 30 next for three 100-horsepower induction motors. A.

TALENT, ORE.—The Jackson County Light and Power Company has been incorporated for $10,000; A. W. Silsby and others, incorporators.

ESCONDIDO, CAL.—A $30,000 electric-lighting and power plant is to be built here. Crude oil is to be the fuel for the steam-generating plant.

COLUMBIA, S. C.—The Twin City Power Company has received authority from the Secretary of State to increase its capital stock from $1,000,000 to $3,000,000.

GEORGETOWN, CAL.—William Ross has filed a notice of appropriation of 2,500 inches of water from the Cosumnes River near here for electric power and other purposes. A.

GLENDALE, CAL.—An ordinance providing for the issuing of bonds for $60,000 for the acquisition of an electric-lighting plant has been given first and second readings by the City Council. A.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed in Los Angeles, Cal., for a $30,000,000 gas and electric company, to control all the gas and lighting plants in southern California.

BELLE PLAINE, MINN.—C. A. Arndt, St. Paul, and F. L. and S. J. Rauchwater, South Park, have incorporated the Belle Plaine Electric Light and Power Company, with a capital of $15,000. C.

RED BLUFF, CAL.—The Butte & Tehama Power Company has opened offices here preliminary to the beginning of construction on its proposed power plant on Mill Creek. The work will be in charge of Leon Bly. A.

BENSON, ARIZ.—The Benson Water Company, through its manager, Frank Treat, has made the announcement that it is the intention of the company to extend its water service and also establish an electric-lighting plant.

STEVENSON, WASH.—W. D. McNary and H. P. McNary, who have extensive interests at Shepherd Hot Springs, are preparing to develop electric power from Wind River for the purpose of lighting the buildings and grounds. A.

THE NIAGARA AND ERIE POWER COMPANY has been incorporated at Buffalo, N. Y., for electric-light, heat and power purposes. Capital stock, $100,000. Incorporators: C. F. Blair, M. J. Binkley, A. F. Tideswell, Buffalo.

ANTIGO, WIS.—Contracts to the amount of $50,000 have been let for improvements to the electric-light plant. A solid brick building, 55x140, will be erected, and an entirely new outfit of boilers and electrical machinery installed. C.

BUFFALO, N. Y.—The Niagara and Erie Power Company has been incorporated to manufacture electricity for light, heat and power, with a capital of $100,000. The incorporators are C. F. Blair, M. J. Binkley and A. F. Tideswell, Buffalo.

SEATTLE, WASH.—The Hanford Irrigation and Power Company will enlarge its power plant in Benton County and will put in new generating machinery to develop power to irrigate 11,000 acres of land just secured from the Northern Pacific Railroad Company. A.

NEVADA CITY, CAL.—A crew of surveyors, under the management of A. D. Foote, president of the Middle River Hydro-Electric Company, began this week preliminary surveys for that company's power plant and transmission system on the Middle Yuba River. A.

SYRACUSE, N. Y.—The Oswego County Light and Power Company has increased its capital stock from $100,000 to $1,000,000, according to a certificate filed by Henry D. Brewster, Ancil D. Brown and Willis H. Michell, of this city. The proportion of stock actually issued is $1,500.

ALBANY, N. Y.—The Syracuse Lighting Company has been authorized by the up-State Public Service Commission to execute a mortgage for $2,500,000 and to issue $143,000 bonds at once, the bonds to be sold at not less than 95. The company asked permission to issue $207,000 bonds, but had remaining unexpended $70,388, applicable to additions and betterments, under the $1,000,000 debenture issue of 1907. This amount will now be used in addition to the $143,000 just authorized.

TRENTON, N. J.—The Union Gas and Electric Company has been incorporated, with a capital of $18,000,000. The object of the company is to operate electric railroads and to build and operate electric and gas plants. The stock is divided into $6,000,000 common and $12,000,000 preferred.

COLUMBIA, S. C.—The secretary of state has granted the Twin City Power Company the right to increase its capital stock from $1,000,000 to $3,000,000. The principal place of business of the company is at Parksville, in Edgefield County. The directors of the company are Thomas J. O'Connor, D. M. Mackaye, G. J. O'Connor, G. R. Coffin and L. F. Dorn.

WALLACE, IDAHO—The Washington Water Power Company, of Spokane, has filed here a $15,000,000 mortgage to the Farmers' Loan and Trust Company of New York. The mortgage is to secure bonds for the construction of an additional power plant at Little Falls, Wash., for extensions to its present systems of power lines and to cover present indebtedness. A.

BUFFALO, N. Y.—A certificate of incorporation has been filed by the Niagara and Erie Power Company. The capital stock is $100,000, and the company will furnish light and power in Erie, Cattaraugus and Chautauqua counties. The directors are Charles F. Blair, M. J. Binkley, A. F. Tideswell, Howard S. Jones, Fred W. Ashford, Warren Tubbs, William K. Lyon and Thomas W. Callahan.

BAKERSFIELD, CAL.—The West Side Electric Company has applied to the Board of Supervisors for an electric transmission franchise covering the West Side oil fields from Sunset to McKitrick. Bids for the franchise will be received up to August 10. The franchise will be for fifty years and the successful bidder must pay to the county two per cent of the gross receipts after the first five years. A.

SANFORD, N. C.—Electric power from the Carolina Power and Light Company's plant, at Buckhorn Falls, has been turned on at Sanford Cotton Mills, and now their 11,000 spindles and 400 looms, which were formerly run by a 450-horsepower engine supplied by steam from four 100-horsepower boilers, are operated by electric motors. This is the second manufacturing plant in this town to use electric power, the Sanford Ice Plant being the first, and others will follow as early as wiring can be done, the power line having been completed only a few weeks ago.

COLUMBIA, S. C.—The negotiations which the Southern Power Company, of Charlotte, N. C., is making to secure a franchise from the Columbia City Council to enter the city and use its streets for lighting and power, have been held up temporarily by the summer holiday of the Council, which will reconvene the first Tuesday in September. Overtures have been made to the Southern Power Company to make its central office at Columbia, and the Chamber of Commerce of this city has appointed a special committee, composed of Gadsden P. Shand, C. Fitzsimmons and State Senator F. H. Weston, to wait upon the company. B.

LINCOLNTON, GA.—Some interest is being shown throughout the Southeast at this time in the proposed development of waterpower on the Savannah River, near this point, at Prices Island. Five years ago the location was investigated, but the matter was almost forgotten when recently, after the War Department had given permission for the starting of the work, the construction of a concrete dam was started, to cost from $3,000,000 to $4,000,000, with a watershed extending back up the river for twenty miles. The corporation in charge is the Twin City Power Company, composed of Northern capital. The power will be transmitted to Augusta, and other points, while the company will operate an electric railroad from the plant to Modoc, S. C. As soon as the first dam is completed it is proposed to build another twenty miles up the river, developing power sufficient to operate thousands of cotton mill spindles and to supply electricity for lights, power, etc., for a radius of 50 to 100 miles around. L.

FALLON, NEV.—The Nevada Hills and the Nevada Wonder mining companies are likely to build jointly at Fallon an electric power plant of sufficient capacity to furnish power not only for the two principal companies, but for the other mines of Fairview and Wonder camps as well. W. H. Webber, of Salt Lake, is manager of the Nevada Hills Company. The Nevada Wonder people, who are Philadelphia capitalists, have been figuring upon building a power plant of their own, with the intention of enlarging mine operations and building a mill, and when they discovered that the Nevada Hills Company owns the only important available water supply in the county, that of Horse Creek, they invited that company to join them in the power plant project. Coming just at the time when the Nevada Hills Company is installing heavier machinery and planning to build a large mill, the proposal was welcome, and there is little doubt but that an arrangement will be entered into which will be greatly to the advantage of both companies and both camps.

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ELECTRIC RAILWAYS.

(Special Correspondence.)

LANSING, MICH.—The Delta Traction Company, of Escanaba, has been incorporated. Capital, $300,000.

ELWOOD, IA.—It is reported that the Clinton, Maquoketa, Cascade, Dubuque interurban will be built this year.

WILLIMANTIC, CONN.—Present indications are that the Willimantic-South Coventry trolley line will be in running order about August 1.

IDAHO FALLS, IDAHO—A street-railway franchise was recently granted here, and work will begin soon on the construction of the line. U.

CRESTON, IA.—It is reported that arrangements have been made for the construction of the Creston, Winterset & Des Moines interurban road to Winterset.

WINSTON-SALEM, N. C.—An interurban trolley line between Winston-Salem and Salisbury is now being promoted by T. H. Vanderford and associates of Salisbury, N. C.

WEBSTER CITY, IA.—The Fort Dodge, Des Moines & Southern interurban will electrify the Crooked Creek Railway and extend its lines through Blairsburg, Dows and Clarion.

BOISE, IDAHO—The Albion Interurban Railway System, Limited, connecting Albion and Burley with an electric railway twenty miles in length, has been incorporated. Capital, $150,000.

AUBURN, CAL.—W. S. Fletcher, of Pasadena, who has $300,000 invested here, has applied for a franchise to build an electric road from Colfax to Bath, sixteen miles. It will cost $250,000.

MINOT, N. D.—H. F. Bartling, of the Illinois Land Company, and others are considering the organization of a stock company to construct an electric line to the Canadian boundary. C.

ST. PAUL, MINN.—The Great Northern Railway Company is now using electric locomotives to haul trains through the Cascade Tunnel, in Washington, which is two-and-a-half miles long. C.

BOONE, IOWA—The Iowa Light and Traction Company has been organized to take over the Reynolds electric properties. The company is having lines surveyed to Ogden and Story City, with a view to building interurbans. C.

SPRINGFIELD, ILL.—The Herrin & Southern Railway Company has been incorporated to construct and operate a railway from Herrin, Ill., to Metropolis, Ill. Capital, $100,000. Incorporators: G. Willard, J. M. Dering, E. A. Howard.

SEATTLE, WASH.—D. C. Conover and E. P. Moran have been granted a franchise for an electric line between Bellevue and Lake Sammanish, construction work to begin at once. Main line to be six miles long, with several branches.

TOLEDO, O.—The Bellefontaine Commercial Club is backing a project to run a new electric line from Bellefontaine, O., to Richwood, by way of West Mansfield and York. In the meantime an automobile line is being operated to advantage over the route. H.

TOLEDO, O.—Application has been made by the Fort Wayne & Toledo Electric for a franchise through the streets of Bryan, O. The road will be about forty miles long and passes through Hicksville and Farmer. It is expected that it will be in operation before July of next year. H.

REXBURG, IDAHO—G. R. Armstrong, division plant superintendent, and N. P. Jones, division commercial superintendent, were in Rexburg recently, and after a conference with Local Manager Upham, decided to make about $20,000 worth of improvements in the local telephone system. U.

BUTTE, MONT.—The board of county commissioners has voted to extend to Manager J. R. Wharton, of the Butte Railway Company, a franchise to build a street car line in the McQueen addition. The new line will connect with the Garden tracks near the Pittsmont smelter, and go in a northerly direction for about a mile.

BOZEMAN, MONT.—At the annual election of the stockholders of the Gallatin Valley Electric Railway Company the following officers were chosen: H. S. Buell, president; George Cox, vice-president; Charles B. Anderson, secretary and general manager; H. S. Buell, George Cox, R. M. Hart, Charles B. Anderson and George P. Dier, board of directors.

TOLEDO, O.—The right-of-way for the extension of the Toledo, Bowling Green & Southern Electric from Findlay to Kenton, O., has been secured through Hardin County, and the line now looks like a certainty. Hancock County will donate the right through its territory, and George B. Kerper, promoter, promises to have cars running inside of fifteen months. H.

GREEN BAY, WIS.—A deal is projected between Geo. B. Caldwell, Geo. H. Taylor and L. E. Meyers, of Chicago, and the Hydro-Electric Company, which is constructing a waterpower on the Peshtigo River, looking to the construction of a line to Two Rivers, by way of Mishicot and Cooperstown; the building of a line north from Two Rivers, connecting Algoma, Kewaunee and Sturgeon Bay, and the possible absorption of the Manitowoc & Northern Traction Company by the Murphy interests, which own the street railway and lighting systems of Green Bay. C.

HARRISBURG, PA.—A special meeting of the stockholders of the Central Pennsylvania Traction Company has passed a resolution authorizing a $2,000,000 loan for the improvement of the company's system and the construction of a new car barn on North Cameron Street. The bonds will be four-and-one-half per cent, and $300,000 worth will be issued at once for use this year.

AUSTIN, TEX.—Articles of incorporation of the Pecos Valley Southern Railway, with a capital of $45,000, have been approved by the attorney-general, and filed with the secretary of state. The incorporators are: J. F. McKenzie, M. L. Swinehart, J. G. Love, F. W. Johnson, W. D. Cowan, B. R. Stine, Will P. Brady, Pecos; E. D. Balcome, Balmorhes; H. Robbins, Saragosa, and C. W. Griffin, Toyahvale.

TACOMA, WASH.—Articles of incorporation have been filed at Olympia, Wash., by George T. Reid, western counsel for the Northern Pacific, of the Connell-Northern Railway Company, with a $50,000 capital. Headquarters will be at Tacoma. It is announced that the object is to build and operate a railway from Connell, in Franklin County, to Adrian, with a branch to Ritzville and Tekoa, Adams County.

GLOBE, ARIZ.—That the Gila Valley Railway Company contemplates the immediate improvement of its line through the city from the passenger depot to the new Miami line, near the old Dominion smelter, was evidenced by the fact that at a recent session of the City Council, representatives of that company made formal application for permission to change not only the grade but the route of the present line.

BANGOR, ME.—The work of surveying the route for the electric road between Camden and Belfast has been started. This is believed to mean that this road will be built, and it is hoped that some of the grading may be done this season. The line will be twenty miles or more in length. The stockholders of the Rockland, Camden & Thomaston Street Railway Company are said to be back of the proposed extension.

MONTGOMERY, ALA.—The Hixon, Sumter and Northwestern Railroad Company, with nominal capital, has been incorporated at Livingston to build a line of road from Hixon, in Sumter County, to the Mississippi line, about forty miles to the northwest The incorporators are: John Alexander, G. G. Hixon, J. M. Hixon and J. F. Hughes. The road will reach a fine line of interests in that section, including both farm lands and timber.

DENVER, COLO.—Articles of incorporation of the San Luis Valley & Southern Railroad Company, with a capitalization of $1,000,000, were filed recently with the secretary of state. The object of the road is to open for agricultural purposes the Great Costilla Grant and develop the Labelle mining district. Franklin E. Brooks, former congressman, is president. A total of $10,000,000 gives an idea of the vastness of the plans of the incorporators.

HARRISBURG, PA.—Governor Stuart has approved a charter application for the Finleyville Southern Railroad, an electric line, to operate fourteen miles of system in Washington County. The capital is $84,000. The directors are: H. B. Hayden, president; J. E. Hayden, and S. C. Wilson, Monongahela; A. E. Hayden, Finleyville; T. Hayden, Castle Shannon; A. Henderson, Venetia; George Englert, Pittsburg, and J. R. Hayden, Muncie, Ind.

PHILADELPHIA, PA.—It is stated that Drexel and Company will exercise their option on August 15 to purchase the remaining $1,250,000 of the $5,000,000 collateral trust five per cent bonds of the Philadelphia Rapid Transit Company, which were authorized last fall. These bonds are due in 1957. The same bankers purchased $2,500,000 of the issue last December, and on May 15 took $1,250,000 more. The disposal of the remainder in August will bring the loan up to the full amount authorized.

SPRINGFIELD, ILL.—Articles of incorporation for the Springfield, Beardstown & Quincy Railway have been filed in the office of Secretary of State Rose. Capital stock, $25,000. The principal office is located at Springfield. Incorporators and first board of directors: Henry H. Colby, of Petersburg; Robert E. Bone, of Petersburg; Charles W. Houghton, of Petersburg; John S. Hurie, of Petersburg; John J. Tolan, of Farmingdale; George L. Harnsberger, of Springfield; William T. Gates, of St. Louis, Mo.

HOUSTON, TEX.—Lon C. Hill, who is promoting the proposed railroad from San Antonio to Brownsville, has stated his plans and the proposition that he will make to San Antonio. Mr. Hill said there were four available routes and that the company would choose the one where the most encouragement was given. He further stated that the roadbed of the proposed line would cost about $13,000 a mile on the average and, with the cost of equipment added, the cost of construction would total about $17,500 per mile. In speaking of the $100,000 bonus offered by San An-

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tonio, he stated that he did not wish an option with that amount, as the sum was too small and the restrictions too great. As he stated the proposition, his offer to the city would call for $250,000, terminal and depot properties and rights of way through the city and Bexar County. Various San Antonio and St. Louis capitalists are interested.

ST. JOSEPH, MO.—It is stated that bonds have been placed in Brussels and London that will realize $8,000,000 for the construction of a line between Kansas City, St. Joseph and Excelsior Springs, including the construction of the bridge across the Missouri River at Kansas City, and the building of the necessary terminals. Construction work is expected to be started within sixty days. Leslie M. Shaw, former secretary of the United States Treasury, is interested in the project and has lately returned from Europe with the company's chief engineer.

GALESBURG, ILL.—Work on the construction of a $2,000,000 electric interurban railway in Missouri, in which Chicago capital is invested, has been started. The line will extend from Hannibal to Kirksville, Mo., 100 miles. Passengers and freight will be carried. The corporation will be known as the Hannibal & Northern Missouri Railroad Company. Capt. F. W. Latimer, Galesburg, Ill., is president; Nathaniel Board, Chicago, vice-president. On the board of directors are William B. Chandler, Chicago; J. Walter Farrar, Kansas City, and Henry Funk, Shelby County, Missouri.

INDIANAPOLIS, IND.—A contract, it is stated, by E. M. Bowman, president of the Indianapolis, Cloverdale & Vincennes Traction Company, was let recently to J. J. Burns & Co. of Chicago for the construction of the road between here and Vincennes. The company is to be financed by the issue of $2,000,000 worth of bonds. Negotiations for the bond issue are in progress at the present time between Louis A. Coleman, attorney for the company, and the Central Trust Company. The road, it is estimated, will cost $18,000 per mile to construct, the contract with Burns & Co., it is stated, being made upon this basis.

INDIANAPOLIS, IND.—Articles of incorporation have been filed in the office of the secretary of state for the Cincinnati, Louisville & Indianapolis Electric Railroad Company, capitalized at $100,000, with the declared intention of constructing an interurban railroad connecting Cincinnati, Louisville and this city, and reaching the following points: Greendale, Lawrenceburg, Aurora, Rising Sun, Patriot, Florence, Markland, Vevay, Lamb, Brooksburg, Kent, Blocher, Madison and Scottsburg. The following persons are named as directors: John C. Hooven, Clinton B. Hooven, Frank B. Shutts, William B. Mayo and Wilbur Hargitt.

MEXICO CITY, MEX.—A modification of the concession for the building of an electric railway from here to Puebla was conceded by the ministry of communications and public works to Andres Lefebre, the concessionist, and work on the road will begin soon. Under the new arrangements the electric line connecting Puebla and Mexico will be completed by September 17, 1913. Failure to have the track laid between the two cities by this date will involve a heavy fine for every additional day of delay. The new stipulations provide for the laying of twenty kilometers before September 17, 1910. For each of the succeeding years the concessionaire must put down not less than ten kilometers.

NEW YORK, N. Y.—After many years of delay, actual construction work has been started on the New York & Port Chester Railroad through the Bronx from One Hundred and Thirtieth Street and Harlem River to Port Chester. It is to be a six-tracked electric line, and will cost in the neighborhood of $21,000,000. It will be operated as a part of the New York, New Haven & Hartford Railroad Company's suburban service, and is one of the important links in the $200,000,000 plan, in which the Pennsylvania, New Haven and Long Island Railroad companies are engaged in Manhattan, Queens and the Bronx. This company began its fight for a franchise in the Board of Aldermen in 1903.

LORAIN, O.—The original plans for the construction of the Oberlin & Lorain Interurban Railway by way of Amherst have been altered, the present plans being to construct the road only as far as Amherst. The engineer who went over the line representing New York capitalists approved the line from Oberlin to North Amherst by way of South Amherst. The money to build the road is promised, subject to certain conditions which the promoters say will be easy to comply with. The annual meeting of the stockholders of the road was held in Lorain last week and the following directors were elected: W. F. Stanley, George J. Chapman, Conneaut; Captain R. Thew, Lorain; R. M. Summers, George C. Westervelt, Elyria, and M. D. Skeels and C. R. Summers, Oberlin.

GRAND JUNCTION, COLO.—Twenty miles of interurban electric lines will be built in the Grand Valley during the next two years as the result of the consolidation effected in Colorado Springs of the Grand Junction Street Railway Company and the Grand Junction Electric, Gas and Manufacturing Company. The holding company is known as the Grand Junction and Grand River Valley Railway Company and was incorporated here two months ago for $2,000,000. The bonds already have been underwritten for $1,225,000 and, it is stated, this money will be spent at once on improvements. The Grand Junction Electric, Gas and Manufacturing Company was taken into the new corporation at a valuation of $500,000 and will be at once enlarged to furnish adequate power both for lighting and operating the interurban system.

MANITOWOC, WIS.—It is said that George Caldwell, George Taylor and L. Meyers of Chicago and A. M. Murphy, W. P. Wagner, R. M. Howard, of Green Bay, and F. H. Josslyn, of Oshkosh, propose to transmit power from the Peshtigo River above Green Bay to Manitowoc and Two Rivers. They are also interested in an interurban project which may lead to the absorption of the Higgins line, the Manitowoc & Northern Traction Company, between here and Two Rivers, and it is also reported that the new deal will probably result in the connection of Manitowoc with Green Bay via Two Rivers, Mishicott and Cooperstown. Another deal reported is the building of an interurban north from Two Rivers to Algoma, Kewaunee and Sturgeon Bay, along the lake shore. If these plans are carried out and the Milwaukee & Northern connects Sheboygan and Manitowoc, as now planned, there will be a continuous interurban line from Sturgeon Bay south to Chicago along the west shore of Lake Michigan. The promoters are now building an immense power plant on High Falls on the Peshtigo River.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

VELASCO, TEX.—The Brazos Telephone Company has been incorporated with a capital stock of $10,000. W.

LYONS, NEB.—The Lyons Independent Telephone Company has been incorporated with a capital stock of $25,000. W.

DES MOINES, IOWA—The Mutual Telephone Company will spend $100,000 in extending and improving its system. C.

VICTORIA, B. C.—The British Columbia Telephone Company will place its wires underground at an approximate cost of $50,000.

CŒUR D'ALENE, IDAHO—The Interstate Telephone Company has begun improvements on its lines, which will cost about $8,000.

OVANDO, MONT.—The National Forest Service is constructing a telephone line, twenty-two miles long, to the Seeley Lake ranger station. C.

NORTHPORT, WASH.—The Farmers' Telephone Company has been organized and will install telephones all through Deep Creek farming section.

HOQUIAM, WASH.—More than $10,000 will be expended rebuilding the entire telephone system of this city by the Pacific States Telephone and Telegraph Company.

KINSTON, N. C.—A franchise, after much debate, has been granted to the Carolina Telephone and Telegraph Company to operate in this town. The term of the franchise is twenty years. L.

SAN LUIS OBISPO, CAL.—A wireless station has been erected here for the purpose of relaying messages between San Francisco and Los Angeles and to report vessels passing up and down the coast.

OAKLAND, CAL.—Proposals are now being received for the construction of a central telephone exchange at Fruitvale, Cal., by the Home Telephone Company of Alameda County. The building will cost about $6,000.

HOPE, IND.—A new company, headed by J. W. Aspy, has purchased the Hope and the Hartsville telephone plants and has arranged for long-distance connections over the Bell and the Independent toll lines. The two systems will be combined and improved. S.

NAPA, CAL.—The Imrie Farmers' Telephone Company has been organized at this place to construct and operate rural telephone lines along certain highways of this county. The directors are W. G. Furber, H. S. Swan, F. N. Zettle, E. H. McMillan and Wm. McKenzie.

DECKER, IND.—The White River Valley Telephone Company has incorporated with a capital stock of $10,000. The company is in the market for material to build and equip a new telephone system in Knox County. Directors, J. F. Breithaupt, D. N. Lane and Richard Ready. S.

TOLEDO, O.—James S. Brailey, of Toledo, this week purchased at mortgage sale the property of the Rome Home Telephone Company, of Rome, N. Y. The price paid was $20,100, and it is said the purchase was made for the stockholders. The company carried a mortgage of $140,000. H.

LOWELL, MASS.—The Cumberland Telephone and Telegraph Company reports gross earnings for the month of May of $524,954, against $503,357; net earnings of $256,397, against $210,567, and surplus, after charges and taxes, of $186,390, against $174,460.

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For five months the gross earnings were $2,643,848, against $2,554,614, and net earnings $1,158,620, against $1,062,615. The surplus, after charges, was $915,441, against $874,980.

OMAHA, NEB.—The first step in the proposed consolidation of the Bell telephone interests in Nebraska, Iowa, Minnesota, North and South Dakota, has been taken by centering the management of these five companies in Casper E. Yost, of the Iowa Telephone Company, with headquarters here. C.

MONMOUTH, ILL.—The Monmouth Central Union Telephone plant has been purchased outright by the Monmouth Telephone Company. For weeks and even months the deal has hung fire and at one time it looked as though the consolidation would fall through, but the project has been finally consummated.

DECKER, IND.—The recently incorporated White River Valley Telephone Company, having purchased the Wabash Home Telephone Company's property, announces that the plant will be remodeled, improved and extended. Considerable new equipment will be installed in the exchange station. D. N. Lane, Richard Ready and J. F. Breithaup, directors. S.

INDIANAPOLIS, IND.—Articles of incorporation have been filed with the secretary of state by the Indiana Telephone Toll Clearing House. The capital stock is $10,000. This company proposes to conduct all the business relating to a system of toll clearances for the independent lines in the state. J. W. Coffey, W. J. Uhl and Theodore Thorward are the directors. S.

SHERIDAN, WYO.—The Sheridan City Council, at its last meeting, granted a franchise to an independent company, and Sheridan and surrounding towns will soon have two telephone systems. It is expected, as a result of the independent company securing this franchise, that a strong rival of the Rocky Mountain Bell Telephone Company, which has had a monopoly in Wyoming, will enter the field.

SIOUX CITY, IOWA—Announcement is made by W. R. Sly, general manager, with headquarters in Sioux City, of the sale to the Nebraska Telephone Company, of Omaha, of the Iowa Clark Auto Company and the Nebraska Clark Auto Company, for $100,000. The properties were turned over to the Omaha Corporation, which is the Bell Telephone Company, July 1, last. The Iowa Clark Auto Company and the Nebraska Clark Auto Company have been in operation about six years. Alfred S. Clark, of Providence, R. I., a wealthy capitalist, was president, and W. R. Sly, of Sioux City, general manager. Originally the companies included about 40 cities and towns equally divided between Iowa and Nebraska. The automatic phones were used at first, but were discarded later for manual service, when toll connections were established with the Bell Company.

PHILADELPHIA, PA.—The National Telephone and Telegraph Company, the charter for which has been applied for at Harrisburg, by C. E. Wilson, general manager, and Clarence L. Harper, a director of the Keystone Telephone Company, and F. R. Shattuck, attorney, has for its object to acquire, construct and operate lines, through the state of Pennsylvania, to connect with other lines running west to form a long-distance telephone system. There are at present 43 independent telephone companies in Pennsylvania that are members of the Eastern Traffic Association, which is an existing organization for independent lines to formulate long-distance rates. Three of the companies, "the Forest Telephone and Telegraph Company," "the Charleroi Telephone Company" and the "Independent Telephone Construction Company," joined the association July 1, 1909. This association also includes in its membership eight companies in West Virginia, seven in New Jersey, one in Delaware, one in Ohio and three in Maryland. The capitalization is set at $100,000,000, and the new company is considered a consolidation of the principal independent telephone companies being formed by representatives of Pennsylvania, West Virginia, Ohio, Indiana and Illinois independent telephone concerns.

NEW PUBLICATIONS.

ANNUAL REPORT OF THE WIRE DEPARTMENT, Boston, Mass.—The 1908-1909 report of James E. Cole, Commissioner of Wires, Boston, Mass., has just come to hand. Mr. Coles shows, with the aid of tabular matter and some excellent illustrations, the progress that has been made in the city of Boston toward putting underground the various complicated overhead systems of wires in selected districts. The report also contains a list of fires and miscellaneous troubles due to electricity, accidents to persons due to electricity, and various other matters pertaining to electrical transmission and the work of the Wire Department.

TELEPHONE COMPETITION, OPPOSITION AND CO-OPERATION.—The Information Department of the American Telephone and Telegraph Company has issued to the stockholders a statement concerning the value of the property of the Bell System, comprising the American Telephone and Telegraph Company and its associated holding and operating companies. This tabulation shows that the value of the property exceeds the capital obligations against it. The Bell System, comprising the thirty Bell associated operating companies, has 3,215,245 stations and 7,800 connected independent companies' lines or systems, with 1,150,000 stations, making a total of 4,365,245 stations. In the local or territorial area of these companies the system has 1,276,000 miles of toll lines, connecting the various exchanges with each other, making comprehensive territorial systems. These territorial systems are connected with each other by 456,000 miles of long-distance lines, forming a universal system. The bulletin also analyzes the companies not connected with the Bell System, taking up in detail the investment and the earning possibilities.

HYDE'S TELEPHONE TROUBLES AND HOW TO FIND THEM—The twenty-fifth anniversasry edition of "Hyde's Telephone Troubles and How to Find Them" has been published by W. H. Hyde & Company, Milwaukee, Wis. This compact little booklet of fifty-six pages contains in condensed and readily located form many valuable suggestions for the "trouble man" on magneto and central-energy telephone systems. The book is illustrated with a large number of diagrams and contains also a valuable manual of construction labor costs. These are arranged in tabular form and give the values in units for estimate work.

A NEW SYSTEM OF ELECTRICAL TRANSMISSION OF PICTURES—An interesting little booklet has been written in German by Dr. Robert Schönhöfer, of 45 Seidengasse, Vienna, Austria, and entitled "Ein Neues System der Elektrischen Fernphotographie." The system makes use of selenium cells at both the transmitting and receiving stations. The connecting circuit may be of the simplest kind and may be grounded. At the transmitting station the picture to be sent is enlarged by means of a projection apparatus and thrown upon a surface containing a multitude of selenium cells. Each of these is connected to a synchronizing apparatus on one side and to ground on the other. The synchronizing apparatus is connected through a battery and the transmitting line to a similar apparatus at the receiving end. From each element of the synchronizer at the receiving station a connection goes to a surface of corresponding selenium cells similarly connected. There is also provided at this end a source of light capable of reflecting the rays from the selenium-cell surface to a photographic apparatus which reproduces the picture. In this manner small elements of the picture are transmitted one at a time and, depending upon the number of these elements, the picture can be reproduced with considerable fidelity. The booklet is concluded with some interesting opinions about the possibilities of transmitting moving pictures by electrical methods.

NEW MANUFACTURING COMPANIES.

JERSEY CITY, N. J.—The Anderson Winding Machine Company has been incorporated to manufacture electrical machinery. The capital is $50,000, and the incorporators are H. Sutcliffe, W. O'Connor and C. E. Fisk, Jersey City, N. J.

BUFFALO, N. Y.—The McKinnon Chain Company has been incorporated to manufacture chain steel, and to engage in electric welding, with a capital of $1,000,000. The incorporators are: L. E. McKinnon, W. A. Notman and R. L. Notman, Buffalo.

BUFFALO, N. Y.—The Bogart Gas Power Engineering Company has been incorporated to manufacture gas engines, gasoline engines, motors, electrical goods, etc., with a capital of $25,000. The incorporators are: S. Ginsburg, J. A. Venable, Buffalo, and B. Ginsburg, Detroit, Mich.

ATLANTIC, IOWA—The Electric Automatic Carrier Company has been incorporated under the laws of South Dakota with a capital of $1,000,000 to exploit a trolley-wire system for rural mail delivery, invented by E. W. Riggs, who is president. J. S. Harkan is secretary, and Charles R. Hunt, treasurer. C.

PERSONAL MENTION.

THEODORE W. RICHARDS, professor of chemistry at Harvard, has been made a doctor of science by the Victoria University of Manchester, Eng.

FRANCIS A. STRATTON has been elected president of the Westchester (N. Y.) Lighting Company. He is also president of the Northern Westchester Lighting Company and the Peekskill Lighting and Railroad Company.

J. BRODIE SMITH, general manager of the Manchester Traction, Light and Power Company, Manchester, N. H., was married to Miss Charlotte D. Stewartson, at his summer home, on Uncanoonuc Mountain, July 14. Both bride and groom are prominent in Manchester business and society circles.

JOHN DALE, president of the Dale Company, New York, N. Y., and Mrs. Dale are spending the summer months in the Alps of Switzerland. Mr. Dale, who was quite ill for several weeks in the early part of the summer, is now greatly improved in health, and expects to return in about six weeks completely recovered.

HUGH M. WILSON, well known in trade journalism by his connection with the *Railway Age*, later consolidated with the *Electric Railway Review* and *Street Railway Journal*, as publisher

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and proprietor, has entered a new field, becoming, on July 3 last, a director and vice-president of the Barney & Smith Car Company, of Dayton, Ohio. Mr. Wilson will enter on his new duties on August 1 next.

M. L. NEWMAN & COMPANY announce the opening of an office for consulting and industrial engineering at 25 Broad Street, New York. M. L. Newman, the senior member, is perhaps best known by his long experience for the Government at the Brooklyn Navy Yard. Alfonse Kaufman recently severed his connection as manager of the Alaska Chemical Company, to become actively engaged with Mr. Newman in consulting and industrial engineering in the above company.

LOUIS WINDMULLER, in the May *Forum*, has presented a logical and stirring analysis of present-day conditions in commerce in an article entitled "Under the Spell of Protectionism." Mr. Windmüller points out the discrepancies in the selling values which obtain here and abroad for products which are manufactured in this country, and indicates the unwisdom of such a policy, attributing to the high protectionist the attitude and the artifice of robbing Peter to profit Paul.

BYRON BRIGGS BRACKETT, A. M., Ph. D., professor of electrical engineering at the Clarkson Memorial School of Technology, Potsdam, N. Y., for the past six years, has been appointed head of the new department of electrical engineering at the South Dakota College, Brookings, S. D. Dr. Brackett is a graduate from the classical course of Syracuse University, and from post-graduate work in applied electricity, physics and mathematics at Johns Hopkins University. He holds both a certificate of proficiency in electrical engineering and a doctor's degree from the latter institution. He has taught electrical engineering in Union College and Rutger's College, as well as Clarkson. He is a member of the Phi Beta Kappa scholarship society, also the Sigma Xi scientific honor society. In addition to membership in several of the national engineering societies, he has been a president of the St. Lawrence County Science Club during the past two years. Dr. Brackett and his family are leaving Potsdam and will spend July and August at the Thousand Islands and central New York. He will take up his new work, as head of the electrical engineering department at the South Dakota College, Brookings in September next.

RAY D. LILLIBRIDGE announces the change of his office location to 100 Broadway and the taking into partnership of William L. Rickard. Mr. Lillibridge started business under his own name at 20 Broad Street, New York, about ten years ago, after having had a general advertising agency experience and later serving as advertising manager for some concerns in the technical line, notably the C. W. Hunt Company. The idea occurred to Mr. Lillibridge of rendering advertising service to several non-competitive concerns on a salary or retainer basis, eliminating entirely commissions from publishers, upon which is based the agency business. Mr. Lillibridge also engaged in preparing and circulating catalogues and other media in a comprehensive way not contemplated by the ordinary agency. This business was successful from the beginning. Coincident with its establishment Mr. Lillibridge secured the accounts of the American Bridge Company, the Electric Storage Battery Company, the Link Belt Engineering Company, and subsequently the Stanley Electric Manufacturing Company, the Otis Elevator Company, Dodge & Day, and the White Sewing Machine Company's automobile department. In 1901 the business was moved to 170 Broadway, where it remained until the first of May of this year, followed by a temporary shift, and then the establishment of the present address. Mr. Rickard was for eighteen years with the Otis Elevator Company, entering the employ of that company as a boy. For a number of years he occupied the position of assistant to Vice-President Mills, in charge of the sales, and later was manager of the Otis Elevator Company's foreign department. His experience and work with the Otis Company eminently qualified him for a business such as technical advertising, and his connection with Mr. Lillibridge has been a peculiarly satisfactory arrangement.

OBITUARY.

LEFFERT L. BUCK, former chief engineer of the Bridge Department of New York City, died suddenly on July 17 at his home in Hastings-on-the-Hudson. He was apparently in the best of health and was preparing to go to his office when he was stricken with apoplexy. He died without regaining consciousness. Mr. Buck's name was connected with several of the greatest bridges in this country, among them the Brooklyn, Manhattan and Williamsburg bridges in New York City, two steel arch bridges at Niagara Falls, the Driving Park Avenue steel arch bridge and the Platt Street bridge over the Genesee River at Rochester, the Columbia River bridge for the Northern Pacific Railroad at Pasco, Wash., and the Verugas bridge in Peru. He retired as chief engineer of the department in New York city in 1902, after a controversy with Bridge Commissioner Gustav Lindenthal over the policy of the department. Mr. Buck was born in Canton, N. Y., in 1837.

ELECTRICAL SECURITIES.

The market is under the influence of the usual July dullness. The public is not in it, and as far as prices are concerned it looks just now as though the bull trend had reached its limit. On the other hand, there are no signs of liquidation on the part of important interests, and therefore it is probable that late in August there will be another upward movement, as all conditions are favorable and the situation is quite sound. The only uncertain points are the tariff and the rather poor reports about the cotton crop.

Electrical securities of all kinds are being floated at this time and are regarded with favor.

DIVIDENDS.

Albany Home Telephone Company; a regular quarterly dividend of one per cent, payable July 20.

American District Telegraph Company of New Jersey; the regular quarterly dividend of one per cent, payable July 22.

American Light and Traction Company; the regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable July 20; the usual quarterly dividend of two per cent, and an extra one per cent on the common stock, payable August 2: also from undivided profits a dividend of one share of common on every ten outstanding, payable on or before September 1 to common stockholders of record July 20.

Columbus Railway Company; the regular quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable August 2 to stock of record July 15.

Commonwealth Edison Company; the regular quarterly dividend of one-and-one-half per cent, payable August 2 to stock of record July 20.

Connecticut Railway and Lighting Company; the regular quarterly dividend of one per cent on the common and one per cent on the preferred stocks, payable August 15.

Edison Electric Illuminating Company of Boston; the regular quarterly dividend of two-and-one-half per cent and one per cent extra, payable August 2 to stock of record July 20. (An extra dividend of one per cent has been declared at this period in the past two fiscal years.)

Electric Bond and Share Company; its initial dividend of two per cent on its common stock, payable to stockholders of record July 14.

Havana Electric Railway Company; regular quarterly dividend of one per cent on the common stock, payable August 14 to stock of record July 24; also, regular quarterly dividend of $1.50 per share on the preferred stock of the company, payable August 14 to stockholders of record at the close of business July 24.

Michigan State Telephone Company; the regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable November 1; also, the regular quarterly dividend of one-and-one-half per cent on the common stock, payable September 1.

NEW YORK.	July 19.	July 12.
Allis-Chalmers common	15	15
Allis-Chalmers preferred	51¾	51⅝
Amalgamated Copper	82¼	81¼
American Tel. & Cable	80*	80*
American Tel. & Tel.	140⅝	140½
Brooklyn Rapid Transit	78¾	78
General Electric	165	163½
Interborough-Metropolitan common	15⅝	11
Interborough-Metropolitan preferred	48½	30⅛
Kings County Electric	130	130
Mackay Companies (Postal Telegraph and Cables) common	79¼	..
Mackay Companies (Postal Telegraph and Cables) preferred	73⅝	..
Manhattan Elevated	145	145
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	124	125
U. S. Steel common	72⅛	68⅞
U. S. Steel preferred	127¼	125⅜
Western Union	72¼	71¾
Westinghouse common	84⅝	84
Westinghouse preferred	..	121

*Last price quoted.

BOSTON.	July 19.	July 12.
American Tel. & Tel.	140⅝	140½
Edison Elec. Illuminating	250	248
General Electric	165	163½
Massachusetts Electric common	12½	13¼
Massachusetts Electric preferred	72⅛	71½
New England Telephone	133	134
Western Tel. & Tel. common	10½	10
Western Tel. & Tel. preferred	86	37

PHILADELPHIA.	July 19.	July 12.
American Railways	45½	44¾
Electric Company of America	12⅝	12⅝
Electric Storage Battery common	53	52
Electric Storage Battery preferred	53	52
Philadelphia Electric	11¾	11¾
Philadelphia Rapid Transit	28½	28¾
Philadelphia Traction	90¾	91
Union Traction	53	53

CHICAGO.	July 19.	July 12.
Chicago Railways, Series 1	112	112
Chicago Railways, Series 2	38¼	41
Chicago Subway	20½	21
Chicago Telephone	133	132
Commonwealth Edison	121	120½
Metropolitan Elevated common	16¾	15
Metropolitan Elevated preferred	48	47
National Carbon common	91¼	91
National Carbon preferred	118	115

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INDUSTRIAL ITEMS.

WICKES BROTHERS, Saginaw, Mich., are distributing their monthly stock list, dated July 15.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., is distributing an interesting folder describing the many points in favor of metal molding.

THE ELECTRIC GOODS MANUFACTURING COMPANY, Boston, Mass., is distributing a unique folder naming twenty points in favor of Hub annunciators.

THE KEYSTONE LUBRICATING COMPANY, Philadelphia, Pa., is distributing a folder describing the advantages of mineral grease over animal grease for lubricating purposes on electric railway motors.

THE ELECTRIC CONTROLLER AND MANUFACTURING COMPANY, Cleveland, O., has issued a folder containing several illustrations of the uses of its lifting magnet, copies of which may be had on request.

GEORGE GARRETSON, San Diego, Cal., who handles the "K. & G." single and two-spindle boring machines for boring holes at any angle in ceiling rafters, etc., has issued some unique literature pertaining to his wares.

THE DIEHL MANUFACTURING COMPANY, Elizabethport, N. J., announces that owing to increased business, its New York office, of which C. C. Remsen is manager, has moved from the previous address at 561 Broadway to 90 Prince street.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing two new bulletins, one descriptive of Siemens Arc Light Carbons, and the other Perkins and Bryant socket material. Both of the bulletins contain a complete list of the latest prices.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., has removed the sales office formerly located at Tucson, Ariz., to 173 San Francisco street, El Paso, Texas, where it will be continued as a branch of the Los Angeles office.

THE CHARLES L. KIEWERT COMPANY, Milwaukee, Wis., American distributor of Siemen's carbons, is publishing a price-list and some descriptive matter concerning Siemen's "A" carbons for direct-current and alternating-current circuits for moving picture arc lamps. Full information will be furnished to those interested upon request.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, Ill., announces that J. C. Murray has been appointed district sales engineer of the states of Illinois, Indiana, Ohio, West Virginia, Kentucky and the southern territory. F. C. King, of the Logansport Home Telephone Company, will continue Mr. Murray's excellent work in Indiana.

THE NATIONAL-ACME MANUFACTURING COMPANY, Cleveland, Ohio, has issued a general catalogue of Acme automatic multiple-spindle screw machines, and Acme semi-automatic screw slotting machines. The printing and illustrations in this handsome publication are unsurpassable, and frequent use is made of "phantom" pictures to show the interior working parts while preserving the main outlines of the machine illustrated.

THE CROCKER-WHEEELER COMPANY, Ampere, N. J., held a directors' meeting the early part of this month at the New York office of the company. The following officers were elected for the ensuing year: President, Dr. Schuyler Skaats Wheeler (re-elected); first vice-president, Gano Dunn; second vice-president, A. L. Doremus; chief engineer, Gano Dunn; secretary, Rodman Gilder; treasurer, W. L. Brownell; assistant treasurer, G. W. Bower.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has just published Bulletin No. 1519, describing type "An," Tomlinson Barometric Condensers. In addition to a complete and instructive description of the operation of these condensers, made clearer, if possible, by sketches, this bulletin gives information regarding pumps, air leaks at stuffing boxes, the remedy, and other sources of trouble which should prove of general interest to those interested in condensers.

THE GENERAL ELECTRIC COMPANY has issued Bulletin No. 4658, describing the Type US-14 Ball-Bearing Trolley Base. The type of double ball bearing used on this base produces an extremely sensitive action which, by eliminating the arcing, pounding, wrenching, etc., inherent in ordinary forms, insures a minimum wear on trolley wheel and overhead construction. A cushioned stop is provided to protect the pole from bending or breaking should the wheel leave the wire. A list of supply parts for this base is also contained in this publication.

THE HOYT ELECTRICAL INSTRUMENT WORKS, Penacook, N. H., has issued an instructive pamphlet describing the Hoyt Triune voltammeter for direct current. This voltammeter combines practically three instruments in one, a ten-volt coil for testing storage batteries and making other voltage measurements, a thirty-ampere coil for testing dry cells, and a one-and-one-half-ampere coil for testing coil units. Instructions for use are given, and a method of testing coils of an automobile ignition system with the engine stopped is diagrammatically illustrated.

THE MILWAUKEE LOCOMOTIVE MANUFACTURING COMPANY, Milwaukee, Wis., has brought out a very handsome trade booklet on gasoline-driven locomotives, publication No. 150. The company describes the locomotives as being made for service in manufacturing plants, mills, lumber yards and camps, mines, plantations, quarries, railroad, electric railway, tunnel and canal construction, general freight and passenger transportation. A general description of the locomotive, with handsome illustrations of the work done, is given, and a compact catalogue of the various types made occupies the latter part of the brochure. A form of questions put for the benefit of intending purchasers is also given.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY. Pittsburg, Pa., has issued a handsomely printed little booklet describing the applications of its line of small motors to office, store and shop services. The numerous illustrations scattered through the pages suggest many time and labor-saving uses for these efficient little power devices. Among these are the motor-driven adding machine, mailing machine, eraser, graphophone, envelope sealer, vacuum cleaner, buffing and polishing wheel, blower, sign-flasher, box-covering machine, hand drill, hack saw, coffee grinder, etc.—applications selected at random from the large number of uses where the electric motor provides the ideal power. The booklet, "Westinghouse Electric Motors for the Office, Store and Shop," will be sent on request.

THE INDUSTRIAL INSTRUMENT COMPANY, Foxboro, Mass., supply data on their instruments in the form of engineering bulletins, each bulletin being devoted to a certain line or class of meters, or to those instruments of different classes that group themselves conveniently for a certain industry. This method shares much of the elasticity of loose-leaf catalogues without involving the trouble of their maintenance. It furthermore eliminates the formidable general catalogue, only a small part of the contents of which is of interest to the average customers. The engineering bulletin treats one type or class of instruments exhaustively, without including irrelevant matter. The varioust bulletins published by this company are 8x11 in size and punched for binding together in substantial covers.

THE UNION SWITCH AND SIGNAL COMPANY, Swissvale, Pa., has issued a catalogue and price list of its Keystone insulated rail joint. This rail joint is so designed and constructed that the track may maintain its surface and alinement, that the joint be of neat appearance, compact and easily applied, that maintenance and renewals be readily accomplished and that current leakage be a minimum. The special feature of the joint is that there is a metal filler under the rail head, which increases the area of insulating material, and receives the shocks from passing trains. The filler and angle bar are of rolled steel. The angle bar section is such that it makes the joint as strong to resist both vertical and horizontal stresses as is the non-insulated joint. The only material used other than steel is insulating fiber, the area of which is such that the pressure per square inch upon it is low, as compared to the pressure between the ordinary angle bar and the rail.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has issued a number of new publications, as follows: Bulletin 4661 contains a description of aluminum arresters for alternating-current circuits, which up to a certain critical voltage allow an exceedingly low current flow, but which, at higher voltages, permit a flow of current which is limited only by the exceedingly low internal resistance of the arrester cell. These arresters have an enormous discharge capacity, and their design and construction enable them not only to discharge large quantities of lightning, but to safely take care of continuous and recurrent discharges lasting for long periods. Bulletin 4662 describes the various types of Thomson recording wattmeters, of various current capacities, for switchboard service. Dimensions and connection drawings of these meters are given. Bulletin 4663 covers lightning arresters for both alternating and direct-current circuits. These arresters, designed upon an elaboration by Prof. Elihu Thomson's fundamental patents, consist of a series of spark gaps shunted by graded resistances but without series resistance. The bulletin gives detailed information with regard to the construction and design of the various types of multi-gap arresters, together with curves, illustrations, dimensions and connections. These cover not only the arresters, but also the auxiliary apparatus, including disconnecting switches, choke coils, horn gaps, etc. Bulletin 4669 describes the various types of Curtis steam turbines for low pressure and mixed pressure, and contains also curves showing tests of an engine in combination with a low-pressure Curtis turbine, and a chart showing the power output and costs. These clearly indicate the increased capacity and economy secured by installing low-pressure turbine sets. All the above bulletins are splendidly illustrated, and the letterpress and general style are unexcelled.

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DATES AHEAD.

Maine Electric Association. Annual convention, Portland, Me., July 29-30.

Society of Automobile Engineers. Annual convention, Chicago, August 5-7.

Michigan Electric Association. Annual convention, Detroit, Mich., August 17-19.

Old-Time Telegraphers' and Historical Association. Annual reunion, Pittsburg, Pa., August 17-19.

Indiana Electric Light Association. Next meeting, French Lick Springs, Ind., August 18 and 19.

Northwest Electric Light and Power Association. Annual convention and joint session with Seattle branch, A. I. E. E., Seattle, September 7-9.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8-10.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 14-16.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) July 6, 1909.

It has been impossible to publish a list of electrical patents issued on Tuesday, July 13, owing to the failure of the delivery of the Official Gazette of the United States Patent Office up to the time of going to press.

926,732. ARC LAMP. Richard Fleming and Cromwell A. B. Halvorson, Jr., Lynn, Mass., assignors to General Electric Company. Filed November 16, 1903. Means are provided for simultaneously reciprocating one electrode and oscillating the other, non-consuming, electrode.

926,754. SOCKET FOR ELECTRIC LAMPS. William G. Lindemann, Milwaukee, Wis. Filed February 20, 1909. A casing has means at its lower ends for supporting the shade holder from its exterior surface and the switch mechanism from its interior surface.

926,792. ELECTRIC ARC LAMP. William S. Weedon, Schenectady, N. Y., assignor to General Electric Company. Filed March 12, 1904. Renewed April 7, 1906. One portion of an electrode is caused to be impinged against one portion of a pivoted block of carbon to turn the latter about its pivot and thereby force another portion of the block into contact with a different portion of the electrode.

926,793. ARC LAMP. William S. Weedon, Schenectady, N. Y., assignor to General Electric Company. Filed June 13, 1904. Renewed April 7, 1906. Means are provided for moving one electrode into line with a stop normally out of alinement with the electrodes, and another means for thereafter allowing it to drop into engagement with the same in a feeding operation of the lamp.

926,818. BLOCK SYSTEM FOR RAILWAYS. George W. Nistle, North Muskegon, Mich., and Edward Inskip and Bernard W. Brady, Chicago, Ill. Filed November 18, 1907. A contact lever operating circuit-controlling devices and pivoted between its ends upon a suitable support is provided with two oppositely inclined track surfaces whereby the lever is oscillated and its position changed twice by a traversing member carried by a train.

926,831. TELEPHONE JACK. Alfred L. Sohm, Whittier, Cal., assignor to National Electric Works, Whittier, Cal. Filed August 4, 1908. The several subscriber jacks may be independently removed.

926,857. TERMINAL FOR ELECTRIC CABLES. Charles W. Davis, Edgeworth, Pa., assignor to Standard Underground Cable Company, Pittsburg, Pa. Filed August 3, 1908. Comprises a thimble for securing to the sheath of a cable a conducting element for connecting the cable conductor to an aerial, a disk carried by the conducting element, and an insulating sleeve interposed between the thimble and disk and adjustably connected to the thimble.

926,874. MOTOR-CONTROLLING DEVICE. Leopold Janisch, Berlin, Germany, assignor to General Electric Company. Filed October 10, 1907. An electromagnetic switch to throw a resistance in the motor circuits in and out of circuit to vary the motor speed is closed by the initial movement of the motor-controlling mechanism and opened when the motor reaches a predetermined speed.

926,884. AUTOMATIC CARRIER. Sam H. Libby, East Orange, N. J., assignor to Sprague Electric Company. Filed August 7, 1905. An automatic electrically-driven carrier comprises a hoisting motor and a traversing motor, with a control switch for the former and a reversing switch for the latter, both switches being controlled by a height-limit device.

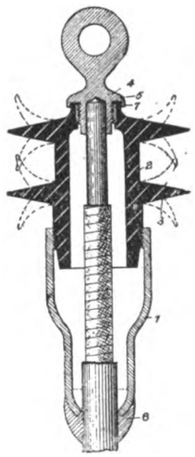
926,890. ELECTRIC LOCK. Thomas C. Nixon, Chicago, Ill. Filed February 19, 1908. The armature of an electromagnet is arranged to resist movement of the bolt except when the magnet is energized.

926,900. TRANSMITTING APPARATUS. Harry Shoemaker, Jersey City, N. J. Filed December 10, 1908. In combination with a source of energy are a number of pairs of differentially related inductances associated therewith, and a transmitter for controlling an inductance of a pair, whereby the combined inductance of that pair is greatly reduced and the consequent increased current greatly reduces the combined inductance of another pair.

926,906. DISTRIBUTING INSULATOR BRACKET. Albert L. Stadermann, Terre Haute, Ind. Filed June 26, 1907. The insulators are supported by a U-shaped member adapted for securing to a pole.

926,933. WIRELESS TELEGRAPHY. Lee de Forest, New York, N. Y., assignor to De Forest Radio Telephone Company. Filed March 22, 1905. A spark-gap device for wireless-telegraph transmitting apparatus includes a vacuum tube having a condensing chamber at one end and containing a liquid electrode at its other end, and having also between its ends laterally offset depending pockets, each containing a liquid electrode with a circuit terminal extending into it.

926,934. WIRELESS-TELEGRAPH TUNING DEVICE. Lee de Forest, New York, N. Y., assignor to De Forest Radio Telephone Company. Filed January 20, 1906. A spiral of metallic ribbon has a contact operating transversely across it whereby its capacity and inductance may be varied in a continuous manner.



926,857.—TERMINAL FOR ELECTRIC CABLES.

926,935. WIRELESS-TELEGRAPH TRANSMITTER. Lee de Forest, New York, N. Y., assignor to De Forest Radio Telephone Company. Filed February 2, 1906. A double-walled ventilated muffler encloses the spark electrodes, which are electrically connected to a helix mounted on the muffler.

926,936. SPACE TELEGRAPHY. Lee de Forest, New York, N. Y., assignor to De Forest Radio Telephone Company. Filed June 20, 1907. A system of space telegraphy comprises a circuit capable of developing a practically continuous train of high-frequency electrical oscillations, a radiating conductor associated therewith, an oscillation circuit capable of developing intermittent trains of electric oscillations of much lower frequency and associated with the other circuit, and a controllable source of vibratory electromotive force associated with the oscillation circuit.

926,937. SPACE TELEPHONY. Lee de Forest, New York, N. Y., assignor to De Forest Radio Telephone Company. Filed June 25, 1907. Each of a number of oscillation circuits has a transmitting device. Means common to all of the transmitting devices are provided for controlling the same, also means for converting the energy of the oscillation circuits into electroradiant energy.

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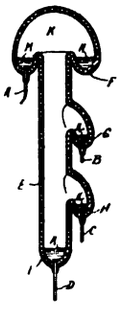
926,950. AUTOMATIC RINGING CIRCUIT AND APPARATUS FOR TELEPHONE EXCHANGES. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Filed February 1, 1907. A balanced thermal relay connected on one side to the generator wire controls the ringing relay.

926,951. ELECTRICAL SWITCH. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company. Filed February 28, 1907. Describes a form of hook-switch for effecting circuit changes in a telephone set.

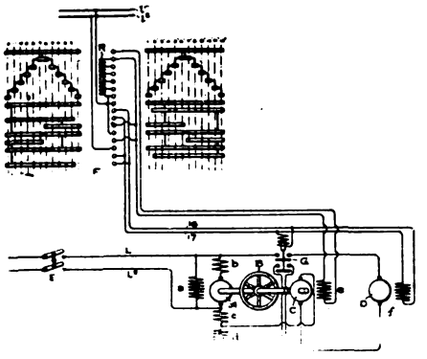
926,956. ILLUMINATING DEVICE. William N. McComb, New York, N. Y. Filed March 25, 1908. A multi-colored electric display device has a number of groups of compartments, those belonging to the same group showing a unitary design of the same color when lighted.

926,962. THERMAL CUT-OUT. Frank D. Reynolds and Joseph Sachs, Hartford, Conn., assignors to the Sachs Company, Hartford, Conn. Filed January 7, 1908. Renewed December 12, 1908. The fuse strip has angularly disposed, radially projecting and longitudinally extending flanges.

926,976. SPARK INDICATOR. Frank W. Brandow, Pittsfield, Mass., assignor to Jacobson-Brandow Company, Pittsfield, Mass. Filed August 5, 1907. An adjustable electrode mounted on an insulation base comprises an upwardly extending support on which is a sleeve or casing, and a movable stem member projected through the sleeve is provided at one end with a contact point and at the other end with means for manipulating the stem member.



926,933.—WIRELESS TELEGRAPHY.



927,178.—MOTOR-CONTROL SYSTEM.

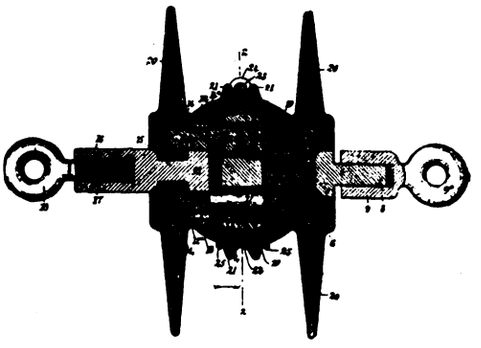
927,111. ELECTRIC PROTECTION SYSTEM. Charles U. Carpenter, New York, N. Y. Filed November 23, 1908. Describes an electric protective system for a number of structures distantly removed from one another.

927,129. SIGNAL DEVICE. Frank S. Dombrowski, Chicago, Ill. Filed June 16, 1908. The upward movement of a float beyond a predetermined distance closes a circuit including an electric alarm.

927,142. ROTARY CONVERTER FOR DIRECT CURRENTS. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. Filed March 28, 1908. Sets of field coils in the different field circuits are displaced circumferentially from each other, whereby a relative variation of current in the circuits shifts the field magnetization circumferentially with respect to the field magnets and the brushes so as to vary the relative amounts of voltages induced in the armature between the two sets of brushes.

927,173. ELECTRIC HEATER. Karl Schlüter, Kiel-Gaarden, Germany, assignor to Fried. Krupp Aktiengesellschaft Germaniawerft, Kiel-Gaarden, Germany. Filed May 20, 1908. Tubular resistance members of nickel open at both ends are suspended from a top plate with the open ends of the tubes adjacent to the intake and outlet respectively.

927,178. MOTOR-CONTROL SYSTEM. John A. Seede, Schenectady, N. Y., assignor to General Electric Company. Filed May 28, 1908. Comprises a source of direct current supplying the motor of a flywheel motor-generator set, an auxiliary field winding on the motor connected across the terminals of the generator, a second motor supplied by the source and generator in series, and means for varying the potential of the generator so as to oppose the potential of the source when the second motor is starting and to assist the potential of the source when the second motor is running at high speed.



927,186.—HIGH-POTENTIAL STRAIN INSULATOR.

926,994. TELEPHONE-CONNECTING APPARATUS. Edward C. Molina, Arlington, Mass., assignor to American Telephone and Telegraph Company. Filed June 19, 1907. A telephone-switching mechanism has transmission-line terminals, two groups of testing-line terminals with independent movable members contacting respectively with them, substation lines having third conductors connected to one group of test terminals, and groups of trunks with the third conductors connected to the other group of test terminals.

927,010. ELECTRIC ARC LAMP. Thomas Spencer, Philadelphia, Pa. Filed April 3, 1907. Bearings engaging the angularly disposed rods are provided with means for free oscillatory movement.

927,014. CONTROLLING DEVICE FOR VEHICLES. Richard Werkner, Budapest, Austria-Hungary. Filed January 14, 1908. Describes a method of control for a gasoline-electric vehicle.

927,018. ELECTRIC SIGN. Francis D. Ammen, New York, N. Y. Filed February 8, 1908. Describes a method of successively lighting and extinguishing the units of a series of lights to produce certain effects.

927,025. CALL-DISTRIBUTING TELEPHONE-EXCHANGE SYSTEM. Sidney H. Browne, Pittsburg, Pa., assignor to American Telephone and Telegraph Company. Filed February 11, 1905. Renewed October 25, 1907. A locking testing relay controls the energizing of a cut-off relay so that the former is de-energized by the de-energizing of a line relay.

927,027. ELECTRIC WATER HEATER. Harry W. Denhard, San Francisco, Cal., assignor to George B. Katzenstein, Jr., San Francisco, Cal. Filed June 25, 1908. The heating chamber has a discharge opening and a feed tube extending into the chamber with means of deflecting the rising current from the descending current and thus providing for proper circulation.

927,045. COMBINED INSULATOR AND LIGHTNING ARRESTER. William F. Hiatt, Danville, Ind., assignor of one-half to Melville E. McHaffie, Greencastle, Ind. Filed August 24, 1908. The outer cylinder has a core of insulating material constructed of two separable sections, one of which has an irregular groove therein and the other a projection on it adapted to enter the groove and hold the wire therein.

927,185. TUBULAR INSULATOR. Louis Steinberger, New York, N. Y. Filed June 4, 1906. A tube of insulating material comprises a number of cylindrical members disposed concentrically and connected together by spacing partitions.

927,186. HIGH-POTENTIAL STRAIN INSULATOR. Louis Steinberger, New York, N. Y. Filed July 30, 1906. Comprises a disk provided with holes of tapering diameter, sleeves of insulating material fitted into the holes, bolts of tapering diameter fitted into the sleeves and extending through the disk, mechanism connected with the bolts for exerting upon them a mechanical strain, and means for connecting the disk to a tension member.

927,187. INSULATOR. Louis Steinberger, New York, N. Y. Filed September 16, 1907. Comprises a number of disks of insulating material provided with holes, headed tension members provided with prongs for extending through the holes, and fastening members for engaging the prongs.

927,191. ELECTRIC MEASURING INSTRUMENT. Elihu Thomson, Swampscott, Mass., assignor to General Electric Company. Filed November 13, 1907. Has means for producing a magnetic field of uniform density, and a triangular current-carrying coil mounted for bodily edgewise movement in the field along the line from the apex to the base of the triangle.

927,209. ARMATURE FOR ELECTRIC MACHINES. Walter J. Bauroth, Columbus, Ohio, assignor, by mesne assignments, to the Jeffrey Manufacturing Company. Filed August 23, 1906. Describes a form of laminated armature.

927,218 and 927,219. JUNCTION BOX FOR ELECTRICAL CONDUCTORS. James F. Burns, Philadelphia, Pa. Filed September 30, 1908. A spring clip retains the insulating bushing.

927,230. DICTOGRAPH. William F. H. Germer, New York, N. Y., assignor to General Acoustic Company. Filed July 31, 1908. A key normally opens one wire in each three-wire

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circuit extending from a stenographer's station to each of the managers' stations, and is adapted to open another wire of each three-wire circuits to non-communicating managers' stations when talking circuits are established to any particular manager's station.

927,255. SPARKING PLUG FOR HYDROCARBON MOTORS. Abbot A. Low, Horseshoe, N. Y. Filed February 20, 1909. The threaded lower portion of the spark plug screws into a bushing which is secured in the wall of the combustion chamber.

927,274. DYNAMO-ELECTRIC MACHINE. Laurence A. Pape, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed August 19, 1907. Means are provided for automatically tightening the conductors on the rotor during the operation of the machine.

927,314. CURRENT INDICATOR OR DETECTOR. Clifford D. Babcock, New York, N. Y. Filed August 15, 1908. A Hertzian wave detector depends for its action on the property of a chemical salt which changes its conductivity as its temperature arises until a critical temperature is reached, and then increases its conductivity at a different rate for further changes of temperature.

927,318. DYNAMO-ELECTRIC MACHINE. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed May 17, 1906. The laminated core has circumferential ventilating passageways and the rotary field member comprises a rim (with field poles secured to it) having fan blades on one side, and a shield directs the air from the fan blades outward along one side of the core and across the outer periphery of the latter in one direction to the other side of the coil.

927,321. INSULATOR. John T. Bond, Palatka, Fla. Filed March 13, 1908. Has a number of longitudinal, spaced grooves intersecting an annular groove.

927,344. ADJUSTABLE CASING FOR LAMP SOCKETS. Edgar H. Freeman, Trenton, N. J. Filed July 15, 1908. Has a number of positioning slots opening through one end, and a single locking hole.

927,346. SPARKING MECHANISM FOR EXPLOSIVE ENGINES. Gustavo Germani, Pittsburg, Pa., assignor of one-half to Raffaele Zangrilli, Pittsburg, Pa. Filed September 8, 1908. Means for starting an explosive motor consist of a generator, means embodying cam-grip mechanism for positively coupling the generator with the motor and for automatically uncoupling therefrom, independent actuating mechanism, and separate means embodying cam-grip mechanism for positively coupling the generator with the independent actuating mechanism, and for automatically uncoupling therefrom.

927,347. TELEGRAPHIC INSTRUMENT. John J. Ghegan, Newark, N. J., assignor to J. H. Bunnell & Company, New York, N. Y. Filed August 25, 1908. Comprises a baseboard with three binding posts, a transmitting key, a switch lever and a key frame having three insulated points to which the three binding posts are respectively connected, one being the contact for the key, another being the switch lever and the third a contact piece for the switch lever.

927,373. SPRING HINGE FOR ELECTRICAL AND OTHER DEVICES. Lembert H. Moulthrop, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company. Filed July 31, 1908. The faceplate of an electrical plug receptacle is provided with an opening with a door for closing the opening and provided with a hinge consisting on one side of a plain pin and on the other side of a spiral spring, secured at one end to the door and at the other to the plate.

927,375. ELECTRIC ISOLATION SYSTEM. Nathaniel C. McClure, Healdsburg, Cal. Filed October 18, 1907. The electromagnet of each subscriber's instrument is placed in the radial line of a deflectable arm carrying an oscillating coil, but in a different angular relation to every other subscriber and in a homologous relation to the indicator markings at the central office corresponding to that of the said subscriber.

927,377. SIGNALING SYSTEM. James G. Nolen, Chicago, Ill., assignor to John E. Shepherd, Chicago, Ill. Filed October 4, 1905. Engagement of an actuating spring with code teeth (provided at each station) causes a break in the line at each side of the spring.

927,384. CONNECTION BLOCK FOR ELECTRIC SERVICE CIRCUITS. Joseph G. Swallow and Walter E. McCoy, New York, N. Y., assignors of one-third to Frank W. Smith, New York, N. Y. Filed October 12, 1907. Binding posts are provided for service and circuit wires and also for wires to a meter or other electric appliance, and a series of intermediate receptacles for attachment of fuse plugs are provided for certain connections.

927,395. TELEPHONE TRANSMITTER. Charles Adams-Randall, New York, N. Y. Filed April 16, 1907. The diaphragm or other vibrating medium carries or supports a confined variable resistance of uniform depth, a low-resistance and large-conducting capacity is held in a confined mass under pressure in direct contact therewith, a co-operating electrode is in adjustable electrical contact with the variable resistance, and a source of current supply has connections with the variable resistance conductor and the co-operating electrode.

927,397. SINGLE-PHASE MOTOR CONTROL. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed January 4, 1908. The motor is started with the armature short-circuited, a voltage is then impressed on the exciting winding and a resistance in series, after which the armature short-circuit is opened so as to include the armature in circuit with the exciting winding, whereupon the resistance is cut out.

927,398. ALTERNATING-CURRENT MOTOR. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed April 7, 1908. Has inducing and exciting windings on the stator, and an armature provided with a commutator, and brushes and connections short-circuiting the armature on the line of magnetization of the inducing winding through the central portion of the inducing winding.

927,399. ALTERNATING-CURRENT MOTOR CONTROL. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed June 1, 1908. Manually operated controlling means are arranged to short-circuit the motor armature at starting and to open the short-circuit for operation at high speeds, and an automatic controlling switch has an actuating winding connected in shunt to a field winding of the motor.

927,404. BLOCK-SIGNAL SYSTEM. Albert G. Davis, Schenectady, N. Y., assignor to General Electric Company. Filed March 28, 1906. Describes the details of an electric block-signal system.

927,413. INDUCTION COIL. Albert K. Keller, Lafayette, Ind., assignor to Sterling Electric Company, Lafayette, Ind. Original application filed September 9, 1907. Divided and this application filed August 3, 1908. An induction coil for telephone-desk sets comprises a core and windings thereon, a terminal head projecting above the coil and the windings, and instrument terminal secured to the head and forming one element of a spring-jack switch.

927,414. TELEPHONE SYSTEM. John M. Latimer, Flushing, N. Y., assignor to Consolidated Fire Alarm Company, New York, N. Y. Original application filed April 21, 1900. Divided and this application filed September 14, 1908. Repeating coils are connected to both leads of the telephone subscribers' circuit at the telephone exchange, so that they will be responsive to currents which flow through the telephone subscribers' leads in parallel and not to the telephone subscribers' signaling and talking current.

927,426. MOTOR-CONTROL SYSTEM. Wilhelm Naumann, Berlin, Germany, assignor to General Electric Company. Filed March 3, 1908. Means are provided for closing and opening a control circuit to a line switch for a motor rotating a hopper.

927,428. THIRD-RAIL-CONDUIT SYSTEM. Philip M. Reynolds, San Francisco, Cal. Filed November 30, 1908. A conduit for electric railways comprises a housing for the electric conductor or conductors, having a number of sections, and a conductor extending longitudinally of the housing and embedded therein and providing a continuous electrical connection.

927,433. TRANSMITTING APPARATUS. Harry Shoemaker, Jersey City, N. J. Filed July 22, 1908. A transmitter of electroradiant energy comprises oscillation-producing means connected with a source of energy, a number of pairs of differentially related inductances associated with the energy source, and a key for cutting in and out an inductance of each pair.

927,455. ELECTRICAL SELECTOR. Ernest A. Faller, New York, N. Y., assignor to the North Electric Company, Cleveland, Ohio. Filed April 8, 1904. A progressive contact maker comprises contact points divided into groups or sets, a normally rotating trailer arm adapted to make contact with multiple contact points of one group at one time, means for interrupting the rotation of the trailer arm, and means for controlling the interrupting means.

927,465. CONTROL APPARATUS. George H. Hill, Schenectady, N. Y., assignor to General Electric Company. Continuation of application filed August 13, 1906. This application filed April 18, 1908. A movable contact member is biased to the "off" position and is controlled by electromagnets.

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CONTENTS.

EDITORIAL:
The National Electrical Contractors' Association 187
A Power Load 188
The Abuse of Telephone Privileges 189
National Electrical Contractors' Association's Annual Convention—Complete Report of the Proceedings 190
A Novel Wind-Turbine Exhibit 193
Chart for Calculation of Voltage Losses 194
Tribute to John Chamberlain Fish 195
A Catalogue Classification Association 195
For an All-British Cable 195
The Magnetic-Survey Yacht "Carnegie" 196
To Reduce Cable Rates 197
Southern Pacific Electrification Plans 197
Characteristics of Dry Cells 198
Electricity in the Home 200
May See Lighting Company's Books 200
Low-Pressure Turbines 201
National Telephone and Telegraph Company Incorporated 202
The Copper Market Situation 202
Notable Aeroplane Records 202
To Control United Railways 202
Park Lighting in Oklahoma City 203
Interesting Celebration at the Opening of the McAdoo Tunnel 203
Government Wireless Tests 203
The New Electric Railroad in Switzerland 204
Fuel and Energy Problem of the South 207
Chicago Electric Club 207
Largest Electric Sign in the South 207
Congressman McKinley's Electrical Interests 208
Toronto to Try Electric Pumping on Big Scale 208
Decides Street Cars Are Licensed 208
American Telephone's Wonderful Position 209
Ohio State Electrical Contractors 209
Big Decrease in Freight-Car Surplus 209
Croker to Finance Subway 209
Western Union's Business 209
Wireless Telecontrol 210
Data on Direct-Current Motors 210
British Telephone Rates 210
Power Sites Withdrawn 210
Annual Report of the City Electrician of Chicago 211
Railroad Electrification in Canada 211
Western Association of Electrical Inspectors 211
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 212-213
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE 214-215
INDUSTRIAL SECTION:
Intercommunicating Telephones at the American Mills Company's Offices 216
The "Any Angle" Tungsten Lamp 216
Westinghouse Gas Engine for Chemical Works 217
Individual Motor Drive in an Electrotype Establishment 217-220
Another Successful Supplementary Storage Battery for Twenty-Four-Hour Service 220
The New 200 to 250-Volt Tungsten 220
CURRENT ELECTRICAL NEWS 221
LIST OF ELECTRICAL PATENTS 227

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THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.

The ninth annual convention of the National Electrical Contractors' Association, which was held at Toledo, Ohio, July 21, 22 and 23, a full report of which appears on other pages of this issue, was undoubtedly successful from every point of view. The weather, except for the early part of Friday, when an all-day excursion to Sugar Island was held, was perfect, and full advantage was taken of the opportunities for many pleasant invasions into the delightful country surrounding the convention city.

In point of attendance there were not as many contractors present as has been the case on some previous occasions, but there was a more determined effort to get at the basic principles of organization effort under the leadership of President Sanborn. The speakers upon this occasion struck out from the shoulder and indicated in plain terms the shortcomings of all concerned and the opportunity and necessity for mutual helpfulness.

As the representative of the National Electric Light Association and as president of the National Conference on Standard Electrical Rules, no one is better qualified to address a meeting of electrical contractors on the subject of the relation of the contractor, the code and the central-station company than William H. Blood, Jr. Mr. Blood very forcibly indicated the necessity for co-operation between the electrical contractors, central-station companies, and those responsible for the National Electrical Code. Each owed to the other a service. These three interests formed the large links of a chain which could only be held together by smaller links, these links being characterized by what is generally known as "confidence." In the past these links of confidence have been greatly strained, but where there is a mutual understanding of the difficulties under which each of the elements labor the stress is more evenly distributed, and it may be expected that there will be less probability of a rupture in the future than there has been in the past. Concerning the much-mooted question of central-station companies undertaking interior wiring Mr. Blood pointed out the necessity of contractors establishing a reputation for integrity and good workmanship, as the permanent investment of the central-station company depended in large measure in many cases upon the ability of the contractor to do good work at a reasonable price.

Speaking for the architect, George C. Nimmons, of Chi-

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cago, gave a delightful sketch of the conditions of comity which existed among the early Greek architects and contractors. So intense was the personal interest of the early Grecian builders that it is little wonder that their work stands today as a monument of a spirit which appears to have been lost in the hurly-burly of high-speed modern construction. Concerning the present-day scheme of competitive bidding upon specifications, which has persisted from the early days, Mr. Nimmons had some strong words to say and offered some enlightening suggestions. Under the scheme of competitive bidding the owner and the architect were set at odds with the contractor, because by the terms of the contract the latter's profit depends upon minimizing the cost of the work to him by whatever means he can devise and still keep barely within the terms of the contract. It is to the contractor's interest to give as little work and as little and as cheap materials as the terms of the contract will allow. All ambition on the part of the men to strive for skill or excellence in their trade is killed. The accomplishment by the workman which pleases most his employer is speed and the ability to save every unnecessary dollar from going into the cost of the work. Money so saved from going into the building increases the profit to the contractor. Hence the contractor and his workmen naturally strive to keep all the money they can out of the building, while the architect, on the other hand, tries to get the best material and workmanship he can for the good and permanency of the building.

Under competitive bidding the cost of making estimates by the contractors is a considerable amount, which is indirectly added to the cost of every building erected. Recently five representative general contractors in Chicago were asked to give an estimate of the cost to them of making bids on buildings during one year. Each general contractor distributed specifications to six sub-contractors, making the total cost of working up these bids for each building two or three per cent of the total cost of the building. In addition to this it was shown that the average number of jobs bid upon by each contractor was seventy-two, and out of this number ten jobs were secured by each one, so that each contractor averaged one job to every seven on which he figured. Computing the expense of these five contractors, their sub-contractors, and material men for estimating during the year, it was found that it cost over $180,000 merely to estimate the cost of the buildings. On this basis if the cost of new buildings reaches the total of $100,000,000, as it now promises to do in Chicago for the current year, the cost of estimating this work will be from $2,000,000 to $3,000,000. Six-sevenths of this immense sum will be unproductive of any work, consequently a dead loss, which will be charged over against the buildings that are built. By this reason alone competitive bidding adds materially to the cost of each building.

When a contract for an important building is let on a competitive bid basis for a lump sum the owner cuts himself off from any saving there may in the contingency fees included by the various contractors. Another defect of this system is that the contractor least capable of doing the work may get it by reason of his being the lowest bidder. Inexperienced or incapable contractors often value their services very little, and frequently take the work at a small profit.

The changes in the system most needed are the abolition of competitive bidding, the provision of some means by which a contractor can make his profit other than by taking it out of the cost of the building, and the arrangement of all matters connected with a building so as to create and encourage the best co-operation between contractor and architect. There is no reason why a contractor should not receive a share of the confidence placed in the architect, and there is no reason why a contractor should not be selected for his integrity, skill and ability and special fitness for the job in hand just as an architect is selected for each building.

Taking up the matter from the viewpoint of the distributor, or jobber, Fred Bissell, of Toledo, pointed out the necessity for the contractor and the jobber both observing their particular functions and establishing a direct line of cleavage between their natural work. Where one persisted in going into the other's field there would always be friction and never satisfaction. Any attempt to foster one by war upon the other would result in economic disasters, for it had been proved that both were essential. If this were not the case those which were not essential would automatically cease to exist.

With such an excellent foundation the business sessions of the convention were full of ardor and enthusiasm, and based upon the suggestions made by the speakers at the open sessions plans were outlined for greatly increasing the membership and strengthening the position of the organization. The entire administration was re-elected to office for the ensuing year, and it is expected that when the next convention will be held at Atlantic City, N. J., very satisfactory progress will be reported.

A POWER LOAD.

In a recent year, the electric motor load of 1,996 rated horsepower in a small city consumed 1,894,143 kilowatt-hours and paid an income of $46,792.

Of this total motor load, 1,377 horsepower was represented by seven large consumers, and the remaining 619 horsepower was divided between fifty-five consumers. More than one-half of the consumers, or thirty-nine, had a total of not more than ten horsepower in motors each.

Per inhabitant of the city, the motor income of $46,792 amounted to $1.32, and it also amounted to $23.44 per horsepower of motors. The total horsepower of motors was 60.5 per 1,000 of the population.

Annual revenue per horsepower of their motors varied much among the different classes of consumers. The lowest revenue per horsepower for any class was $18.04, and this was earned by the operation of motors of 326 aggregate horsepower owned by nine consumers, whose individual equipments ranged from twenty-six to fifty horsepower each. Seven consumers had mo-

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tor capacities between eleven and twenty-five horsepower each, and these motors to a total of 131 horsepower cost their owners $32.21 per horsepower to operate. Motor equipments of more than fifty horsepower individual capacity, and totaling 1,377 horsepower, brought a revenue of $22.93 per horsepower to the electric system.

The largest income per motor horsepower was $33.14, and this was earned by the supply of thirty-nine consumers that had motor equipments of no more than ten horsepower each.

While these motor groups of not more than ten horsepower each paid the highest rate per horsepower, they consumed on the average only 405 kilowatt-hours per horsepower of capacity during the year, which was less than the energy used by any other class of motor customers. In contrast with this last-named figure, the seven customers that had motor equipments of more than fifty horsepower each used 1,147 kilowatt-hours per horsepower during the year. The motor equipments that varied between eleven and fifty horsepower each had a total of 457 horsepower capacity, and consumed 544 kilowatts per horsepower.

Even greater variations existed in the rates per kilowatt-hour to the several classes of motor users. The highest rate, 8.18 cents per kilowatt-hour, was paid by consumers with motor equipments of not more than ten horsepower capacity each, and the lowest rate, 1.84 cents per kilowatt-hour, applied to motor equipments of more than 100 horsepower each. On the total sales of 1,894,143 kilowatt-hours the average rate of income was 2.47 cents. For all equipments of not more than 100 horsepower the average rate was 3.7 cents per kilowatt-hour.

Most of the output to motors was delivered between 6 a. m. and 6 p. m., both summer and winter. On a day in August, the maximum power load was 730 kilowatts and the output for motors 8,300 kilowatt-hours, so that the power-factor for this load during the twenty-four hours was 47.3 per cent. On a December day, the maximum power load was 870 kilowatts and the output for motors was 9,700 kilowatt-hours, the power-factor for this load during twenty-four hours being 46.4 per cent.

Taking the 870 kilowatts of the December day as the maximum motor load for the year, there were 2.29 horsepower of connected motors per kilowatt of this load, and 2,117 kilowatt-hours were sold during the year for power, per load kilowatt.

The power earnings of $46,792 during the year amounted to $53.78 per kilowatt of the 870-kilowatt load

THE ABUSE OF TELEPHONE PRIVILEGES.

Quite recently the daily press contained a brief reference to the action of the Supreme Court of Iowa in ordering a telephone company to restore service to a patron whose instrument had been removed for alleged improper use. So universal has become the employment of the telephone that it was a subject of considerable conjecture as to the basis upon which the opinion was rendered, and the fact that the telephone company could not exercise this privilege of restraint was generally deplored. This case, however, comes under the same category as many others in which there are qualifying conditions, and in which the Court upholds the action of the company in spirit, but finds no provision in the letter of the law for arbitrary dealing.

The patron denied the use of profanity, but admitted the use of what might be considered by some opprobrious language, and it was pretty well established by the testimony that at least one member of his family had abused the privilege accorded them. But it did not appear that they persisted upon being warned that such conduct would not be tolerated, nor that they were guilty of any impropriety thereafter during the two months between the warning and the removal of the telephone. Under such circumstances and the further fact that when the telephone was removed after said two months it was apparently done owing to the threat of another patron rather than because of any persistent interference with the service by the plaintiff, the Court approved a decree directing the restoration of the telephone and connections.

However, the Court holds that no one can well defend the language employed by the plaintiff. A telephone line when used in common enters many family circles, and the proprietor is warranted in assuming, at least until the contrary appears, that its patrons will have regard for the ordinary amenities of life and observe the courtesies of civilized society. If upon discovery and due warning he persists in the use of improper language, or purposely interferes in conversations between other patrons of the system, there would seem to be but one adequate remedy, and that is to withdraw the service from such person. The very nature of the service undertaken exacts a control to this extent, for without the power to withdraw it under the circumstances mentioned there could be no assurance of its character or efficiency.

And here is where we find some grain of satisfaction. There have been some of peculiarly liberal mind who have argued that when a person pays for the use of the line it is his property to do with as he pleases, and that the telephone company has no more right to object to improper language then than the police official has to prevent a man from using bad language in his home if he chooses so to do. But, as the court holds, the only assurance of the character or efficiency of the service renders control to this extent necessary. This power, however, cannot be arbitrarily exercised and allowance must be made for the infirmities of human nature, for local customs, habit, and early environment, which more often than an evil spirit, is responsible for bad manners. The penalty of being deprived of this most convenient means of business and social communication is great compared with the effect of its abuse upon those who are subjected to the indignity, and it is a nice question to decide as to what constitutes a punishable offense. For our own part we hope that it will be largely left with the telephone companies, for to deprive a man of service would be uncommercial, and the telephone companies are commercial. But we should be left every safeguard to keep this very necessary avenue of communication free from objectionable misuse.

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The National Electrical Contractors' Association.

Ninth Annual Meeting, Toledo, Ohio, July 21, 22, 23.

What will probably be considered the most successful convention ever held by the National Electrical Contractors' Association was conducted at Toledo, Ohio, July 21, 22 and 23. Hotel headquarters were established at the Hotel Boody. There was a very representative gathering of contractors and a large number of manufacturers and representatives in attendance, several manufacturers making interesting exhibits.

The open meetings and the executive sessions were held in the Chamber of Commerce rooms. The convention was formally opened shortly after 10 o'clock on Wednesday, July 21, when Marvin W. Hanson, of Toledo, National Director for Ohio, introduced the Honorable Brand Whitlock, Mayor of Toledo, who welcomed the delegates to the city.

President Sanborn replied to the mayor with a few well-chosen words, and introduced William H. Blood, Jr., president of the National Conference on Standard Electrical Rules, and fire insurance expert of the National Electric Light Association. Mr. Blood took for his topic "The National Electrical Code and the Relation of the Contractor to the Central Station." Mr. Blood said in part:

In the early days of Roman history, it is recorded that the entire empire was governed by three men ruling together—a triumvirate, as it was called. It was considered then that no man had sufficient ability to rule alone. Today, the triumvirate of the electric lighting industry consists of the code, the contractor and the company. No one of these interests rules alone, yet each has its individual duty to perform, and together the three interests control the situation. No one of these has unlimited power, but each is a check on the others, and all are automatically controlled by financial limitations.

If the company's lighting rates are too high, the prospective customer declines to use electricity and turns to gas or oil. This prevents the company from exercising unlimited authority. If the contractor attempts to make undue profit, or insists upon too costly construction, the prospective customer again refuses to use electricity and the contractor's business is thereby curtailed. If the code requirements are unnecessarily severe, this has the same result of decreasing the use of the electric current.

Were I commissioned to pick out a symbol for the electric lighting industry, I should not hesitate for a moment in a choice. I should select a chain composed of three large links, representing the code, the contractor and the company, respectively, and each of these three firmly fastened together by three smaller links, all three representing the necessary bond which we call "confidence." For the continued success of the electric lighting industry, these little links of confidence are essential. Each of the three interests is dependent upon the others and through these bonds of confidence is firmly tied to the others.

Previous to the year 1895, on account of the great diversity of rules relating to the installation of electric wires and apparatus, no such thing as uniformity in practice existed. A number of organizations had rules of their own which they attempted to enforce, and owing to inherent differences in the rules themselves and to varied interpretations of them, the National Electric Light Association, in 1895, decided that this chaotic condition must cease and that the time had come to insist upon a single standard set of rules. As a result of this conviction, a National Conference on Standard Electrical Rules met in New York city, on March 18, 1896, and spent several days in considering the adoption of a single standard. For this conference to work on, the National Electric Light Association committee prepared a large pamphlet showing in parallel columns the rules of the National Electric Light Association, the National Board of Fire Underwriters, the Associated Factory Mutual Insurance Companies, together with those of the Phœnix Fire Company and the Board of Trade, both of England. Following this conference, in the fall of 1897 the first edition of the National Electrical Code was sent out by the National Electric Light Association.

Since that time the code has been published by the National Board of Fire Underwriters and has been regarded as their property.

While it is admitted that these are the Underwriters' rules, still the code is national in scope as well as in name. The electrical committee of the Underwriters recognizes this and appreciates the value of frequent conferences with the practical men coming from all over the country who make a business of installing the wiring and of furnishing the supply of current for the various electrical devices.

Everyone who has had to work under the National Electrical Code realizes its imperfect character, but unless one makes a serious attempt to revise it or tries to get up a faultless system, he will hardly appreciate the good qualities of the existing code. The rules have been modified from year to year and are, therefore, now like any code of rules which have been frequently revised without being recodified. The new edition which is soon to be published will relieve this condition of affairs.

The lack of uniform interpretation of the rules has been a serious annoyance to contractors and to electric lighting companies. This lack of uniformity will continue so long as individuals are called upon to interpret them. As a matter of fact, the Underwriters fully realize the seriousness of such conditions and are making earnest and effectual efforts to correct mistakes and errors caused by inefficient or prejudiced inspectors. Supplemental rules promulgated by local underwriting boards at various times have rendered inoperative some of the provisions of the code, but through the active efforts of your own officers and those of the National Electric Light Association and others this practice has been discountenanced and even forbidden by those in authority of the National Board of Fire Underwriters.

Standard rules and uniform interpretations of them do much to facilitate the business of the contractor. With an increase of wiring installations the company sells more current, and to secure more customers is an essential part of the company's business. The company cannot afford to have cheap or unsafe work done, nor can it permit the expense of getting ready to use the current to be so great that it will scare off prospective customers. A wiring job which costs $2 per outlet produces as much revenue for the electric lighting company as one which costs $4 or $5 per outlet, and a $50 wiring job may appeal to a customer, whereas perhaps a $100 installation would not be considered but would drive the customer to use gas or oil. It would be shortsighted for a contractor to insist upon the expensive work when the cheaper form of installation would be fully as satisfactory. A conduit job is desirable for some installations, but from the electric lighting company's standpoint a knob-and-tube job properly installed generally gives as large an income, and, costing about one-half as much, appeals to the customer, whereas the conduit job would not.

There are but few electric lighting companies which, of their own volition, take up this line of business (inside wiring) unless they are forced into it. Most lighting companies would be glad to give their entire attention to their legitimate (the word is used advisedly) business of supplying the electric current. Personally, I am strongly opposed to most electric lighting companies undertaking the work of general wiring. Oftentimes, however, there are mitigating circumstances which render it necessary. It is not infrequent that electric lighting companies exist in cities which are too small to support a competent wiring contractor, and we frequently find a man in such localities without a reputation and without a conscience, who will put in any kind of a job so long as he can get his money for it, and will charge any kind of a price, when he knows that he has no competition. Certainly no blame can be attached to a lighting company under these conditions for having its own men do safe wiring and for charging but little in excess of cost when it expects to make a continuous profit from selling this customer electric current. Current it must sell, and to neglect any opportunity of increasing these sales results in heavy financial and oftentimes permanent losses.

If a number of contractors should get together and arbitrarily fix the price of wiring installations at a high rate during the time of active building operations in a given city, you can readily see that a permanent injury would be done the lighting company, for the new buildings would go up piped for gas, with the electric wires left out. If the contractor charged but a reasonable profit, however, or the company did the wiring substantially at cost, gas pipes would be omitted, and by having the wires once installed the lighting company would be assured of a continuous revenue. No one questions the right of the contractor to a fair profit, or wants to see him do business at cost, and if he will pursue the policy of fair charges, coupled with honest and intelligent workmanship, the electric lighting company will not be forced to enter into competition with him. The electric lighting company must, however, for its own salvation, see that all new buildings are wired, and to do this the price must be reasonable and the work honest.

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Mr. Blood was followed by George C. Nimmons, architect, of Chicago, Ill., who read a paper entitled "The Relation Existing Between the Contractor and the Architect."

Mr. Nimmons gave a very interesting sketch of the attitude and accomplishments of early Greek architects and contractors, and showed how, although the interested spirit of the early Grecians had disappeared, the methods of dealing with contractors was very much the same. He deprecated the taking of competitive bids, and he believed that by seeking to obtain the lowest cost for a building in this way some buildings cost much more than they would if only reasonable profits were included for all the contractors and all others concerned. The present scheme of making contracts puts the contractor at odds with the architect and owner, and the work suffers. The work involved, and the amount of money spent by contractors in figuring upon specifications, were enormous and something should be done to take care of this. The system makes impossible any real co-operation between architect and contractor. The unlimited percentage contract implies confidence in the contractor, and some of our largest buildings have been successfully erected on this plan.

This paper was discussed very briefly, J. R. Strong, of New York, raising the question as to whether the employment of a general contractor did not impair the quality of the work, as it was frequently the case that when a job was carried out on this line the general contractor shaved the price to the sub-contractor so low that poor material and worse construction went into the work. Mr. Strong thought that a great deal of good could be accomplished by the sub-contractors coming into contact with the architects and owners. On a great many big jobs done today the architect never came in contact with the sub-contractor and knew very little of his troubles and the difficulties under which he worked.

Mr. Cates stated that when a job was handled by a general contractor it invariably resulted in impairing the quality of material and of the work.

Mr. Kreider said that a good deal of improvement could be had if specifications were so written as to afford only a single interpretation. He also thought that there was little incentive for good work when good jobs were given out to a general contractor.

A vote of thanks was tendered to Mr. Blood and Mr. Nimmons for the presentation of their papers.

The business session was held in the Chamber of Commerce rooms at 2 p. m., Wednesday, when nearly all of the routine matters were taken up and discussed.

On Wednesday evening the Sons of Jove held a rejuvenation in the Elks' Hall, when seventeen new members were inducted into the order.

On Thursday, July 22, the open session was held at 10 a. m. in the Chamber of Commerce rooms. Fred Bissell, the well-known supply man of Toledo, read a most interesting and significant paper entitled "Co-operation Between Electrical Jobbers and the Electrical Contractors." Mr. Bissell said in part:

That it is advantageous to the contractor to buy from the jobber is an old statement and grows stronger every day. The time-worn story that the jobber does concentrate merchandise, making a depot from which the contractor can draw assorted items on demand, that he makes a few shipments of many items, that he can always offer good railway facilities because jobbers are found only at points having such facilities, that the contractor needs no large investment in merchandise and can devote his capital to other necessities in his business and that he can and does on occasion receive financial favors—all these things are true and are better understood every day.

We recognize that there are advocates of other policies who disagree from this, but with the changes constantly making in all parts of the business world, and which are very active in the electrical field, it is certain that the jobber who fits himself to handle properly the contractor's business and who treats the contractor justly will always have his reward.

That many things are now in the wrong and that we are far from the ideal are obvious, yet we believe that the trend of opinion and of events is in the right direction. The thing to do is to get together, but it is much easier to outline the present defects and the future perfections than it is to tell how to avoid one and to reach the other.

One of the first troubles is found in the jobber who does a construction business or runs a construction department and for a reason in which he is sincere and which is generally based on some local condition. This method is not approved by jobbers in general.

Then again there are contractors who attempt a jobbing business, and for reasons equally sincere and to them equally satisfactory, yet retain their construction business Both of these men are detriments to their respective associations and have been the causes of the most serious obstacles in the working out of this problem. If such a jobber be asked to cease construction or the sale of merchandise to isolated plants, he points to the contractor who is striving to retain his construction business and yet get into the jobber's field. And to make his argument entirely sound from his side he will attempt to prove that the contractor is always the one who is trying to buy direct from the manufacturer and to cut out the jobber. This same contractor, brought on the carpet for his sins, points to the jobber who still retains a construction department, and because the pot and the kettle are both black they soil everything in reach.

The contractor points with disgust at the curbstone operator with the proverbial screwdriver and coil of annunciator wire and is unable to appreciate how the little fellow can get stuff at the big contractor's prices. Yet he fights vigorously and sometimes viciously against a quantity price, himself endeavoring to buy one at the price of one hundred, has plenty of reasons why an initial price with rebates for quantities purchased in a given time is all wrong, and in other ways obstructs plans which, possibly imperfect, yet have the merit of being honestly designed for the protection of the big buyer without forgetting justice to his little brother. There is not a man in either association who was not once small and who was entitled to and had his chance and the right to prosper if he showed ability, and nothing short of that is thought of today. Nor will the economics of business, regardless of legal objections, ever permit anything different. The price for quantity always has made a difference and doubtless always will, but what can be urged further than that, what distinctions may be made to conform to divisions of business, no one is prepared to say.

Along this line of investigation it may be well to ask if the jobber is really a business necessity. No doubt exists in the minds of the jobbers themselves, although there have been some manufacturers and some contractors unkind enough or misguided enough to regard the jobber as not an absolutely essential member of society. For those who entertain such ideas it may be well to remind them that no one who is useless endures. The progress of events takes him out. Yet from the earliest history merchants who bought in bulk and sold in broken lots have been prominent and doubtless always were dominant in the business world, as they are today.

One betterment which is coming rapidly is in improved internal business methods. Both jobber and contractor are keenly alive to these. The better methods include buying with regard to the profit which can be made when the goods are sold, better bookkeeping, collecting and paying, fewer open accounts either way, selling goods and doing work only when a profit can be made, and along these lines success is certain.

Perhaps the greatest enemy to the contractor's success, particularly if he is a retailer, is the unwise attitude adopted by some central stations of giving away articles which consume current. For this there is no reasonable defense. Many manufacturers protest against this with varying vigor, but some absolutely prohibit the slaughter of their articles which are controlled by patents.

A manufacturer cannot be a jobber, nor a contractor, nor a retailer unless he assumes all the responsibilities, risks and expenses which go with those divisions of business; and when he does assume them, the exclusive jobber and the exclusive contractor can always beat him.

Mr. Bissell's paper elicited prolonged applause, and a number of the members expressed their appreciation of his suggestions.

E. Leavenworth Elliott, editor of *The Illuminating Engineer,* delivered a highly interesting impromptu address on the subject of "Illumination and the Electrical Contractor." Before taking up the direct line of thought concerning illumination Mr. Elliott asked permission to digress so that he might endorse Mr. Bissell's suggestions concernin-
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old, and the real entrance of professional engineers into this work dates back to not more than four years ago. For a long time in the development of the electrical industry interior electrical work consisted to a considerable degree of simply stringing wires. Conditions have changed, and in competition with the source of light which is a flame, there are now electric-light sources of great variety. The development of the past few years in this direction has been revolutionary. The majority of installations equipped up to two or three years ago are already antiquated, and it is entirely within the province of the electrical contractor to change all this and bring these installations up to date. The contractor must not wait for the consumer to come to him and insist upon modern appliances and modern methods of placing light sources, but should profit by the splendid opportunity to go to the consumer and indicate to him the benefits which are available.

Mr. Elliott did not wish any remarks he might make to be construed as disparaging in any way the consulting illuminating engineer. His field would necessarily have to do with special installations of a large or peculiar nature where training and experience were necessary. The majority of installations, however, would remain with the contracting engineer. Central-station companies and lamp manufacturers properly should, and do, maintain illuminating engineering departments, but this need not in any wise interfere with the electrical contractor doing his portion of the work. The electrical contractor is in an exceptionally independent position to decide which is the best material to use and what is the best method to pursue in disposing of the material.

The information extant for the study of illuminating engineering was not very extensive, but the electrical contractor could learn sufficient from close observation and a perusal of the literature available in text-books and in the technical press to work out every problem with which he came in contact.

Mr. Elliott closed his address with a few references to the manufacture and utilization of fixtures, a great improvement in which was to be noticed at the present time. He also called attention to the strong position held by the gas industry and indicated the necessity for making the best utilization of electricity as a light source in order to properly compete with gas. It was his opinion, also, that despite the great advances made in gas lighting, modern electric-light sources installed upon engineering principles could beat every time a gas installation installed haphazardly.

Mr. Elliott was followed by James R. Strong, who presented a vigorous arraignment of the contractors in connection with their support of the national organization. Too little appreciation had been shown by contractors in general to the remarkably important work which had been done by the officers and committees. A determined effort should be made to stimulate interest in the association, and discussion should be had and effort be brought to eliminate unnecessary profits between manufacturers, jobbers and consumers. Mr. Strong thought that a change should be made in the method of fixing prices on material.

At the business session on Thursday afternoon several matters of extreme importance were brought up, thoroughly discussed, and a strong working basis adopted, which would indicate that the coming year would prove a banner one in increasing the strength and the membership of the organization. The officers were re-elected as follows:

President, G. M. Sanborn, Indianapolis, Ind.

First vice-president, M. L. Barnes, Troy, N. Y.

Second vice-president, Charles L. Kreider, Chicago, Ill.

Third vice-president, H. S. Potter, Washington, D. C.

Secretary, W. H. Morton, Utica, N. Y.

Sergeant-at-arms, J. C. Stearns, Buffalo, N. Y.

The convention next year will be held at Atlantic City, N. J.

A trolley ride was given the ladies on both Tuesday and Wednesday mornings, the men's banquet being held in the dining-room of the Boody House on Thursday evening and the ladies' banquet in the parlor at the same time.

On Friday morning the steamer "Greyhound" left Toledo shortly after 9 o'clock, reaching Sugar Island, at the mouth of the Detroit River, at high noon. Following the box luncheon, there was an exciting game of baseball between the eastern and western teams, captained, respectively, by James R. Strong and E. McCleary, the game being won by the westerners, with a score of six to three.

The Westinghouse Electric and Manufacturing Company made an elaborate exhibit of carbon and flaming-arc lamps, fans, small motors, electric ranges, and heating and cooking utensils and supplies. The company was represented by J. C. McQuiston, G. Brewer Griffin, W. B. Reacks, Detroit manager, B. A. Harris and H. S. Wales.

The Nernst Lamp Company made a very imposing display of its new types of Westinghouse Nernst lamp, the remarkable qualities of the new instantaneous lighting units attracting a great deal of attention. These units were shown in clusters, in handsome designs, in brush brass, of the box, Renaissance and Art Nouveau types, and the handsome high-candlepower Duretta housing lamp was also shown to advantage. The company was represented by Max Harris, sales manager; John J. Sorber, Chicago manager, and J. L. Anderson, Cincinnati manager.

G. M. SANBORN, INDIANAPOLIS, PRESIDENT.

W. H. MORTON, UTICA, N. Y., SECRETARY.

The Western Electric Company made a comprehensive and attractive display of interior telephones, small motors, "enameled" wire, ignition sets, fans and supplies. The company was represented by C. A. Bissonette and Messrs. Herring and Van Gorder.

The Electric Cleaning Company exhibited and demonstrated its "Positive" electric vacuum cleaner.

The Shelby Electric Company was well represented by a large staff headed by

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the ever-genial George Loring, assisted by H. F. Viot, H. W. Strock, W. H. Myers, Jonas Feighner, William Love, D. C. Pierce and Mr. Skiles.

Among others present were:

N. C. Cotabish, general sales manager, National Carbon Company.

Alexander Henderson, American Circular Loom Company.

Romaine Mace, Okonite Company.

George Searing, western manager, Hart & Hegeman Manufacturing Company.

Fred Bissell, F. Bissell Company.

Avery P. Eckert, sales manager, wire department, National India Rubber Company.

K. A. Albrecht, manager arc-lamp department, Chas. L. Kiewert Company.

D. W. Hopper, Federal Electric Company.

F. J. Basil, F. W. Wakefield Brass Company.

A. L. Hancock, Central Electric Company.

H. F. MacGuyer, D & W Fuse Company.

John J. Waldman, manufacturers' agent.

C. E. Corrigan, vice-president, and W. J. McKenna, National Metal Molding Company.

W. G. Nagle and V. C. Maxwell, W. G. Nagle Electric Company.

R. I. Phillips, Chicago manager, Cutler-Hammer Manufacturing Company.

Howard R. Sargent, managing engineer, wiring supplies department, General Electric Company.

E. B. Kipple, western manager, Alfred E. Braddell, Henry H. Hornsby, Sprague Electric Company.

V. R. Despard, sales agent, Pass & Seymour.

A. F. Hills, sales manager, E. C. Mack, D. C. Gidley, Crouse-Hinds Company.

Arthur O. Einstein, electrical specialties.

W. J. McKay, secretary, Western Conduit and Manufacturing Company.

C. H. Froelich, manager, fixture department, Federal Sign System-Electric.

R. P. Tillotson, Appleton Electric Company.

Cy Fralick, Chicago.

W. A. Merrill, Chicago Fuse Wire and Manufacturing Company.

C. Hight, F. D. Sears Company.

George C. Knott and H. E. Watson, Benjamin Electric Manufacturing Company.

Herman Andrae, Julius Andrae & Sons Company.

Paul Cratty, American Circular Loom Company.

A Novel Wind-Turbine Exhibit.

At the seventieth annual show of the Royal Agricultural Society of England, held at Gloucester, Eng., June 22 to 26 last, J. G. Childs and Company, of Willesden Green, London, N. W., made an interesting exhibit of wind turbines, showing their application to electric generation for residence illumination, cooking apparatus, etc.

The exhibit included a twenty-four-foot diameter plant, which consisted of a Childs turbine upon a steel tower sixty feet high. The vertical shaft drove a fifty-volt, vertical, Morris-Hawkins variable-speed generator, which was used to charge a twenty-eight-cell Pritchett and Gold battery having a discharge capacity of 450 ampere-hours.

The firm was responsible for the lighting of the show cottage of the Country Gentleman's Association 200 yards distant, and supplied current for working an electric grill there by means of the wind turbine at its own stand. Another point of interest is that the storage-battery is divided into two parts, and by means of a special arrangement it was possible to use fifty volts for working the cooking-apparatus and other machines exhibited, and have twenty-five volts for the lighting, thus making use of metallic-filament lamps.

The plant also supplied the energy for running two electric grills, saucepan and steamers, radiator, kettles, fans, irons, etc., all by the Phœnix Electric Heating Company; also a deep well pump by Le Grand and Sutcliffe, a butter-churn and cream-separator by the Dairy Outfit Company, and a circular saw of special design suited for turbine driving.

The generator has a special switch, by means of which it can be run as a variable-speed motor for driving any of the above machines when there is no wind, taking current from the battery. This plant, in localities where the wind averages about eight miles an hour, will produce about 3,000 kilowatt-hours per annum.

We are indebted to *The British Trade Review*, of London, for the foregoing particulars.

A Good Idea.

A plan is on foot, which it is to be hoped will be standardized throughout the country, to adopt distinctive colors for painting piping in power plants to identify the various lines of pipe and thus eliminate confusion from this source among workmen and others.

No Field Telephone Work at Illinois National Guard Encampment.

Considering the importance of the telephone and telegraph in the field maneuvers of troops today, the installation of a modern equipment for communication in the camp of over three thousand men, comprising the First Brigade, Illinois National Guard, at Elgin, Ill., July 10 to 17, would naturally present an interesting feat in telephone engineering. Much to the disappointment of the Signal Corps, however, they were not given a chance to grasp this annual opportunity of installing a field equipment.

The Elgin Telephone Company installed the necessary telephone lines to Wing Park, the site of the camp, before the arrival of the troops. Each regiment was connected, by a direct line, to the Elgin exchange, consequently should one regimental commander desire to communicate with another it would be necessary to call Elgin, and be connected in the usual way.

The Rhodes Scholarships.

President Edmund J. James of the University of Illinois, chairman of the Illinois State Committee for the assignment of the Rhodes scholarships at Oxford University, England, announces that the next qualifying examination for the Rhodes scholarships will be held on October 19 and 20, next, at an hour and place to be named later. All persons in Illinois expecting to enter this qualifying examination for the Rhodes scholarship should send name and address to the chairman of the committee, University of Illinois, Urbana-Champaign, at an early date.

This scholarship is for a period of three years, and is worth approximately fifteen hundred dollars ($1,500) per year. Beginning with the October term, 1907, the whole number of scholars on this foundation was 160, distributed among the various colleges of Oxford University. Any student completing the sophomore year is eligible for this examination.

Richmond Railway Reorganized.

John J. Dickinson, Jr., secretary of the Richmond Railways reorganization committee, on July 19 forwarded to depositors a letter requesting them to present their certificates of deposit at the Equitable Trust Company on and after July 21 and there would be delivered the new securities and cash to which depositors are entitled under the plan of reorganization of the Richmond street-railway properties.

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CHART FOR CALCULATION OF VOLTAGE LOSSES.

BY H. P. LIVERSIDGE.

This article describes the construction and use of a chart for the calculation of voltage losses in an alternating-current circuit, where the energy loss per cent of delivered power is already known or assumed.

In the construction of the chart, the various factors entering the solution of alternating-current transmission problems are plotted in such relation to each other that results may be obtained directly, without the calculation and table references usually employed.

In general, the relation between per cent energy loss and actual volts drop is dependent on the size of wire, power-factor of the load, frequency, distance between phase wires and transmission voltage. This relation may briefly be expressed in the following general equation,

$$E^1 = P \times E \times C$$

where E^1 = volts loss in transmission circuit;

P = energy loss per cent of delivered power;

E = voltage at receiving end;

C = a constant, dependent on wire spacing, power-factor, frequency and size of conductor used.

In order to simplify the construction, a wire spacing of eighteen inches has been assumed throughout the calculations and the factor C solved with this value of wire spacing constant. This assumption is sufficiently accurate for all practical purposes, providing the reactance of the line is not excessive, or the losses unusually high. Where the results are expressed in terms of volts loss, as given by the chart, the inaccuracy involved will be considerably less than one per cent of the receiving voltage, for all wire spacings from twelve to thirty inches inclusive—an error which, for practical work, is negligible in comparison to the per cent variation in consecutive wire sizes of standard manufacture.

In the construction of the chart, values of C for eighteen-inch spacing, twenty-five and sixty cycles, and power-factors from eighty to 100 per cent are plotted with standard wire sizes from No. 0000 to No. 8 B & S gauge for abscissas and reactance values for ordinates. The inductance values used in the calculations are taken from the table of inductances calculated by Ralph D. Mershon. The relation existing between the factors above noted is expressed by the curved lines shown in the plot, each being marked in accordance with the values of power-factor and frequency assumed.

Values of per cent energy loss and voltage per phase at the receiving end are next plotted as successive division factors of the reactance values located on the curves, each factor being plotted at right angles to the base line of the preceding value. These division factors, when plotted, take the form of the radial lines shown on the chart and, when combined with the factors previously noted, are related in the following sequence—wire size, reactance, line loss, transmission volts, volts loss. Values of per cent energy loss are plotted from two to twenty per cent, inclusive. Transmission voltages are plotted from 100 to 750 volts, and are arranged so that any multiple of these values may be used as the conditions of the problem may require.

From the foregoing construction, it is evident, therefore, that any one of the five factors previously noted can readily be ascertained if the remaining values are known or assumed.

In order that the method of using the chart may be clearly understood, the following problems have been selected and the solutions explained in detail:

Problem No. 1. Energy loss assumed. Volts drop required.

Wire size	No. 1
Power-factor, per cent	85
Frequency, cycles per second	60
Energy loss, per cent	15
Receiving voltage	550

The following diagram, Fig. 1, has been roughly plotted to eliminate all the values not necessary in the solution. This plot expresses the relation between one value of each of the division factors used, so that the successive steps in the solution may be more readily followed, without referring to the larger chart, Fig. 2.

In accordance with the sequence of factors printed on the chart, starting with the first value, No. 1 wire, in Fig. 1, follow the horizontal line A until it intersects the reactance curve marked sixty-five per cent P. F.—sixty cycles, which is the second factor in the sequence. Since each successive value, by construction, is taken at right angles to the preceding one, the next value, loss, is reached by following the vertical line B at right angles to the first motion A until it intersects the line marked fifteen per cent energy loss. At right angles to this motion, follow the horizontal line C until it intersects the radial line, marked in terms of the next factor of the sequence, 550 volts. The intersection of the vertical line D drawn from this point with the horizontal line marked volts loss, the last factor in the sequence, gives ninety-seven volts, the drop for the values assumed in the problem.

For all voltage values higher than those plotted on the diagram, the results in volts loss must be increased in direct proportion to the increase of transmission voltage above the values indicated on the chart. For example, in the previous problem, if the line volts had been assumed to be 5,500, the result would be 970 volts, or ten times the value obtained. This construction, for very high voltages, is only approximately correct, but for all practical purposes the error involved is negligible.

Problem No. 2. Volts drop known. Per cent energy loss required.

Volts, loss	97
Power-factor, per cent	85
Frequency, cycles per second	60
Receiving voltage	550
Wire size	No. 1

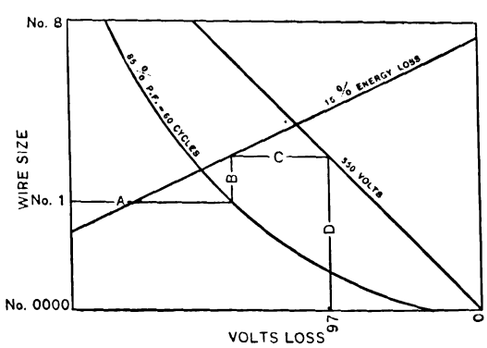

FIG. 1.—PROBLEM NO. 1. ENERGY LOSS ASSUMED. VOLT DROP REQUIRED.

For purposes of comparison, the same values have been used in this problem that were assumed in the previous example.

In Problem No. 2, the unknown factor, energy loss, does not occur at either end of the sequence and is determined, therefore, by the intersection of the right-angle lines drawn from the adjacent factors, reactance and volts.

Starting from the point marked No. 1 of Fig. 1, follow the line A to the intersection of the reactance curve. This point of intersection determines the vertical line B. Starting again from the end of the sequence marked ninety-seven volts, follow the vertical line D to its intersection with the voltage line, and thence at right angles to the line B—the point of intersection lies on the radial line marked fifteen per cent energy loss, the value desired.

From the above solution, it can be seen that any one value may be directly determined by following the sequence of

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factors noted, care being taken only that each motion is made at right angles to the preceding line, as indicated in the foregoing solutions.

Problem No. 3. Energy loss assumed. Volts loss required.

Wire size .....No. 0
Power-factor, per cent 85
Frequency, cycles per second..... 25
Energy loss, per cent..... 16
Receiving voltage 3,000

Referring to the large chart for this solution and starting at the point marked No. 0 wire, follow the sequence of factors noted to reactance curve, eighty-five per cent, twenty-five cycles—sixteen per cent energy loss—300 volts, intersecting finally the horizontal line marked volts loss at approximately 45.5 volts. Since the voltage multiple used was ten the correct result will be ten times 45.5 volts or 455 volts, the loss for the values assumed in the problem.

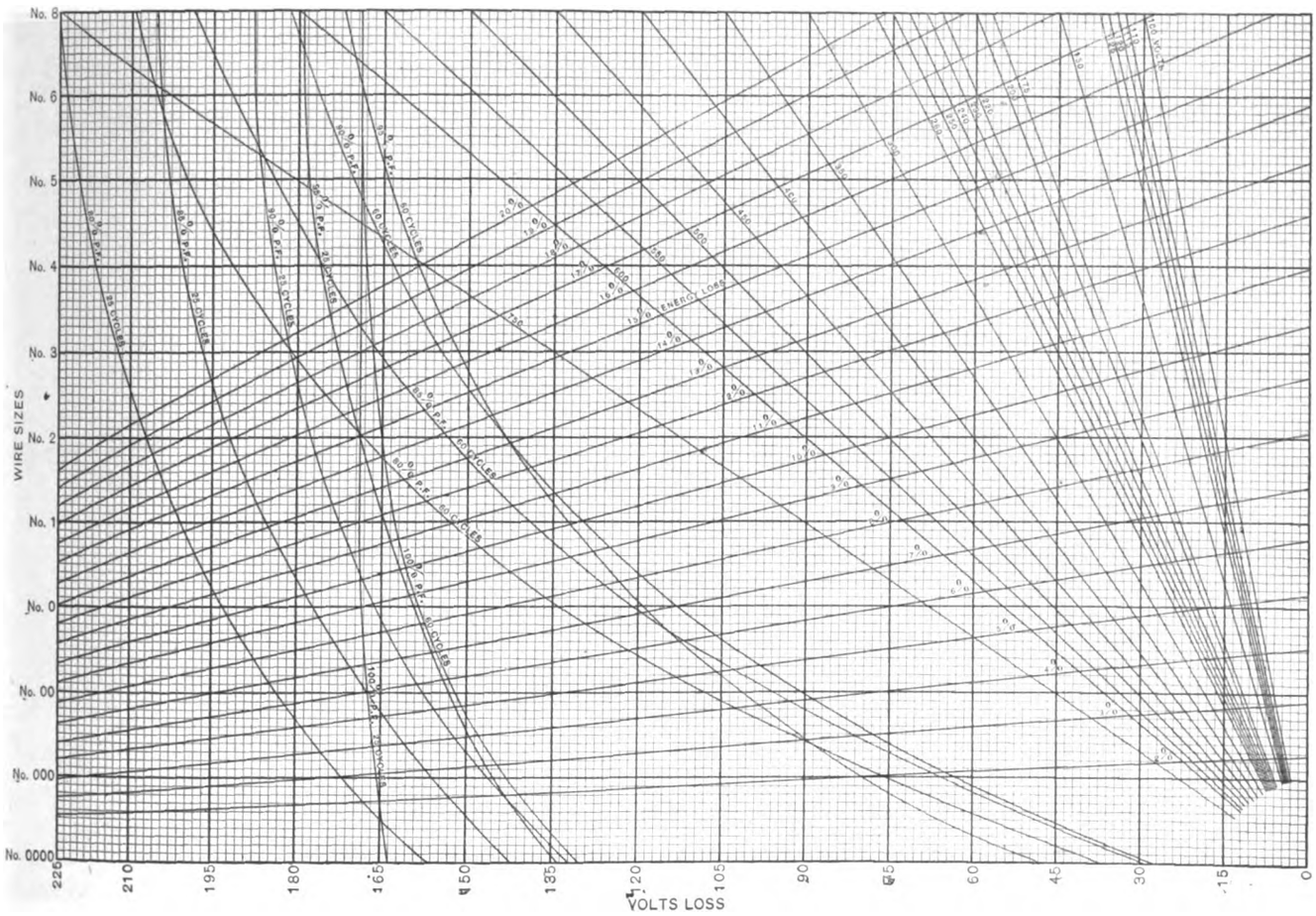

FIG. 2.—CHART EXPLAINING SOLUTION OF PROBLEMS GIVEN.

An International Long-Distance Telephone.

It is reported from London that a long-distance telephone service with four lines will be established by January 1, next year, between London, Paris, Madrid, Barcelona and San Sebastian.

A Tribute to John Chamberlain Fish.

The directors of the Shelby Electric Company have prepared a beautiful memorial to John Chamberlain Fish, late president of the company. The resolutions, which have been engrossed, are reproduced in a book bearing the testimonial of appreciation and affection and subscribed to by each of the directors of the company.

The following quotation is taken from the testimonial:

"His was an exceptionally busy life, and yet with the multiplicity of his affairs he was never too busy to stop and give kind counsel to others. A familiar expression of his was, 'I would rather make men than money.' His own success inspired him to work devotedly to the advancement and betterment of those just entering the activities of life, and the number of men who pay tribute to his unfailing kindness and unselfish precepts is a monument to this beautiful side of his character. From our human viewpoint he was removed all too early in life, yet we know that his accomplishments were far greater than those of the average man who has lived his 'threescore years and ten.'"

A Catalogue Classification Association.

A new departure, which should meet with the most cordial approval of the engineering fraternity, has been made in London by the organization of "The Engineer's Standardized Publications Association." The object of this association is to classify, index, and standardize the immense amount of heterogeneous literature that every engineering man receives in the course of each year and to convert it in this way into a ready and convenient reference library, which should prove of considerable value. The association also proposes to assist the manufacturer in the proper distribution of his advertising matter to those particularly interested therein, and to help him to some extent in its compilation and make-up. The offices of the association are at Craven House, Kingsway, London, W. C.

For An All-British Cable.

The London *Times* is authority for the statement that the Canadian Pacific Railroad, in the event of the laying of an Imperial Atlantic cable, will grant permission to use its right-of-way from east to west for a special land wire to connect the Atlantic with the Pacific cable.

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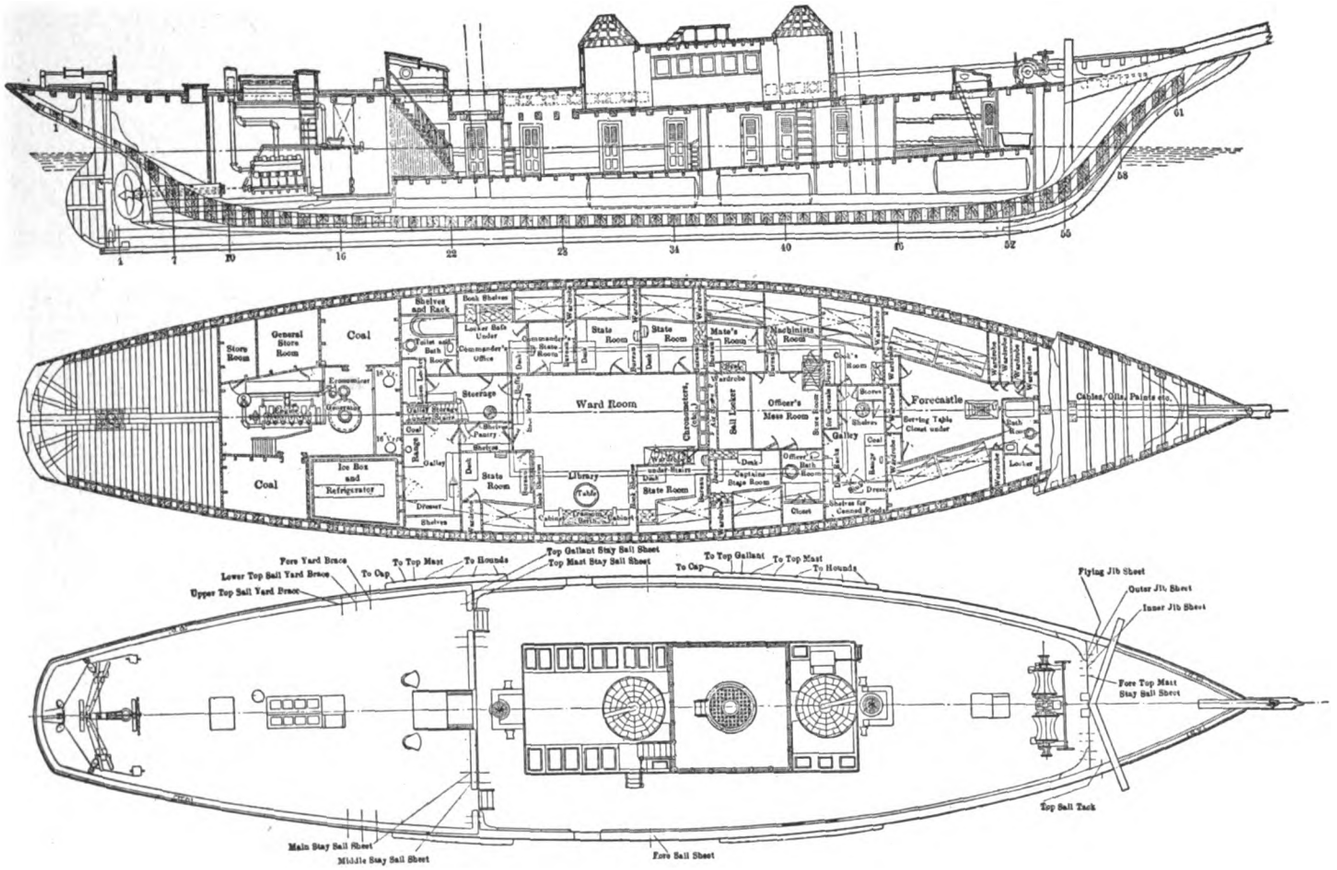
The Magnetic-Survey Yacht "Carnegie."

On June 12 the new magnetic-survey yacht "Carnegie" was launched at Brooklyn, N. Y. This interesting vessel is being built for the Department of Terrestrial Magnetism of the Carnegie Institution, Washington, D. C. This department of activity of the Carnegie Institution has reached considerable proportions, and it is the endeavor to complete within a period of about fifteen years a magnetic survey of the entire earth's surface. Considerable work has been accomplished already. The new ship will continue and complete the work of surveying the oceans.



INBOARD PROFILE, GENERAL ARRANGEMENT AND DECK PLAN OF THE "CARNEGIE."

As is seen from the accompanying illustrations, the "Carnegie" is a sailing vessel which is provided with auxiliary propelling power to enable it to proceed during calms. The most interesting feature about the vessel is the fact that in order to eliminate, as far as possible, disturbances from the presence of magnetic material in the ship itself, the amount of iron and steel in her construction has been reduced to a total of not over 600 pounds. With all stores and equipment on board the yacht has a displacement of 568 tons. The principal dimensions of the "Carnegie" are: Length over all, 155 feet six inches; beam, thirty-three feet; depth of hold, twelve feet nine inches. She is built throughout of the very best timbers and other materials with most substantial construction, and combines the finish and workmanship of a yacht with the sturdy strength of a merchant vessel.

Since the nature of the work for which she is intended requires that the entire structure shall be practically non-magnetic, the "Carnegie" is the first survey vessel in the construction of which iron and steel and other magnetic metals will have so little part; in other words, with the exception of cast-iron pistons in the cylinders of the bronze internal-combustion engine, and the steel cams necessary for operating the valves, aggregating less than 600 pounds, there will be no magnetic materials used in the construction of the vessel. Moreover, the "Carnegie" is the first vessel of any size and importance in America to be propelled by producer gas.

The vessel has full sail power with a brigantine rig carrying about 12,900 square feet of plain sail. The rigging is of special Russian hemp. The designing of auxiliary propelling means involved a careful study of what motive power could be used which had a minimum amount of iron in its equipment. It was finally decided to use an internal-combustion engine and to have it supplied with producer gas. By this selection the bulk of equipment and large amount of iron necessitated by a steam plant was avoided and the danger of using gasoline and oil likewise was done away with. It was believed that a gas producer for marine purposes could be built which would supply a suitable gas for the engine from anthracite coal, and that such a plant could be constructed almost entirely of non-magnetic materials.

The "Carnegie" has a four-cylinder Craig internal-combustion engine of 150 horsepower. This is sufficient to drive the vessel at a speed of six knots in calm weather. The producer is furnished by the Marine Producer Gas Company. It consists of a copper cylinder six feet high, having a diameter of five feet, six inches, and built of copper with asbestos and fire-brick lining and manganese-steel grates. The producer is of the suction type and the gas from it passes through a scrubber of special construction before going to the engine. The coal bunkers have a capacity for twenty-five tons of coal, giving the vessel a cruising radius of about 2,000 nautical miles at a speed of six knots per hour.

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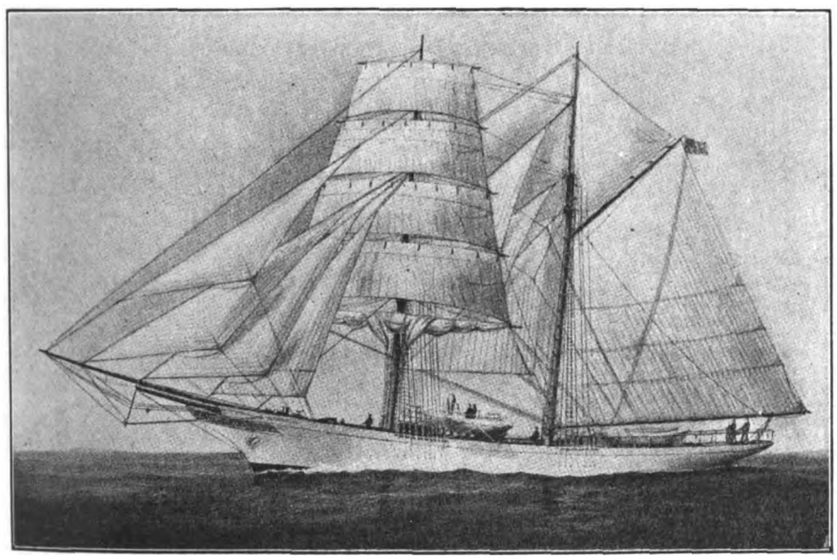
A refrigerating plant constructed of bronze and copper and operated by a special six-horsepower engine is provided. Two non-magnetic twenty-foot whaleboats and one sixteen-foot non-magnetic gig constitute the boat equipment. Four bronze anchors of special design are used as ground tackle.

On the main deck is the magnetic observation room, fore and aft which are circular observatories with revolving domes similar to those of astronomical observatories. This enables magnetic observations to be made both in the open and under shelter inside the observatories. The living quarters are below.

The plans of this unique vessel were made by Henry J. Gielow, of New York city, who also supervised the construction. The vessel was built by the Tebo Yacht Basin Company, under the special care of its vice-president and manager, Wallace Downey. W. J. Peters has acted as special representative of the Carnegie Institution to insure that no magnetic materials were used in the construction except as specified. Fully equipped the cost of the vessel will be about $115,000.



THE "CARNEGIE" AS SHE WILL APPEAR UNDER FULL SAIL.

To Reduce Cable Rates.

A recent dispatch from London announces the fact that as an outcome of the recent imperial press conference in London, representatives of the Eastern and Indo-European cable companies have agreed to reduce the press rate from one shilling to nine pence a word between Great Britain and India, Australia and South Africa, provided the British and Colonial Governments are prepared to assume their share of the reduction. This will probably soon be done.

Southern Pacific Electrification Plans.

With the filing of an application on July 10 for a power plant on the North Yuba River, the Southern Pacific Railroad made its first move in the open toward the electrification of its mountain division crossing the Sierra.

The application was filed with Forest Supervisor Bigelow by C. S. Curtis, who is in charge of the electro-hydraulic department of the Southern Pacific Company, under Chief Engineer W. Hood.

After filing the application, Mr. Curtis said in an interview at Nevada City, that it was the purpose of the Southern Pacific Company not only to use electric power on its mountain division, but that eventually steam would be replaced by electricity on other divisions, and that the electric equipment for the mountain division had already been ordered in the East, and would be ready for installation when the Auburn-Truckee cut-off is completed.

The maps filed with the application are described in a dispatch from Nevada City as indicating that water will be carried in flumes and canals from the North Yuba in Sierra County, at a point below Sierra City, where the intake of the system will be located, to the site of the main power station, just below Downieville.

It is admitted that the plans of the Southern Pacific Company to displace steam on its mountain division, and to substitute electricity, have been in active preparation for several months, and Mr. Curtis said that orders for $13,000,000 worth of electric equipment have already been placed in the East.

On the Rubicon the preliminary engineering work has been completed, and it is stated that the first power station to be erected there will be near Hale's Camp, in northern El Dorado County, and the second on the banks of the Rubicon River.

It is reported that W. P. Hammon is planning to divert the waters of Lake Tahoe by a nine-mile tunnel to the Rubicon River, and that the Bay Cities Water Company has financed a $12,000,000 electric power project on the south fork of the American River.

These activities, taken together with what is being done by William F. Bourn on the Yuba, have led engineers to believe that the intentions of the Southern Pacific company in its change to electric power are on a larger scope than has yet been admitted.

William Hood, chief engineer of the Southern Pacific, was much perturbed at the report as given above, and denied that the electric equipment has been ordered for the mountain division. He admitted, however, that the Rubicon Power Company may be taken over by the Southern Pacific, and that filings on the Yuba have been taken out for this company, but he denied that any definite plans had yet been made as to exactly how much of the line will be electrified.

Telephone Suits in Court.

The appeal of the New York Independent Telephone Company for permission to place telephone wires under the streets of New York city has been denied by the Appellate Division. In refusing permission, Justice Clarke says the company merged with the Mercantile Electric Company in 1905, and now claims a right to lay wires under the franchise of a concern organized for a burglar-alarm business.

When the adjourned motion in the matter of the Public Service Telephone Company against the Empire City Subway Company, Limited, was called by Supreme Court Justice Bischoff, it was announced by Edmund L. Mooney, counsel for the Empire City Company, that at the request of the Public Service Company, the application for a mandamus compelling the Empire company to allow the telephone company the use of its ducts, and the motion of the city to be allowed to intervene in the action, be adjourned until the first Monday in October.

The Public Service Company contends that it has a 999-year franchise from the city, but Corporation Counsel Pendleton says that under the recent law a franchise is not valid for more than twenty-five years.

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Characteristics of Dry Cells.[1]

A "dry" cell is classed as an open-circuit source of electrical energy, and though this statement seems contradictory, still it is justified from the fact that the open-circuit condition is the one expected during the greater part of its serviceable life.

It seems impossible to avoid deterioration when the cells are "on shelf," that is, in storage before use, for the reason that a large number of ingredients are used, and in practice it is impossible to have them chemically pure. The presence of impurities explains almost entirely why "dry" cells are never without some degree of internal action producing harmful effects, no matter how insignificant. For a time when cells are new these harmful effects seem to be of no particular importance, but as time goes on, their effect becomes more apparent, and finally, after a considerable period, cells when tested for available energy are found to have practically none.

The question of providing a condition under which the maximum energy may be drawn from a cell is one which is not of practical interest, but the question does come up as to the number of watt-hours available under various service conditions. If the rate of discharge is too high, then the cell will not have time properly to recuperate or depolarize when the open-circuit interval occurs. On the other hand, if the rate of discharge is too low, there is a tendency for the cell to use itself up internally, and thus restrict the amount available. In tests which have been made, and from which this result is simply an inference, it seems that if the energy is drawn out under ordinary working conditions at such a rate that the cell is exhausted in a period of about a month, the maximum energy is obtained, but if the work is such that the time during which the cell is in service is extended over a year, the percentage of the maximum amount of energy available is considerably reduced. It is not to be understood from this that a cell may not be depended upon for long periods of service. It simply means that a reduced watt-hour output (which in itself may be more than sufficient for requirements) is to be expected.

"On shelf" a cell will deteriorate slowly at low temperature, and this deterioration will increase as the temperature is increased. Cells stored in a dry atmosphere where the temperature is kept below the freezing point of water, will probably show no appreciable deterioration, whereas at 100 degrees Fahrenheit, or above, the effect of harmful action will be noted in a comparatively short period, hence the desirability of storing cells in cool places. Where cells are on light service, requiring only a small energy drain, it follows that the ratio of useless chemical action producing flow of current, will be low at low temperatures and high at high temperatures. Where the rate of energy drain is high, then the temperature is not of so much importance, because the time during which harmful action can take place is greatly reduced. It would be difficult to state this as a formula, but the general law is quite definite. The internal resistance of cells does not seem to be materially affected by wide temperature variations.

There is a characteristic difference between "wet" and "dry" cells, in that the internal resistance enters as a very different factor in the two cases. The internal resistance of "wet" cells in general is fairly constant, while that of "dry" cells is a constantly varying quantity. When a "dry" cell is new, its internal resistance may be approximately one-twentieth of an ohm, and it increases from this up into the hundreds of ohms. The magnitude of the internal resistance of the "dry" cell determines the age it has reached in its period of useful life.

On the charts are shown two sets of curves which bring out very strongly this factor of internal resistance. The test conditions were the closure of the circuit at certain intervals through an external resistance for a period of time which remained constant throughout the test. In the first set there is a high rate of energy discharge, and in the second a low rate. The ordinates of these curves are expressed in volts and the abscissas in time. The three curves in each set marked A, B and C represent, respectively, the electromotive-force on open circuit, the potential difference at the time of closure of the circuit through an external resistance and the potential difference at the end of a period, which is constant throughout the test.

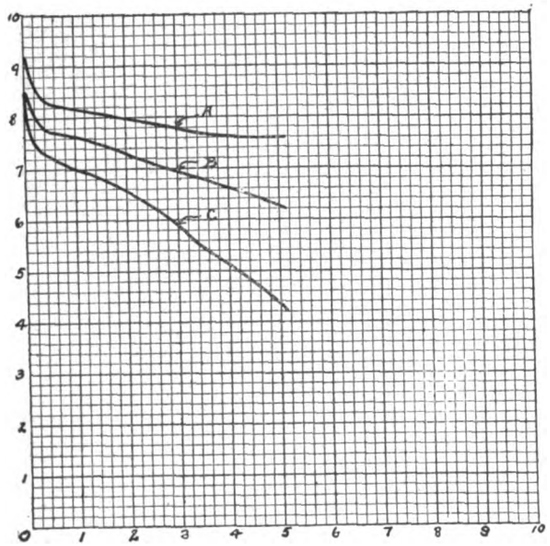

FIG. 1.—CHART SHOWING HIGH RATE OF DISCHARGE OF DRY CELLS—ORDINATES REPRESENT VOLTS, ABSCISSAS TIME.

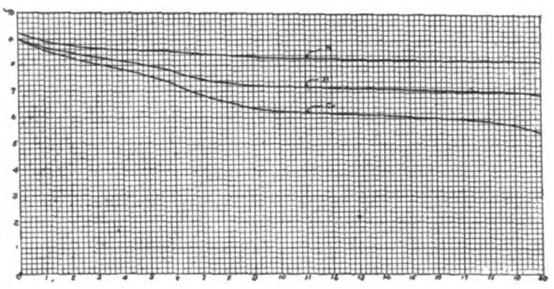

FIG. 2.—CHART SHOWING LOW RATE OF DISCHARGE OF DRY CELLS—ORDINATES REPRESENT VOLTS, ABSCISSAS TIME.

It will be seen from these curves that at the start the potential difference at the beginning of closed circuit and the potential difference at the end of the period are practically identical. The electromotive-force curve is somewhat higher. As the cell is used, it will be noted that these curves diverge, and if carried far enough, the lowest curve would finally touch the line, indicating zero potential difference. The high electromotive-force on open circuit is of no particular value, because it indicates a condition where no work can be done. The instantaneous drop, when the circuit is closed, shows the magnitude of the internal resistance when the current starts to flow.

The difference between the potential at

[1] Abstract of a paper by F. H. Loveridge of the Western Electric Company, Chicago, Ill., before the twenty-eighth annual convention of the Association of Railway Telegraph Superintendents, Detroit, June 23, 24 and 25.

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the beginning of the period of closed circuit and the potential at the end indicates to what extent the internal resistance increases, or the "practical polarization." These curves give a very correct idea of the characteristics of the "dry" cell, and from them may be deduced most of the data which should lead to the proper use under service conditions.

As will be seen from the chart, the available energy from a cell decreases from the start. If the drain continues long enough, the zero point will ultimately be reached. There is no reason why cells should not be left in circuit as long as they contribute electromotive-force to the current flowing, but if the potential of individual cells is allowed to drop to a very considerable extent, it will

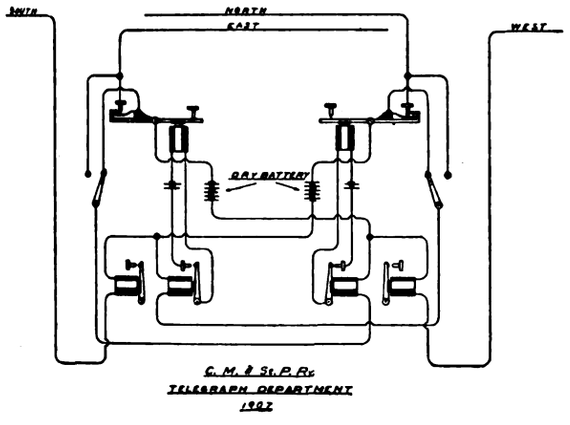

FIG. 3.—CIRCUIT DIAGRAM OF DRY-CELL BATTERY CONNECTED WITH TELEGRAPH RECEIVER.

be necessary to increase correspondingly the total number in series, so that the required potential for working conditions may be maintained.

The determination of the point at which cells should be taken out is something that must depend on the particular service condition. If in telegraph work there is a permissible variation in the current from ninety down to sixty mil-amperes, the average potential per cell could drop from 1.5 volts to one volt. When this point is reached the entire set must be replaced unless additions are made to the series.

If a sufficient number of cells to do the work are placed in a circuit, a larger number is objectionable, for the reason that too heavy a flow of current is produced. Where "dry" cells are used in circuits of widely varying resistance, this fact points to the desirability of determining the necessary electromotive-force for each circuit and connecting the proper number of cells in series to give the required flow of current. If the circuit resistance is known, a voltmeter across the terminal of the battery will show whether or not there is sufficient electromotive-force to produce the desired flow of current, or, if the resistance is not known, a mil-ammeter will serve the purpose equally well.

It has been found by experience that where "dry" cells are installed as a "unit," that is, a certain number in series which are all put in and taken out together, it is highly desirable to have cells uniform in quality and condition. One defective or run-down cell among fresh ones will drag the others down so that the set is unfit for service before the fresh cells have given out their normal amount. The greater the degree of uniformity, the more satisfactory will be results.

The use of "dry" cells in multiple is sometimes of advantage where the current drains are heavy and frequent. It may be that two sets of cells in multiple will work more than twice as long as either set by itself. A similar arrangement to meet similar conditions to connect sets so that, by means of a switch, one set is in circuit at a time, thus giving the other set or sets time to recuperate. The adoption of plans like the above must be determined by conditions.

It has been mentioned already that after a time, at average temperatures, the deterioration of cells comes to be an objectionable factor. It follows from this that cells should be put into service as fresh as possible. If renewals are to be required after a certain period, it is best to get fresh cells from the maker, rather than to order a large stock and keep them on hand for use when needed.

Cells, either in storage or service, should also be protected from moisture, for the reason that short-circuits may occur from the cartons or paper boxes becoming saturated and forming conducting paths between the external surfaces of adjacent cells. They should also be protected from dust and dirt, because conducting particles may form accidental short-circuits. If an accidental cross occurs between leading wires, it is apparent that there will be a very heavy energy drain, sufficient perhaps to cause the wires to become red hot. A heavy drain of this kind is so much loss to the total available energy.

"Dry" cells are liable to damage from rough handling. The wax used for sealing, if cracked or broken, tends to hasten the drying out of the interior. The resistance between the zinc cup and its lining may be so increased as to become a serious defect if the cell is subjected to pounding, and there is also increased harmful chemical action.

Battery gauges are not very reliable, and their usefulness is confined practically to detecting cells which have reached such a condition that they should no longer be left in service. In the first place, their accuracy is no greater than should be expected where the price they bring is taken into consideration. Then, again, the method of making contact with cell terminals causes the readings to be exceedingly variable.

When it comes to a question of determining the relative merits of new cells, the gauge is of practically no value, unless there are "defectives" which it is desirable to find. The battery-gauge test, however, is much to be preferred to the method sometimes used of short-circuiting cells through a wire on which an ordinary compass is placed and judging their condition by the magnitude of the deflection.

The best way to test cells in service is to allow the current to flow through its circuit under standard conditions and then to apply a high-resistance voltmeter of good construction, noting the potential difference at the terminals of individual cells. By this method each cell will show what it is doing under regular working conditions.

The question is often asked as to the quality of new cells of various makes or of various lots of the same make, as determined by instrument readings. It is impossible to answer intelligently with only such limited data to go by. The only satisfactory determination is to give cells a closely observed service test and from results form conclusions. Cells must have time to show their staying qualities, and these cannot be demonstrated in a moment. It is possible to make cells that will give remarkably good initial readings, but which have no staying qualities, and the reverse is also true. The best plan for the user of dry cells is to determine by service tests the make adapted to his requirements which he knows he can best depend on as being reliable in quality and in uniformity of grade.

With the majority of telephone equipments for train dispatching now being recommended a key is associated with the transmitter and so arranged that when

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the user wishes to talk to the distant party, or, in other words, when the transmitter is in use, the key is depressed, thus closing the battery circuit. During the period when the distant party is talking the button is released, thus opening the local transmitter circuit, and saving the cells from a current drain during the time it is not required. A device of this kind is also of benefit from a transmission standpoint, for the reason that if the cells are given intermittent service during conversation they will have a chance to recover during the intervals of open circuit, and will maintain a more nearly constant voltage on the transmitter.

The author was indebted to Mr. Fry for a circuit diagram showing a very ingenious arrangement of "dry" cells used with a telegraph repeater. The arrangement is such that the current requirement of the "dry" cell is reduced to a minimum and the current energy is used to the best advantage. From the diagram it will be seen that only the set of "dry" cells on the receiving side is in service, and that here the current flows only during the "space" or "open" period of the sending line. As the sending and receiving functions are alternated, it will be understood from the diagram how the two sets of cells are alternately brought into action, thus carrying the reduction of closed-circuit periods to its limit.

The numerous advantages of the dry cell for open-circuit work are now being appreciated. The wet cell, formerly used in telephone service, has disappeared, and with its exit has gone a source of annoyance and expense. The possibility of having a certain quantity of electrical energy in a form requiring no attention for maintenance, giving out its energy as demanded, and so cheap that it may be thrown away when no longer useful is almost ideal. As time goes on the field of application will constantly widen, until all requirements for a small amount of electrical energy used intermittently over a long period will be taken care of by the "dry" cell.

Receivers' Certificate Rights Upheld.

Judge Lacombe, in the United States Circuit Court, at New York, signed an order holding that the $3,500,000 in receivers' certificates issued by Adrian H. Joline and Douglas Robinson, as receivers for the Metropolitan Street Railway Company, New York city, and William W. Ladd, as receiver for the New York City Railway Company, are entitled to all the rights of the old certificates.

Electricity in the Home.

In view of the efforts which central-station men in this country are making toward popularizing the use of electricity in the home, an account of the experiences in England of a contributor, signing herself "Maud," in a recent number of *The Electrical Review,* of London, should prove of interest.

The house has eight rooms, all of which are lighted electrically. The sizes of the rooms are not given, and it is to be assumed they are of the fairly commodious kind usually found in English suburban houses.

The dining room is amply lighted by means of a single fifty-candlepower electric lamp with a white shade, at a cost of six cents for sixteen-and-one-half hours' service, as against seven-and-one-half cents for an incandescent gas light for the same time.

Under the previous gas régime wall papering had to be done once every two years; with electric lighting, once in four years is sufficient, an estimated saving of nearly two dollars a room per annum! Moreover, with the electric lighting, curtains last twice as long, and draperies, plants, etc., have a much longer life. On plants and cut flowers alone the estimated saving was twelve cents a week.

The drawing room has two fifty-candlepower lamps. For ordinary purposes one of these is quite sufficient. On special occasions, as when entertaining company, both are switched on, when a most brilliant light is afforded. There is also in this room an electric radiator of the non-luminous type, which consumes one unit of current per hour when full on, but which can be regulated to a third or two-thirds of the heat when the room is of the required temperature. The cost of this at full current is twenty-four cents per day of twelve hours, against nineteen cents for a coal fire, or thirty-six cents for a gas fire for the same time. This compares favorably even with a coal fire, as the cost for cleaning and attendance is practically zero.

By using an electric kettle on the drawing-room table, tea can be made at a cost of one-fifth of a cent per quart for the hot water required. An electric hot-plate costs two-fifteenths of a cent per tea-time, or two-thirds of a cent per day if used during each meal. A portable electric fan is considered necessary in the hot weather, and uses up about as much current as a sixteen-candlepower lamp.

The kitchen is well lighted by a sixteen-candlepower lamp, and the scullery and back passage by one of eight candlepower. An electric iron is almost a necessity, costs about $5.25, and uses up about half a cent's worth of current an hour when in use.

The hall is lighted by an eight-candlepower lamp fixed in an old gas lantern, thereby saving the cost of a new fitting. This need only be used when necessary, as when visitors are calling. This effects a great saving over a gas light, which usually has to be left burning continuously.

The landing is lighted by an eight-candlepower shaded lamp, and the bathroom by a similar lamp mounted on a universal bracket for use in shaving. The hot water for this latter operation can be most conveniently heated by an electric kettle.

The bedrooms take a sixteen-candlepower lamp each, and the lamps should be fitted with neat shades. Turndown lamps are desirable in this connection. A small portable electric radiator is a great convenience in each of the bedrooms, as it makes no smell and requires no attention. Other useful bedroom articles are an electric milk boiler for the baby, electric curling irons for the ladies, bed-warmers, etc.

As outlined above the electric lighting for the whole house does not cost more than $18.75 a year, and when account is taken of the numerous savings it effects, as already briefly hinted at, it cannot really be said to cost more than one-half of this amount.

The costs data cited above appear to be somewhat lower than those obtaining in this country.

May See Lighting Company's Books.

The Appellate Division has decided that New York city may inspect the books and papers of the United Electric Light and Power Company and the New York Edison Company in an effort to ascertain the cost of electricity for lighting purposes charged against the city by the two concerns for the year 1903. This ruling reverses that of the lower court.

The city refused to pay the bill for electric lighting on the ground that the charge was not a reasonable one, and asked to be allowed to inspect the books of the two concerns in an effort to find out whether its contention is correct. The companies refused this permission, and were upheld in the Supreme Court, but the Appellate Divison holds it to be a reasonable request and orders accordingly.

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Low-Pressure Turbines.[1]

The excessive demand on central stations during the peak load has developed a problem to be decided from both a financial and an engineering standpoint. A central-station company must supply the demand for power, and the expenditure for additional machinery must be kept within the limits of the earning capacity of the plant.

Most of the companies cannot afford to discard existing reciprocating engines, even though they be of low efficiency, for new and more efficient units, and obviously it would be impracticable to install more units of the same class to cover the peak loads.

This is where the low-pressure steam turbine comes in to increase the efficiency of the reciprocating engines already in commission, to bring up the power to the necessary point when required, and yet without increasing the total cost to an amount which would not permit of profitable working for the whole installation. Of course, the combination of reciprocating engines and low-pressure steam turbine is not as efficient as a complete new turbine installation with high and low-pressure units, and this addition of a low-pressure turbine to an existing reciprocating steam engine is only recommended where the cost of a complete new installation is prohibitive under the circumstances in question.

The low-pressure turbine affords a means of increasing the capacity of an existing central station equipped with reciprocating steam engines without a material increase of fuel used, or additional boiler capacity. The steam engine is an efficient piece of apparatus for utilizing the available energy of steam between the boiler and atmospheric pressures, and the low-pressure steam turbine is very efficient when worked on low-pressure ranges (below atmospheric). By combining or adding a low-pressure steam turbine to an existing reciprocating plant, exhausting the high-pressure engines into a suitable receiver, and then into a properly proportioned turbine, and the latter exhausting into a good condenser, affords as efficient a means of utilizing the available energy of steam as can be designed, where engines are in operation.

The low-pressure turbine requires something like thirty-four pounds of steam per kilowatt-hour with a vacuum of twenty-eight inches as referred to thirty inches barometer (this consumption per kilowatt-hour varying in different makes and designs).

Assume an existing central station operating compound and simple engines at 120 pounds gauge pressure and exhausting to the atmosphere through a common exhaust header with a back pressure of 1.5 pounds and requiring thirty-five pounds of steam per kilowatt-hour. By comparing the above approximate pounds of steam required by the steam turbine it will be found that an increase of approximately 100 per cent capacity is available without any increased cost of fuel, other than that necessary for the auxiliaries (which would not exceed fifteen per cent) necessary to operate the condenser and possibly the cooling tower.

With more economical engines, for example a compound condensing unit using a twenty-six-inch vacuum, requiring, say, about twenty-two pounds of steam per kilowatt-hour at full load and condensing, and about twenty-eight pounds noncondensing, the aggregate capacity could be increased about seventy per cent for the same fuel consumption, and the combination would take about 15.5 pounds of steam per kilowatt-hour developed.

The efficiency of a well-designed low-pressure turbine is remarkably uniform over a large range of load, making the combination a very attractive proposition during the lighter loads, due to the very flat economy curve, and in a well-designed low-pressure turbine and engine plant, where the units are split up, it is a very easy matter to operate the flat loads of the day very economically and at the same time take care of the peak loads without losing the general economy of the plant.

The possibilities of low-pressure steam will be more readily understood by considering the available work through all the ranges. In one pound of saturated steam, operating from a pressure of 150 pounds gauge to a pressure of one pound above atmosphere, the available energy is approximately 132,000 foot-pounds, and if saturated steam operates from a pressure of one pound above atmosphere to a vacuum of twenty-eight inches, the available energy is approximately 132,000 foot-pounds per pound of steam. Thus, there is approximately as much power available below atmospheric pressure as there is above, and owing to the fact that a properly constructed low-pressure steam turbine will work more economically on the low-pressure ranges than the reciprocating engine on the high-pressure range, this is an ideal condition.

With the reciprocating engine it is impossible to utilize the total possible expansion of the steam owing to the fact that the necessary diameter of the low-pressure cylinder or cylinders would be prohibitive, and cylinder condensation and other losses would more than offset the advantage gained.

Several instances of successful low-pressure turbine installations are given in the original paper, both for central-station and rolling-mill work. These show that the combined unit is extremely flexible and efficient in all the cases cited.

The low-pressure turbine has long since passed the experimental stage, and owing to it being a very simple piece of equipment, it is not expensive to build, does not require a very difficult means of sealing the glands to retain a high vacuum, runs at fairly low speeds, is governed very easily, and the buckets or blading is not run with small clearance, which reduces the bucket or blading trouble.

The author proceeded to illustrate by numerous curves, which he discussed in detail, the possibilities for the use of the low-pressure steam turbine.

The primary question of whether or not the installation of a low-pressure turbine is warranted in any plant can be answered only after a careful analysis of the character and conditions of the operation of that particular plant. There can be no question about the increased efficiency obtainable, and the consequent increase of capacity or decrease of power cost.

In plants, such as rolling mills, where the engines are intermittent in their operation, and conditions are such that but little economy can be effected by operating them condensing, there is no doubt that the low-pressure steam turbine has found a very valuable field. In power plants, however, where the engines may be operated condensing, while the low-pressure turbine will undoubtedly show added efficiency, the probable remaining useful life of the engine to which it is to be tied, as also the future increased demand for power, and the value of a spare unit must all be weighed.

In general it is safe to say that in large plants, comprising two or more modern engines, the low-pressure steam turbine has a proper place; whereas, in small plants having only one engine, and this perhaps in the last stages of decrepitude, it would generally be better policy to install a complete high-pressure condensing turbine of the full power required, and to hold the engine solely as a spare.

As the effective range of pressure in a

[1] Abstract of a paper by F. M. Lege, Jr., presented at the fifth annual convention of the Southwestern Electrical and Gas Association, Dallas, Tex., May 21, 1909.

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low-pressure turbine is naturally small, a good vacuum is of far greater importance than with any other type of steam-power generator. Unless a vacuum at least equivalent to twenty-six inches referred to a thirty-inch barometer can be economically maintained, the installation of this machine can scarcely be justified.

The reason that the combination of reciprocating engines and the low-pressure turbine does not display a markedly higher efficiency than does a single high-pressure condensing turbine, in view of the admittedly higher efficiency of the reciprocating engine in the higher ranges of pressure, is on account of the very important loss occurring between the low-pressure exhaust and the turbine inlet, at which point a drop from a pressure of eighteen pounds absolute to a pressure of sixteen pounds absolute is equivalent to a loss of two-and-one-half per cent of the total available energy, or from three to three-and-one-half per cent of the actual work.

National Telephone and Telegraph Company Incorporated.

The National Telephone and Telegraph Company, which will operate in every county in Pennsylvania and throughout the United States, has been incorporated at Harrisburg, Pa. The route of the company begins at a point vaguely stated "at the Delaware River, in Bucks County, Pa." It then starts west in Pennsylvania, with ramifications and branch lines in every county, city, town, borough, village and hamlet in the state, passing through Philadelphia, Lancaster, Reading, Harrisburg, all points east, west, north and south on the way to Pittsburg. Its lines then extend to every other state and territory, north, south, east and west, as far east as Maine, west to the Pacific Slope, south to the Gulf and north to Alaska. The nominal capital of the new company is $10,000, which is to be largely increased. The incorporators are Charles E. Wilson, Clarence L. Harper, F. R. Shattuck, Edwin M. Finletter and Horace M. Schell, all of Philadelphia. Mr. Harper is treasurer, with offices at No. 140 South Fourth Street, Philadelphia. It is understood that the new company will operate a long-distance line from the coast to St. Louis, and will have in its system a number of independent companies that are now established and doing business, among them the companies having headquarters in the various cities in Pennsylvania.

The Copper Market Situation.

The general condition of the market lately has been heavy, and the tendency downward. Several important sales were made recently at what looked like cheap figures at the time, but the volume of trade generally has been very restricted. A market reaction set in recently, and prices have had a sagging tendency for several weeks. Manufacturers bought heavily in excess of near requirements some time ago, and therefore a comparatively small number of buyers have been compelled to place many new orders of large size lately. Heavy accumulations and large speculative holdings are among the outstanding features of the situation, and until the bulk of the present surplus stocks is wiped out there will probably not be any well-sustained advance in the market for copper.

Production of copper at present is the greatest on record, and preparations are made to keep the mines hard at work to maintain output at a permanently heavy level. The abnormally great exports are taking enormous quantities of copper out of this country every month, but the effect is to increase the accumulation of the red metal abroad. Shifting of stocks from this country to Europe must prove a mere temporary expedient to right a bad situation. The remedy for the present awkward condition is curtailment in production. Domestic consumption is developing very favorably, but it is unequal to the task of assimilating copper at the rate now produced.

Time Extended in New York City Railways—Metropolitan Hearing.

Judge Lacombe, of the United States Circuit Court, in an order filed Saturday, July 17, extended the time thirty days for the taking of proofs for the final hearing of the action brought by William W. Ladd, as receiver of the New York City Railway Company, against the Metropolitan Securities Company.

The extension was granted on the petition of Theodore W. Morris, Jr., of counsel for the receiver, who says that at the hearing of July 12, certain evidence was introduced on behalf of the defendants of such a character as to require the examination of the books of the Metropolitan Securities Company in order to determine whether it was necessary to cross-examine the witnesses then produced. He says, also, that it may be necessary for the complainant to introduce certain proofs in rebuttal.

Notable Aeroplane Records.

During the past few days some record-breaking performances have been attempted in aerial navigation and two of them have proved wonderfully successful.

Hubert Latham, a French monoplanist, twice essayed to cross the English Channel from Calais to Dover, a distance of twenty-one miles. On each occasion his motor failed him and he fell into the sea, the first time after negotiating sixteen miles and the second after traveling all but two miles of the required distance. He was picked up each time by a French torpedo boat.

Louis Blériot, another French monoplanist, met with better success in his attempt to cross the channel on Sunday, July 25. Starting from the cliffs near Calais at daybreak, he landed successfully near Dover after a speedy flight accomplished at the rate of forty-three miles an hour, thereby winning the prize of $5,000 offered by the *Daily Mail*, of London, for the first person to cross the English Channel in a heavier-than-air machine.

The United States also furnished history this week in the performance of Orville Wright, who made a record-breaking flight, carrying a passenger, in the course of his government trials at Fort Myer, Va., on Tuesday, July 27. Wright remained up in the air in his biplane for one hour, twelve minutes and forty seconds. Further records are looked for from the Wright brothers' machine, as it was reported at the time of going to press that Orville Wright was going to attempt to establish new speed records in order to win the bonuses offered by the United States Government.

To Control United Railways.

According to reports from St. Louis, the North American Company will lose control of the United Railways. Plans are being worked out quietly for the organization of a syndicate composed principally of St. Louis inventors, to acquire a major percentage of the stock of the street-railway lines. The North American Company will then control only the Union Electric Light and Power Company.

Last month the North American Company surrendered the control of the Laclede Gas Light Company. It probably will not retain control of the United Railways Company, and later may dispose of its interests in the Union Electric Light and Power Company, and retire entirely from St. Louis.

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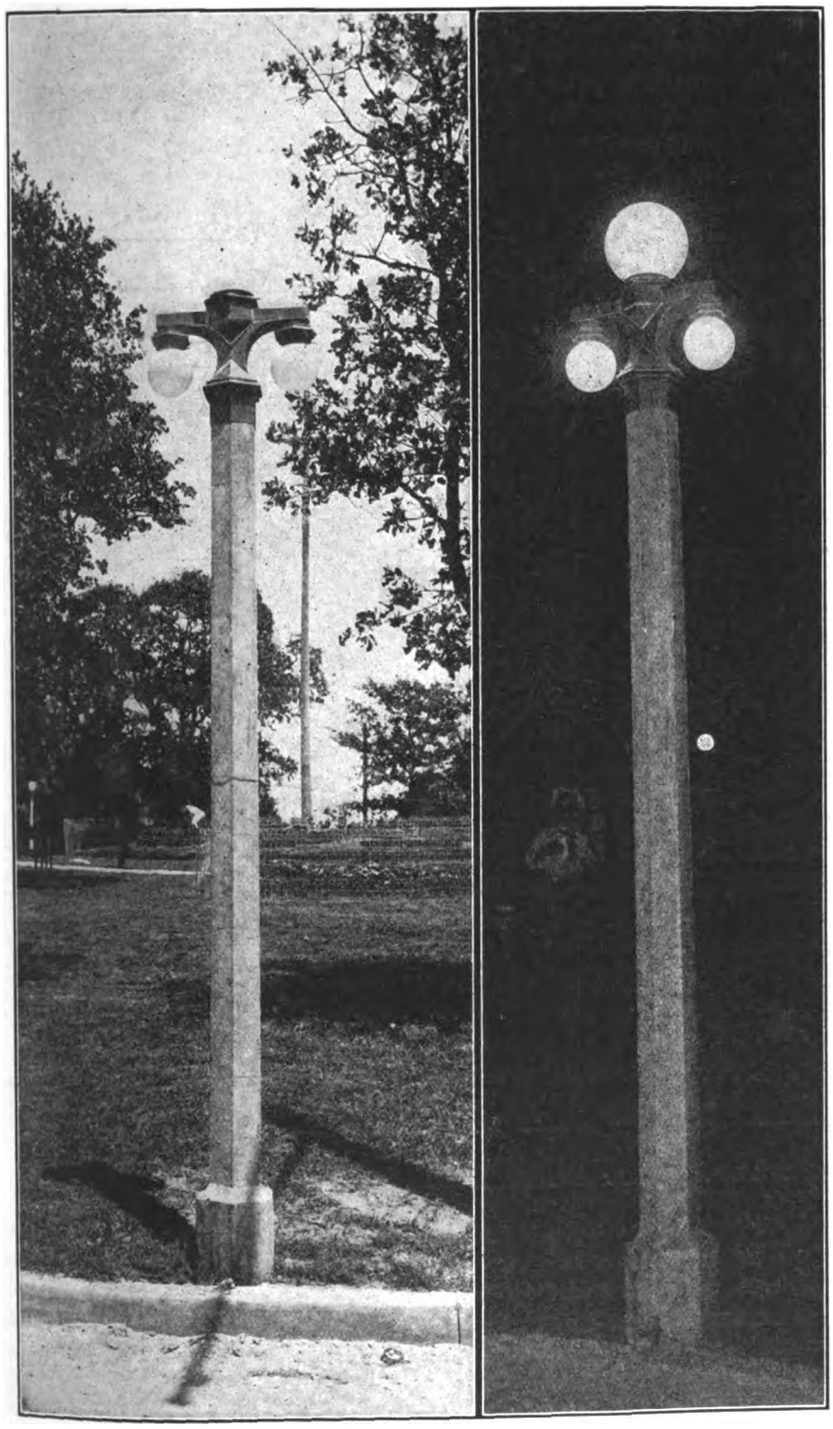
Park Lighting in Oklahoma City.

Recently the Oklahoma Gas and Electric Company presented to Oklahoma City the equipment for lighting Stiles Park, one of several small circle parks at intersections of streets, with the new twenty-six-mile boulevard.



DAY AND NIGHT VIEWS OF TUNGSTEN PARK LAMPS AT OKLAHOMA CITY.

The equipment consisted of eight concrete posts, four carrying three globes, and four carrying single globes. The posts are of reinforced concrete, hollow, and hexagonal in design, and are manufactured by the Hollow Concrete Pole Company. They are surmounted by ornamental copper caps, which carry the lights, as shown in the accompanying illustrations.

The lighting of the three-globe posts is furnished by one upright 100-watt tungsten, and two sixty-watt tungsten lamps, suspended from twelve-inch arms. The single-globe posts are lighted with 100-watt tungstens. This lighting supplants one enclosed arc formerly hung from a sixty-foot pole in the center of the park.

The popularity of the park has greatly increased since the installation, the present use being more than double the former attendance.

The residents of McKinley Avenue have petitioned the Council to install 100-watt tungsten lamps on fifty-seven concrete poles now carrying the company's lines along that thoroughfare.

Interesting Celebration at the Opening of the McAdoo Tunnel.

Two cities celebrated the passage of the official train through the new Hudson tunnel on the morning of July 19. The signal was given by Miss Harriet Floyd McAdoo, daughter of the president of the Hudson & Manhattan Railroad.

The people in Jersey City realized that they are now only three minutes from New York, and that New York has solid connections with the Lackawanna, Pennsylvania and Erie railroads. This means something to the business man as well as to the traveler.

A speaker's stand was erected in front of the City Hall in Jersey City, the building being decorated with bunting for the occasion.

Among the guests were Governor Fort, of New Jersey, Acting Mayor Patrick F. McGowan, of New York, Attorney-General Edward R. O'Malley, of New York state, and James W. Wadsworth, speaker of the New York Assembly; William G. McAdoo and Charles M. Jacobs, president and chief engineer of the Hudson & Manhattan Railroad Company, accompanied the party on the first train. Vice-President Sherman and Secretary of War Dickinson, who, it was hoped, might be present at the ceremonies, sent their regrets to Mayor Wittpen. Other guests were: John F. Ahearn, president of the Borough of Manhattan; Postmaster E. N. Morgan, of New York; J. P. Morgan, Jr.; J. D. Thayer, W. H. Truesdale, president of the Delaware, Lackawanna & Western; F. D. Underwood, president of the Erie Railroad; W. K. Vanderbilt, H. M. Vreeland, Otto Wittpen, mayor of Jersey City; William H. Corbin, Charles F. Adam, 2d, of Harvard University; William F. Baker, First National Bank; William M. Barnum, Samuel Rea.

Government Wireless Tests.

Tests with the apparatus that is to be installed in the 1,000-foot wireless tower to be erected at Washington have been begun at Brant Rock, Mass. The specifications drawn by the Navy Department provide that it shall be sufficiently strong to send and receive messages over a radius of 3,000 miles.

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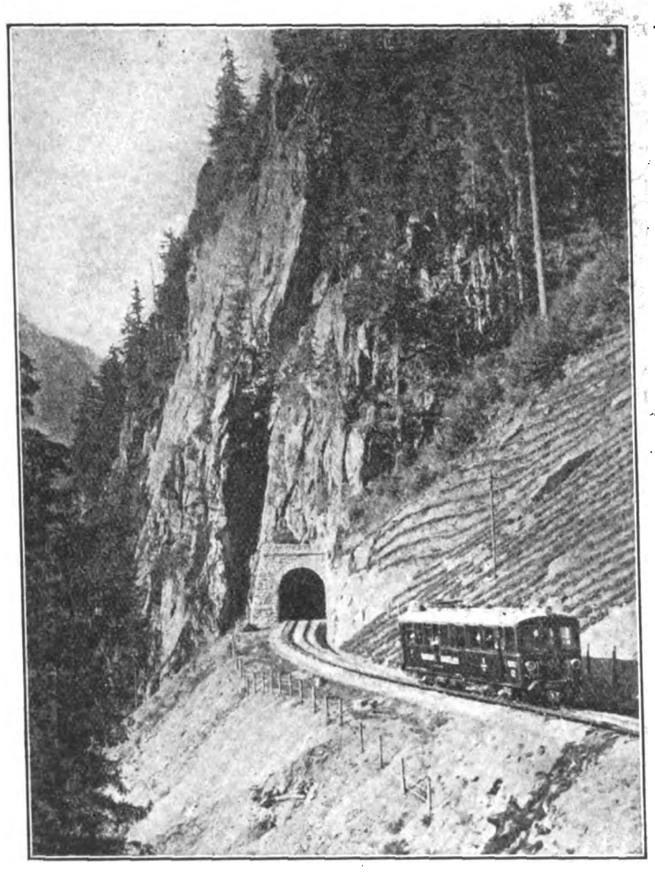
THE NEW ELECTRIC RAILROAD IN SWITZERLAND.

BY C. L. DURAND.

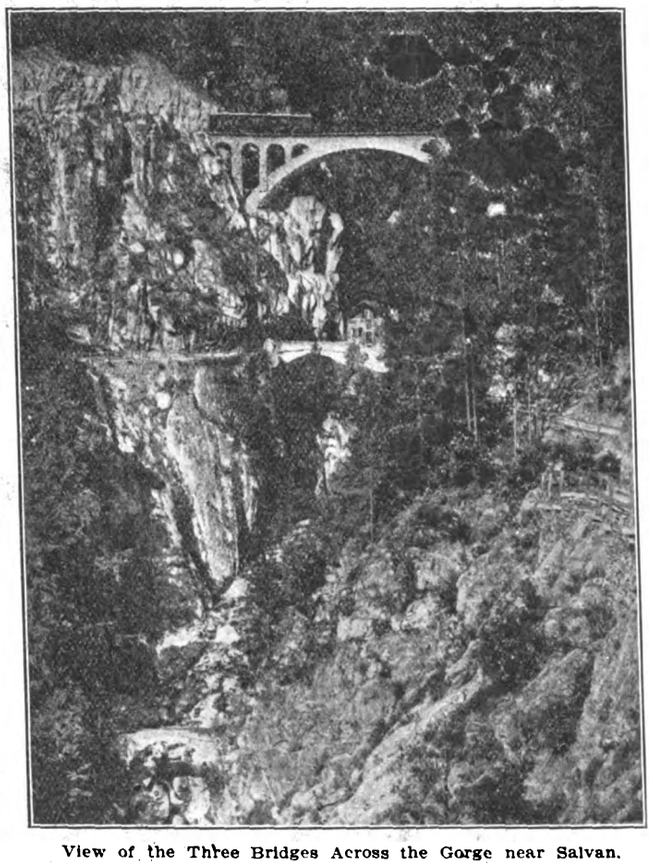
It is only within recent years that tourists have been able to reach Chamonix in a convenient way. Before 1901 the Mont Blanc region could only be reached by diligent effort. It was therefore desired to afford a better means of communication with this much-frequented region, and this led the Paris, Lyons and Mediterranean Railroad Company to establish a direct connection between Geneva and Chamonix. The steam railroad runs from Geneva to the station of Fayet, and at this point the electric line commences, mounting the picturesque valley of the Arve, which lies at the base of Mont Blanc. The Fayet-St. Gervais-Chamonix electric line has been described already, so the present article will relate to the work which has been carried out quite recently in the Mont Blanc region, this being the extension of the present railroad beyond Chamonix, following the valley of the Arve and reaching the Swiss frontier. The line connects at this point with an electric road which is operated by a Swiss company and is an entirely new enterprise. The new railroad continues along the valley between the high mountain ranges and then descends to the town of Martigny, which lies in the Rhone valley. In this way the entire region is traversed by electric railroad, and the enterprise taken as a whole is one of the most considerable traction installations which has been carried out in the Alpine region.

We will refer briefly to the first of these lines, which includes the portion lying on French territory and operated by the Paris-Lyons-Mediterranean Railroad Company. Starting from the terminus of the steam railroad at Fayet, the electric line, which is of one-metre gauge, mounts up the valley of the Arve in gradients which reach as high as nine per cent. It crosses this mountain torrent in a number of places and also the Bonnant, and this required seven viaducts, including the viaduct of Sainte-Marie, which has a central arch of twenty-five metres span and fifty metres height and seven arches of fifteen metres span. Along the line there are three tunnels, one of these having 126 metres length. The distance from Fayet to Chamonix is nineteen kilometres, and the difference of altitude is 458 metres. Along this part of the line there are four stations, Cheddes, Servoz, Houches and Bossons. The latter station lies at the base of the well-known glacier of the same name. One arrives then at Chamonix (1,035 metres altitude), where the first portion of the line which was formerly described had its terminus.

From this point the electric railroad has been extended to nearly double the former length. Beyond Chamonix one reaches the station of Les Tines, where the line crosses the Arve and then passes in tunnel under the steep slopes of the Flegère. The road then runs in the gorge of the Tines, and in this region one has a wide view of the lofty mountain peaks of the Aiguilles Rouges and the Argentière glacier. At 8.1 kilometres beyond Chamonix the station of Argentière (1,254 metres altitude) is reached, with a view of Mont Blanc and the peak of Aiguielle Verte. Here the line crosses the stream on a three-arch bridge of twenty-five metres height. Next one comes to the tunnel of Montets, which is 1,883 metres long, and arrives at Vallorcine, then passing in the short tunnel of Bellecombe the Swiss frontier is reached at the station of Le Chatelard, which is 17.3 kilometres from Chamonix.



The Grosse Larze Tunnel near the Highest Point at Finhaut.



View of the Three Bridges Across the Gorge near Salvan.

THE NEW SWISS ELECTRIC RAILROAD (MARTIGNY-CHATELARD).

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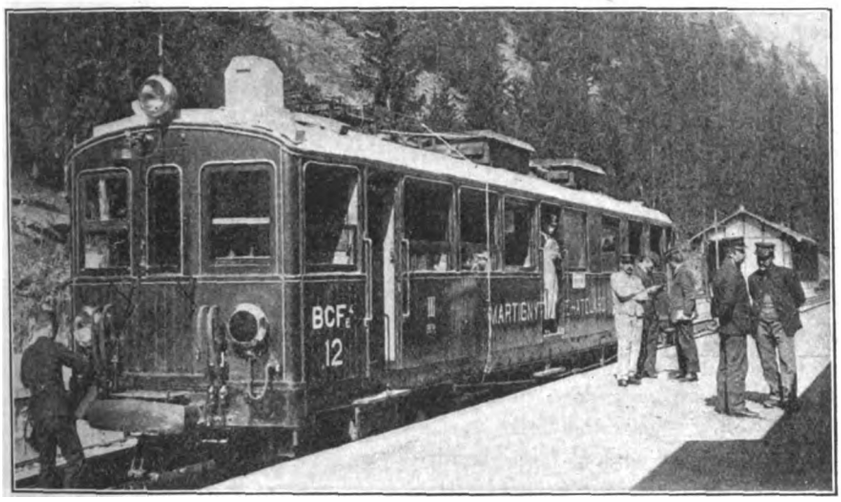
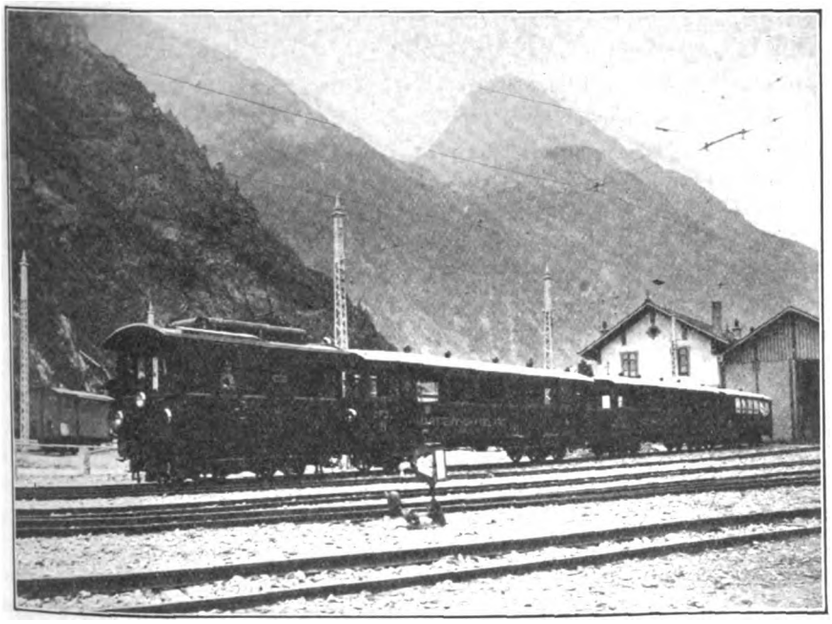
The entire length of the line, which is operated by the Paris-Lyons-Mediterranean Company, is therefore about twenty-two miles.

The trains are made up of motor cars of a short type. In order to give the necessary adhesion for mounting the nine per cent gradients, all the cars are provided with motors and the trucks have the same general design, containing two motors of sixty-five horsepower each. The electric outfit was supplied by the Alioth firm, of Basle. In the present line the third-rail system with 550 volts direct current is employed. The front car is fitted with the controlling devices and the remainder is used for baggage, while the remaining cars are fitted for passenger service. All the motor cars can be operated from the controller on the front car by means of a compressed-air multiple-unit control system, which was devised by M. Auvert, chief engineer of the Paris-Lyons-Mediterranean Company.



240-HORSEPOWER MOTOR CAR ON THE MARTIGNY-CHATELARD ELECTRIC RAILROAD.

The new Swiss electric railroad connects with this line at Vallorcine on the frontier and proceeds thence through the Mont Blanc region, descending on the other side of the mountains, and reaching the Rhone Valley at Martigny, where it connects with the Swiss Federal Railroad. The practically continuous line which is formed by the two railroads now penetrates into the heart of the Mont Blanc region and crosses it entirely. Passengers can thus start from Geneva and arrive at Chamonix, proceeding thence on the other side to the Rhone Valley, where they can take the train on the Federal Railroad to the Simplon tunnel, or, in the other direction, by way of Lake Leman, either to Lausanne or to Geneva. Tourists will find this arrangement to be of great convenience when traveling in this part of the Alpine region.



TRAIN ON THE MARTIGNY-CHATELARD ELECTRIC RAILROAD.

The electric railroad which lies upon Swiss territory has only recently been opened for traffic. It is operated by the Martigny-Chatelard Railroad Company, which has its headquarters at Geneva. During a recent trip to Switzerland the writer had an opportunity to inspect this new electric line through the courtesy of M. Loew, its manager, and to obtain the following information, which has not hitherto been published outside of Switzerland:

Martigny, the starting point of the electric railroad, lies in the valley of the Rhone at the mouth of the valley of the Dranse, and it is a station on the Swiss Federal Railroad which runs from Lake Leman along the Rhone valley, ending at Brigue, where it connects with the Simplon tunnel route. Owing to the opening up of the new electric line, which will bring a considerable amount of tourist traffic, as well as to hydraulic plants and carbide works which have been recently started in this region, Martigny is likely to become a prominent center in this part of the country. It is also the starting point for an electric road which is to be constructed across the mountains to Italy, ending at Aoste.

Owing to the heavy grades which occur upon a portion of the Martigny-Chatelard Railroad, it was found necessary to use the rack-rail system upon one section of the line. In order to allow the train to run through without changing cars, it was decided to build locomotives and motor cars which use the combined rack-rail and adhesion systems. Adhesion alone is employed upon the parts of the line where the gradient is not above seven per cent, but on the portion having twenty per cent the rack-rail is used. The track is one-metre gauge in all cases.

Starting from Martigny, there are three separate sections of the line. The first section runs from Martigny to Vernayaz, which lies in the Rhone valley at the foot of the mountains. Here the line passes over a level stretch of road for 4.8 kilometres, and the overhead trolley is used; the other two sections use a third rail. At Vernayaz the line commences to climb the mountain, and the rack-rail section commences and mounts for 2.5 kilometres to the station of Salvan, at a maximum gradient of twenty per cent. After this point the line is operated by simple adhesion, the

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last section being twelve kilometres in length and terminating at the French frontier.

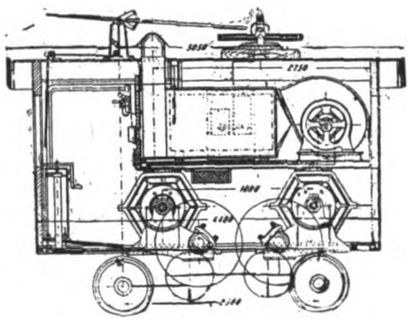
There are a considerable number of bridges and tunnels on the present line. After leaving Martigny, the line crosses the Dranse River on an iron bridge of twenty-seven metres span. On the rack-rail section there are three tunnels. Near the station of Marecottes there is a sixty-three-metre tunnel, and the line then passes through the rocky gorge of the Trientschlucht, where several tunnels are built, among which is the Triege tunnel of 153 metres length. The Triege viaduct has a thirty-seven-metre span. At Lachat there is the longest tunnel on the line, 579 metres. The road reaches its highest altitude at the station of Finhaut (1,227 metres), and then descends in a maximum gradient of seven per cent through several tunnels to Chatelard and the terminal point at Vallorcine.

Current for the line is supplied at 750 volts from a turbine plant located near Vernayaz. The station is placed at an elevated point on the mountain slope and lies above the celebrated fall of the Pissevache, in a rocky gorge. The water after passing through the turbines is returned to the fall so that the flow of the latter will not be diminished.

The type of electric locomotive which is used on the Martigny-Chatelard system will be observed in one of the photographs, coupled to the train, while the general disposition of the motors and the various parts is shown in the sectional view. It is of a short type such as is used on a number of mountain roads in Switzerland, and it is intended to work upon the rack-rail portion of the line, as well as by simple adhesion, upon the remainder of the course. Its weight when fully loaded is 48,000 pounds, and it has sufficient motor capacity for drawing a thirty-eight-ton train up a maximum gradient of twenty per cent at a speed of seven kilometres an hour. The mechanical part of these locomotives was built by the Swiss Locomotive Works, of Winterthur, and the electrical equipment installed by the Compagnie de l'Industrie Electrique, of Geneva.

The truck is mounted upon two axles with wheels of small diameter, using a wheel base of 2.5 metres. Upon the top of the truck and within the car body there are mounted two six-pole motors. Each of the motors is fitted with gears and countershaft so as to drive the pinions for the rack-rail and also the main drive wheels of the locomotive. There are thus two pinions for the rack mounted in the middle of the truck between the car axles. The countershaft is driven at slow speed by a reduction gearing which connects it with the motor. From the countershaft both the rack wheel and the car axle are driven by gearing. To this end the rack wheel is mounted on a short shaft and a pinion mounted on the shaft is driven from a gear wheel placed on the countershaft. The gear sets for the rack and the adhesion wheels are designed so that these will be driven at the same speed. The gears are protected by a dustproof covering.

On the motor shafts there is a steel band brake which is designed to work either by hand or as an automatic brake. In the latter case the action of a centrifugal governor causes the brake to be thrown on when the current fails for any reason or where the running speed rises above nine kilometres an hour. A brake



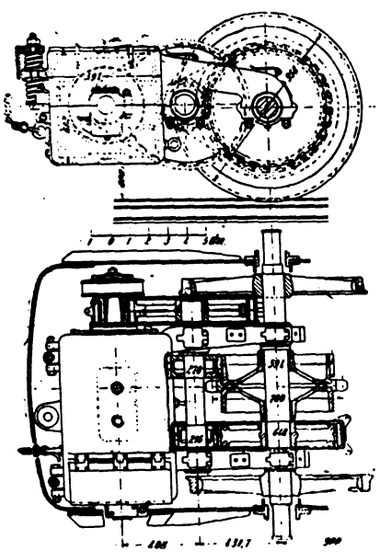
SECTION OF ELECTRIC LOCOMOTIVE.

cylinder is also mounted on the shaft of the rack-wheel, and there is a safety device at this point which prevents the wheel from slipping from the rack in the sidewise direction, should the car wheels be lifted off the track. At each end of the locomotive there is also mounted a safety grip device which prevents the wheels from leaving the track. Besides the above-mentioned brakes, each of the locomotive wheels is provided with a four-shoe brake which is designed to work as an air brake or by hand.

Current is taken from the 750-volt overhead line or the third rail, as may be desired. A bow trolley of the Siemens type is mounted on the roof of the locomotive for working on the overhead section. On the third-rail section there are used four contact shoes of the type designed by the Compagnie de l'Industrie Electrique, in which the metal contact portion is carried at the end of an articulated arm in such manner that the contact shoe bears upon the rail by its own weight, this being the only pressure employed in this case.

The two motors of the locomotive are each designed to furnish 150 horsepower at the normal working rate, using 750 volts and 150 amperes. The field bore is 580 millimetres and the armature diameter 570 millimetres, with an armature length of 300 millimetres. On the armature there are 176 slots, in which is laid a winding of 2.4 by 9.6 millimetre copper strip.

At the front end of the locomotive is placed the controller, which is made up of two separate portions. One of these is a contact drum carrying a set of twenty-five contacts, while the other part



DIAGRAMS OF SIXTY-HORSEPOWER MOTOR FOR MOTOR CAR.

contains the mechanism for reversing and also for operating the brakes. In order to prevent sparking at the contacts of the controller there is used a special carbon shunt device, which is placed outside the controller proper. When the current is broken in the controller, this action causes an electromagnetic device to bring together two carbon pieces, one fixed and the other movable, so that the current flows in the circuit of the carbons. When the electromagnetic device is then put out of action, the break takes place between the carbons.

In the middle of the locomotive is placed a sheet-metal cylinder containing the resistance coils for the controller. The coils are made of galvanized-iron wire. A strong draft through the metal cylinder is given by a fan, so that the coils can be made of a smaller size wire and therefore take up less space. At one end is placed a Sirocco blower, which is driven by a sixteen-horsepower motor, direct-coupled on the shaft. The motor

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is series-wound and runs normally at about 950 revolutions per minute. In order to secure the most effective cooling, the current in the motor, and consequently the air blast, is made to depend upon the amount of current in the resistance coils.

Trains are made up, as shown in an accompanying view, with an electric locomotive of the above type and one or more cars. These latter are built as motor cars in order to give the necessary adhesion, and can thus be run separately or with several cars coupled together, if need be. A multiple-unit control system of special design is used in order to operate the train from the controller on the locomotive or the front car.

The design of the 240-horsepower motor car will be observed in the general views and also in the detail view of the bogie. The mechanical part of the motor car is furnished by the Swiss Locomotive Works. For some of the motor cars the electrical equipment was supplied by the previously named Geneva firm and for the remainder by the Oerlikon Company. The motor cars are of a long type and are mounted on double bogies. The framework of the bogie is built of pressed steel and is mounted upon each of the axle boxes by means of a short elliptical spring. The middle cross-bar of the frame is connected to the under side of the axle boxes by a long spring and a pair of steel side bars. As the present type of motor car is designed to work on the combined adhesion and rack-rail system, a sufficient space had to be allowed in the middle part of the bogie in order to accommodate the two rack wheels, so that this led to the placing of the motors on the outer side of the driving axles, at each end of the bogie. One of the motors is used to drive the corresponding main axle for the adhesion and also one of the rack wheels. The method for the combined drive is observed in the plan view of one end of the bogie. Between the motor shaft and the car axle is placed a countershaft, this latter being driven from the motor by a single-reduction gearing; the gear is mounted outside the bearings at the end of the countershaft. The rack wheel is mounted upon the car axle, but runs loose upon the latter. It is driven from the countershaft by a pinion. At the other end of the countershaft is mounted a pinion which meshes with a gear wheel keyed to the car axle, thus driving this axle independently of the rack wheel.

Each of the four motors is designed normally for sixty horsepower. The motor is of the four-pole ironclad type, of rectangular section, with a field bore of 400 millimetres and armature diameter of 393 millimetres, the armature length being 316 millimetres. For the armature there is used a drum winding laid in fifty-nine slots. A copper bar winding is used having a 1.5 by thirteen millimetre section.

The controller of each motor car is made up of two separate parts similar to the locomotive. For the forward drive with parallel coupling of the motors there are used six contacts in the controller, and ten contacts for the forward drive with series coupling. Eight contacts are used for the brakes when working with parallel coupling, and nine contacts with series coupling. For the reverse drive with series coupling there are employed two contacts. With the controllers is mounted a separate carbon shunt device, as above noted, for preventing the sparking at the contacts. The resistance coils for the motors are placed in the baggage compartment at the middle of the car. The coils are mounted in two vertical sheet-metal columns, and each of these has a strong cooling draft furnished by a fan. Both the fans are driven by belt from a single four-pole motor of twelve horsepower. The motor is over-compounded so as not to race should the belting become broken.

On the bogies there is used an electromagnetic brake which is at the side and lying between the car wheels. The brake is designed to work upon the track rail and consists of a suspended piece containing a suitable exciting winding and six projecting poles which come next the rail. Each of the magnet pieces can lift a weight of 1.3 tons. In order to secure a reliable action, the current is furnished from a storage battery, which is carried upon the car in two separate cases, with a total of eighteen cells. The battery can be charged from the line current by using a resistance in series, and the circuit of the magnetic brakes is controlled from a switch mounted on the platform.

The motor cars are designed to work with two bow trolleys mounted upon the roof, when using the overhead-wire section. Upon the third-rail section there are employed four side contact shoes which are mounted in the same way as for the locomotive.

For the above information the writer is indebted to M. Poulet, chief engineer of the Paris-Lyons-Mediterranean Railroad, and M. Auvert, chief engineer of the traction department of the same company, as concerns the French line, and for the Swiss line, to the Martigny-Chatelard Railroad Company, whose headquarters are at Geneva; also to the resident general manager at Martigny, M. Loew.

Fuel and Energy Problem of the South.

President R. M. Miller, Jr., of the North Carolina Cotton Manufacturers' Association, in a recent interview at Charlotte, N. C., sounded a strong note of warning relative to the fuel and energy supply of the future, in which he declares that the tendency of the many hundreds of manufacturing plants in the South generally is now to make use of power from many hydroelectric plants.

Mr. Miller bases this statement on the cost of coal, and says that unless the railroads shall make a material reduction on charges for hauling it, the manufacturers will turn to the electric current, now so widely distributed through the cotton-mill section of the South, for their power. Mr. Miller has pointed out that the issue is clearly drawn, and that unless the railroads take unanimous steps toward reducing the cost of handling coal, they will have to face the consequences, in his opinion. Mr. Miller also points to the Southern Power Company, with its ultimate development of 200,000 horsepower, as a proof of what he contends concerning the fuel and power proposition.

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The Chicago Electric Club.

Following the regular Wednesday noon luncheon of the Chicago Electric Club in the grill room of the Chicago Automobile Club, July 21, Frederick P. Vose introduced the speaker of the day, Samuel E. Kiser, editor of the "Alternating Currents" column of the Chicago *Record-Herald*. Although editor of "Alternating Currents," Mr. Kiser succeeded in maintaining a direct current of laughter throughout his entire recital of amusing poems and stories.

Largest Electric Sign in the South.

Montgomery, Ala., believes in advertising, particularly electrical advertising, and the largest electric sign in the South has just been set up there. It bears the words "Montgomery, Your Opportunity," together with a symbolic key. The sign is seventy-five by eighty-five feet and contains about 2,500 lights. It was constructed by the Montgomery Light and Water Power Company.

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Congressman McKinley's Electrical Interests.

Congressman William B. McKinley, of Champaign, Ill., whose syndicate has just bought the Des Moines (Iowa) electric-light plant, is one of the pioneers in Illinois electrical affairs, particularly as to interurban lines. Mr. McKinley built the waterworks and electric-light plant in his home town, Champaign, in 1885, and since that time he has been buying and operating gas, water, electric and interurban properties.

The Illinois Traction System, of which he is the head, has in its network of interurbans and city railway lines a total of 520 miles of track. It was organized under the laws of Maine in 1904 with an authorized capital of $11,000,000. Long before this time Mr. McKinley had been in the interurban business and as early as 1890 he controlled the Champaign and Urbana City Railway Company.

The company owns the controlling stock of the following public-service corporations: Bloomington & Normal Railway and Light Company; Chicago, Bloomington & Decatur Railway Company; Citizens' Railway Company, of Venice; Danville & Eastern Illinois Railway; Danville Street Railway and Light Company; Danville, Urbana & Champaign Railway; Illinois Central Traction Company; Decatur Railway and Light Company; Illinois Western Railway Company; Jacksonville Railway and Light Company; Madison County Light and Power Company; Peoria Railway Company; Peoria, Bloomington & Champaign Traction Company; Peoria, Lincoln & Springfield Traction Company; St. Louis, Decatur & Champaign; Springfield & Northeastern Traction; St. Louis & Northern; St. Louis Electric Terminal; St. Louis & Springfield; St. Louis & Staunton; St. Louis Electric Bridge Company; Tri-City Traction; Springfield Belt Railway; Urbana & Champaign Gas, Railway and Electric Company, and the Urbana Light, Heat and Power Company.

The purchase of the Des Moines electric-light plant is one of the largest transactions ever put through in Des Moines.

Denver Company Prosperous.

Net earnings of the Denver Gas and Electric Company for June were $72,835, as compared with $59,473 in June a year ago, an increase of $13,362, or 22.47 per cent.

The Royal Society of London.

Among the papers presented at the meeting of the Royal Society of London, on June 24, were the following:

"The Effect of a Magnetic Field on the Electrical Conductivity of Flame," by Prof. H. A. Wilson. A series of experiments were undertaken on the change of conductivity of a Bunsen flame by a horizontal magnetic field, the current through the flame being horizontal, but at right angles to this field. The ratio of the potential gradient in the flame to the current was taken to define the resistance. The results gave $\delta R R = AH^2 + BH$, where H is the magnetic field, R the resistance, and A and B are constants. From the AH^2 term the velocity of the negative ions was calculated as 9,600 centimetres a second for one volt per centimetre, a result in complete agreement with that obtained by E. Gold by a different method. The BH term, presumably due to the upward motion of the flame gases, has a value about fifty times the one given by the ionic theory.

"The Electrical Reactions of Certain Bacteria Applied to the Detection of Tubercle Bacilli in Urine by Means of an Electric Current," by C. Russ. During electrolysis of certain salt solutions containing bacteria, these latter were found in certain cases to migrate to one electrode, whether the organisms were living or dead. This fact was utilized in testing tuberculous urine in an electrolyte in which tubercle bacilli had shown marked migration, the cathode being arranged in the form of a bacterial trap, thus affording a means of collection and examination. The differences in behavior of various bacteria suggest a possibility of using this method for the purposes of specific discrimination.

"The Absorption of Homogeneous B-Rays by Matter," by W. Wilson. Experiments were made to determine the variation of the absorption coefficient of the B-rays with the velocity. A beam of rays emanating from radium was passed into a magnetic field, so that approximately homogeneous rays could be brought into an electroscope. The strength of the magnetic field determined the velocities of the rays. By interposing screens of metal of different thicknesses in the path of the rays it was found that the law of absorption was approximately linear, except for large thicknesses of absorbing material. That B-rays from uranium, actinium, etc., are absorbed by matter according to an exponential law was shown to be a proof of their heterogeneity. Other experiments showed that the velocity of the rays is appreciably reduced as the rays penetrate matter. No simple relation could be found between the absorption of the rays and their velocity.

Toronto to Try Electric Pumping on Big Scale.

The city of Toronto, Can., is evidently going in strongly for electric pumping, to judge from an announcement emanating from the city engineer's office, which is as follows:

The City of Toronto will shortly call for tenders on approximately the following apparatus: Two 1,500-horsepower induction motors, direct-connected to turbine pumps; four 1,500-horsepower synchronous motors, with turbine pumps; four 500-horsepower synchronous motors, with turbine pumps; two 500-horsepower induction motors, with turbine pumps; two 300-horsepower induction motors, with turbine pumps; two 225-horsepower synchronous motors, with turbine pumps, together with valves, piping, bedplates, couplings, switchboards, connecting material, etc.

This makes a total of 13,050 horsepower for electric pumping, quite a respectable beginning for one city.

Decides Street Cars Are Licensed.

Justice Swayze, in the New Jersey Supreme Court, has filed an opinion in which he holds that the North Jersey Street Railway Company must pay Jersey City an immense amount of money for street-car licenses which the city had failed to collect since 1867.

The license fee on each car is $10. Justice Swayze said that if the street-car company and Jersey City could not agree upon the amount, he would determine it himself.

The case has been before the court for several years, and this is the first time it has been decided on its merits, former decisions being made on technical points.

Electric System for Harbor Guns.

The batteries of San Francisco harbor are to be connected by a new system of electric communication. The work will be done by the cableship Burnside. At present there are fifty large guns at the Presidio and Forts Miley, Baker and Barry, each battery being commanded independently. They will be connected by cables, so that they may be fired simultaneously upon an enemy at any given point.

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American Telephone's Wonderful Position.

What is regarded as another step toward unifying the Bell telephone system of the country was announced last week, when the shareholders of the New York and New Jersey Telephone Company received a circular from the management informing them that the American Telephone and Telegraph Company has offered to exchange its stock for that of the New York and New Jersey Company share for share. This announcement explains the recent sharp advance in the shares of the New Jersey Telephone Company.

The circular telling of the offer, which is signed by President U. N. Bethell, states that the action was taken with a view to securing further improvement in service and economy in administration.

The New York and New Jersey Telephone Company is generally regarded as one of the subordinate companies of the American Telephone and Telegraph Company, although the latter owns but a small part of the New York Company's capital stock. Another subsidiary of the American Telephone and Telegraph Company, the New York Telephone Company, is, however, a large holder of New York and New Jersey Telephone stock.

Under the terms of the American Telephone and Telegraph Company's offer the New York and New Jersey Company's stock, which pays seven per cent dividend, must be transferred by Monday next. The authorized stock issue of the New York and New Jersey Company is $50,000,000 with a funded debt of $1,195,000.

There is discerned, however, behind the offer of the American Telephone and Telegraph's proposition to exchange one share of its stock for each one share of the New York and New Jersey Company, a far more important consideration than the securing of further improvement in service, and economy in administration. By merging completely the most important subsidiary telephone companies, the American Telephone and Telegraph will have a stronger grip on the business. In fact, in this regard it patterns after the United States Steel Corporation, which is made up of a large number of different steel companies, of which the general public knows little.

As an industry under one corporate name, the American Telephone is the second in size and importance, the United States Steel Corporation alone preceding it. However, it would not be at all surprising if the next decade brings about a change where in business done, and in outstanding securities, the American Telephone will be the ranking corporation. As the population in this country becomes denser, the use of the telephone will increase enormously. The American Telephone has moreover shown a decidedly greater sustaining power in periods of depression than the steel business.

Ohio State Electrical Contractors.

The ninth annual meeting of the Ohio State Electrical Contractors' Association was held at Toledo, Ohio, on July 20, and the following officers were elected:

President—A. Oppenheimer, Cleveland.

Vice-president—Emil Grah, Toledo.

Secretary—J. A. Welke, Canton.

Treasurer—William G. Reuter, Cincinnati (re-elected).

There are about thirty members in the state association, and it was estimated that one-half attended. Marvin W. Hansen, of Toledo, who has served as national director for three years, was succeeded by former State President James C. McMaster, Columbus. Mr. Hansen declined to serve another term.

Resolutions of thanks for Mr. Hansen's efficient work in arranging details for the national convention were adopted. The convention was addressed by President McMaster, National President Sanborn, Indianapolis, and National Secretary Morton, Utica, N. Y.

Metropolitan Securities Company.

The United States Circuit Court of Appeals, in a decision handed down on July 14, affirms the finding of the lower court directing the Metropolitan Securities Company to pay over to William A. Ladd, receiver of the New York City Railway Company, the sum of $5,271,582, the remainder of the $8,000,000 promised for betterments at the time the New York City Railway Company took over all the Metropolitan lines. The Court of Appeals agrees with the lower court that the $8,000,000 was not a loan.

Big Decrease in Freight-Car Surplus.

The official bulletin issued by the publicity bureau of the American Railway Association, which was made public last week, shows that there are less than 250,000 idle railroad cars in the country at the present time. This report is significant of trade conditions, when it is compared with the report for the same period last year, when there was a car surplus of over 450,000.

Croker to Finance Subway.

According to reports current in Wall Street, most of the $80,000,000 which the Bradley-Gaffney-Steers Company commands to meet requirements of its bid to construct the tri-borough subway is foreign capital. Richard Croker is credited with activity in the negotiations in London, which led to subscription of English and Continental capitalists to the New York rapid-transit investment.

James J. Gaffney, formerly alderman, and a relative of Mr. Croker by marriage, declined to confirm the report that Mr. Croker was interested in the Bradley-Gaffney-Steers bid. He admitted, however, that a very large amount of the capital needed had been assured from foreign sources.

Negotiations for the additional capital required were completed early last winter by a representative of the New York principals sent abroad for that purpose. This man was formerly closely associated with Mr. Croker and was in frequent consultation with him in England. Mr. Croker is said to have come to New York for his recent extended visit principally in connection with the subway bid.

Western Union's Business.

Speaking of the general improvement in the telegraph and telephone business since the return of commercial and industrial prosperity, Col. R. C. Clowry, president of the Western Union Telegraph Company, says: "Figures usually tell the story where business is concerned. As to the present noticeable improvement, Wednesday, July 21, proved to us that the week preceding was the best in point of income ever experienced by the Western Union. On each Wednesday morning we receive reports of best receipts from various sections of the country, and the amount shown on that day in advance of any other week is a sure sign that telegraphing is still very much in evidence. The next best week was in 1907.

Telephone Companies' Capitalization.

The telephone statements published recently make it possible to gain an accurate idea of just how large the American Telephone Company's interest is in the stocks of its thirty operating companies. At present the operating companies and the Western Telephone have outstanding $419,406,800 of capital stock, of which $227,235,600 is owned by the American Telephone and Telegraph Company. This is 53.9 per cent of the total.

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Wireless Telecontrol.

Remote control by wireless methods is the subject of many individual experimentations which are going on simultaneously in different parts of the world. The principle is to control a local relay on the distant mechanism.

In France, M. Gustave Gabet, the French engineer who has built a dirigible torpedo, made a first test of his invention in the Seine the other day. This new rotary automatic torpedo is in shape like a submarine. It is nearly ten yards long. At the top of it is a long cylindrical floater with two small masts and two acetylene lamps.

When the torpedo was placed in the river, M. Gabet entered a small motor boat about seventy yards away, in which was fitted the wireless apparatus. M. Gabet set his wireless directing machinery to work. The propeller of the torpedo at once began to revolve, and for several minutes the torpedo, under the influence of the electric waves from the motor boat, moved to and fro, to right and left, according to the desire of its inventor. M. Gabet believes that he will be able to direct a torpedo from a distance of eight miles. An official test is to be made next month.

In Sweden, a new dirigible torpedo, invented by a Swedish engineer, has attracted considerable attention in naval circles. The projectile is operated by electricity. It is said to have a range of 5,000 yards, and its course can be altered, while submerged, from the point of departure at the will of the operator. Furthermore, it can be exploded whenever desired, and it has a speed of thirty knots an hour at any depth.

In the United States, Mark O. Anthony, an electrical engineer of New York, recently made a successful private test of a remote control for his model dirigible balloon. Before representatives of one of the European governments, he succeeded in sending his balloon over the ocean near Sandy Hook a distance of a mile-and-a-quarter, directing the movements of the craft from the beach by manipulation of the keyboard of a special form of wireless transmitter. Persons who saw the experiments from a distance of several thousand yards state that during some of the flights a brisk breeze was blowing in short, but that the little dirigible, with its large propeller, at all times made good headway, and appeared to be much steadier and to travel faster than other and larger craft they had seen which were operated by a pilot aboard.

DATA ON DIRECT-CURRENT MOTORS.

BY HOWARD M. NICHOLS.

The accompanying table gives data on a line of direct-current motors from one-fourth horsepower to fifteen horsepower, built by one of the large electrical manufacturing companies. Its principal value is that it furnishes a designer with a convenient means of roughly checking his work when designing motors along similar lines.

The upper portions of the table give the speed, voltage and various dimensions of the principal parts in inches and the lower half gives the weight of the various parts in pounds.

DIRECT-CURRENT MOTORS.

Rating in horsepower..	¼	½	¾	1	2	3	5	7½	10	15
Speed in R. P. M....	1,800	1,600	1,440	1,425	1,060	1,060	1,060	800	640	610
Voltage	110	110	110	110	110	110	110	110	110	110
Number of poles.....	2	2	2	2	2	2	2	4	4	4
Number of commutator segments.....	30	34	34	36	40	40	44	98	98	100
Dimensions in Inches—										
Diameter of commutator.....	2¼	2¾	2¾	3	4	5	5	7	8	8
Length of commutator bar.....	2	2½	2½	3	3	3¾	4¼	5	5¾	7¼
Diameter of shaft....	⅝	¾	¾	1	1⅛	1⅜	1⅝	1⅞	2	2¼
Diameter of pulley...	2½	3	3½	4	4½	5	5½	8	10	11
Face of pulley.....	2	2½	3	3¼	3½	4	5	6¾	7¾	10
Length over all.....	15¼	17¼	18½	20½	25	29	34	37	40¼	44¾
Width over all.....	9	10¼	10½	12	14	16½	18½	20¾	23	26
Weight of Various Parts in Pounds—										
Frame	20	33	42	65	107	185	255	263	330	455
Poles	2¼	3	3¾	5½	12¼	12½	15½	19½	28	39
Bearings (both ends).	9¾	13½	13½	17¼	40½	61	97	124	166	268
Brush rigging.....	1½	1½	1¾	1¾	3½	7¾	7¾	16	16½	19½
Field winding.....	4	6	6¼	6¼	15½	25	43	60	90	135
Armature shaft.....	1¾	3	3¼	4½	10	14½	22¾	35	45	62
Heads	½	2	2	4	5½	5½	8	17½	29	40
Armature core.....	5¼	7¼	10	13	26	30¾	43¾	96	102	140
Armature winding....	¾	1½	1½	3	5	7	10½	16	23	30
Commutator shell....	¾	1	1	1½	3	6	7¼	18½	32	50
Commutator	½	1	1	1½	4¾	8½	11	21¾	27	38
Weight of complete machine.....	55	80	90	128	240	365	530	720	890	1,290

When laying out special machines that are not included in the standard line, such as a four-horsepower motor, for instance, the method employed is to use the parts of either a three or a five-horsepower motor and change the field and armature windings so as to get four horsepower at rated voltage and speed. Whether the lower or the higher horsepower frame is used, depends on what service the motor is going to be put to and also what heating guarantees are required. This same scheme of using standard parts and changing the windings is employed to get small variations of speed and voltage from the standard line.

In the Flight of Time.

The New York Aerial Manufacturing and Navigation Company, of Brooklyn, has been incorporated at Albany, N. Y., to carry on the business of "transportation of passengers, animals, freight, baggage, and other commodities, by airship, aviators, aeroplanes, and other vehicles." Its capital is $250,000.

British Telephone Rates.

The British Postmaster-General, in reply to a memorial sent him by the Associated Chambers of Commerce of the United Kingdom, states that, so far as the Post Office is concerned, his aim has been to adopt such telephone rates as would cover the working expenses of the system, including sinking fund and an allowance for depreciation of plant, together with a reasonable return on the capital expenditure involved. It is impossible to say what rate of charges should be adopted when the whole service is transferred to the Post Office.

The Postmaster-General adds that no final settlement of the question can be arrived at until some experience of the results of the transfer has been obtained. Any parliamentary inquiry at the present time would be premature. The plant of the National Telephone Company would be purchased at the end of 1911 at its then value, exclusive of any allowance for past or future profits or any compensation for compulsory sale; and in the settlement of the value, either by agreement or arbitration, regard is to be had to its suitability for the purpose of the Postmaster-General's telephone service.

Power Sites Withdrawn.

Carrying out the policy of Secretary Ballinger of the Interior Department in preventing the monopolization of great waterpower sites by large corporations, Acting Secretary Pierce, on July 21, withdrew for temporary power sites 25,086 acres of land along the Green River and its tributaries, in Wyoming. All the waterpower sites withdrawn will be reported by the secretary to Congress in order that legislation may be enacted by Congress to preserve them to the government.

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Annual Report of the City Electrician of Chicago.

The annual report of the Department of Electricity of the City of Chicago for the year ended December 31, 1908, has just been published in book form. The report was compiled by William Carroll, city electrician, and comprises 143 pages. Under his control is the entire system of municipal lighting, the management of the fire-alarm and police telegraph systems, the inspection of all electric wiring within the city, and all electrical matters in which the city is interested. In the department were 486 officers and employes.

The most interesting feature in the report is that relating to the municipal electric lighting system, for whose extension during the year there was expended $567,360.56. The average number of arc lamps owned and operated wholly by the city during the year was 8,602; the average number operated with current bought from the Commonwealth Edison Company was 193; the average number rented outright from this company was 678. The average cost of operation and maintenance of the arc lamps owned and operated by the city was $45.86 per lamp per year; this does not include interest, depreciation, water rates, rental of poles, and other investment charges.

The four arc lighting plants formerly operated by steam were changed so as to be supplied with current from the Sanitary District of Chicago, and two substations receiving this current and distributing to alternating-current series arc circuits were put in operation during the first half of the year. There have been erected two new distributing substations, which, however, were not placed in service during the past year. With these two latter stations, each of which has a capacity of 1,350 lines, the city has eight lighting stations, four of which operate alternating-current circuits, and the other four direct-current circuits.

As the result of the co-operation between the City of Chicago and the Sanitary District, whereby the current for lighting the city streets is obtained from the latter municipal organization at practically cost price, there has been a material reduction in operating expenses. On account of the Sanitary District current not being used for the full year an exact comparison of the expenses of the former and present costs per lamp is not possible. For the mixed operation during 1908 it is estimated that there was a net decrease in operating cost of $7 per lamp. The investment charges, however, were increased so that the net decrease was $3.69 for the past year.

At the substation at Emerald Avenue near Thirty-fourth Street, which operated a part of the year with 936 lamps, or an average of 502 lamps for the year, the cost per lamp is far below any price heretofore obtained, the operating cost being $23.89 and the investment charges $13.03, thus making a total cost of $36.92 per lamp per year. The two new substations at 855 South Wood Street and at 4762 Wentworth Avenue, it is believed, will have equally low costs per lamp for this year, thus reducing the average cost over the entire city quite materially. The old stations that were formerly operated by steam power are now driven by alternating-current motors supplied with Sanitary District current. These motors drive the old direct-current generating equipment. It is not anticipated that the operating costs at these plants can be reduced as low as in the alternating-current substations.

The total number of lamps in use for street lighting at the close of 1908 was 9,500 arc lamps, 12,250 mantle gas lamps, 8,950 flat-flame gas lamps, and 7,013 gasoline lamps, a total of 37,713. It is contemplated to extend the electric service from year to year so as to have ultimately all of the city streets illuminated with electric lamps.

The bureau of electrical inspection received revenues amounting to a total of $98,855.42 from fees during the year. It reports the following numbers of electric-lighting stations and lamps in the city at the close of 1908:

	Stations.	Arc Lights.	Incandescent Lights.
Commercial companies, central stations	24	18,973	2,322,097
Isolated plants	1,402	16,696	839,540
City plants, street lighting	5	8,602	.....
City plants, isolated, including water works	12	73	2,725
Totals	1,443	44,344	3,164,362

In this list the commercial companies include all of those stations operating in restricted neighborhoods, such as those operating within a single city block.

The total number of feet and the cost of conduit laid by the various public utility companies and by the municipal organizations within the city of Chicago during the year 1908 were as follows:

	Trench Ft.	Duct Ft.	Cost.
Chicago Telephone Company	127,778	587,692	$148,663.47
Commonwealth Edison Company	185,391	1,184,571	301,413.00
Chicago City Railway Company	203,912	1,434,614	250,000.00
Chicago Railways Company	224,393	1,362,151	263,626.00
Western Union Telegraph Company	1,109	3,000	350.28
Sanitary District of Chicago	39,876	244,600	$42,560.40
City of Chicago	40,728	145,436	47,567.12

The last two are the municipal systems operated within the city.

Railroad Electrification in Canada.

Deputy-Consul C. A. Steeves, at Moncton, N. B., reports that the electrification of the Grand Trunk Pacific, or National Transcontinental Railway, from the St. Lawrence River to Moncton, is now under serious consideration by the railway company, the Dominion government, and the New Brunswick cabinet. Mr. Steeves sends the following details:

Electrical engineers who have given the subject consideration declare the conditions to be entirely favorable. The distance between the St. Lawrence and Moncton is about 460 miles, and for a considerable part of the distance the road passes through dense forests of spruce and fir in lower Quebec and northern New Brunswick, as well as through the rich farming country along the upper St. John valley. What has given impulse to the new power plan is that at Grand Falls on the St. John River, 170 miles from the St. Lawrence and 160 miles from Moncton, is located waterpower sufficient to develop a current for the working of the whole road. At this point the river has a natural fall of about 130 feet and a flow that electrical experts estimate will be sufficient to furnish from 100,000 to 125,000 horsepower continuously by the utilization of comparatively inexpensive means of storage and conservation. As the requirements of the road are estimated at not more than 40,000 horsepower, there is every reason to believe that the supply will be more than equal to the needs.

Western Association of Electrical Inspectors.

The annual meeting of the Western Association of Electrical Inspectors will be held at Detroit, Mich., October 26, 27 and 28. Among the addresses arranged for are the following:

"Municipal Control of the Electrical Hazard," by James E. Cole, wire commissioner, Boston, Mass.

"Relation of the Manufacturer to Electrical Inspection Work," by Alexander Henderson, American Circular Loom Company.

"The Technical Press and Its Relation to Electrical Inspection Work," by J. B. McCarthy, president Electrocraft Publishing Company.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

WESTINGHOUSE ELECTRIC'S BUSINESS

During the month of June Westinghouse Electric booked the largest volume of business that it has secured in any month since the business depression set in almost two years ago. On the basis of the results for last month, the company's business is now running at the rate of about $26,000,000 per annum, with the result that officials of the company are confident that business will be back in normal shape before the end of the present year. As it has been estimated that Westinghouse can earn its fixed charges and sinking-fund requirements, and also make liberal allowance for maintenance on gross sales of from $20,000,000 to $22,000,000 per annum, it will be seen that, on gross sales of $26,000,000 per annum, the company should be in a position to show something earned for the $35,000,000 stock.

PHILADELPHIA RAPID TRANSIT.

Preliminary figures on the business of the Philadelphia Rapid Transit Company for the fiscal year ended June 30 indicate that the strike cost the company fully $300,000. The receipts for the year were $18,306,000, compared with $18,288,763 for the previous year. The increase in earnings of $17,000 was in the face of a traffic decreased by more than 48,500,000 passengers over the year before. The figures that the various fare changes made during the fiscal year resulted in producing an average fare of 3.94 cents per passenger, as against 3.57 cents as the average collection from the 512,869,023 passengers carried during the fiscal year 1907-08. Last year 464,364,656 passengers were carried. The present average fare is 4.18 cents.

Large reductions were accomplished by the Rapid Transit Company last year in operating and maintenance expenditures. Much of this came as a result of heavy curtailment in the service. The previously normal car service was cut down heavily, about 200 cars being withdrawn during the time that industrial depression was at its worst.

Transportation expenses during the year just closed were cut down about $409,000, having been, according to unofficial figures, $4,413,000 against $4,822,472 for the previous year. Owing to the cost incident to changing some 300 cars to the pay-within type, the maintenance of equipment expenses were increased about $20,000, which would bring the item to about $935,000. Figures are not yet available for the cost of maintenance of way, of power and of general expenses.

AURORA, ELGIN & CHICAGO.

The report of the Aurora, Elgin & Chicago Railroad Company for the month of May and eleven months ended May 31 compares as follows:

	1909.	1908.
May gross	$ 133,029	$ 119,049
Expenses	71,356	62,770
May net	$ 61,673	$ 56,279
Charges	28,549	28,423
May surplus	$ 33,123	$ 27,856
Eleven months gross	1,316,430	1,275,516
Expenses	725,795	704,279
Eleven months net	$ 591,635	$ 571,236
Charges	308,794	306,145
Eleven months surplus	$ 282,840	$ 265,091

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of June and nine months ended June 30 compares as follows:

	1909.	1908.
July gross	$ 354,918	$ 331,212
Expenses	190,320	166,083
June net	$ 164,598	$ 165,128
Charges	48,134	48,992
June surplus	$ 116,464	$ 116,136
Nine months gross	2,791,973	2,672,763
Expenses	1,171,403	1,651,707
Nine months net	$1,077,570	$1,021,056
Charges	309,891	319,563
Nine months surplus	$ 767,679	$ 701,493

LONDON UNDERGROUND.

The Underground Electric Railways of London report earnings for the week ended July 10 and for twenty-seven weeks ended July 10, 1909, compared as follows:

	1909.	1908.
Bakerloo	$ 3,365	$ 3,090
Piccadilly	5,675	5,420
Hampstead	3,990	3,305
Tramways	6,988	7,678
District	10,348	9,422
Total	$ 30,366	$ 28,915
Bakerloo	90,225	82,240
Piccadilly	156,440	146,410
Hampstead	105,110	87,975
District	268,926	242,934
Tramways	158,093	173,350
Total	$778,794	$732,909

The Underground Electric Railways of London report earnings for the week ended July 3, and for twenty-six weeks ended July 3, 1909, compared as follows:

	1909.	1908.
Bakerloo	£ 3,210	£ 2,970
Piccadilly	5,650	5,250
Hampstead	3,880	3,380
District	10,343	9,188
Tramway	6,546	8,088
Total	£ 29,629	£ 28,876
Twenty-six weeks:		
Bakerloo	£ 86,860	£ 79,150
Piccadilly	150,765	140,990
Hampstead	101,120	84,670
District	258,578	233,512
Tramways	151,105	165,672
Total	£748,428	£703,994

CUMBERLAND TELEPHONE AND TELEGRAPH.

The report of the Cumberland Telephone and Telegraph Company for the month of June and six months ended June 30 compares as follows:

	1909.	1908.
June gross	$ 536,985	$ 504,364
Expenses	302,279	292,209
June net	$ 234,705	$ 212,155
Charges and taxes	41,540	35,374
June surplus	$ 193,165	$ 176,781
Six months gross	3,180,833	3,056,978
Expenses	1,816,404	1,782,208
Six months net	$1,364,428	$1,274,770
Charges and taxes	255,822	223,009
Six months surplus	$1,108,607	$1,051,761

RIO DE JANEIRO TRAMWAY.

The Rio de Janeiro Tramway, Light and Power Company has issued its report for the year ended December 31, 1908, as follows:

	1908.	1907.
Gross income	$7,138,247	$6,303,706
Operating expenses	4,407,813	4,183,385
Net income	$2,730,434	$2,120,321
Interest on mortgage bonds, bank loans, etc.	1,860,198	.....
Surplus	$ 870,236	.....

A comparative analysis of the gross and net earnings of the company for the years 1907 and 1908 follows:

Gross income:		
Tramways	$3,625,013	$3,504,744
Telephone	174,963	116,208
Light and power	841,346	306,857
Gas	2,496,925	2,375,897
Total	$7,138,247	$6,303,706
Net income:		
Tramways	$1,529,711	$1,353,273
Telephone	104,702	47,758
Light and power	643,240	229,599
Gas	452,782	489,691
Total	$2,730,435	$2,120,321

President F. S. Pearson says in his report:

"Until January 1, 1908, the various companies which are controlled by this company were operated as separate concerns, but from this date the operation of these companies was taken over by this company under operating contracts and leases, so that the earnings of the various companies appear for the first time in the financial statements of this company.

"While the new electric lines were opened late in the year, and it has been impossible to utilize the electric cars to their full advantage on account of the reconstruction, and consequently to reduce operating expenses to any material extent, yet the ratio of the net income to gross income of the tramways has been increased from 38.6 per cent in 1907 to 42.19 per cent in 1908. As the larger portion of the new mileage was completed near the end of the year, the number of mule-car-miles run was not materially decreased over that of the year previous, the total mule mileage being, in 1908, 7,769,378, as against 8,558,030 for 1907;

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the combined electric and trailer-car mileage being increased from 4,348,234 in 1907 to 5,022,627 in 1908.

"In regard to the telephone department, an active canvass for telephone subscribers has been made, with the result that the subscribers have increased during the year from 2,680 to 3,520, or an increase of 31.3 per cent. The gross revenue for the year was $175,000, an increase of $58,000, or fifty per cent over 1907, and the net revenue increased from $47,700 to $104,700, or 119 per cent.

"The gas department is the only one in which the results of operation for the year are unsatisfactory, as the company, not having made final arrangements for the construction of its new plant, has carried on the operation of this service as during the year previous. In consequence of this, no effort has been made to increase the consumption of gas either for lighting or heating.

"An opportunity being presented of acquiring about seventy-five per cent of the shares of the Jardin Botanico Tramways Company, thus assuring a controlling interest of this company, the board considered it wise to purchase these shares."

PHILADELPHIA COMPANY STOCK INCREASE.

At their special meeting on July 22, stockholders of the Philadelphia Company authorized an increase in the capital of the company from $42,000,000 to $47,000,000.

The increase in the common stock of the corporation and the proceeds will be used especially for the exchange of $5,000,000 convertible debentures. It is provided that any of the shares not exchanged may be used for the general purposes of the company.

A large part of the money secured from the sale of the debentures will be advanced by the Philadelphia Company to the Pittsburg Railways Company and the Allegheny County Light Company for extensions and improvements. Among the improvements provided for by the Railways Company will be the purchase of modern double-truck cars.

SUFFOLK GAS AND ELECTRIC.

Permission has been granted the Suffolk Gas and Electric Company by the up-State Public Service Commission, of the state of New York, to mortgage its property for $500,000 to the Kings County Trust Company and to issue at present $350,000 five per cent bonds.

RUTLAND RAILWAY, LIGHT AND POWER.

The report of the Rutland (Vt.) Railway, Light and Power Company for twelve months ended June 30, 1909, compares as follows:

	1909.	1908.
Gross earnings	$249,658	$254,807
Operating expenses	131,692	140,444
Net earnings	$117,966	$114,363
Interest and taxes	81,396	.....
Surplus	$ 36,570	.....

LEXINGTON & INTERURBAN RAILWAYS.

The report of the Lexington & Interurban Railways Company for the month of May and five months ended May 31, 1909, compares as follows:

	1909.	1908.
May gross	$ 49,907	$ 49,149
Expenses	33,463	35,727
May net	$ 16,444	$ 13,422
Five months gross	215,140	214,905
Expenses	163,972	157,142
Five months net	$ 51,168	$ 57,763

KANSAS CITY HOME TELEPHONE COMPANY.

The Kansas City Home Telephone Company has issued its report for the fiscal year ended March 31, 1909; also a report for the Kansas City Long Distance Telephone Company, of which it owns the entire capital stock. The reports, compared with three previous years, follow:

KANSAS CITY HOME TELEPHONE COMPANY.

	1909.	1908.
Gross	$819,786	$766,946
Expenses	413,535	412,971
Net	$406,251	$353,975
Interest	150,260	150,102
Surplus	$255,991	$203,873
Dividends	141,450	*141,450
Surplus	$114,541	$ 62,423

*Approximate.

KANSAS CITY LONG DISTANCE TELEPHONE COMPANY.

	1909.	1908.
Gross	$280,295	$188,266
Expenses	176,674	79,340
Net	$103,621	$108,926
Interest	54,277	53,883
Surplus	$ 49,344	$ 55,043

VIRGINIA RAILWAY AND POWER.

The report of the Virginia Railway and Power Company for the month of May and five months ended May 31 compares as follows:

	1909.	1908.
May gross	$178,350	$167,383
Expenses	101,320	108,667
May net	$ 77,030	$ 58,716
Five months gross	834,570	781,538
Expenses	471,505	523,334
Five months net	$363,065	$258,204

KINGS COUNTY ELECTRIC LIGHT AND POWER.

The report of the Kings County Electric Light and Power Company, including the Edison Electric Illuminating Company of Brooklyn, for the six months ended June 30, 1909, compares as follows:

	1909.	1908.
Gross	$1,839,765	$1,776,723
Operating and general exp.	874,878	824,660
Net	$ 964,887	$ 952,063
Replacement and depre.	211,426	194,998
Balance	$ 753,461	$ 757,065
Fixed charges	303,280	303,280
Balance	$ 450,181	$ 453,785
Dividends	400,000	400,000
Surplus	$ 50,181	$ 53,785

The earnings during the first half of the year 1908 included $84,979 received from special railroad and other service which is not a feature of the company's regular business. With allowance made for this special revenue, the increase in the company's business was upward of $148,000.

Also in the expenses for 1909 there are included certain items under the system of accounting adopted by the Public Service Commission which formerly were treated as annual rather than monthly charges. This makes the expenses appear higher in comparison with the previous year than is actually the case. The purely operating expenses for the first six months of 1909 were only $670 in excess of the same expenses for the first six months of 1908.

The net surplus of the company on June 30, 1909, was $1,254,421.

TOLEDO RAILWAYS AND LIGHT.

The report of the Toledo Railways and Light Company for the month of June and six months ended June 30 compares as follows:

	1909.	1908.
June gross	$ 216,156	$ 201,766
Expenses	129,075	107,458
June net	$ 87,081	$ 94,308
Other income	188	8
Total income	$ 87,269	$ 94,316
Charges and taxes	70,917	71,762
June surplus	$ 16,352	$ 22,554
Six months gross	1,301,488	1,230,375
Expenses	750,184	682,388
Six months net	$ 551,304	$ 547,987
Other income	1,096	2,783
Total income	$ 552,400	$ 550,770
Charges and taxes	425,568	420,136
Six months surplus	$ 126,832	$ 130,634

NORTHERN OHIO TRACTION.

The report of the Northern Ohio Traction and Light Company for the month of June and six months ended June 30 compares as follows:

	1909.	1908.
June gross	$198,203	$174,444
Expenses	107,976	98,895
June net	$ 90,227	$ 75,549
Charges	44,245	44,120
June surplus	$ 45,982	$ 31,429
Six months gross	973,942	837,744
Expenses	553,365	517,657
Six months net	$420,577	$320,087
Charges	263,320	263,898
Six months surplus	$157,257	$ 56,189

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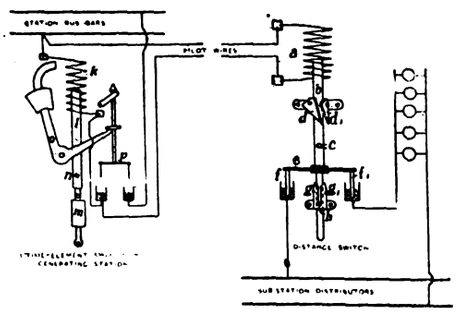
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

A REMOTE-CONTROL SWITCH FOR STREET LIGHTING.

A novel form of switchgear has been recently supplied to the Neath (Wales) Rural District Council for controlling the electric lights in the outlying districts, and during the six months it has been in use not a single hitch has occurred in its operation. The supply at Neath is 220-volt, fifty-cycle, alternating current. The distance switch consists of a solenoid *a* having a core *b*, which carriers in a suitable position a strong pin *c* projecting on either side of it. Below the solenoid *a* and above the pin *c* are suspended two metal arms or guide pieces $d\,d_1$, at right angles to each other, and of such shape and so pivoted that they hang normally with their under sides sloping at a steep angle to the vertical. Below the pin *c*, and fastened to (but insulated from) the core *b* is a metal bar *e* carrying at each end a metal pin $f\,f_1$, which form a bridge piece capable of joining together two mercury cups suitably placed and connected into the circuit to be controlled. On an extension of the core, below this bridge piece, is a second pin *h* capable of rising above, and falling to the bottom of, one or other of four slots between four upright pointed teeth *g g*, etc. (only two shown), arranged in a circle round the core. This pin *h*, together with the slots referred to, acts as a stop to prevent the core from falling too far, and also as a guide to insure the core rising and falling vertically when the pins $f\,f_1$ of the bridge piece are leaving and entering the mercury cups. The action of the switch is as follows: Assuming the switch to be in the off position, when current is applied to the solenoid, the core is raised through a certain distance, without turning, until the pin *c* strikes the underside of one of the guide pieces $d\,d_1$, causing the core as it continues to rise to be turned through a quarter circle. This turning movement has carried the bridge piece attached to the core into a position directly over the mercury cups, so that when current is cut off from the solenoid the core falls and the bridge piece enters the mercury cups, closing the lighting circuit. To switch off the lights, exactly the same operation is gone through, and the bridge piece takes up a position out of and at right angles to the mercury cups, ready for the operation of switching on again. To insure that the switches are not left with their solenoids energized (when they would be inoperative) and also to indicate whether the street lights are on or off, a special controlling switch, having a time element and an indicator, is installed at the generating station, one being connected to the pilot circuit of each distance switch. The action of this is as follows: When it is desired to operate a distance switch, the time-element switch in the generating station is closed by the attendant; this energizes the solenoid *k*, as well as that of the distance



REMOTE-CONTROL SWITCH FOR STREET LIGHTING.

switch. The core *l* then rises slowly against the retarding action of a dashpot *m*, till a pin *n* in the core *l* raises and tilts over a weighted lever *o*, and thus opens the pilot circuit by raising the bridge piece *p* out of the mercury cups. An indicator, actuated by the lever *o*, shows the word "on" at a small window in the cover, because the distance switch is now closed and the lights are on. The same action takes place when switching off, only that the indicator moves to "off." The largest current controlled by any distance switch is sixty amperes, but one of them, on test, dealt perfectly satisfactorily with ninety amperes, 440 volts, direct current, the break being very long and quick. The pilot wires are 0.007 square inch in cross-sectional area, and in length from three-fourths of a mile to three-and-three-fourths miles from the generating station. On the long line three distance switches are operated simultaneously.—*Abstracted from The Electrical Review (London), July 2.*

THE "QUARTZ" SYSTEM OF ELECTRIC HEATING.

A new type of electric heater, which it is claimed possesses a much greater radiating efficiency than any similar device on the market, has been introduced by the firm of Drake & Gorham, Ltd., of London. There are six heating elements, each consisting of a quartz tube enclosing a spiral of pure nickel wire which oxidizes only to a very small extent and is practically unaffected by contact with the air at high temperatures. When the current is switched on, the quartz tube or glower and the spiral are brought to a red heat within fifteen seconds. The quartz tube permits of the maintenance of high temperatures, and each spiral has a useful life of at least 1,000 hours, and

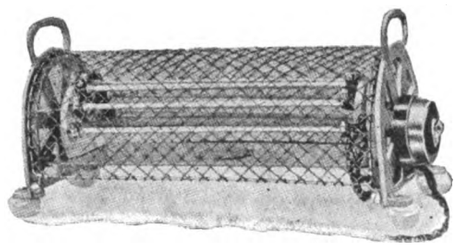


FIG. 1.—THE QUARTZ HEATER COMPLETE.

probably 2,000 or 3,000 hours. A spiral can be renewed at a cost of twelve cents, provided the glower is not broken. The device consumes about 750 watts. It can be set against a wall if required, and, as can be seen from the illustration, is

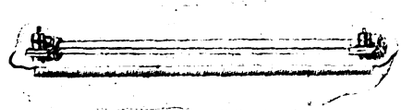


FIG. 2.—THE HEATING ELEMENT.

effectively protected by means of a wire netting. Ovens, grills, and other apparatus will shortly be produced on the same principle.—*Abstracted from The Electrical Times, July 8.*

A REGULATOR FOR ALTERNATORS.

Electrical engineers have been trying for a long time to design an alternator having some arrangement equivalent to the compound or series winding of a direct-current machine, to keep the voltage constant under a varying load. In the direct-current dynamo the main current

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of the machine can be taken around the field magnets in a few series turns, thus increasing the field as the load comes on, and keeping constant, or even raising, the voltage. With an alternator the problem is different, since there is only an alternating current available for the purpose of producing or increasing a unidirectional field, which is clearly impossible. The apparatus to be described depends on the fact that while an alternating current cannot directly produce a unidirectional field, it can have a strong action in diminishing such a field. If, consequently, an iron leakage path be laid across the pole-pieces of the magnet, and a powerful current passed through the exciting windings, it is clear that, provided the cross-sectional area of the leakage path is less than that of the magnets, the iron of the leakage path will be more or less saturated—that is, will be incapable of passing very many more lines of force, even when the exciting current is greatly increased. Now, if an alternating current is passed through the winding on the leakage path, it will be seen that when passing in one direction it cannot, owing to the iron being saturated, greatly increase the leakage flux in the leakage path, but when passing in the other direction it can and will—provided it be of sufficient strength—very greatly reduce the leakage flux. Hence the net result is a reduction of the leakage flux. It is this principle that has been applied in Parson's Patent Compound Wound Alternator. The leakage-path windings are placed between the windings of the alternator and its neutral point, which is usually either earthed or at a potential differing but little from earth, but notwithstanding this they are insulated for the full working voltage of the alternator. All extra apparatus required on a compound alternator of this type is entirely electromagnetic—there are no moving parts whatever nor any electrical contacts to be made and broken, nor are there any complications such as solenoids and electrical condensers. There is no commutator to change the alternating current into direct current, and all the parts required for the compounding are fixed on the exciter. Thus if, in spite of the great simplicity of these parts and the care taken to prevent breakdown, trouble should occur in this part of the machine, it is only a matter of a few minutes to remove the compounding apparatus.—*Abstracted from The Times (London) Engineering Supplement, July 14.*

ELECTRIC NARCOSIS AND RESUSCITATION.

The phenomenon known as "electric narcosis," first discovered by Professor Leduc, of Nantes, is brought about by passing through the nerve centers a current, preferably from a battery, which by means of a special commutator is interrupted 100 times a second, the current actually flowing for one-tenth of the period between each interruption. This is now known as the Leduc current; and if there are no signs of its displacing ether and chloroform for producing anæsthesia in human beings, it certainly has done so to a large extent in the conduct of laboratory experiments upon animals. Dr. Louise G. Robinovitch, of New York, has recently published a series of papers in which she makes several important communications regarding the uses and properties of such currents. Speaking of electric anæsthesia in laboratory work, she points out the following advantages among others: 1. The blood pressure, respiration, and temperature remain about normal, even after eight hours or longer anæsthesia. 2. It can be induced not only centrally but locally. 3. No animals have been lost from this anæsthesia. 4. A voltage of from five to ten volts is all that is required to produce electric anæsthesia, and this potential is quite free from danger to life. Finally, Dr. Robinovitch has been able to perform important operations, such as exposure of the brain, carotid artery, vagus nerve, and abdominal organs, under its influence. Carrying her investigations further, she has made the somewhat paradoxical discovery that if properly applied this current can resuscitate electrocuted animals. The animal having had the hair shaved off at three places—head, upper part of dorsal region, and lower part of spine—is placed in the cradle with an electrode fastened to each shaved area. The electrode placed at the end over the lower part of the spine is the anode, the other two are cathodes, that at the root of the neck at first being disconnected. When everything has been prepared, a lethal current is passed through the body until apparent death sets in. The cranial electrode is then disconnected, that at the root of the spine being joined up in its place, and the operator by means of a suitable break carries on rhythmical excitations with a sufficient potential to cause maximum respiratory expansions. These are practiced for one second with an interval of from two to three seconds. From ten to thirty of these are generally necessary to restore spontaneous respiration, and a successful result may occur after a much longer period. Carrying her work still further, Dr. Robinovitch has succeeded in resuscitating animals after cardiac or respiratory syncope has been induced by chloroform or ether, the method of applying the current as well as the current itself being essentially the same as that which we have described. The possible practical importance of these experiments in surgery is obvious, for there would seem to be no valid reason why, in cases where the administration of a general anæsthetic was attended with some anxiety, arrangements should not be made to apply rhythmical electrical excitations.—*Abstracted from The Lancet (London), July 10.*

THE CONTA ARC LAMP WITHOUT REGULATING MECHANISM.

The Conta lamp has no mechanism, contains no regulating coil, and is controlled automatically. The vertical carbon brakes itself automatically and carries at the same time the other or "lighting" carbon. The combustion directly effects the release of the brake and consequently the descent of the carbons. They descend in the measure as they are consumed without mechanical or electrical intervention, which might be a cause of disturbance. The starting is effected by means of an oblique carbon which swings outward when the circuit through the lamp is closed, and thus produces the arc. The light is absolutely steady on account of the constant length and resistance of the arc. The light efficiency is considerable, the consumption being 0.13 watt per hefner candle. A small lamp consuming only 330 watts gives an average light intensity of 1,600 hefner candles in the lower hemisphere with mineralized carbons. The large 600-watt lamps furnish about 5,000 candlepower. The Conta lamps can be connected in series or parallel, according to the potential of the distribution line, and may be used on alternating as well as direct-current circuits. They are manufactured by the Regina Bogenlampen Fabrik, of Cologne, Germany.—*Translated and abstracted from L'Industrie Electrique (Paris), July 10.*

Electric Storage Battery.

After a routine meeting of the directors of the Electric Storage Battery Company, an official said that the company is having the biggest year in its history, and a still further increase in business is expected in the fall.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Intercommunicating Telephones at the American Mills Company's Offices.

The requirements for rapid communication between the different departments in large factories, mills and stores, which cover a considerable area or occupy several floors, have for some time been successfully taken care of by the intercommunicating telephone. It is, however, a somewhat new and further advancement in business systematizing, that this mode of communication should find its way into banks, small stores and salesrooms which occupy one floor, and consist of from one to eight departments. The value of an intercommunicating system has nevertheless grown on its merits. In many cases its installation has reduced the routine, which necessarily increases as the business grows. The automatic intercommunicating system has raised the standard of business efficiency, since it enables more work to be handled by the same number of employes and with less friction to all concerned.

The accompanying illustrations show an automatic intercommunicating system installed in the sales offices of the American Mills Company, 395 Broadway, New York city. This installation connects the manager, the sales department, the bookkeeping department, the stock department and the shipping department.

The types of instruments used in this system are especially interesting, as they show the value of the different sets in connection with the service which is performed through them. Fig. 1 shows the type of instrument used in the manager's office. This is a very convenient hand set, which can be used at a desk where a long-distance telephone is required and where two desk sets would occupy considerable space. These sets are extremely convenient, as they consist of receiver and transmitter mounted together in such a way as to be operated while held in one hand. When not in use this set is suspended from a hook at the left of the desk. It may, however, be hung at any convenient place, being independent of any apparatus in connection with its hanging. Fig. 2 shows a similar set installed at the bookkeeper's desk.

Figs. 3 and 4 show a wall type of this intercommunicating instrument which is used for the same service. Fig. 4 represents the stock department, which has a continual need of communication with the head of the shipping department, shown in Fig. 3. The stock department in turn is engaged in conversation in connection with every order, at least once with the order clerk.

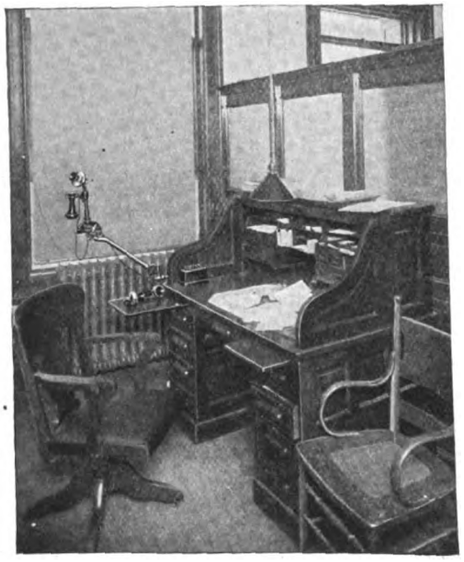

FIG. 1.—MANAGER'S OFFICE, AMERICAN MILLS COMPANY.

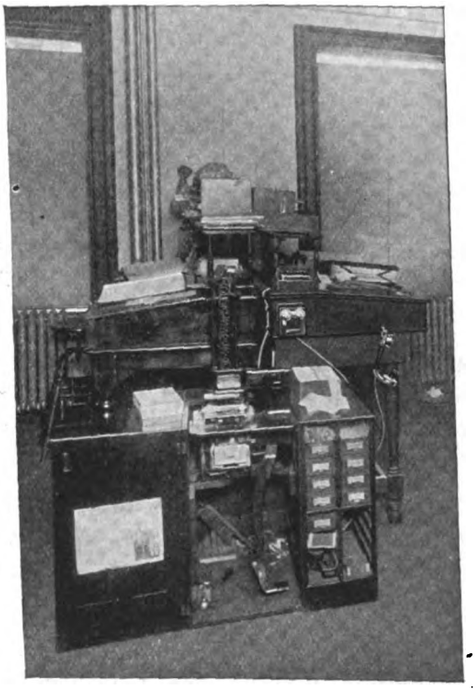

FIG. 2.—HAND SET, AT BOOKKEEPER'S DESK.

To secure telephone connection with these different stations to which the instruments are connected, it is only necessary to press the proper buttons. One

FIG. 3.—SHIPPING DEPARTMENT, AMERICAN MILLS COMPANY.

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button is mounted on the face of each wall set for each of the stations connected to the system, and a name-plate is provided with a space opposite each button, for designating the name or location of the station associated with the button. The act of pressing down the button rings the party, and one talks as with the ordinary telephone instrument. The system is always available for use both night and day, since no operator is required. In case a hand or desk set is used a metal box contains the connection keys and buttons; this arrangement is shown in Fig. 1.

Telephone instruments of this character are made of such a capacity as to accommodate either eleven, twenty-one, or thirty-one stations. The one illustrated, however, has only five stations equipped at present, yet is an indispensable feature of this business organization. The American Mills Company has two factories located at New Haven, Conn., to manufacture its goods, and at each of the factories there is installed the same system of communication. The systems, both in the factories and offices, are of Western Electric Company manufacture, and were installed by that company.

As seen in the illustrations, the apparatus is arranged to suit best the conditions in which it is to be used, being furnished in three different styles: one for wall mounting, one for desk use, similar to the long-distance telephone set, and a special hand set, which is very convenient in many cases where room for the desk set is not available. In connection with the long-distance desk set at the chief executive's office, Fig. 1, an extension arm is used. This is known as an equipoise arm, and is so balanced that it remains in any position desired, and comes into that position with very little effort. With this arrangement one may use the telephone with equal ease and convenience while standing or sitting. It may be moved in a radial direction, so that it is out of the way, yet always within reach.

In connection with the wiring of the equipments, the conductors both for ringing and talking extend through the system in cable, the conductors being provided with double-silk and single-cotton insulation, colored for identification. In damp interior locations, when not made fireproof by protecting conduits, the cable has a lead cover.

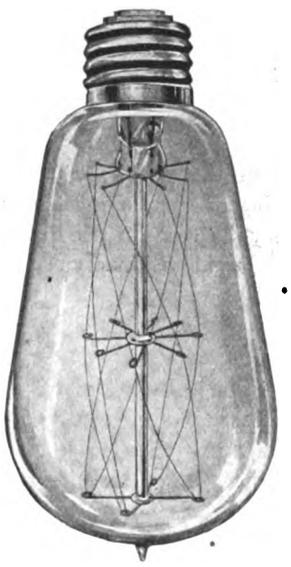
For ringing purposes, when the maximum distance between any two stations is 1,300 feet or less, the battery used is sufficient to give a potential of about seven volts with a talking battery of about four volts. With 1,600 feet as a maximum distance, a nine-volt ringing battery is used and a four-volt talking battery. It is therefore seen that, since no operator is required, the expense connected with this system is largely maintenance, consisting of battery supply. This expense is very low.

FIG. 4.—STOCK DEPARTMENT, AMERICAN MILLS COMPANY.

The "Any Angle" Tungsten Lamp.

The Novelty Incandescent Lamp Company, Emporium, Pa., is meeting with great success in distributing its "any angle" tungsten lamp, an illustration of which is shown herewith. The filaments in this lamp are arranged with centrally located anchors and spirally displaced threads, so that the lamp may withstand shipment, burn in any position, and be submitted to considerable rough handling.

The Novelty regular tungsten lamp is similar in construction to other American-made tungsten lamps, and is manufactured in all standard sizes, including the four-candlepower, five-watt, ten, twenty, twenty-five and twenty-seven-and-one-half sign-lamp sizes. This lamp gives the same candlepower and consumes but one-third of the current of the ordinary four-candlepower carbon-filament lamp. The forty-watt small-bulb lamp is made in the same size bulb as the sixteen-candlepower carbon lamp and gives twice the candlepower at one-third the cost.



THE "ANY ANGLE" TUNGSTEN LAMP.

Westinghouse Gas Engine for Chemical Works.

The Roessler & Hasslacher Chemical Company, 100 William Street, New York, has installed in its works at Perth Amboy, N. J., a 300-horsepower Westinghouse horizontal gas engine operating on producer gas derived from anthracite coal. The generator furnishes three-phase, sixty-cycle alternating current at 480 volts, to be used for power and lighting services about the plant. A large proportion of the power will be utilized in carrying on chemical reactions in the manufacture of the products of the laboratory.

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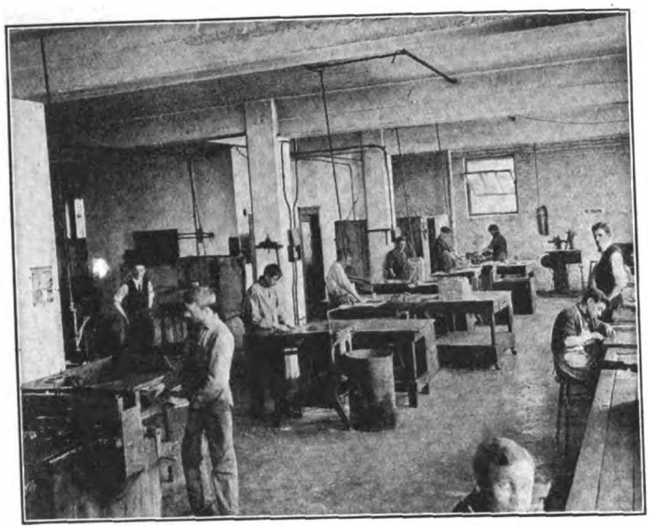
Individual Motor Drive in an Electrotype Establishment.

That individual motor-driven machinery is replacing the single-motor system, wherever possible, is shown particularly in the equipping of modern electrotyping establishments. Lower power bills, more floor space, convenience and cleanliness are some of the points in favor of this class of installation, a good example of which may be seen in the plant of the Advance Rapid Electrotype Company, Chicago, Ill.



VIEWS OF MOTOR-DRIVEN SAWS AND TRIMMERS.

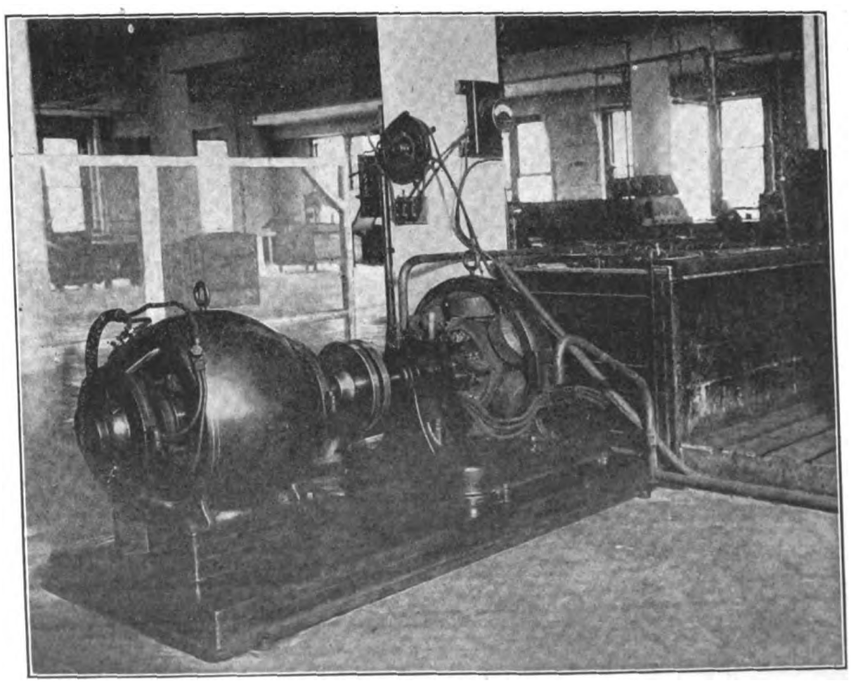
An idea of the general layout of this plant is given in the accompanying illustrations. The natural light is excellent. The machines are all driven by individual motors, in nearly every case mounted on the machines, either belted, or in a few cases direct-connected, so that there are no overhead belts. The wiring is carried through conduits, and the general appearance of the shop is particularly clean and attractive.

A 220-volt, Commonwealth Edison three-wire, direct current, from the Ohio Street substation, supplies the plant with power.

In the processes used in producing electrotypes, the first machine used is the wax shaver, shown herewith, a machine into which the wax plates are placed to be shaved smooth and even, after the wax, in its natural form, has been melted and run out, to the thickness of about one-sixth of an inch, on metal plates. The cutter has a reciprocatory motion, cutting the wax material in going forward and passing over it freely in reversing. A one-horsepower, compound-wound, reversible Roth motor, running at a speed of 1,200 revolutions per minute, is used to operate this machine. The motor is controlled by a Cutler-Hammer No. 12 starting box, equipped with special attachments for inserting dynamic resistance across the armature for quick stopping.

After the wax plate is trimmed it is ready for the molding press. This is a powerful hydraulic machine capable of a pressure of 800 tons, if necessary, obtained through a motor-driven triplex oil pump. The type matter sinks into the wax, under this pressure, and an absolutely perfect impression is obtained. The plant under consideration is equipped with two of these molding presses. One is a twenty-four by thirty size and is driven by a two-horsepower, shunt-wound Roth motor, running at 1,100 revolutions per minute. In this press the motor is geared to the pump. The other machine is a thirty-two by twenty-five and is driven by a three-horsepower shunt-wound Roth motor, belt-connected to the pump. This motor has a speed of 1,825 revolutions per minute. The pump in this press is built in the base and runs constantly in oil, the oil being used also as the medium for conveying pressure to the plunger.

After obtaining the pressure desired in the wax plate, it is then ready for the polishing machine. This machine, frequently called the black-leader, is used for coating the wax with black-lead. It is equipped with six large, soft badger's-hair brushes, moving rapidly up and



DEPOSITING DYNAMO WITH DIRECT-CONNECTED MOTOR.

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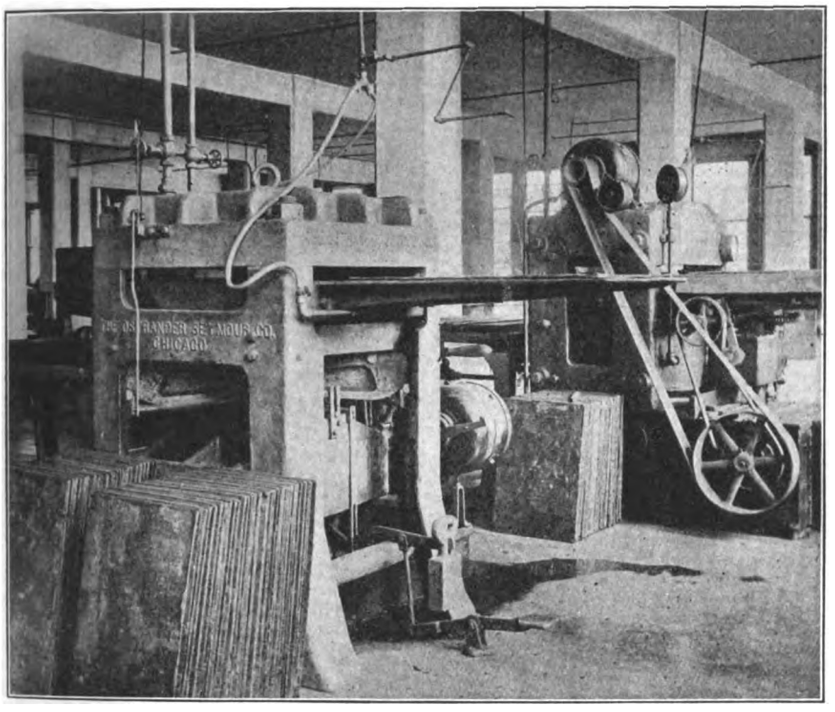
down, by reason of being mounted on eccentric rods. These brushes work the black-lead into and polish the minutest indentations, the plates being carried back and forth under these brushes on a slowly moving bed. A one-and-one-half-horsepower, shunt-wound, belt-connected Roth motor is used for driving this machine, the motor being mounted as an integral part.



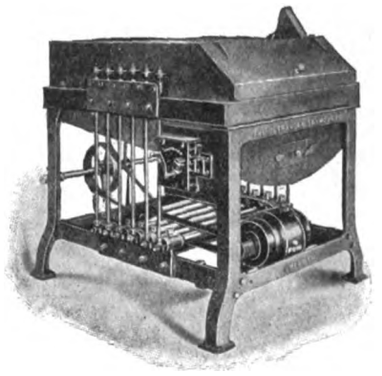
MOTOR-DRIVEN MOLDING PRESSES.

After some minor operations to prepare the wax matrices for the electroplating bath, they are thoroughly washed, a positive pump being used to give increased pressure to the water. This pump is driven by a one-horsepower, shunt-wound, belt-connected Roth motor.

The plating dynamo is an Ostrander-Seymour 2,000-ampere, compound-wound, six-volt electroplating machine. It is mounted on an iron bedplate and direct-coupled to a twenty-horsepower Roth motor. The motor and generator are insulated from each other on the base, and an insulating coupling is used, which is of a flexible type. To prevent what is known as "burning" and to secure an absolutely even deposit on all portions of all plates, the plating solution is constantly agitated by air, which is pumped into it through perforated lead piping. This pump is gear-driven by a one-fifth-horsepower Roth motor, running at 1,075 revolutions per minute.

The plate is removed from the bath, after a thin shell of copper has been deposited, washed with acid, and a sheet of tinfoil placed over it. It is then taken to a cooling table and, after being backed with melted lead, is cooled by a three-quarter-horsepower Roth blower. This blower is mounted under the cooling table, two air outlets being provided from the blower piping.

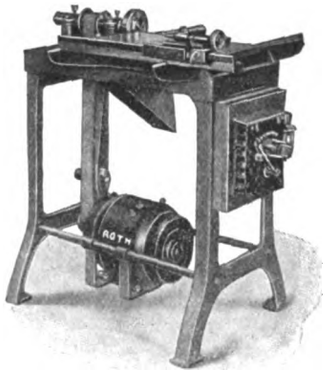
The complete cast is then taken to the roughing machine. This machine, which planes the backs of the metal plates before they are mounted on wood, is driven by a two-horsepower Roth motor, running at 1,100 revolutions per minute, which is mounted directly on the machine and gear-connected to it. The power shaver, directly driven by a two-horsepower, shunt-wound Roth motor, planes the plates to the required thickness, and they are then ready to be mounted on wood blocks.



BLACK-LEADING MACHINE.

There are numerous other machines used in this establishment for sawing, trimming, planing and routing both wood and metal. The saws are driven by one-and-one-half-horsepower, shunt-wound Roth motors, with a speed of 1,800 revolutions per minute. The motors are mounted under the machines on brackets and belted up through the frame of the machine. Idlers are provided for maintaining the proper belt tension. The

WAX SHAVER.



TRIMMER.

MACHINES.		MOTORS.			
NAME.	MAKE.	TYPE.	HORSE-POWER.	WINDING.	SPEED R. P. M.
Wax Shaver	Ostrander Seymour	Roth	1	Compound	1,200
Molding Press	" "	"	2	Shunt	1,100
Molding Press	" "	"	3	Shunt	1,825
Black Leader	" "	"	1½	Shunt	850
Plating Dynamo	" "	"	20	Shunt	575
Backing Pan	" "	"	¾	Shunt	2,600
Bougher	" "	"	2	Shunt	1,100
Power Shaver	" "	"	2	Shunt	1,100
4 Saws	" "	"	1½	Shunt	1,800
2 Trimmers	" "	"	¾	Shunt	2,350
Vertical Router	" "	"	¾	Shunt	2,350
Daniels Planer	" "	"	2	Shunt	1,100
Tipi Planer	" "	"	2	Shunt	1,100
Agitator	" "	"	⅛	Shunt	1,075
Jig Saw and Drill	" "	"	½	Shunt	525
Motor Grinder	Roth		⅛	Shunt	2,500

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trimmers are similar in their design to the saws and are driven by three-quarters-horsepower, shunt-wound Roth motors, running at 2,350 revolutions per minute. These motors are also provided with idlers. A two-horsepower, shunt-wound Roth motor, of the vertical type, having the pulley down, is used for driving the Daniel's wood planer. This machine has a revolving head, fitted with two tools, mounted on a vertical shaft, and is used for planing the wood blocks to a certain thickness before the plates are mounted thereon. The routers, machines for routing out or removing certain portions of the metal plates, are also driven by motors of the vertical type, these being, in this case, three-quarters-horsepower, shunt-wound Roth motors, with a speed of 2,350 revolutions per minute, which drive the router tools at a speed of 15,000 revolutions per minute.

In every case, save the wax shaver, the motors are controlled by the ordinary type, No. 10 Cutler-Hammer starting box, and wherever possible both starting box and switch are mounted on the machine, this arrangement being very convenient to the operator.

The nature of this business is such as to produce a great amount of dust and dirt, and it is therefore necessary to have all of the motors of the enclosed type.

The table given shows the table machines and motors used in driving them, in this plant.

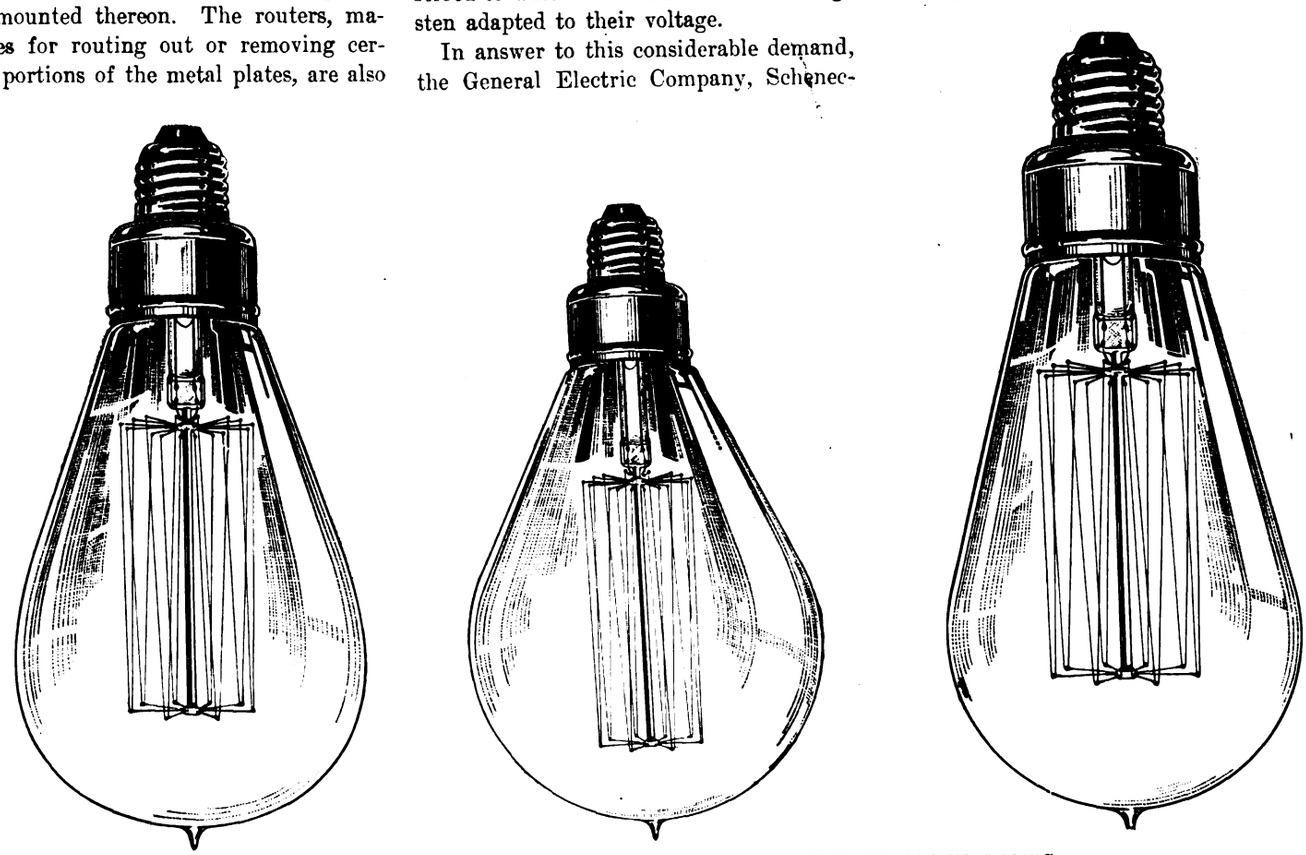
The New 200 to 250-Volt Tungsten.

The advantages and economy of the tungsten over the carbon-filament lamp have been practically denied to most circuits operating at 200 to 250 volts, because the regular multiple tungsten lamps were designed for the standard voltage of 100 to 125. On these larger voltage circuits—for example, 220 volts—in order to use tungsten lamps at all it was necessary to operate two 110-volt lamps in series. Most users of the higher voltages preferred to wait for the advent of the tungsten adapted to their voltage.

In answer to this considerable demand, the General Electric Company, Schenectady, N. Y., has extended its production of tungsten lamps into voltages from 200 to 250. This gives to the users of higher voltages the opportunity for the adoption of the economical high-efficiency lamps for multiple service. The regular General Electric 200 to 260-volt carbon-filament lamps ranged in efficiency from 3.8 watts per candle to 3.1 watts per candle. The new tungstens have the usual tungsten efficiency of 1.25 watts per candle. They possess all the excellent qualities of the regular General Electric 100 to 125 volt tungsten lamps, including the same form of specially anchored filaments.

Thorough and ample tests of the new 200 to 250-volt tungstens show exceptionally good results, the average life and performance of these lamps being fully up to that of the standard multiple lamps. They are a decided triumph for lamp manufacture and will prove very popular with all who require lamps of this higher voltage.

The lamps are supplied in the following sizes: 45, 70, 110 and 180 watts.



GENERAL ELECTRIC COMPANY'S NEW 200 TO 250-VOLT TUNGSTEN LAMPS.

Another Successful Supplementary Storage Battery for Twenty-Four-Hour Service.

The city of Wilmot, S. D., is operating a municipal lighting plant, and in September, 1907, installed a battery consisting of 132 "chloride accumulator" cells, manufactured by the Electric Storage Battery Company of Philadelphia, with a capacity of ten amperes for eight hours, the jars being sufficiently large to permit increasing the battery capacity later by 150 per cent when necessary, in order to take care of the natural increase in the day load.

This battery has now been in operation for over eighteen months, and its installation has resulted in a gross increase in business of from twenty-five to thirty per cent. The operating expenses of the plant have only increased about five per cent and the net receipts for power during the hours when the generating equipment is shut down amount to about twenty per cent of the cost of the battery installation.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JULY 16.—As I reported some time ago, a deputation from the City of London Corporation recently visited the Continent in order to investigate systems of street lighting. This deputation has now issued a report which has been received with considerable ridicule in the electrical press. It certainly contains some very remarkable recommendations, but seeing that the deputation was unaccompanied by an engineer, this is not surprising. In the first place further experimental lighting is recommended before it is definitely decided that the present system—or to be more accurate want of system—should be drastically altered. As a general principle, however, it is laid down that wherever possible, the lighting of the city of London should be by means of centrally hung lamps, these to be high-pressure incandescent gas lamps, if possible. This at once indicates the prejudice with which the City of London Corporation views this question of street lighting, and exemplifies the influence of the gas company. In the early eighties, the Corporation adopted electric arc lighting and forced the electric-lighting company to use a most inefficient basket pattern of globe with thick frosted glass, which was designed by the corporation engineer. This went on for many years; meanwhile great strides were being made with high-pressure gas, and eventually, although the gas company was allowed to demonstrate by the side of the old-fashioned arc lights what could be accomplished by up-to-date methods, for a very long time the electric light company was not allowed, even at its own expense, to show the latest developments of arc lighting by means of flame arcs. Last year, however, an opportunity was afforded in this direction, and lamps supported over the center of the roadway from the building on either side were installed on an important thoroughfare. It is presumably the success which has attended this experiment which has led the deputation to recommend such a system on a much wider scale. But for reasons which are not given, gas is to be used in this way if possible; if not, and there is a big if, then flame arc lamps. It is a curious fact that the whole policy of the corporation in this matter is in direct opposition to the advice of its technical officers, so it will be seen that "politics" play an important part. It is to be remarked, however, that the report has not yet come before the corporation and that the streets committee has not, as is usually the case, reported upon the proposals.

There is a strong inclination on the part of many electric supply authorities to develop supply to small houses—a class which is at present the monopoly of the gas people—by charging a fixed sum per lamp per annum irrespective of the number of hours for which the lamps are burned. At Eccles the system is to be actually adopted and at Beckenham it is under consideration by the electricity committee.

A serious position was revealed at the meeting of the British Electric Traction Company last week. This company has done splendid pioneer work in this country by purchasing horse tramways and reconstructing them for electric traction, yet during the past few years no dividends have been paid, and the revenue has been decreased to the extent of nearly $1,000,000 per annum by the exactions of the local authorities. In most cases a reorganization of the fares cannot be carried out in consequence of agreements with the local authorities, but it is clear that before long there will be a general movement toward a shortening of the stages in order to put tramway undertakings generally on a sounder footing.

Hitherto it has been the policy of the London County Council to allocate to tramways account only a portion of the cost of street improvements which have been necessitated by the tramways. Even this was more or less at the discretion of the committee, with the result that a very small sum, comparatively, has in the past been charged to tramways. A special sub-committee is now to be elected, however, to deal with this question upon certain definite lines, which will have the effect of charging the tramway accounts with a much larger—and fairer—sum in this connection than has been the custom lately. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, JULY 18.—The new fertilizing product, cyanamide, is now manufactured on a large scale in France in the works which have been erected at Notre Dame de Briancon, on the Isere River. It will be remembered that this product is obtained by heating calcium carbide in a current of nitrogen. All these products are obtained on the spot, and for this purpose there is employed a turbine plant in the neighborhood, which can afford 13,000 horsepower. At present the station has three turbine-alternators of 2,500 horsepower, using Oerlikon three-phase machines. The plant is laid out for a total of seven groups of this size. A voltage of 15,000 is used on the power line, which runs for seven miles to the electric furnace plant. Part of the current serves for the carbide factory and the rest for the nitrogen and cyanamide plant. A transformer post located at the works is used to supply a reduced voltage of 150 volts. The present plant is operated by the Societé des Produits Azotés, of which M. Ch. Pluvinage is chief engineer.

A new multiple telephone switchboard is being erected at Paris in a building which is rented for the purpose near the central exchange. This latter, it will be remembered, was completely burned, and but few of the apparatuses could be saved. At present there is a temporary shed erected beside the burned building and some apparatuses are installed there. At the same time, the new switchboard which we mentioned is intended to serve for 10,000 subscribers, and will aid in setting matters right. It is expected to have it finished this winter. The multiple board is designed on a new Swedish system and is the invention of a Stockholm engineer.

There has been installed in the region of Tunis an electric railroad line which passes through the suburbs and along the seacoast as far as the town of Marsa. It is designed to give a ready access to the coast region and replaces the steam railroad which formerly ran through this district. The traject of the electric road, however, has been changed so that it now passes over the long jetty which is built through the Tunis Lake, and this shortens up the course by several miles. The road passes over the site of ancient Carthage and mounts to the locality of Sidi-bou-Said, then descending to the terminal point at Marsa. It is installed by the French Thomson-Houston firm and uses the third rail, with trains made up of motor cars of 250 horsepower, coupled together on the multiple-unit system. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, JULY 24.—Sir Wilfrid Laurier inaugurated, a few days ago, a new style of pay-as-you-enter street cars in Ottawa. The success of this type of car has caused its adoption in many of the largest centers on the continent. Montreal was the pioneer in this direction.

G. W. Ross, the managing director of the Montreal Street Railway, will become the head of the biggest private corporation interests in the city of Quebec. The purchase, by Montreal interests, for several months past, of the stock of the Quebec Railway, Light and Power Company, which recently gave the controlling interest to Montreal capitalists interested in the Montreal Light, Heat and Power Company, has all along been understood to be the initial step to the amalgamation, under the same management, of the rival gas and electric-light companies in the city of Quebec.

The largest gas-engine contract, for lighting and power purposes, that has yet been consummated in Canada, has been given by the Dominion Light, Heat and Power Company to the Colonial Engineering Company. The former company was recently granted a charter to sell electric current for all purposes. The company's station will be the most modern one of the kind in the Dominion, if not on the continent. This plant is to be in operation by December next.

The city of London, Ont., is expected to be the storm center, now, of the Niagara power battle, as Messrs. Mackenzie and Mann have about completed the purchase of the South Western Traction Company, and will use that road as one of the implements of the warfare. The Electrical Development Company, or one of its kindred companies, has a charter for a Hamilton to Windsor railroad, which will pass through London. Electricity from the Falls will be used on this railroad, and the intention is to obtain as many of these trolley lines as possible to use power. By having a market for a large portion of its power, the Development Company will be able to dispose of its surplus at a rate much lower, it is expected, than the Niagara power. The London Electric Company has ordered two 500-horsepower producer gas engines, and will sell power in opposition to Niagara power. Other companies will not take Niagara power, but will obtain it elsewhere. On the outcome of the pending electrical struggle depends the success or failure of the Niagara power scheme.

The Canadian Pacific Railroad has just added another branch to its big system. This time it is an electric expansion on the

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borders of the state of Maine and the province of New Brunswick. There, the company controls a railway system of some 440 miles, with its affiliations. This New Brunswick combination has a lease of the Aroostook Valley Railway, which has planned to build a unit of track, twelve miles long, between Presque Isle and Washburn, Me., with an ultimate extension of 119 miles more north to the St. John River. The extension is to be an electric road, for, under the United States law, the Bangor & Aroostook Railroad has a monopoly of steam railways in northern Maine, and neither the Canadian Pacific nor any other system can enter its territory with a steam line. The proposed new road is intended for both passengers and freight. Its voltage will be the same as that of the New York Central's Park Avenue Tunnel, 1,200 volts, direct current. It will be the first line of its kind in New England. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

IMPORTANT TRACTION MERGER—An important traction consolidation is being promoted whereby the Jefferson Traction Company, of Punxsutawney, the Du Bois Traction Company and the Indiana Street Railway will be consolidated under a holding company with $1,500,000 capital and connections made between the three towns. It is proposed also to connect the system with the Bradford lines, giving the company connection with Buffalo, and to also make connections with Pittsburg by way of Derry and Greenville. Judge John P. Elkin, of the Superior Court, is president of the Indiana lines. New York and Boston capital is interested in the project.

HYDROELECTRIC PLANTS IN SOUTH CAROLINA—The waterpower on Saluda River, near Lexington, S. C., has been bought in, it is reported, by the Augusta-Aiken-Columbia interurban lines, and a force of hands has begun work on a hydroelectric plant. It is understood that James U. Jackson, of the interurban lines, was in Lexington recently for the purpose of investigating the property, and obtaining a general view of the situation. The extension of the Augusta-Aiken trolley to Columbia is practically assured, according to a reported interview with President Jackson, and the line will be completed within eighteen months. Property owners on the proposed right-of-way are said to be interested in the movement and willing to give the right-of-way through their lands in order to secure the road, about seventy miles in length. The proposed development is at Dreher's Ferry, six miles from Lexington, and the available horsepower being developed, electricity would be easy to secure for lighting Lexington, and for many other uses, so that the plan is meeting with good support. Philadelphians are also said to be interested in the development plans above mentioned. L.

MERGER OF BIG CALIFORNIA-NEVADA WATERPOWER INTERESTS—One of the biggest financial deals since the earthquake and fire has been consummated in San Francisco by the merging of the power and water companies of the high Sierras under one head by W. P. Hammon, representing his own interests and those of a syndicate of eastern and English capitalists. The amount involved in the actual taking over of the properties is $3,000,000, but this is only the beginning of the expenditure. Before the new company has completed its organization and is in full preparation, $4,000,000 more will be spent. The new company will be known as the Lake Tahoe Power and Water Company. It will supply water and electricity to the entire valley of the Sacramento as far south as the city of Sacramento and its lines will go to every center and every hamlet in the Sierra range. They will extend as far north as Oregon. To the east they will spread through Nevada and touch Ely near the farthest line. Power will be furnished for the operation of the mines and the lighting of the towns. In Nevada the company will construct lines 400 miles in length. It is thought that these will be the longest lines in existence.

LIGHTING AND POWER.

(Special Correspondence.)

THIBODEAUX, LA.—This city will install electric-light equipment to cost $25,000. W.

MAHNOMEN, MINN.—Work has been started on the construction of an electric lighting plant. C.

HOLDREGE, NEB.—The Holdrege Lighting Company has reorganized with a capital stock of $150,000. W.

BLACKWELL, OKLA.—An electric-light plant is to be constructed by the city, to cost about $20,000. U.

ARDMORE, OKLA.—Oscar Ayres and others propose putting in an electric power plant on the Washita River. W.

CALLAWAY, NEB.—The Callaway Electric Light and Power Company has been incorporated with a capital of $15,000. W.

FAIRFIELD, IOWA—The Fairfield Gas and Electric Company has decided upon spending about $25,000 in improvements. W.

ALEXANDRIA, LA.—An ordinance is being prepared to vote on the issuance of $45,000 in electric-light and water bonds. W.

SIOUX FALLS, S. D.—The Northwestern Electric Company has been incorporated to do an electric construction business. W.

LINDEN, WIS.—The Mineral Point Electric Light Company has been granted a franchise to furnish the village with light and power. C.

ROCHESTER, MINN.—Mayor Thompson vetoed the resolution of the City Council to purchase machinery for the electric-light plant. C.

SHEBOYGAN, WIS.—The Business Boosters will erect a monster electric talking sign on Eighth Street. It will contain about 3,000 electric lamps. C.

LITTLE ROCK, ARK.—The Ouachita Power Company has been incorporated with a capital of $50,000, and will put in a dam on the Ouachita River. W.

KENDRICK, IDAHO—The construction of the electric-light plant for which a franchise was given to Richardson Brothers, of Wallace, will be started next month.

ST. MARIES, IDAHO—A franchise for lighting the town has been granted to G. H. Jay, of Great Falls, Mont., who will install a waterpower plant at a cost of $35,000. C.

NEW WESTMINSTER, B. C.—The Pitt River Brick Company has decided to install a new lighting plant. The plant will be erected by Mowbray & Co. at a cost of about $2,000.

TWIN FALLS, IDAHO—The Great Shoshone and Twin Falls Water Power Company has ordered the hydraulic and electrical equipment for the power plant at the lower Salmon Falls.

ODESSA, WASH.—The Washington Water Power Company may extend its line to this place in order to furnish light and power, and a franchise will be requested with this end in view.

DUNN, N. C.—The local electric-light plant is being doubled by the installation of a boiler and other new machinery. The plant at present supplies about forty arcs and 1,100 incandescents. L.

MILTON, N. H.—The Great Falls Manufacturing Company has begun work on a dam across the Salmon Falls River near the Flume. It is reported that the company will put in an electric plant there in the near future.

AUBURN, ARIZ.—The El Dorado Placer Dredging Company has decided to install a combination bucket and suction dredge at Cache Creek Rock on the American River to take the place of the dredge recently destroyed by floods.

INDEX, WASH.—J. A. Soderberg and associates, who recently filed valuable water rights on the Skykomish River, in this state, are planning the erection of a large power plant to light and furnish power to a number of towns along the Great Northern Railway.

ATLANTA, GA.—The franchise to the Central Georgia Power Company to enter the city of Atlanta, has finally been granted by the aldermanic board. The franchise empowers the company to bring power from its plant at Jackson, Ga., to Atlanta for lighting, heating and power purposes. L.

PRESCOTT, ARIZ.—J. B. Cleveland, general manager of the Arizona Central Copper Company, is in the market for a new electrical equipment for the Shylock mine preparatory to resuming operations. New electrical hoist, electrical pump and Temple drills are to be purchased.

CHEHALIS, WASH.—Thomas Rush has sold the Chehalis Water Company to the Lewis County Water Company. A. Welch is president of the new company. The consideration for the sale was $80,000. Extensive improvements will be made, including in all probability a gravity water system.

SCOTTSBURG, IND.—Plans are being made to install a lighting system in this city, the current to be obtained from the Indianapolis & Louisville Traction Company. This company is furnishing current to Crothersville and Henryville in a similar manner, and the systems are giving great satisfaction. S.

JERSEY CITY, N. J.—The Joy Construction Company has been incorporated to operate a waterpower system in the towns of Madison and Clinton, Conn., and elsewhere, with a capital of $100,000. The incorporators are: M. Joy, New Haven, Conn.; D. J. Greene, Milford, Conn.; T. E. Smith, Weehawken, N. J.

WILSON, N. C.—The Wilson electric-light plant is making extensive improvements, including the installation of a new Murray-Corliss 450-horsepower engine. About $8,500 in new electrical equipment has also been put in, and the plant, when finished up, will be ample to take care of the town's needs for some years to come.

MARTINSBURG, W. VA.—Secretary of State Reed has issued a charter to the Hydro-Electric Development Company, of Morgan County, this state, which will utilize the waterpower of the Great Cacapon River and erect a big plant for supplying neigh-

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boring towns with electricity for lighting and manufacturing purposes. The authorized capital is $100,000 and the incorporators are William B. Osler, Morris A. Ornduff, Great Cacapon; W. F. Disher, Berkeley Springs; Samuel A. Boyer, Hanover, Pa., and Albert E. Holland, Baltimore.

SPARTANBURG, S. C.—The city having granted a franchise to the Southern Power Company to enter this city with its power lines, representatives of the company are now engaged in procuring rights-of-way to bring their transmission lines into the city, which already has abundant electrical energy supplied by another company. L.

PUEBLO, COLO.—Advices have been received here of a conference held in Chicago, July 13, headed by Ira T. Miller, of Pittsburg, to build a $50,000 plant at Pueblo, for the purpose of extracting iron for the supply of the Pittsburg mills. E. W. Marlin, of Pittsburg, is heavily interested in the new project, as is John Farson, of Chicago, banker.

SALT LAKE, UTAH—The American Steel and Fuel Company, recently organized, is said to have plans for the erection of a 1,000-ton iron smelter and rolling mill in Salt Lake valley. A railroad to the mines in Wahsatch and Utah counties is also contemplated. B. F. Bauer, of Salt Lake, is president, and A. A. Sweet, of Salt Lake, is vice-president.

DAYTON, ORE.—The application for a franchise to establish an electric power and lighting plant by the Pacific Electric Engineering Company, of Portland, is being considered by the City Council, and if their investigations prove favorable and satisfactory terms are made the company promises lights for municipal and private use within a few months.

TONOPAH, NEV.—The directors of the Tonopah Extension Mining Company have authorized the issuance of $187,000 bonds, the proceeds from the sale of which are to be used for the erection of its $150,000 mill. The bonds are to be dated July 1, 1909, and will run for five years, with interest at the rate of 6 per cent per annum, payable half-yearly.

BUFFALO, N. Y.—The Buffalo General Electric Company has been given permission by the Public Service Commission to issue $242,000 in its first refunding five per cent gold bonds, to be sold at not less than 97 per cent of the value. The proceeds of the issue will be used for burying wires in William Street and Broadway and in the purchase of new machinery.

ALBANY, N. Y.—The New York Public Service Commission, Second District, has authorized the Newburgh Light, Heat and Power Company to issue $250,000 twenty-year five per cent bonds, to be sold at not less than ninety-six. The proceeds are to be used to refund $125,500 prior lien bonds and for new construction and improvements of an estimated cost of $159,750.

WALLACE, IDAHO—A mortgage for $15,000,000 has been filed with the county recorder by the Washington Water and Power Company, of Spokane, to cover the amount necessary for the proposed construction of the additional power plant at Little Falls, Wash., and the improvement and extension of the present system of power as well as to cover the present indebtedness.

HARTFORD CITY, IND.—The Hartford City Lighting Company announces that it would erect and equip a large power house and distributing system in Hartford City at once. The company will take over and combine the Montpelier system with the distributing system and close the power house at Montpelier. The estimated cost of the new power house, exclusive of equipment, is $150,000. S.

IDAHO FALLS, IDAHO—At a recent meeting of the directors of the Idaho Power and Transportation Company the plan of increasing the capacity of the plant by the installation of different machinery and additions to the building was taken up. The expenditure will involve an outlay of from $75,000 to $100,000. The work will begin as soon as the stage of water will permit.

LEXINGTON, N. C.—The Southern Power Company, after meeting with some opposition in procuring rights-of-way in Davidson County, North Carolina, has carried the issue before the county clerk of the court, and the company has been granted the condemnation privilege, and a jury named to assess valuation on property so condemned by the company for building its transmission lines through this county. L.

LANSING, MICH.—A change in the management of the Michigan Power Company will take place August 1, and W. H. Zimmerman, who has been manager of the company for the past three years, will retire and his position will be taken by D. W. Lowe of Alliance, Ohio. Mr. Lowe will have the active business management of the local plant, while Mr. Zimmerman will take charge of all construction work, both in the city and of the eighteen miles of transmission lines to be constructed between this city and Charlotte. Mr. Zimmerman is financially interested in the Construction Electric Company, a new organization which will soon be incorporated, and proposes to look after the distribution of light at Charlotte, Potterville, Bellevue and Olivet. Several local capitalists are also interested in this project. During his management of the Michigan Power Company, Mr. Zimmerman has installed an entire new equipment. The present change is made on his suggestion.

ALBANY, N. Y.—Authorization has been given by the Public Service Commission to several companies controlled by the Associated Gas and Electric Company to mortgage their property for the issue of bonds for the payment of improvements, as follows: Hornell Gas Light Company, $250,000; Penn Gas Light Company, $100,000; Newark Gas Light and Fuel Company, $100,000, and the Norwich Gas Light Company, $250,000.

CHEYENNE, WYO.—Manager Young, of the Cheyenne Street Railway, has denied the report that has been current for several months that his company will erect a large power and light plant. It is stated that the Cheyenne Power Company, at present furnishing power to the street railway concern, has completed plans for greatly enlarging its plant, and that it is for this reason that the street-railway company will not build.

NEWARK, N. J.—Electricity is to be substituted for steam by the Clark Thread Company in the operation of its mills in Newark and East Newark. In connection with the change it is said that the company will, by changes in its power plant, arrange its motive power so that each factory will be independent and in case of an accident to the machinery one section of the plant can be shut down without affecting the balance of the establishment.

CHICAGO—The Commonwealth Edison Company has just let contracts for the building and equipment of the new Troy Street substation. This will be a transformer station, stepping down from the transmission voltage to the regular 4,000-2,200 sixty-cycle distribution system. It was referred to in these columns in the issue of May 29. Contracts have also been let for the new substation to be built on East Indiana Street. This will take the place of the old Illinois Street substation.

SPENCER, N. C.—The Southern Railway now has in operation at this point a power-generating plant of nearly 100 horsepower. This power is used in the operation of some ninety-eight motors, ranging from three to seventy-five horsepower, for various purposes, running machines, furnishing lights, and not a minute's delay has been occasioned by the substitution of electricity in place of steam, and sixty-seven of the 200 locomotives entering the Spencer yards are equipped with electric headlights. L.

ATLANTA, GA.—An interesting appreciation of the work of Prof. S. W. McCallie, state geologist, has been embodied in a request by Gifford Pinchot, chairman of the national conservation commission, for copies of a pamphlet, "Inventory of the Water Powers of Georgia," by Professor Callie. Mr. Pinchot has announced that he will put a copy of the pamphlet in the hands of every state chairman of the conservation commission. In his work Professor Callie divides the state into the "Savannah basin," the "Altamahe basin," the "Ogeechee basin," the "Mobile basin," the "Apalachicola basin" and the "Tennessee basin." This inventory of hydrographic basins enumerates the probable waterpowers of the entire state that can be developed. L.

WADESBORO, N. C.—A hydroelectric plant to supply power for a number of industrial enterprises is planned by A. H. Richardson, of Ansonville, N. C., and other leading men of Anson County, at Kendall Ferry, on Rocky River, fifteen miles north of Wadesboro. The estimated cost of the power development on the river is about $400,000, and the river fall at the point designated will afford between 6,000 and 7,000 horsepower. At this point it is proposed to establish a new town, the existence of which will depend largely on the development of the waterpower in question. The site is declared by engineers to be a most ideal one. The promoters are now endeavoring to secure the necessary options and get sufficient capital subscribed to carry out every detail of their plans. L.

WILLIMANTIC, CONN.—The Rockville-Willimantic Lighting Company, which has taken over all the charter rights of the Willimantic & Stafford Springs Street Railway Company, has elected Walter Learned, of New London, president, H. C. Murray, of Willimantic, vice-president, and Alexander J. Campbell, of New London, secretary, treasurer and general manager. The company has issued $400,000 of stock, $200,000 being six per cent cumulative preferred and $200,000 common shares. It has authority to issue $400,000 preferred stock and $300,000 common. The Willimantic & Stafford Springs Street Railway Company had a franchise to construct and maintain a trolley line and also to operate lighting plants in various towns. The new concern will not attempt to utilize the street-railway rights for the present, but it will dominate the electric and gas-lighting companies of Willimantic, Rockville and Stafford Springs, and in addition will extend lighting facilities to several other towns in Windham and Tolland counties. The lighting interests at Willimantic, Rockville and Stafford are all controlled by the Alden M. Young syndicate, which owns the Rockville-Willimantic Lighting Company.

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ELECTRIC RAILWAYS.

(Special Correspondence.)

SANTA ROSA, CAL.—The City Council has granted an electric-railway franchise in this place to the Sonoma & Lake County Railway Company. A.

GRAND RAPIDS, WIS.—The contract for the construction of the street railway to Nekoosa has been let to the Knox Construction Company, of Chicago. C.

WATERLOO, IOWA—The Iowa Light and Traction Company has petitioned the Council for a franchise in connection with the proposed interurban road between Des Moines and Waterloo. C.

BRUNSWICK, GA.—The new street-car system now being constructed is expected to begin operations within sixty days. Several miles of tracks have been completed, and the remaining work will be rushed through. L.

CHARLESTON, S. C.—A company which, it is said, is backed by Vanderbilt interests, is seeking to procure a charter in the city of Charleston, S. C., for the purpose of building a system of street railways and a power house. L.

ALTOONA, PA.—The final surveys are now being made for an electric railway to connect Frombell, Beaver County, with the Baltimore and Ohio lines, and Grove City, Mercer County, with the Bessemer and Lake Erie road.

VINCENNES, IND.—The Vincennes Citizens' Street Railway Company has increased its capital stock from $50,000 to $350,000. It is understood that the increased capital will be used in improving, extending and re-equipping the system. S.

AUBURN, CAL.—W. S. Fletcher and associates, of Pasadena, Cal., have applied for a franchise for an electric railway from Colfax to Bath in this county, a distance of about sixteen miles. It is given out that an investment of about $250,000 will be put into the road.

JACKSON, GA.—The town has granted franchises to the Middle Georgia Interurban Electric Railway and the Central Georgia Power Company. Capt. W. F. Smith, of Flovilla, who is promoting the electric lines, is now engaged in grading the tracks from Indian Springs to Jackson. L.

INDIANAPOLIS, IND.—The McKeen Motor Car Company, of Omaha, is looking for a site in this city upon which to erect a plant to manufacture motor cars on an extensive scale. The plan is to remove from Omaha to Indianapolis. The company will also manufacture gasoline engines. S.

COLUMBUS, OHIO—The Cedar Point Railway Company, of Sandusky, has been incorporated, with $10,000 capital stock, by W. C. Phelps, T. M. Kirby, C. C. Owens, H. T. Clark and W. B. Whiting. They propose to construct and operate an electric street railway connecting Sandusky with Cedar Point and Rye Beach.

FT. WAYNE, IND.—Promoters of the Ft. Wayne & Toledo Traction line have asked for a franchise in this city, agreeing to commence the work of building a line from this city to Brien, a distance of forty miles, in a short time. The purpose is to operate over the lines of the Toledo and Indiana railway from Brien to Toledo. S.

EUGENE, ORE.—A. Welch, vice-president and manager of the Portland, Eugene & Eastern Railway, running the street-car line here, states that a big waterpower project will probably be carried out at Martin's Rapids, about thirty miles east of here, this year, furnishing power for all the company's lines as far north as Albany.

SCOTTSBURG, IND.—The officials of the Cincinnati, Madison & Western Traction Company have announced that work on the construction of a road from this city to Cincinnati by way of Lexington and Madison will be commenced soon. A subsidy election in aid of this road will be held August 9. This line will open up a new and picturesque country abounding in fertile farms and prosperous villages. S.

INDIANAPOLIS, IND.—A campaign for extension and improvement will be pursued by H. J. Milligan, recently appointed receiver of the Indianapolis, Crawfordsville & Western Traction Company. The road runs through fifty miles of fertile territory, and Mr. Milligan proposes to have the road perform its full duty to the public. Considerable new equipment will be added and the roadbed thoroughly improved. S.

CONCORD, N. C.—A franchise has been formally granted to the Piedmont Carolina Railway, to use the streets of the town for railway tracks. The line will not only be built in the city, but will be extended to several towns near by. This company is somewhat identified with that contemplating the building of an electric line from Winston, N. C., south to Salisbury, twenty-three miles north of Concord, T. H. Vanderford being interested in both propositions, and it is considered that this step is but another in larger plans for constructing a system of interurban lines between the principal towns and cities of Piedmont, N. C. The development of these and other plans previously referred to will give a clear stretch of 104 miles, with a line to the west, some forty-five miles long. L.

TRENTON, N. J.—The Union Railway, Gas and Electric Company has been incorporated, with a capital of $18,000,000. The charter is recorded in the Camden County clerk's office. The company is to operate electric railways and electric and gas plants. The incorporators are: F. R. Hansell, John A. MacPeak and James F. Cotter.

LANSING, MICH.—The Detroit, Lansing & Grand Rapids Railway Company has filed articles of incorporation with the secretary of state. The road, which is capitalized at $25,000, is to be an electric line, and will connect Detroit and Grand Rapids by way of Lansing. The principal stockholders are Oliver H. Lau and Henry M. Wallace, both of Detroit.

GOLDFIELD, NEV.—Within a very short time the thirteen miles of railroad from Tecopa Consolidated Mines Company will be well under way with its construction. Last week the Tonopah and Tidewater sold the mines company all the necessary steel and material, and work will begin right away. The amount involved in the building of the line will be approximately $200,000.

BLUFFTON, IND.—The Wells Construction Company has been incorporated with an initial capital stock of $20,000. The purpose of this corporation is to construct, equip, lease and operate in the state of Indiana, or elsewhere, street and interurban railways and plants for the generation and distribution of electric light, heat and power, and to make contracts therefor. The primary object of said corporation is to construct an interurban railroad from Bluffton to Geneva. H. C. Arnold, L. A. Williamson, L. C. Justus, S. Bruder and S. G. Briggs, directors. S.

VANCOUVER, WASH.—Articles of incorporation of the Clark County Railway Company have been filed in the office of the county auditor by Bert Yates, J. W. Sifton and Omar C. Spencer. The object of the company will be to build electric lines in Clark County. The life of the company is for fifty years, and the principal place of business will be Vancouver. The capital stock of the company is placed at $150,000, divided into shares of $100 each. The directors of the company are James G. Kidwell, of Walla Walla; J. H. Murphy, A. Welch, C. E. Moulton and Omar C. Spencer.

INDIANAPOLIS, IND.—C. F. Goodrich, of this city, is exhibiting and demonstrating the operation of an automatic switch for interurban roads on North Pennsylvania Street. The device is designed to save time in the operation of trains or street cars. By means of a device that may be attached to the tracks any distance from the switch, the switch is operated from the motor car by means of a lever without stopping the train or car. A similar device placed on the track closes the switch after train has passed out of the siding. The automatic switch is attracting considerable attention from traction men.

PITTSBURG, PA.—Electric service has been installed on the Pittsburg and Castle Shannon Railroad by the Pittsburg Railways Company, and the old steam road, which has been in operation for forty years, has passed out of existence. The Pittsburg Railways Company has put in a standard gauge line and an equipment of the latest standard electric cars. The Pittsburg and Castle Shannon Railroad was of the old narrow-gauge variety. Its equipment consisted of a half dozen locomotives and about fifty cars. It was originally built to develop coal property, although passenger service was installed many years ago.

MERIDEN, CONN.—The Meriden, Middletown and Guilford Electric Railway Company was formally organized at a meeting held here last week. This road will have a tributary population of 300,000, as it furnishes a direct trolley line from Hartford, Meriden, Middletown, New Britain and other places to the shore and a trolley in Guilford, something that has long been needed. The incorporators were Francis Atwater, James H. White, Clarence P. Bradley, Eugene A. Hall and Charles F. Rockwell, of Meriden; D. Luther Briggs, Joseph Merriam, Isaac E. Palmer, Charles E. Jackson, of Middletown, and A. H. Augur, of Middlefield.

OTTAWA, ILL.—The McKinley Interurban road was to have had its cars running between Grand Ridge and Streator by the last of July. At the last meeting of the Streator City Council they were granted an extension of time until August 31. By that time they will have the cars in operation without fail. When asking for the extension of time at Streator the other night the company announced through its representatives that the line to Ottawa would be completed and in operation by next winter. The McKinley company is evidently very much in earnest in its efforts to get into Joliet and to form a Chicago connection.

CADILLAC, MICH.—The R. G. Peters Lumber Company, of Manistee, is reaching the end of its cut of timber on Lake Mitchell, about seven miles from this city, and it is given out from a reliable source that the railway from this timber to Manistee will be transformed into an electric line which will

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extend to this and possibly other nearby cities. There are power dam opportunities on the Manistee River. Most of the land along the river has been bought up by local and Manistee capitalists, and electric power will be developed in sufficient quantity to run several such electric railways as the one proposed between this city and Manistee.

WHITE PLAINS, N. Y.—Justice Martin J. Keogh has appointed H. R. Barrett, a lawyer, referee to sell the Tarrytown, White Plains & Mamaroneck Railway Company, a trolley line, at foreclosure sale. The application for the sale was made by the Knickerbocker Trust Company, of New York, acting as trustee for the bondholders. The bonded indebtedness of the company amounts to about $300,000. The company is now in the hands of Receiver J. Addison Young of New Rochelle, who recently purchased twenty-five new pay-as-you-enter cars and has put the roadbed in condition and made other improvements. It is expected that the road will be sold in September or October.

MEXICO CITY, MEX.—A modification of the concession for the building of an electric railway from here to Puebla has been conceded by the ministry of communications and public works to Andres Lefebre, the concessionist, and work on the road will begin soon. Under the new arrangements the electric line connecting Puebla and Mexico will be completed by September 17, 1913. Failure to have the track laid between the two cities by this date will involve a heavy fine for every additional day of delay. The new stipulations provide for the laying of twenty kilometres before September 17, 1910. For each of the succeeding years the concessionaire must put down not less than ten kilometres.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

LAKE CITY, ARK.—The Peoples Telephone Company has been incorporated with a capital of $10,000.

SPENCER, NEB.—The Home Interstate Telephone Company has been incorporated with a capital of $25,000.

EDGAR, NEB.—The Edgar Home Telephone Company has been incorporated with a capital stock of $100,000.

CULBERTSON, MONT.—The Montana Star Telephone Company recently increased its capital stock from $20,000 to $50,000. The line will be extended to Nashua, there to connect with the Moore telephone line. C.

SOUTH BEND, IND.—By the completion of a toll line from this city to Decatur, Mich., during the past week by the Home Telephone Company, long-distance service has been established with all the Independent exchanges in Indiana, Ohio and Michigan. S.

MISHAWAKA, IND.—The City Council has passed an ordinance compelling the New Electric Light Company and the Bell Telephone Company to place their wires underground and to remove all poles from the streets and alleys. The Home Telephone Company has completed a new conduit system with all its wires underground. S.

TOLEDO, OHIO—The final hearing of the injunction proceedings brought by the United States Company against the Bell and local Independent companies restraining them from contracting for joint long-distance toll service at Bellefontaine, Ohio, has been postponed until the second week in August. Judge Brodrick will request another judge to preside at the final hearing. H.

WARRINGTON, IND.—The Warrington Telephone Company has been organized and will be incorporated with a capital of $10,000. The company proposes to build, equip and operate a telephone exchange in Warrington and extend the lines throughout the northern part of Hancock County. G. H. Blakely, chairman of the board of directors, states that the company is in the market for material and equipment. S.

YORKVILLE, S. C.—The Piedmont Telephone Company has been granted a franchise here following a long fight of ten years to procure it. The company agrees also to give free service to practically every point or subscriber in the county, one with the other, except two points. The overhauling of the system will likely be made with the installation of more modern apparatus, and the new system will be ready for use about October 1.

RALEIGH, N. C.—Petition to the corporation commission has been argued by the Asheville (N. C.) Telephone Company, and the Southern Bell Telephone Company in Wilmington, N. C., two of the largest towns of the state, for the power to increase rates, the two companies alleging that present rates do not justify the service given, measured by dividends made. Many protests were sent up against the raise by Wilmington citizens, but Asheville was not heard from. In the last-named town the increase desired would apply only to residences, but in Wilmington would apply to all telephones. The petition, involving an important precedent, was taken under advisement by the Corporation Commission. L.

ELECTRICAL SECURITIES.

The statement of the net earnings of the United States Steel Company for the months of April, May and June, and in particular the splendid returns for June, showed Wall Street very conclusively that the wave of prosperity had reached the country's industries. Probably the statement had been discounted, but nevertheless the declaration of three per cent dividend, an increase of one per cent, added to the strong undercurrent prevailing. There is nothing at present in the way to interfere with future strong markets provided the tariff is satisfactorily adjusted and the crops turn out as well as present reports seem to indicate. Transactions on the New York and Chicago stock exchanges are naturally not large at this time, but the volume of new securities being put out is quite remarkable and the public seems to be ready to digest them.

DIVIDENDS.

American Gas and Electric Company; the regular semiannual dividend of three-and-one-half per cent on the preferred stock, payable August 2 to stock of record July 22.

Central District Printing and Telegraph Company; the regular quarterly dividend of two per cent, payable August 2. Books closed July 27 and reopen August 2.

Chicago Railways Company; a dividend of $8 per certificate on series 1 participation certificates, payable September 1 to holders of record August 2. The dividend is for the year 1909 and satisfies all arrearages.

Helena Light and Railway Company; the regular quarterly dividend of one-and-one-fourth per cent on the preferred, and a dividend of one per cent on the common, payable August 2 to stock of record July 26.

Montreal Light, Heat and Power Company; a quarterly dividend of one-and-three-fourths per cent, an increase of one-fourth of one per cent quarterly.

Western Telephone and Telegraph Company; the regular semiannual dividend of two-and-one-half per cent on the preferred stock, payable August 2 to stock of record July 22.

It is stated in Boston that the Dallas Electric Company, Dallas, Tex., has sold $1,300,000 six per cent cumulative first preferred stock out of the $2,000,000 recently authorized by the stockholders. A syndicate, of which Stone & Webster are managers, offers the unsold balance of this $1,300,000 stock with a certain amount of common stock in blocks consisting of ten shares of first preferred and four shares of common stock, at $925 per block.

NEW YORK.	July 26.	July 19.
Allis-Chalmers common	14½	15
Allis-Chalmers preferred	52	51¾
Amalgamated Copper	84	82¼
American Tel. & Cable	80*	80*
American Tel. & Tel.	140⅜	140⅝
Brooklyn Rapid Transit	78	78¾
General Electric	166½	165
Interborough-Metropolitan common	14⅜	15⅝
Interborough-Metropolitan preferred	45	48½
Kings County Electric	135	130
Mackay Companies (Postal Telegraph and Cables) common	81½	79¼
Mackay Companies (Postal Telegraph and Cables) preferred	73½	73⅝
Manhattan Elevated	145	145
Metropolitan Street Railway	16	20
New York & New Jersey Telephone	140	124
U. S. Steel common	71	72⅛
U. S. Steel preferred	126½	127¼
Western Union	72	72¼
Westinghouse common	84½	84⅝
Westinghouse preferred	121	....

*Last price quoted.

BOSTON.	July 26.	July 19.
American Tel. & Tel.	140¾	140⅝
Edison Elec. Illuminating	248½	250
General Electric	166½	165
Massachusetts Electric common	12½	12½
Massachusetts Electric preferred	74	72⅛
New England Telephone	132	133
Western Tel. & Tel. common	11	10½
Western Tel. & Tel. preferred	86	86

PHILADELPHIA.	July 26.	July 19.
American Railways	45½	45½
Electric Company of America	12½	12⅝
Electric Storage Battery common	56⅝	53
Electric Storage Battery preferred	56⅝	53
Philadelphia Electric	12	11⅜
Philadelphia Rapid Transit	29⅜	28½
Philadelphia Traction	90¼	90¾
Union Traction	53½	53

CHICAGO.	July 26.	July 19.
Chicago Railways, Series 1	117	112
Chicago Railways, Series 2	38½	38¼
Chicago Subway	20½	20½
Chicago Telephone	132¾	133
Commonwealth Edison	119½	121
Metropolitan Elevated common	18	16¾
Metropolitan Elevated preferred	48	48
National Carbon common	90	91¼
National Carbon preferred	118	118

PERSONAL MENTION.

C. H. CAHAN has been elected president of the Western Canada Power Company.

ALFRED SKITT, vice-president of the Manhattan Railway Company, and president of the New York City Interborough Rail-

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way Company, sailed for Europe last Tuesday on the Kaiser Wilhelm der Grosse.

JAY F. HOOVER, who has been manager of the Cleveland office of the Nernst Lamp Company for the past five years, has been appointed special agent of the company, with headquarters in Pittsburg. The Cleveland office is now in charge of J. B. Mitchell.

AVERY P. ECKERT was appointed July 1 sales manager of the wire department of the National India Rubber Company, 42 Broadway, New York, N. Y. Mr. Eckert has had a very successful career in this field and is one of the best known managing sales engineers in the electrical fraternity.

FRANK W. FRUEAUFF, the newly elected president of the National Electric Light Association, and vice-president and general manager of the Denver Gas and Electric Company, is to become a benedict. Mr. Frueauff will marry Miss Antoinette Perry early next fall. Miss Perry has for several seasons been leading lady for David Warfield, but will now give up the stage for good.

CHARLES M. HALL, of the Aluminum Company of America, who was taken ill in Southampton, Eng., is now in the Lake Placid region in the Adirondacks, recuperating. When he was taken sick abroad, Mr. Hall cabled for his home physician, Dr. W. H. Hodge, of Niagara Falls, who hurried to his bedside, and when Mr. Hall was sufficiently strong brought him back to this country. His friends will be glad to learn he will soon be in his usual strength.

P. JUNKERSFELD, for many years in immediate charge of the engineering department of the Commonwealth Edison Company, of Chicago, has been appointed to the position of assistant to the second vice-president, Louis A. Ferguson. This position was formerly held by Homer E. Niesz, who has become manager of the Cosmopolitan Electric Company, of Chicago. Mr. Junkersfeld was graduated from the University of Illinois in the class of '95, receiving the degree of B. S. Later he received the professional degree, E. E., from the same institution. For nearly fourteen years he has been connected with the Commonwealth Edison Company, for the first few years in the operating department, and subsequently in the engineering department, of which he became the active head. In his new position he will still retain general control of all of the engineering work. His former position will be taken by R. F. Schuchardt, who has been associated with Mr. Junkersfeld for several years.

PHILIP STEPHENS DODD, who was connected for the last seven years with the business staff of the Electrical Review Publishing Company, and for the past two years acting as manager, has resigned to become associated with the National Electric Lamp Association. Mr. Dodd was for four years with the Washington Life Insurance Company, of New York city, and was for two years sales manager of the National Roller Company, and later for two years with the New York *Journal*. He became associated with the ELECTRICAL REVIEW of New York in April, 1902. Mr. Dodd has won the affection and esteem of everyone connected with this journal and leaves with the best wishes of all. He goes to a great organization where his fine abilities will lead him to even greater successes.

NEW PROPOSALS.

POST OFFICE, DES MOINES, IOWA—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., August 18, for the installation of a vacuum cleaning system in the United States Post Office at Des Moines, Iowa, in accordance with drawings and specification, copies of which may be had at the office of the custodian, Des Moines, Iowa, or at the Supervising Architect's office.

POST OFFICE, PARIS, KY.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., August 29, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Paris, Ky., in accordance with the drawings and specifications, copies of which may be had from the custodian of site at Paris, Ky., or at the Supervising Architect's office.

SEARCHLIGHT CARBONS, SOLID AND CORED—The purchasing agent of the Isthmian Canal Commission, Washington, D. C., will receive proposals until August 16 for 6,000 cored searchlight carbons, three-fourths by six inches; also for 6,000 solid searchlight carbons, three-fourths by three-and-one-half inches, these carbons to be equal to those made by the National Carbon Company, Cleveland, Ohio. Bidders will be expected to state the name of the maker and the place where the carbons can be inspected before shipment. All proposals must be marked "Proposals for Searchlight Carbons" and addressed to the Purchasing Agent of the Isthmian Canal Commission, Washington, D. C.

POST OFFICE AND COURT HOUSE, NEW ORLEANS, LA.—The office of the Supervising Architect, Washington, D. C., July 22, 1909, will receive sealed proposals until 3 o'clock p. m., August 31, for the construction, excepting mechanical equipment and interior finish, of the U. S. Post Office and Court House at New Orleans, La., in accordance with the drawings and specification, copies of which may be had at the office of the architects, Messrs. Hale & Rogers, 11 East Twenty-fourth Street, New York, N. Y., after July 26, 1909, or at the Supervising Architect's office. Applications must be accompanied by a certified check for $250, which will be held until the return of the drawings and specifications.

LEGAL NOTE.

RIGHTS AFTER TELEPHONE PRIVILEGES HAVE BEEN MISUSED—According to the Supreme Court of Iowa, the plaintiff in the case of Huffman vs. Marcy Mutual Telephone Company was one of six patrons on a rural line when his telephone was removed for alleged use of profane language over the line, interfering and permitting his family to interfere with the use of the line by others. But the evidence contained in the record did not make a strong case against him. The profanity he denied, but admitted the use of the word "chippy" on one occasion when he wanted to ascertain who was interfering with his use of the line by whistling, his testimony being that he remarked: "That sounds nice; it sounds like it might be a 'chippy.'" In short, though not chargeable with all the disturbance on the line, the court entertains no doubt but that both the plaintiff and one of his children, at least, had abused the privileges accorded them, and so far ignored the golden rule as to have made use of the line as a vehicle of petty spite toward two of his neighbors. But it did not appear that they persisted upon being warned that such conduct would not be tolerated, nor that they were guilty of any impropriety thereafter during the two months between the warning and the removal of the telephone. Under such circumstances, and the further fact that when the telephone was removed after said two months it was apparently done owing to the threat of another patron, rather than because of any persistent interference with the service by the plaintiff, the court approves of a decree directing the restoration of the telephone service. No one can well defend the language employed by the plaintiff. As to rules, it would scarcely seem necessary to prescribe in advance one prohibiting the employment of profane, vulgar or indecent language over a telephone line, especially when this is likely to be heard by third persons, or prohibiting interference with the use of the line by others. Such a line, when used in common, enters many family circles, and the proprietor is warranted in assuming, at least until the contrary appears, that its patrons will have regard for the ordinary amenities of life, and observe the courtesies common to civilized society. Upon discovery that in this it has been mistaken as to any subscriber, and that, notwithstanding being duly warned, he persists in the use of improper language over the line, or purposely interferes in conversations between other patrons of the system in order to annoy or interrupt their conversations, or force them to yield the line for his own convenience, and this is persisted in after being duly warned to desist therefrom, there would seem to be but one adequate remedy, and that is to withdraw the service from such person. The very nature of the service undertaken exacts control to this extent, for without the power to withdraw it under the circumstances mentioned, there could be no assurance of its character or efficiency. However, this important power to regulate ought never to be arbitrarily exercised. Some allowance is to be made for the infirmities of human nature. Local customs are not to be ignored. Habit sometimes excuses, if it does not justify, the use of objectionable language. Early environment, more often than an evil spirit, is responsible for bad manners. Undisclosed emergencies may extenuate lapses from propriety. So that, when rules to guide patrons have not been promulgated in advance (and the court discovered none in this record), it is not unreasonable that any patron misusing his privileges be duly warned thereof by the telephone company, and given an opportunity to mend his ways, before being finally deprived of this most convenient means of business and social communication.

INDUSTRIAL ITEMS.

THE LOCKE REGULATOR COMPANY, Salem, Mass., has issued a card illustrating and describing the operation of the improved Locke hydraulic damper regulator.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., has issued an attractive catalogue on "Sherarduct" conduit, which is made of the best tubes procurable for use as conduit. This tube is pickled and cleaned and then "sherardized" by placing it in a drum, packing with a powdery zinc dust obtained by a special process, and subjecting to a careful heat treatment.

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The zinc alloys with the outer surface of the iron, and this non-corrosive alloy is further covered with a protective coating of zinc, thus forming a rustproof tube which may be bent or otherwise roughly treated without injuriously affecting the coating.

THE MOLONEY ELECTRIC COMPANY, St. Louis, Mo., has prepared a finely illustrated catalogue dealing with its regular and special transformers. This catalogue is full of interesting transformer data and will be furnished to those interested upon request.

THE STEAM APPLIANCE COMPANY, Milwaukee, Wis., has issued its Catalogue 16 of steam specialties, including various designs of "Triumph" and "Victor" steam, ammonia and oil separators, "Peters" Corliss-valve steam traps, "Peters" and "Root" pressure regulators, etc.

THE WESTERN ELECTRIC COMPANY is distributing from its New York office (463 West Street) some miscellaneous literature, including a folder descriptive of Hawthorn resin-core solder, another on Hawthorn magnets and test sets, and a third, with a reply postcard for inquiry attached, on individual motor drive for laundries.

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, has published several handsome catalogues dealing with the utilization of its fan motors for summer comfort. New price lists have also been prepared. Full information on the many special applications of this company's "Standard" motors for every variety of service may also be had upon request.

THE KETTLE RIVER QUARRIES COMPANY, of Minneapolis, Minn., has published a number of booklets relating to its creosoting departments. One of these pamphlets describes the new cresoting works that the company has just completed at Madison, Ill. (near St. Louis, Mo.). This large plant is equipped with the most modern machinery for the manufacture and treatment of all kinds of timber, from paving blocks, cross-arms, pins and brackets, to poles, bridge timbers, ties, etc. Both the standard creosoting and a special method devised by its consulting engineer, Walter Buehler, are made use of. This plant has a daily capacity of 250,000 feet of timber. Another creosoting plant of the company is located at Sandstone, Minn. Sales offices are located at Chicago in the First National Bank Building and at St. Louis in the Pierce Building.

THE BISON STORAGE BATTERY COMPANY, of Buffalo, N. Y., states that it has found a considerable demand for its well-known Marx Sparkers for automobile and motor-boat ignition. These sparker batteries are made up usually with three cells in one box having a capacity of either forty or sixty ampere-hours. The set is made up in a very compact and yet accessible and neat form, and is said to be highly efficient and durable.

THE LEA EQUIPMENT COMPANY, New York, N. Y., has issued a small but interesting catalogue describing the Lea high-duty turbine pump. The illustrations show some of these pumps direct-connected to direct-current and alternating-current motors. A chart of a test by Prof. J. E. Denton, on the Lea-Degen two-stage motor-driven centrifugal pump, showed efficiencies of over seventy-seven per cent at speeds of from 400 to 600 revolutions per minute under various lifts.

DATES AHEAD.

Society of Automobile Engineers. Annual convention, Chicago, August 5-7.

Michigan Electric Association. Annual convention, Detroit, Mich., August 17-19.

Old-Time Telegraphers' and Historical Association. Annual reunion, Pittsburg, Pa., August 17-19.

Indiana Electric Light Association. Next meeting, French Lick Springs, Ind., August 18 and 19.

Northwest Electric Light and Power Association. Annual convention and joint session with Seattle branch, A. I. E. E., Seattle, September 7-9.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8-10.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 14-16.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) July 13, 1909.

NOTE.—The delay experienced in receiving the Official Gazette for the 6th, 13th and 20th of July is due to some trouble the Patent Office is having with its contractors. It is hoped, however, that hereafter it can be issued regularly each week, so that this record can be published as promptly as formerly.

927,469. SENDER FOR SELECTIVE SYSTEMS. Frans G. Agrell, Stockholm, Sweden. Filed August 3, 1907. Sets of connecting members are normally disconnected from the conductors and each is adapted to make any one of several different connections; means are provided for predetermining the connection to be made by any set of connecting members; also means for automatically connecting the sets of connecting members in succession.

927,475. SAFETY APPARATUS FOR MOTOR-CARS. John Barberie and Thomas J. Walsh, Brooklyn, N. Y., assignors to Barberie Locomotive Appliance Company, New York, N. Y. Filed September 24, 1904. Renewed October 9, 1905. An electric device in operative connection with the motor operates to de-energize the motor and set the air brakes.

927,476. TELEPHONE DIVIDED MULTIPLE-SWITCHBOARD SYSTEM. William Aitken, Muswell Hill, England. Filed August 27, 1900. A switch at the substation operates a signal, a circuit for which is closed in the operation of the same to maintain the signal actuated after the release of the switch.

927,482. LIGHTING SYSTEM. William L. Bliss, New York, N. Y. Filed June 8, 1904. An electro-responsive device is rendered inert while a storage battery and a generator conjointly furnish the current to operate translating devices connected to them.

927,486. ELECTRIC TIME-SWITCH. Otto A. Bruun, Copenhagen, Denmark, assignor to Niels Bendixen, Copenhagen, Denmark. Filed March 26, 1907. A solenoid time switch is provided with a pneumatic dashpot arrangement.

927,513. LIFTING-MAGNET. Arthur C. Eastwood, Cleveland, O. Filed June 11, 1906. Consists of an annular center pole, an annular concentric outer pole, a magnetic frame or yoke connecting the poles at one end thereof, and an energizing winding, the poles and frame forming a protecting pocket or chamber for the winding.

927,517. PLEASURE-RAILWAY. Frank R. Fageol and Rollie B. Fageol, Oakland, Cal. Filed February 10, 1908. Renewed May 22, 1909. Mechanism carried by each car automatically regulates the energy through the controlling means on the car to vary the speed of the car during its movement relatively to the other cars.

927,519. OZONE-GENERATOR. Theodore Friedlander, Chicago, Ill., assignor to Louis Goldberg, Chicago, Ill. Filed July 24, 1908. Has a pair of concentrically arranged cylindrical electrodes with an air passage between them.

927,541. ELECTROMAGNETIC GOVERNOR FOR INTERNAL-COMBUSTION ENGINES. Eber Hubbard, Chicago, Ill. Filed August 24, 1908. Means subject to the influence of an electromagnetic controller operate a detent to disengage it when released from magnetic influence.

927,583. ANNUNCIATOR FOR CHECKERS OR SIMILAR GAMES. Anthony Nelson, St. Paul, Minn. Filed September 16, 1907. A checker board with depressions in its squares is electrically connected with an annunciator having parti-colored lamps arranged to correspond with the squares of the board.

927,602. SIGNALING SYSTEM. Harry O. Rugh, Sandwich, Ill., assignor to Sandwich Electric Company, Sandwich, Ill. Filed June 26, 1908. Describes a form of telegraphic signaling system.

927,641. WIRELESS TELEGRAPHY. John H. Cuntz, Hoboken, N. J. Filed March 16, 1903. A receiving apparatus of a wireless system comprises a device sensitive to electric waves, a tuning fork, and means for damping the vibrations of the tuning fork.

927,651. SELECTIVE TELEPHONE SYSTEM. Henry G. Guyle, Sargent, Neb. Filed Janury 25, 1905. Describes a party line telephone system.

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927,663. HARMONIC SIGNALING SYSTEM AND MAGNETO HAND-GENERATOR THEREFOR. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company. Filed February 1, 1907. The line circuit of a telephone system has connected with it a tuned ringer operated by periodic current of definite frequency, a central office, a line signal at the office, a generator for delivering periodic current to the line circuit and recurring waves which are adapted to operate the line signal, but which are of too short duration to operate the ringer.

927,664. OPERATOR'S KEY. Ray H. Manson, Elyria, Ohio, assignor to Dean Electric Company. Filed August 23, 1907. A flexible member for transmitting the movement of the key to a movable contact spring has independent movement effecting no change in the circuits controlled by the key before engaging the contact spring.

927,675. MEANS FOR UTILIZING ELECTRICAL ENERGY. Thomas F. Perkins, Atlanta, Tex. Filed March 1, 1907. Describes a form of electric motor.

927,764. ELECTRIC IGNITER DEVICE. Louis Baskin, New York, N. Y. Filed May 7, 1907. Has a nut divided vertically on one side and having an inward flange above the thread fitting the groove of an insulating member, whereby the nut may be sprung open to fit its flange in the groove, and the parts of the nut remain intact, and the nut and insulating member remain united when removed from the base.

927,708. TROLLEY-POLE GUIDE. James P. Brennan, Centralia, Pa. Filed December 26, 1908. On the body of the head are forked shoulders, against which the inwardly bent portions of the guide are adapted to engage and limit the pivotal movement of the guide.

927,714. ELECTRIC SWITCH INSTRUMENT. Clarence W Coleman, Westfield, N. J., assignor to the Hall Signal Company. Filed December 22, 1905. Describes a form of switch instrument for track devices.

927,733. METHOD OF OPERATING ALTERNATING-CURRENT MERCURY WATTMETERS. Robert C. Lanphier, Springfield, Ill., assignor to Sangamo Electric Company. Filed February 9, 1906. The current in the pressure circuit is brought into phase with the impressed electromotive force.

927,739. RELAY. Ray H. Manson, Elyria, O., assignor to Dean Electric Company. Filed August 23, 1907. Contact mechanism is controlled by the movements of the armature.

927,755. ELECTRICALLY-HEATED WATER-FAUCET. Frank A. Robinson, Pittsfield, Mass., assignor to Robinson Electric Faucet Company, Cohoes, N. Y. Filed May 29, 1907. A separate electrically heated conduit leads from the valve chamber to the outlet, and a valve controls communication between the inlet and outlet through this conduit.

927,758. PROCESS OF TREATING SILICATES OF ALUMINUM FOR THE PURPOSE OF OBTAINING VALUABLE PRODUCTS. Alf Sinding-Larsen, Christiania, Norway. Filed November 7, 1907. Material containing aluminum silicate is fed to one end of a long electric furnace and a mixture of iron and a reducing agent to the other end, and an electric current is passed between the electrodes extending into the furnace.

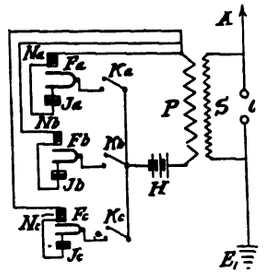
927,803. AUTOMATIC TIME-SWITCH. James Jones and James Jones, Jr., New York, N. Y. Filed February 13, 1908. A hammer is actuated by the movement of a spring-held arm designed to be moved by a cam to strike a lever and throw it out of engagement with a latch.

927,812. BATTERY-GRID. James K. Pumpelly, Indianapolis, Ind., assignor of one-half to Edgar M. Van Norstran, Indianapolis, Ind. Filed June 8, 1908. A two-part battery-grid comprises two perforated plates having inwardly projecting tapered ribs extending beyond the marginal ribs, and marginal ribs adapted to be brought into contact to close the housing and spurs on one plate and adapted to enter perforations in the other plate to hold the plates together.

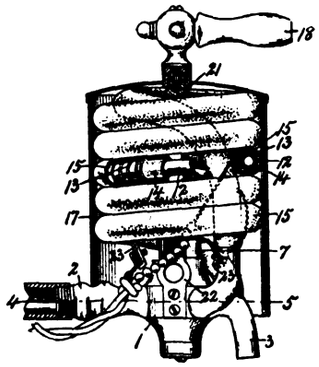
927,816. SELECTIVE RINGING AND TALKING DEVICE. Charles O. Sisler and Lloyd D. Smiley, Uniontown, Pa. Filed October 2, 1908. A mechanism actuated by a lever makes a circuit for a telephone on a party line.

927,817. HYGIENIC ATTACHMENT FOR TELEPHONE-TRANSMITTERS. Eliza C. Smith, Washington, D. C. Filed September 24, 1908. A supplementary protective cone of sheet material for a telephone transmitter has a diaphragm of thinner material than the cone, disposed across its restricted end, the diaphragm being foldable to lie at times out of such position.

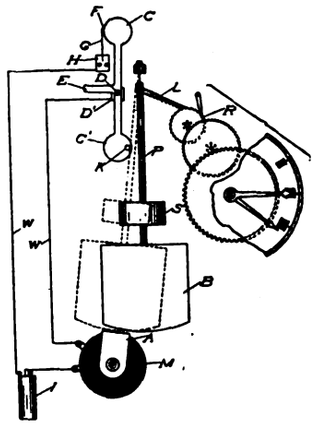
927,865. APPARATUS FOR REGULATING AND CONTROLLING THE SPEED OF MOTOR-VEHICLES. Franz Loos, Meierhöfen, near Carlsbad, Austria-Hungary, assignor of one-half to August Gottl, Fischern, near Carlsbad, Austria-Hungary. Filed May 6, 1907. Means are provided for automatically closing the circuit to a sparker through auxiliary or main terminals.



927,646.—WIRELESS TELEGRAPHY.



927,755.—ELECTRICALLY HEATED WATER FAUCET.



927,907.—ELECTRIC APPARATUS FOR DRIVING CLOCK OR SIMILAR MECHANISM.

927,907. ELECTRIC APPARATUS FOR DRIVING CLOCK OR SIMILAR MECHANISMS. Henry E. Warren, Ashland, Mass. Filed October 22, 1908. Comprises an electric circuit, a time-limit relay therein consisting of a mass resiliently supported so as to be adapted to vibrate for limited varying periods, an abutment against which the mass strikes during vibration, means for starting the mass into vibration and electrical contacts upon the mass and its abutment through which the circuit is closed when the mass is at rest against the abutment.

927,908. ELECTRIC-LAMP SOCKET AND BULB REMOVER AND REPLACER. David L. Webb, Brooklyn, N. Y. Filed January 25, 1909. A rotatable stem mounted in the handle is adapted to operate movable members having jaws thrown in and out of operative position by the movement of the members.

927,917. SWITCH MECHANISM FOR TROLLEY WIRES. Frank M. Zimmerman, Aurora, Ill. Filed February 1, 1908. An arched bridge piece is provided at its ends with conductor wire channels, and mechanism at its center is adapted to hold conductors against its under side; and a replacable switch mechanism is provided under the wires and bridge piece and secured to the latter.

927,935. METHOD OF MANUFACTURING FILAMENTS FOR ELECTRIC LAMPS. Werner von Bolton, Charlottenburg, Germany, assignor to Siemens & Halske, A. G., Berlin, Germany. Filed October 22, 1907. A method of manufacturing filaments of highly refractory metals for electric lamps consists in surrounding each particle of the comminuted concerned metals with a casing of another ductile metal and forming a cohesive mass of the metals and in forming the mass into filaments.

927,959. RESONATOR. Patrick E. Finlay, New Orleans, La. Filed November 24, 1908. A resonator for telephones, etc., comprises a dished body having sound reflectors at opposite sides facing forwardly and inwardly, with the inner wall of one reflector separate and distinct from the inner wall of the other reflector.

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927,970. ELECTROLYZER. Edward Hixon, Chicago, Ill. Filed February 25, 1909. Comprises a mixing tank, a receiving tank and pipe connections between these tanks and an electrolyzing tank, which has a number of vertically disposed transverse partitions removably mounted therein.

928,004. INTERDEPENDENT SIGNAL AND SWITCH APPARATUS FOR RAILWAYS. Friedrich Prochaska, Berlin, Germany, assignor to Siemens & Halske, A. G., Berlin, Germany. Filed April 10, 1906. A single series of supervising devices is dependent upon the condition of the switches, selective devices are provided for the routes, and means are operated by the selective devices for making operative only the supervising devices belonging to the selective routes.

928,010. CROSS-ARM FITTING AND INSULATOR-SUPPORT. Sylvester B. Way, St. Louis, Mo. Filed January 11, 1909. Comprises two members separable on a diagonal line and adapted to embrace a cross-arm, and adjustable means for uniting the ends of the members.

928,013. ACCELERATION-CONTROLLING DEVICE. Varanus A. Wolcott, Schenectady, N. Y., assignor to General Electric Company. Filed May 16, 1908. A motor for a cable reel on a vehicle is arranged to rotate the reel, and means are provided to increase above normal the voltage applied to the reel motor during acceleration of the vehicle in one direction.

928,016. TROLLEY-HARP MOUNTING. Gilbert L. Adams, Altoona, Pa. Filed November 21, 1908. The head has an obliquely disposed socket, the outer end of which is arranged in line with the pole.

928,021. SIGNAL SYSTEM. Elmer F. Bliss, Schenectady, N. Y., assignor to General Electric Company. Filed May 6, 1909. A track relay comprises a winding supplied with current through the track rail, a member adapted to be vibrated by an alternating current in the winding and tuned to a natural period of vibration corresponding to the frequency of the current normally delivered by the source, and a signal which is controlled by the vibration of the aforesaid member.

928,028. CONTROLLER FOR ELECTRIC MOTORS. Victor E. Chamberlin, Indianapolis, Ind., assignor to Pope Manufacturing Company. Filed April 27, 1907. The controller is arranged and connected to close the circuit with the motor fields in series, to shunt one of the fields and then change the circuit to include the fields in parallel without breaking the connection with either of the said fields during all of these operations.

928,037. DYNAMO-ELECTRIC MACHINE. William H. Frost, Schenectady, N. Y., assignor to General Electric Company. Filed July 25, 1904. The field magnet comprises a laminated body portion formed of units, each of which has notches or recesses to receive one tongue from each of a number of polar projections, and polar projections formed each with two rows of notched or recessed tongues out of line with each other.

928,043. ELECTRICAL VIBRATOR. Maximilian K. Golden, San Francisco, Cal., assignor to James Jerome, San Francisco, Cal. Filed January 15, 1908. An electromagnet having a stationary armature is fixed to a vibrating arm and movable therewith, and the energizing and de-energizing of the magnet causes it and the tool-carrying arm to be oscillated with relation to the armature.

928,049. LIGHTNING-ARRESTER. Edward M. Hewlett and Ezra B. Merriam, Schenectady, N. Y., assignors to General Electric Company. Filed May 18, 1907. A number of conductors are arranged in a chute to form a series of air gaps and a sinuous gas passage, and means are provided for connecting one of the conductors to a line conductor to be protected from abnormal charges, also means for connecting another of the conductors to ground.

928,068. ELECTRIC-SWITCH-CONTROLLING SYSTEM. Frederick G. Proutt, Memphis, Tenn. Filed September 13, 1904. Comprises a shunt circuit for connection with the line wires in advance of the device to be controlled, a switch blade adapted to be connected in the circuit between the shunt circuit and the device, a solenoid wrapped by the shunt circuit and controlling the switch blade, an electromagnet also wrapped by the shunt circuit and holding the switch in either the open or the closed position, and means for short-circuiting the electromagnet before every operation of the solenoid.

928,082. WATER GAUGE. Julius Torok, Renovo, Pa. Filed February 13, 1909. Is provided with contacts for sounding an electric alarm.

928,084. INSULATING-STUD. Louis E. Underwood, Lynn, Mass., assignor to General Electric Company. Filed May 5, 1908. A supporting rod carries a metal tube, and an insulating tube is interposed between the rod and the tube and extends beyond the rod at one end and beyond the tube at the other end.

928,089. PYRO-ELECTRIC GENERATOR. George J. Vokel, Philadelphia, Pa., assignor of one-half to C. Thomas Waltz, Philadelphia, Pa. Filed January 21, 1909. A tubular framework is provided for the reception of cooling fluid, and a series of thermo-couples having their end portions resting on a part of the framework are disposed so as to be cooled thereby.

928,096. MICROPHONE. Giuseppe Angelini, Rome, Italy. Filed March 28, 1907. Grains of carbon are compacted between an electrode and a wadding in contact with a flexible disk which touches the electrode.

928,104. RELAY. Edward R. Brodton, Mobile, Ala., assignor of one-fourth to George H. Fondé and one-fourth to Ernest E. Wagar, Mobile, Ala. Filed August 3, 1908. Comprises electromagnetic means included in a line circuit, and two armatures controlled by this means and each biased to respond selectively to a predetermined line current.

928,115. TELEPHONE METERING SYSTEM. Richard M. Eaton, Niagara Falls, N. Y., assignor to the Dean Electric Company. Filed January 10, 1907. The receiver hook controls the time-measuring mechanism.

928,119. TROLLEY-WHEEL. Thomas A. Gannoe, Warren, Pa., assignor of three-eighths to John Schmutz, Warren, Pa. Filed February 18, 1908. Between two outer sections is mounted a movable section supported by a number of arcuate springs.

928,136. CONSTRUCTION OF ELECTROMAGNETS. Howard Lacy, Carshalton, England. Filed August 31, 1906. The diameter of the wire in each successive group of superimposed windings on the core decreases progressively and the number of layers in each successive group increases in direct arithmetical progression.

928,148. BLOCK SYSTEM FOR RAILWAY-CROSSINGS. George W. Nistle, North Muskegon, Mich., and Bernard W. Brady and Edward Inskip, Chicago, Ill. Filed January 2, 1908. Blocking mechanism is associated with one track and train-actuated contact devices are mounted adjacent to the crossing track.

928,152. ELECTRIC-SWITCH HANDLE. Clarence D. Platt, Bridgeport, Conn. Filed February 5, 1909. The handle comprises a turn button having a recess in its under side, a shank molded therein concentric with the recess and having a threaded hole in its outer end, an inverted cup adapted to slide on the shank and a spring acting to force the cup outward, the outer end of the shaft being headed to retain the cup thereon.

928,157. TROLLEY-WIRE SWITCH. Howard O. Shissler, Des Moines, Ia. Filed April 18, 1907. Two trolley wires spaced apart are fixed to one end of a metallic switch plate and in electrical contact therewith, a trolley wire fixed to the other end of the switch plate, and electrically connected to it, is extended under the switch plate to a point adjacent to the other wire, and a flexible trolley wire support fixed to the free portion of the trolley wire beneath the switch plate is fixed to the switch plate at the end opposite from the two trolley wires, and is capable of free lateral movement and of supporting the wire against downward movement.

928,161. ARC-LAMP. George E. Stevens, Lynn, Mass., assignor to General Electric Company. Filed August 14, 1903. The framework comprises a lamp top, a platform, a pair of parallel rods uniting them, and a movable follower block of vitreous material arranged to slide on the rods.

928,171. TELEPHONE SYSTEM. Moriz Baumer, Nuremberg, Germany. Filed November 24, 1908. Describes a form of telephone switch apparatus for an automatic branch exchange switch system.

928,188. COIN BOX FOR TELEPHONES. Charles S. Ellis, Chicago, Ill., assignor to American Coin Register Company. Filed June 17, 1907. A coin channel leads to a signaling mechanism and thence to a coin box, and an oscillatory coin-carrying disk controlled from without positively and simultaneously conveys one coin to the signaling mechanism and another to the coin box.

928,189. ARC-LAMP. Richard Fleming and Cromwell A. B. Halvorson, Jr., Lynn, Mass., assignors to General Electric Company. Filed January 16, 1906. A stop is provided adjacent to the arcing end of one electrode, but out of line with it, and a second electrode normally in line with the other has means for moving it toward the other electrode and also laterally so as to bring it into engagement with the stop and the other electrode.

928,204. INDUCTION-COIL FOR IGNITION SYSTEMS. Burton L. Lawton, Meriden, Conn., assignor to the Unit Coil Company. Original application filed June 19, 1907. Divided and

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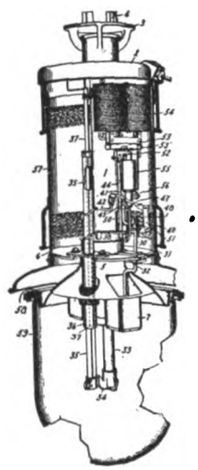
this application filed January 25, 1909. An induction apparatus comprises a number of coils, each consisting of primary and secondary windings, with a vibrator for each primary and a metallic member between the coils forming a local magnetic shield for each secondary.

928,209. COMBINED DISTRIBUTOR AND TIMER DEVICE. Theodor M. Mueller and Albert Jacob, Dalton, Mass., assignors to Pittsfield Spark Coil Company. Filed November 13, 1908. A distributor rotatably mounted with relation to a terminal on the base plate is provided with resilient fingers which are engaged during rotation with a fork terminal.



928,189.—ARC LAMP.

928,214. MEANS FOR UTILIZING ELECTRICAL ENERGY. Thomas F. Perkins, Atlanta, Tex. Original application filed March 1, 1907. Divided and this application filed August 15, 1908. An inductive translating device is included in an electric circuit; another circuit includes a translating device capable of producing useful work; and means are provided for breaking the first circuit and simultaneously completing the second circuit to the exclusion of the charging source of the first circuit.

928,219. SYSTEM OF DISTRIBUTION. Paul Rose, Berlin, Germany, assignor to General Electric Company. Filed January 28, 1909. Means for maintaining a predetermined division of load between two separately excited generators connected in parallel, comprise a voltage regulator for each generator maintaining a main control magnet having a differential winding, one portion of which is responsive to changes of voltage in the line of its own generator and the other to changes of current in the other generator.

928,224. ELECTRICAL CONDENSER AND PROCESS OF MAKING SAME. Harry Shoemaker and Frederick W. Midgley, Jersey City, N. J. Original application filed January 8, 1909. Divided and this application filed May 4, 1909. An electrical condenser comprises a glass or vitreous dielectric material having a roughened surface, a preliminary coating consisting of conducting material in intimate and firm engagement with this surface, and another coating electrically deposited upon the preliminary coating.

REISSUE.

12,992. MANUFACTURE OF SPAR INSULATORS. Fred M. Locke, Victor, N. Y. Filed May 17, 1909. Original No. 907,155, dated December 22, 1908. Common feldspar is subjected to sufficient temperature to reduce it to a homogeneous pliable condition, whereupon the feldspar is molded into an insulator of the desired form and allowed to cool while in the mold.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired July 19, 1909:

479,007. ELECTRIC ARC LAMP. M. S. Logan, Otterville, Mo.

479,017. HANGER FOR ELECTRIC ARC LAMPS. C. A. Pfluger, Chicago, Ill.

479,020. INCANDESCENT ELECTRIC LAMP. M. A. Richter and J. G. Nolen, Chicago, Ill.

479,029. ELECTRIC ARC LAMP. E. A. Sperry, Chicago, Ill.

479,030. ARMATURE FOR ELECTRIC MACHINES. E. A. Sperry, Chicago, Ill.

479,035. SAFETY DEVICE FOR ELECTRIC CIRCUITS. M. Thum, Louisville, Ky.

479,046. ELECTRIC SIGNAL FOR MINE SHAFTS. F. W. Bacorn, Marysville, Mont.

479,062. SPEAKING ATTACHMENT FOR TELEPHONES. D. Eldridge, Boston, Mass.

479,101. RHEOSTAT. J. Waring, Manchester, Conn.

479,107. TELEPHONE SWITCHBOARD. W. Gesterreich, Berlin, Germany.

479,118. DYNAMO-ELECTRIC MACHINE. R. Eickemeyer, Yonkers, N. Y.

479,121. ELECTRIC ARC LAMP. W. E. Irish, Chicago, Ill.

479,138. SIGNAL FOR ELECTRIC RAILWAYS. F. F. Loomis, Akron, Ohio.

479,167. ELECTRICAL METER. A. E. Kennelly, Orange, N. J.

479,168. ELECTRICAL METER FOR THREE-WIRE SYSTEMS. A. E. Kennelly and J. F. Ott, Orange, N. J.

479,169. ELECTROMAGNETIC MACHINE. A. E. Kennelly and J. F. Ott, Orange, N. J.

479,170. COMPOUND-WOUND ALTERNATING-CURRENT DYNAMO. H. Lemp, Lynn, Mass.

479,171. ELECTRIC METER. J. F. Ott and A. E. Kennelly, Orange, N. J.

479,172. ELECTRIC-CURRENT METER. J. F. Ott and A. E. Kennelly, Orange, N. J.

479,178. TELEGRAPHIC REPEATER. R. H. Weiny, New York, N. Y.

479,179. ARMATURE FOR DYNAMO-ELECTRIC MACHINES. M. J. Wightman, Scranton, Pa.

479,184. FACSIMILE TELEGRAPH. T. A. Edison, Menlo Park, N. J., and P. Kenny, New York, N. Y.

479,187. ALTERNATING-CURRENT MOTOR. T. H. Hicks, Detroit, Mich.

479,216. CLAMP FOR ELECTRIC CONDUCTORS. J. Ingmanson and R. Lorang, Chicago, Ill.

479,225. SWITCH AND SIGNAL APPARATUS. J. G. Schreuder, Edgewood, Pa.

479,226. TELEPHONE. G. F. Shaver, Yonkers, N. Y.

479,227. TELEPHONY. G. F. Shaver, Yonkers, N. Y.

Following is a list of electrical patents (issued by the United States Patent Office) that expired July 26, 1909:

479,469. MOTOR FRAME FOR ELECTRIC LOCOMOTIVES. Sidney H. Short, Cleveland, O.

479,493. ELECTRIC RAILWAY. Mark W. Dewey, Syracuse, N. Y.

479,510. ELECTRIC ARC LAMP. William E. Irish, Cleveland, O.

479,520. ELECTRIC SELF-WINDING CLOCK. Malcolm MacKellar and George D. Weaver, Reading, Pa.

479,525. MECHANICAL MOVEMENT. George H. Reynolds, New York, N. Y.

479,540. ELECTRIC SIGNALING DEVICE FOR FIRE-HOSE. John C. Wharton and James W. Braid, Nashville, Tenn.

479,596. THERMO-ELECTRIC ELEMENT. Charles W. Iden, New York, N. Y.

479,659. ELECTRIC ARC LAMP. Jonathan A. Pierce, Austin, Minn.

479,675. ALTERNATING-CURRENT MOTOR. William Stanley, Jr., Pittsfield, Mass., and John F. Kelley, New York, N. Y.

479,676. ALTERNATING-CURRENT MOTOR. William Stanley, Jr., and John F. Kelley, Pittsfield, Mass.

479,727. ALTERNATING-CURRENT MOTOR. William Stanley, Jr., and John F. Kelley, Pittsfield, Mass.

479,746. ELECTROMAGNETIC MOTOR. John F. Kelley, New York, N. Y., and William Stanley, Jr., Pittsfield, Mass.

479,753. SECONDARY BATTERY. Arthur E. Colgate, New York, N. Y.

479,772. MATRIX-MAKING MACHINE. George A. Goodson and Alexander S. Capehart, Minneapolis, Minn.

479,773. MATRIX-MAKING MACHINE. George A. Goodson, Minneapolis, Minn.

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CONTENTS.

EDITORIAL:
The Supply of Electric Current to Other Towns from a Centrally Located Station 231
Load Factors in Motor-Driven Installations 232
Connecticut River Power in Massachusetts 232
Card-Index Files for Advertisers 233
The Design of the Marcel Deprez Type of Electromagnet 233
The Design of the Marcel Deprez Type of Electromagnet 234
Navy Department Supplies 235, 239
Special Tungsten Lighting in Mishawaka, Ind. 236
The Story of a Slogan Sign Backed by a Central Station 237
Boston Edison Lecture Course for 1909-10 237
The British Association Meeting at Winnipeg 237
Losses, Induced Volts and Amperes in Armor and Lead Covers of Cables 238
Tariff Changes on Electrical Goods 239
The Hudson-Fulton Celebration—An Unprecedented Illumination Scheme for New York and the Hudson River 240
New $6,000,000 Merchants' and Manufacturers' Exchange Building for New York 241
British Electrically-Equipped Demonstration House 241
Copper Reforms 241
The Regulation of Potential Transformers and the Magnetizing Current 242
Amsterdam Corporation's Plan for Freight Subway System 244
The Physical Society of London 245
Lamps for Residence Illumination 246
Jersey Coast Lines to Be Electrified 247
Electricity Supply in Coal Mines 247
The Supply of Electric Current to Other Towns from a Centrally Located Station 248
Tractions Buying Copper 250
Assistant Inspector of Electric-Light Plants 250
Society of Wireless Telegraph Engineers 250
The Commercial Organization of an Electric Light Company and Its Relation to the Public 251
Heat Insulation and Efficiency of Electric Heating Apparatus 252
Chicago Electric Club 253
Street Railway Convention—Accountants' Programme 253
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 254
The Tariff on Carbons 256
Outlook in Tungsten Mines 256
Transportation Engineer for New York Public Service Commission 256
QUESTIONS AND ANSWERS 257
General Electric Company to Improve Plants 257
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE 258
INDUSTRIAL SECTION:
Two Giant Electrically-Driven Power Shovels 260
A Unique Boiler and Stoker Equipment 260
Turbo-Generator Sets for Train-Lighting 261
Acheson Graphite Company's Hydro-Electric Plant 261
The Westinghouse Magnetic Brake 261
The Hemere Combined Meter Panel and Cut-Out 262
Motor-Driven Wire-Testing Machines 262
The Roebling Exhibit at the Alaska-Yukon-Pacific Exposition 263
The Dwyer Tubing Machine 263
$25,000,000 Cement Merger 263
More Electrical Projects in Brazil 263
The C. M. B. Continuous-Current Rotary Converter 264
The New 150-Watt Tungsten 264
CURRENT ELECTRICAL NEWS 265
RECORD OF ELECTRICAL PATENTS 271

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THE SUPPLY OF ELECTRIC CURRENT TO OTHER TOWNS FROM A CENTRALLY LOCATED STATION.

What is unquestionably a most potent movement of the time is the centralization of electrical energy supply. The consolidation of the isolated plants in a community into a central station is being followed by the linking together of the plants in isolated communities into far-reaching networks receiving their power from a central plant. In each case reduced investment charges, greater economy of operation, continuous and extended service have resulted. Each case has been made possible by the success of electric power transmission. It has been shown that the loss in transmission to a reasonable distance of the power developed in an efficient station is less than the increased cost of generating the current locally in a small and much less efficient plant. The diversification of service and therefore increased load factor possible in a large central station is a further means of reducing the cost per unit of output. While these facts have become quite well established and the extension of hydroelectric systems has rapidly taken place, it is only within the past year that the extension of electric service from a central steam plant to adjacent towns has received a marked impetus.

Pointing out the advantages and the methods of carrying out such a policy, there have been presented in the last few months before conventions and gatherings of electrical men a number of notable papers and addresses. At the last convention of the Northwestern Electrical Association in Milwaukee a paper on this subject was presented by J. S. Knowlson; at the recent convention of the National Electric Light Association the financial aspects of the problem were discussed by Messrs. Vanderlip and Insull; at a recent meeting in Brooklyn Caryl D. Haskins alluded to this centralizing tendency; at the convention of the American Institute of Electrical Engineers at the Thousand Islands President Ferguson took for the subject of his annual address "The Centralization of Power Supply;" at the convention just held by the Ohio Electric Light Association this topic formed the basis of a most interesting discussion, and two papers with the title that is at the head of these editorial comments were presented by Messrs. Hutchings and Smith. Each of these addresses and papers has been abstracted in the columns of this journal, and the last two are given practically in full in this issue.

Mr. Hutchings' paper points out the shortcomings of the

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small station and the advantages to it and the community in general of buying its power from a larger central station. Mr. Smith's paper gives the actual results attained by a local distributing company that purchases its supply from a neighboring city station. He shows conclusively that in a small town in which a number of attempts had been made unsuccessfully to operate an electric plant it was not only feasible to supply the electric service from a distant source, but highly profitable to do so. Both these papers, as well as the addresses referred to, are worthy of the most careful study by the owners of small local stations and those of larger adjacent plants that are in a position to supply them. The fear and mistrust of the large power company by the small local company is usually unwarranted and the benefits of their getting together are most likely to be mutual. Incidentally the community at large is decidedly the gainer.

LOAD FACTORS IN MOTOR-DRIVEN INSTALLATIONS.

In view of the amount of attention paid lately to load factors in power plants, it is not strange that engineers have sought to improve operating conditions elsewhere by studying the conditions with respect to capacity and actual machine loading. Much remains to be done, however, before the ratios of average to normal output in many specialized industries will even approach ideal conditions. It is probable that as time goes on not a few industrial plants will examine the time elements in their production processes with a thoroughness which will make present methods look exceedingly experimental. The economic waste of an idle machine, the cost of time spent by employes in non-productive or auxiliary work, and the expense of maintaining unused capacity in shop motive power are not as generally appreciated today as they probably will be five or ten years hence, when the value of critical tests and protracted analyses of local conditions will be clearer.

A wider recognition of the importance of a good load factor will lead to a more exact selection of equipment in the field of motive power for tool service, to pass by its beneficial influence upon the distribution and continuance of labor in specific operations. In a plant where the tools are equipped with motors assigned without reference to the percentage of time which the machines are likely to be run at fractional outputs, there is likely to be a positive loss in both the efficiency of power utilization and the economy of manufacture, through the operation of the motors at loads without the range of their most efficient service, which is off the flatter portion of the curve of individual machine economy. Unless the engineer who lays out a plant for either the group or the individual drive makes a special effort to determine what the time elements of the different departments and motor-driven units are likely to be, he is liable to find himself in error as to the fitness of given motor sizes for the permanent service of the installation. Excess capacity in motive power costs appreciably in a large plant, in reference to fixed charges, and the chance of operating motors at such small percentages of their ratings that considerable power will be wasted, even when the machine driven is turning out its utmost output per day. In alternating-current motor installations the operation of individual drives at underloads for the motors introduces the additional disadvantage of poor power-factor, the result of which is to limit the number of machines which a generating station of a fixed size can handle and to interfere with the regulation of the voltage, and hence with the quality of the light available throughout the establishment. In the great majority of individual-motor drives the units are very limited in size, and in motors below ten horsepower the power-factor falls off very rapidly as the output decreases.

The problem of securing a good load factor at the machine tool itself is mainly one for the management of the factory to solve, after the engineering aspects of the driving have been recognized. The technical features of this work belong to the specialist in factory methods, co-operating with the engineer responsible for the motor selection. If the factory expert collates the data relating to the times of use of the different machines and the engineer tests the motor capacity required for the services in hand, a reasonably accurate motor selection should result. Two or three easily connected instruments are all the equipment that is necessary to make a thoroughly scientific determination of the power requirements of tools of established design.

The final engineering efficiency of a motor-driven plant is naturally determined by the character of the component parts of the installation. In endeavoring to raise the load factor, therefore, complete studies must be made, if possible, of the inter-relations of departments, the probable overlapping of loads, possibility of changing the amount of power required by modifying the arrangement of tools and perhaps altering the sequence of operations. Most prosperous plants are continually growing, and the importance of genuine research in relation to the load factor is not likely to lessen.

CONNECTICUT RIVER POWER IN MASSACHUSETTS.

By deciding to admit the Connecticut River Transmission Company to the power market of the city of Fitchburg for the sale of electrical energy in blocks of 300 horsepower and over, the Massachusetts Gas and Electric Light Commission has taken a step which will insure the community the benefits of low-production cost while protecting the existing central-station business of the Fitchburg Gas and Electric Company, which appealed to the Commission in 1908 against a franchise granted to the hydroelectric company permitting it to supply current in territory already occupied by the older concern. This solution, or at least one restricting the sale of power at very low rates to consumers who can take it in bulk, limited by a somewhat arbitrary definition of what constitutes small and large power, is clearly reasonable and fair to all interests concerned, permitting the community at large to benefit from the introduction of the low cost service, encouraging progress and at the same time conserving capital already invested. The advan-

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tages of cheap and reliable power need not be discussed here, but the advantages of an arrangement like the one suggested in the Commission's published decision deserve comment.

Under the plan proposed by the Commissioners, the Transmission Company may sell power to consumers of the minimum connected capacity named above, provided that the consumption of energy reaches 450,000 horsepower-hours per year; it may sell to electric railroads and to the existing Fitchburg Company. This means that the large consumers will secure power at rates which are almost out of the question in a steam-driven central station operating under the conditions of coal and labor cost applicable in New England; and the result ought to be a large increase in the use of electricity in mills which might generate current at very low figures themselves, compared with the regular central-station rates. Undoubtedly the acceleration in the use of the motor drive thus inaugurated in the larger mills will tend to increase the number of small consumers of the central-station company's power, since anything which acts in the direction of a wider use of electric service on a large scale inevitably forces its adoption for economic reasons in innumerable individual establishments. A further benefit, however, should result from the sale of power generated at the water-driven station to the Fitchburg Company, provided it can be delivered at the latter's plant at less than the cost of manufacture locally, which ought not to be much in question. By a local arrangement to take secondary power, and possibly a certain quantity of primary power, it should be possible to improve the load factor of the local station, and thus the small consumer will share indirectly, if not directly, in the benefits of the new service. Just how far it will pay any central station to try to compete with isolated plants in mills operated under liberal management is something of a question; but it is certain that the introduction of power from such a source as the Connecticut Company will tend to discourage consumers from attempting to generate their own electricity, and popularize the service available to those who do business on a smaller scale.

CARD-INDEX FILES FOR ADVERTISERS.

On another page of this issue we announce an arrangement for the use of our advertisers, without any expense other than that of supplying index cards, for distributing 5,000 card-index catalogues of American manufacturers. For some years the export trade of Great Britain and other European countries has been encouraged and stimulated by the use of card-index files containing the names of manufacturers, producers, importers and exporters. The plan of distribution of the card-index catalogues for our advertisers embraces the distribution to two hundred or more American consulates, to the chambers of commerce, boards of trade, and other commercial organizations in the principal trade centers of the world, to a large list of buyers for foreign houses, to commission houses in all the principal cities of the world, to architects, engineers, contractors, purchasing agents and buyers in the United States. The advantages of this additional publicity should be very great for manufacturers in the electrical industry, and this arrangement should be studied with care.

THE DESIGN OF THE MARCEL DEPREZ TYPE OF ELECTROMAGNET.

Electromagnets of the movable-core or plunger type are in common use in connection with such devices as motor starters and other remote control apparatus, where the use of a small electric motor, though more efficient, is undesirable on account of its first cost as well as that of the auxiliary mechanism, and the time required for it to perform the work.

The solenoid and plunger is unique in that it is capable of performing its work in a brief period, when its plunger is attached to the point where the force or pull is to be applied.

The characteristics of the simple solenoid and plunger, as well as a modified form for obtaining a long range of action with a strong pull, are discussed by Charles R. Underhill on page 234. The article shows that the maximum pull due to a long solenoid is directly proportional to the magnetomotive-force and the cross-sectional area of the plunger, and is inversely proportional to the length of the solenoid; while for solenoids of moderate length, the ratio between average radius and length of solenoid has to be taken into consideration. Hence, for a strong pull over a long range, a high value for magnetomotive-force would have to be employed, and then the pull would not be uniform.

The application of the Marcel Deprez type of electromagnet makes it possible to obtain a long, uniform pull over any desired range of action, the degree of smoothness of action depending upon the number of separate coils employed.

In an interesting communication in the *Review of Reviews,* Arthur E. Bostwick relates an interesting incident in the life of Simon Newcomb, America's foremost astronomer. Dr. Newcomb, whose death on July 11 was announced in these columns a few weeks ago, had general oversight of the definitions in physical science in the "Standard Dictionary." On one occasion he came into the office greatly dissatisfied with the definition which had been framed for the word "magnet." The office staff had simply enumerated the properties of the magnet, but Newcomb's mind demanded a logical treatment. His tenacity of purpose kept him, pencil in hand, writing and erasing alternately for an hour or more. Finally he confessed that he could do no better than the following pair of definitions: "Magnet, a body capable of exerting magnetic force," and "Magnetic force, the force exerted by a magnet." With a hearty laugh at this conclusion, he threw down his pencil, and the imperfect and illogical office definition was accepted.

The Tariff Bill has been passed by the Conferees and adopted by the House. Possibly as this goes to press it will be passed by the Senate. The framers contend that the rate upon carbon electrodes for lighting has been reduced. Has it? There are two interesting communications anent all this on other pages of this issue.

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THE DESIGN OF THE MARCEL DEPREZ ELECTROMAGNET.[1]

BY CHARLES R. UNDERHILL.

Where a strong pull is desired over a long range of action, the solenoid or, more strictly speaking, the solenoid and

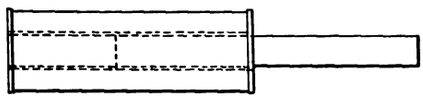

FIG. 1.—SIMPLE SOLENOID AND PLUNGER.

plunger, has long been employed. However, the laws governing the relations between dimensions, pull and range have only within recent years been developed.

A simple solenoid and plunger is shown in Fig. 1, while Fig. 2 shows the general characteristics. It is seen that the pull is maximum when the end of the plunger is somewhat beyond the center of the solenoid, the exact position depending upon the degree of saturation in the plunger.

In general, the longer the solenoid, the greater will be the range or stroke. The pull will, however, vary approximately inversely as the length of the solenoid; so the product of pull and range, which represents the total work done, will be practically constant, for long solenoids, while for short ones the product of pull and range is not so great. This is illustrated in Fig. 3. In this it is assumed that the ampere-turns in the solenoid are the same in all cases, and that the dimensions of the solenoid and plunger, excepting the length, are constant.

In any case the plunger must be at least as long as the solenoid, and, where the solenoid is short, the plunger may even be twice the length of the solenoid for maximum results. From the foregoing it is evident that, in the case of a simple solenoid and plunger, an extremely long plunger, as well as a very long solenoid, would have to be employed where a great range of action is desired without the use of levers.

Where a rapid action is desired, under these conditions, the inertia of the long and heavy plunger is a decidedly objectionable feature. Aside from the ordinary retarding action, due to self-induction, there is another effect to be considered. When the end of the plunger is but a short distance within the solenoid, as at the beginning of the stroke, the induction in the iron is low. As the plunger is drawn further in, however, it is surrounded by more effective turns and the length of the air core becomes less, thus increasing the flux. This constant change of position sets up a counter electromotive-force in the solenoid.

The effect of inertia is greatly overcome, and the range extended indefinitely by a device employed so long ago as 1880 by M. Marcel Deprez. This consists, essentially, of a number of independent solenoids, placed end to end, and with their terminal wires connected to a switch or commutator in such a manner that any number of coils, say three or four, may be successively connected in series without interrupting the circuit proper. The connections are shown in Fig. 4, and the action is as follows: Assume the switch levers or brushes to be in the positions shown in Fig. 4. The current will then flow through the coils A, B and C in series. If the switch levers, which are permanently fixed in juxtaposition with one another, but insulated from each other, should be moved one point to the right on the commutator, the current would then flow through the coils B, C and D in series. This action is continued to the full extent of the commutator, which may have any desired capacity.

This method permits of the use of a very short plunger, and, as the current flows through any individual coil but momentarily, a very strong pull may be obtained without undue heating of the coils. Furthermore, by this arrangement, the plunger may be raised or lowered at will, and held in any desired position. In order to have a perfectly smooth action, it is desirable that the coils be as short as practicable.

By the arrangement shown in Fig. 5 an oscillatory motion may be imparted to the plunger by simply rotating the brushes B and B_1 around the stationary commutator. This rotation may be accomplished by hand, by a small electric motor or by means of a flywheel, geared to the rotary brush holder, and actuated by a connecting rod attached to one end of the plunger. In this latter case the action is automatic. In the cut, the commutator segments are shown widely separated in order to make the wiring diagram clear. In practice they should, of course, be close together, so that there will be no interruption of the circuit.

The coils are preferably wound on

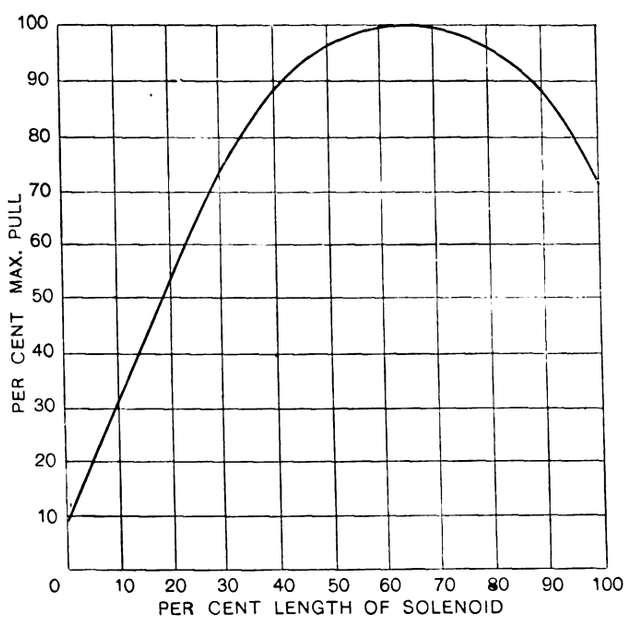

FIG. 2.—CHARACTERISTICS OF SIMPLE SOLENOID AND PLUNGER.

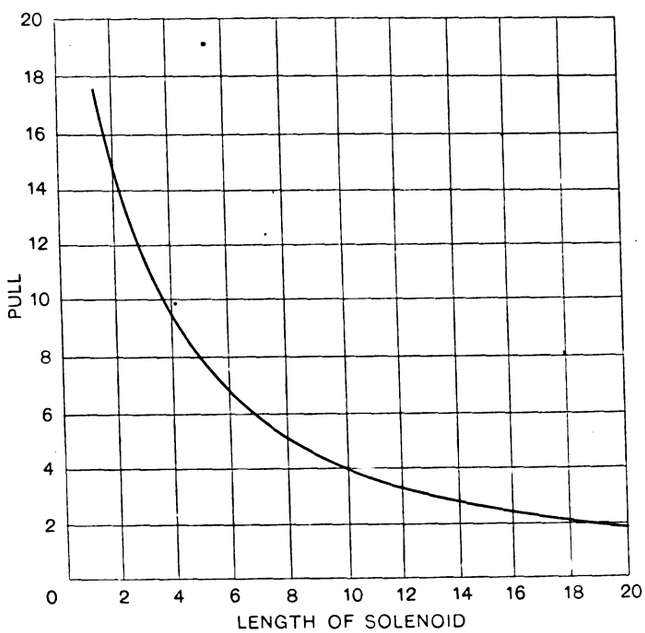

FIG. 3.—RATIO OF PULL TO LENGTH OF SOLENOID.

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forms and taped. The outside diameter of each coil may vary from twice to three times the diameter of the plunger. The separate coils are mounted over a slotted brass tube, through which passes the soft iron or steel plunger. This should also be slotted to avoid induced currents.

By adjusting the relative positions of the switch arms, so as to include different numbers of segments on the commutator, the pull may be considerably varied. The greater the number of segments included between the brushes, the less will be the current used, for constant electromotive-force, and, consequently, the weaker will be the pull.

The pull due to a simple solenoid and plunger, of any dimensions, may be determined by a very simple rule, which may be approximately expressed as follows:

$$P = \frac{A\,IN\left(2 - \frac{r_a}{1.07\,L}\right)}{981\,L}, \qquad (1)$$

wherein P = pull in kilograms; IN = ampere-turns; A = cross-sectional area of plunger in square centimetres; r_a = average radius of coil in centimetres; L = combined length of active coils in centimetres.

This rule,[1] deduced by the writer, is for the maximum pull due to a solenoid and plunger when the plunger is saturated, and is very well adapted for the type of electromagnet in question. In general, approximately 1,000 ampere-turns should be assumed for each square centimetre of cross-section of plunger, in order to obtain the best results.

As an example, assume the following case: Six coils or disks, each one-half inch thick, are to be simultaneously connected in series. The total thickness (or length) of the active part of the solenoid will, therefore, be three inches. The plunger is 1.5 inches in diameter and the average radius of the coil is 1.44 inches.

Reduced to metric units, we have:

Diameter of plunger = 3.81 centimetres; A = cross-sectional area of plunger = 11.4 square centimetres; L = length of active winding = 7.62 centimetres; r_a = average radius = 3.66 centimetres.

If the coils were wound with No. 21 B. & S. magnet wire, and the source of energy was of 110 volts direct current, the ampere-turns would be, by well-known methods of calculation, 11,400.

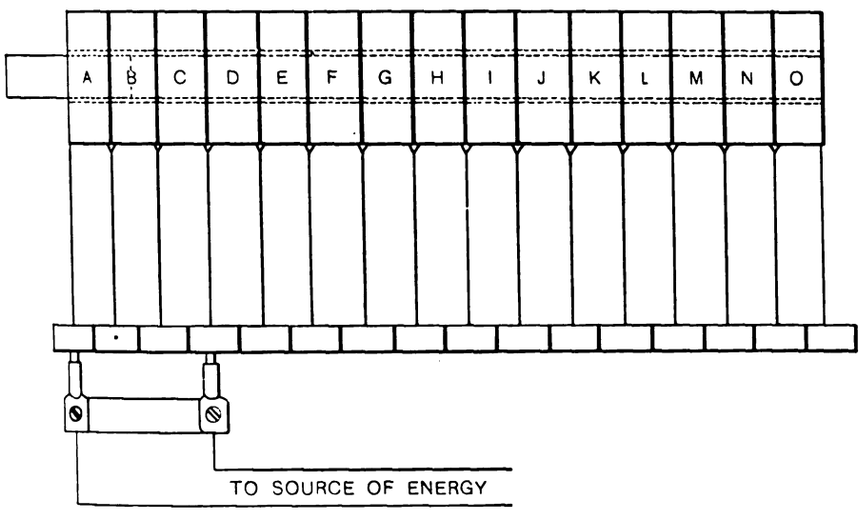

FIG. 4.—CONNECTIONS OF MARCEL DEPREZ ELECTROMAGNET.

The pull may then be determined by equation (1). Hence,

$$P = \frac{11.4 \times 11{,}400\left(2 - \frac{3.66}{1.07 \times 7.62}\right)}{981 \times 7.62} =$$

26.97 kilograms, or 59.3 pounds.

Likewise the ampere-turns required for a given pull may be determined.

Naturally, as thin an insulation as may be consistent with good design, should be employed on the wire, in order to make the resistance of the coil as high as possible; but since the ampere-turns, under the conditions of the above example, are independent of the thickness of insulation, the resistance was not considered.

[1] For complete formulas see "Solenoids, Electromagnets and Electromagnetic Windings." D. Van Nostrand Co., New York.

Electricity in Fiery Mines.

In his report for 1908, J. S. Martin, inspector of the southern mining district of England, deprecates the use of electric coal-cutting machinery at the working face in fiery mines, but favors the use of air compressors underground as far in-bye in the intake airway, as it may be safe to work electrically, to supply compressed air to the coal-cutters at the face.

Massachusetts Street Railway Association Have Special Train to Denver Convention.

Arrangements are being made for a special train which will carry the Massachusetts Street Railway Association and their guests to the Denver convention of the American Street Railway Association in October, and afterward take them on a prolonged tour to the Pacific Coast and the Alaska-Yukon Exposition. Secretary Charles S. Clark will have charge of the train, which will consist of a combination baggage and buffet parlor smoking car (with bathroom and barber shop), a dining-car, standard sleeping-cars, a compartment car and a compartment car with observation end. It will be lighted by electricity, and at all points visited will be sidetracked for occupancy by those persons who desire to make use of it. The party will have the exclusive use of all portions of the train from Boston until they return to Boston.

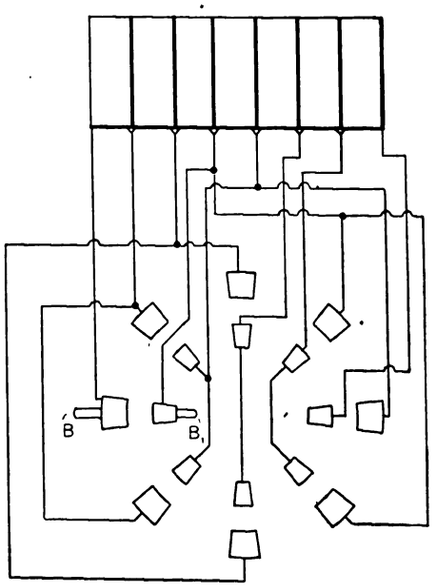

FIG. 5.—CONNECTIONS FOR OSCILLATORY MOTION.

A large number of New England street railway people have already engaged accommodations for the round trip. Those who cannot make the trip to the coast will use the special as far as Denver.

Navy Department Supplies.

The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on August 10 for 41,000 feet of cable, for delivery at Newport, R. I.; miscellaneous tungsten street-lighting fixtures, for delivery at Charleston, S. C.; miscellaneous wire, for delivery at Philadelphia, Pa.; for four centrifugal electric driving machines, for delivery at Washington, D. C.

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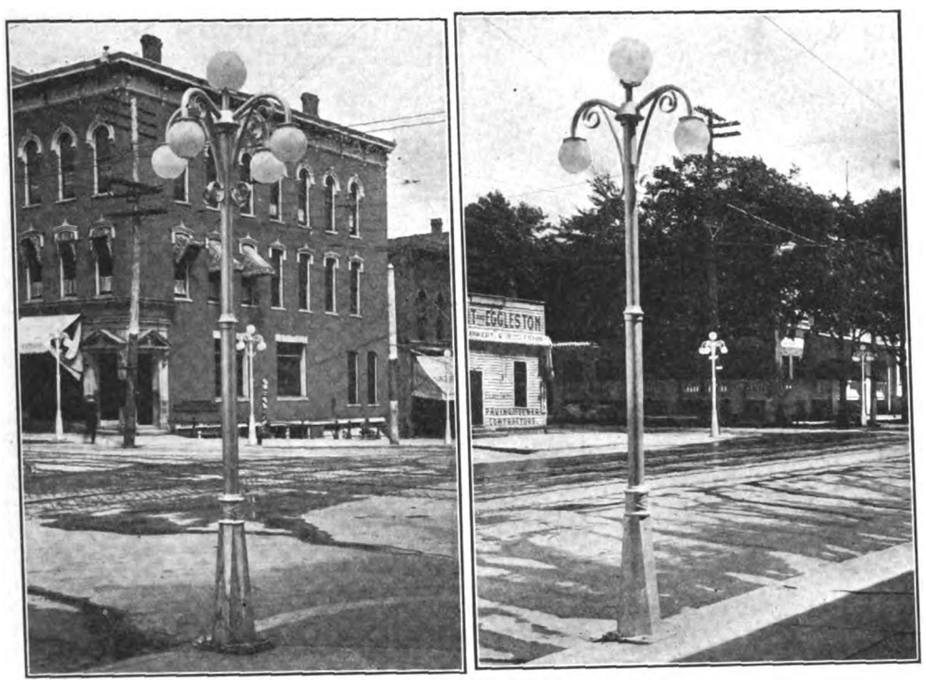
Special Tungsten Lighting in Mishawaka, Ind.

Mishawaka, with its St. Joseph River and excellent manufacturing facilities, has long been known as the "City of Power." Today this can be appropriately changed to "The Indiana City of Light and Power."

For many years the city was content with the street lighting obtained from arc lamps hung over the street crossings. These were scattered along from square to square, and gave a fairly good light at the crossings, but did not illuminate the rest of the thoroughfare to any extent. Early this year a business men's association was organized to boost the city in every possible way. It was decided that if the city could have plenty of power it ought to have an abundance of light in keeping therewith. Plans were therefore made for a revolution in the street-lighting system.



DAY VIEW OF SPECIAL TUNGSTEN STREET LAMPS AT MISHAWAKA, IND

After considering many suggestions for improving the old arrangement, it was finally decided to adopt a system of tungsten lighting with columns at the curb line about fifteen feet high. A contract for the posts was let to the Dodge Manufacturing Company, of Mishawaka, well known for the design, manufacture and installation of power-transmission equipments. The new posts were delivered in short order and placed in position fifty feet apart along the curb line of the entire business section. The posts are painted white and are a combination of cast and wrought-iron resting on a sixteen-inch square base. They were made in three sections, the first two being of three-inch and four-inch pipe joined by cast-iron fittings.

NIGHT VIEW OF THE SPECIAL TUNGSTEN LIGHTING AT MISHAWAKA, IND.

As seen in the accompanying illustrations, two types were adopted. For street corners the posts have four side arms and for intermediate positions only two side arms. These arms are made of one-and-one-half-inch pipe with fancy scroll supports. The distance between the center of the post and that of the arm is twenty inches. The bulbs are of a size that will permit the placing of twenty-five to 100-watt lamps; 14,000 lamps are used in the installation.

The new system produces a brilliant light throughout the business district and gives a very uniform distribution into every nook and cranny. The city of Mishawaka has a population of about 12,000, and believes it is the only community of its size in the country to support a lighting system of this kind. It has proved a very popular feature, and the promenading of the business streets in the evening has increased manyfold.

Demand Five-Cent Fare to Coney Island.

Justice Stapleton, in the Supreme Court, Brooklyn, signed an order directing the Public Service Commission and the Coney Island & Brooklyn Railroad to show cause why the Public Service Commission should not be compelled to establish a five-cent fare on week days on the lines of the Coney Island & Brooklyn Railroad by means of a writ of mandamus. The application for the order was made in behalf of August Kleh.

Share Handsomely in Telephone Dividends.

During the July disbursements of dividends on the part of the big corporations New Haven stockholders received upward of $100,000 in dividends. One of the biggest dividend payments made was that of the Southern New England Telephone Company, which sent out $117,000 to its stockholders all over the state and elsewhere. The bulk of the dividend money went to New Haveners. It is estimated that about $25,000 in dividends from the New York & New Jersey Telephone Company came into the hands of shareholders here.

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The Story of a Slogan Sign Backed By a Central Station.

Easton, Pa., a city of 25,000 people, is in the hills, at the junction of the Lehigh and Delaware rivers, and lies between them. Six railroads enter the town, the Lehigh Canal passes through, and across the Delaware Bridge lies Phillipsburg, with a population of 10,000, which looks to Easton for its market.

Although Easton is ideally situated as an industrial center and already has a number of large and well-known industries, the city has heretofore moved slowly and conservatively and resisted the advance of time. The wealth and industry were owned principally by foreign corporations, so that the people of Easton themselves were inclined to complacency and were not over progressive.

The Easton Gas and Electric Company, one of the three central stations in Easton, during last November changed ownership, and immediately plans were made for the commercial development of the property. A liberal advertising campaign was started, specialists in central-station management were brought into town and undertook to inoculate Easton with the germ of enterprise and action which is essential for the progress of any city. Meetings and lectures were frequent.

MAMMOTH ELECTRIC SIGN AT EASTON, PA.

The Easton Gas and Electric Company announced that it would purchase and maintain at its own expense a mammoth electric sign to advertise the city to the traveling public. A committee was appointed to receive suggestions and make a selection of a suitable city slogan. The result of their choice was "Easton—City of Resources." Shortly after this selection a sign was erected in a conspicuous location in view of all trains.

The sign measures fifty-four feet by forty-five feet and contains 2,000 lamps. In operating, two green arrows shoot out from the center until they form a long, straight line pointing out the breadth of the city, then a red sun looms up behind the green horizon line; then the red sun rays shoot up and writhe and flash tongues of flame in the sun itself. Suddenly over the blazing sun and in the midst of its rays the word "Easton" breaks out in letters of white light, ten feet high, and as the sun rays fade away, the words "City of Resources" flash forth below, in a line of five-foot white letters. This display is repeated once every minute from dusk to midnight.

The result of the enterprise of the Easton Gas and Electric Company is noteworthy. The sign is a success. A new life has been aroused in the city. The city slogan is used freely in many ways and was received with unexpected enthusiasm by the people. The Board of Trade was reorganized, money subscribed for city advertising, and a new industrial life for Easton is assured.

Boston Edison Lecture Course for 1909-10.

The Employee's Club of the Boston Edison Company has arranged, through its lecture committee, for a course of lectures this coming winter, which will be in the nature of a continuation of the course carried through last winter.

"Steam" and "Alternating Current" will be the general subjects taken up, eight lectures being devoted to the former and twelve to the latter topic. The lectures will be duplicated in the afternoon and evening of one day each week beginning on November 4. The double lectures will make it possible for employes who work on different shifts to attend.

Prof. Sydney W. Ashe, who gave the course last winter, has been engaged to conduct the next one. He will take up to a considerable extent the points of advanced theory of operating methods.

The attendance for the course last season averaged twenty-six men at the afternoon lectures and 164 men for the evening lectures, making a total attendance for the twenty double lectures of 3,808.

These courses are conducted under the management of the Employee's Club Lecture Committee, made up of H. W. Moses, chairman; W. E. Cooke, Pierce Kent, D. P. Miner and F. D. Stiles.

While the success of last winter's course and the prospective success of the coming lectures should be credited in a general way to the interest of the Boston Edison employes, between eighty and ninety per cent of whom are members of the club, much credit should be given the officers of the Boston Edison Company, which has taken an active interest in the welfare of the club at all times. Several plans for broadening the scope of the club's activity and for the increasing development of studious habits, as well as a feeling of universal sociability, are under consideration, details of which will be announced later.

The British Association Meeting at Winnipeg.

The seventy-ninth annual meeting of the British Association for the Advancement of Science will be held at Winnipeg, Manitoba, Can., from August 25 to September 1. Prof. Sir J. J. Thomson, of Cambridge and London universities, England, one of the most distinguished of living physicists, will assume the presidency in succession to Dr. Francis Darwin.

Lectures on "The Chemistry of Flame," by Prof. Harold B. Dixon, and "The Pressure of Light," by Prof. J. H. Poynting, will be delivered in the Walker Theatre, which will be thrown open to the public on these occasions.

Excursions will be arranged on Saturday, August 28, to points of interest in the vicinity of Winnipeg, including Stony Mountain and the municipal stone quarries; Lake Winnipeg, St. Andrew's Rapids and Selkirk; the wheat fields of Manitoba; the hydroelectric plant on the Winnipeg River. Members will also have the opportunity of visiting the following works in the city of Winnipeg: Canadian Pacific Railway shops and yards, Canadian Northern Railway shops, Grand Trunk Pacific Railway shops (under construction), Ogilvie flour mills, western Canada flour mills, municipal high-pressure plant and artesian-well system.

An excursion of ten days after the meeting to the Rocky Mountains and the Pacific Coast is contemplated. Accommodation in the special train will be limited to 150 invited members, including twenty-five ladies.

It should be noted that members of the American Association for the Advancement of Science will be admitted as full members of the British Association, for the Winnipeg meeting (and entitled to receive the volume of proceedings), on payment of a fee of $5 (half the regular fee). It is important that those intending to be present should send in their names as soon as possible. Full particulars may be obtained from the local secretaries, the University of Manitoba, Winnipeg.

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LOSSES, INDUCED VOLTS, AND AMPERES IN ARMOR AND LEAD COVER OF CABLES.[1]

BY H. W. FISHER.

PART 1.

This paper is supplementary to Dr. Whitehead's paper presented at the same meeting (see *Footnote*).

It is plainly evident that the impedances of iron-armored single conductor cables cannot be calculated with any degree of certainty, because slight differences in the air gaps between the armor wires very much affect the inductances of the cable. Moreover, the induced volts and amperes are also affected by the same cause, and hence the results here given for the iron-armored single-conductor cable must only be considered approximate in their general application to iron-armored cables.

The first cable considered will be the first one mentioned in Dr. Whitehead's paper, namely, single conductor No. 0 Brown & Sharpe Gauge, insulated with eight thirty-seconds of an inch thick paper over which is one-eighth of an inch of lead with the usual jute bedding and No. 10 Birmingham Wire Gauge steel wires. The dimensions are as follows: Diameter over copper strand, 373 mils; diameter over paper insulation, 873 mils; diameter over lead sheath, 1,123 mils; outside diameter, approximate, 1,500 mils; resistance of conductor per 2,000 feet equals .21; resistance of lead sheath per 2,000 feet equals .53; resistance of armor per 2,000 feet equals .35.

[1] Abstract of a paper presented at the annual meeting of the American Institute of Electrical Engineers, Frontenac, N. Y., June 29, 1909. Mr. Fisher is chief engineer of the Standard Underground Cable Company, Pittsburg, Pa.

The following symbols are used to designate the difference curves shown in Figs. 1 and 2: A indicates that distance between centers of cables was one-and-one-half inches; B, nine inches; C, twenty-four inches.

The figures used in connection with the above letters indicate the following: 1, induced current or volts in lead; 2, induced current or volts in lead, the armor being short-circuited at each end of the cable; 3, induced current or volts in armor; 4, induced current or volts in armor, the lead being short-circuited at each end of the cable; 5, induced current in armor and lead, connected in parallel.

Fig. 1 gives the volts induced by 100 amperes in 2,000 feet of circuit. The reason for expressing the volts in terms of 100 amperes in conductor was to give at sight a general idea of what voltage might be expected with a current somewhat near the amount used in practice. It will be noticed that the induced volts are greatest when the conductors are furthest apart and when the armor is not short-circuited. Under these conditions with a normal load of about 170 amperes, the induced volts for 2,000 feet of circuit would be about eighty-five. For the same load, a minimum induced electromotive-force of forty volts was obtained on the armor when the lead covers were connected at both ends of the cable. Between these extremes will be found various curves giving the different induced volts corresponding to the various tests that were made. The bends in the curves are characteristic of circuits containing iron.

Fig. 2 gives the current induced per ampere in conductor. Here, as would be expected, the greatest current is obtained when both the lead and armor are in parallel, and this amounts approximately to sixty-five per cent of the current flowing in the conductor. From this it will be readily seen that an armored cable would have a tendency to become warmer than an unarmored cable. However, in practice such cables are generally laid in water or in the ground, and hence the dissipation of heat is readily taken care of.

Curve C-3 is interesting in showing that a maximum per cent of induced current is reached with about 100 amperes flowing in the conductor.

Fig. 3 is given to show how the impedance of the cable is affected by the amount of current flowing. The knee of the curve commences at about 120 amperes, and undoubtedly if sufficient current were applied the impedance would commence to decrease as will be shown in some curves given later.

Table 1 gives the effective resistance per 2,000 feet of circuit.

The values given were obtained from wattmeter tests made when the cables were twenty-four inches apart. No. 1 indicates that neither lead nor armor circuit was connected. No. 2 that the lead circuit was connected at each end of the cable. No. 3 that the armor circuit was connected at each end of the cable. No. 4 that both circuits were connected. The conductor resistance to direct current was 0.21, so it will be seen that the maximum total loss is somewhat greater than double the conductor loss. When the distance between centers was one-and-one-half inches the losses in the No. 1 column were increased about one per cent. In the 2, 3 and 4 columns the losses were less as the distances were decreased. At

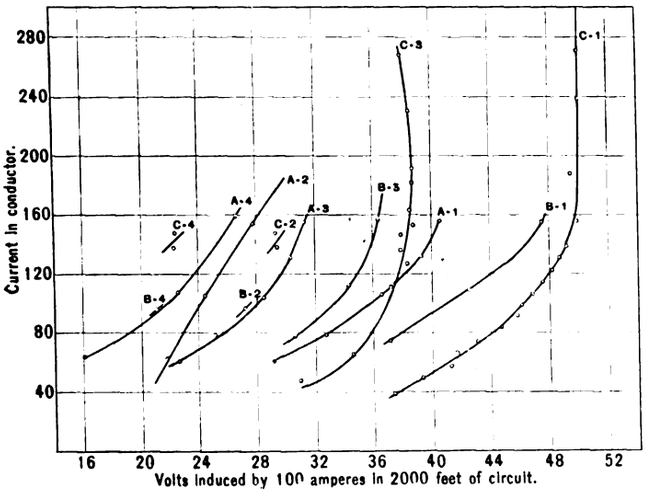

FIG. 1.—DIFFERENCE CURVES, SHOWING RESULTS OF TESTS.

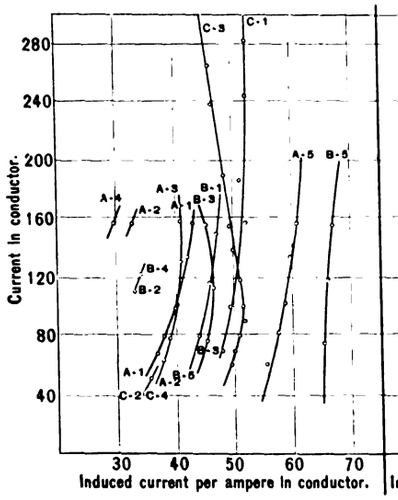

FIG. 2.—DIFFERENCE CURVES.

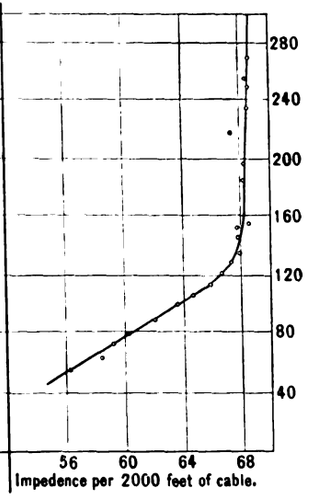

FIG. 3.—IMPEDANCE CURVE.

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one-and-one-half inches separation and with sixty amperes in the conductor, the difference was slight. With 160 amperes flowing the decrease was about 5 per cent.

It is also interesting to note that the relative losses given in column 1 increase with the amount of current flowing. For any particular current the losses in the different columns are not materially different, but such would not necessarily always be the case.

SINGLE CONDUCTOR COPPER ARMORED CABLE.

This cable was made up practically in the same manner as the first-mentioned cable, except that the armor consisted of twenty-four No. 8 Brown & Sharpe Gauge hard-drawn copper wires.

Table 2 gives the volts induced in 2,000 feet of circuit per 100 amperes. Comparing this table with the curves in Fig. 1 shows a marked diminution in induced volts.

TABLE NO. 1.

Current in Conductor.	Effective Resistance per 2,000 Feet of Circuit. No. 1.	No. 2.	No. 3.	No. 4.
60	.33	.36	.36	.35
100	.41	.41	.40	.37
160	.46	.45	.44	.40
240	...	.48	.48	.42

TABLE NO. 2.

Volts Induced in 2,000 Feet of Circuit per 100 Amperes.

Distance Between Centers.	Measured Induced Volts. In Lead Circuit.	In Armor Circuit.
3 inches	8.2	6.6
6 inches	11	9.5
12 inches	14.3	12.6
18 inches	16.2	14.5

TABLE NO. 3.

Current Induced per 100 Amperes in Conductor.

Distance Between Centers.	Measured Induced Current. In Lead Circuit.	In Armor Circuit.
3 inches	14	44
6 inches	18	56
12 inches	23	63
18 inches	25	67

TABLE NO. 4.

Impedance per 2,000 Feet of Cable.

Distance Between Centers.	Measured Impedance. Lead and Armor Free.	Lead Connected.	Armor Connected.	Both Connected.	Calculated Impedance. Lead Connected.	Armor Connected.
1½ ins.	....	....	....	....	.234	.239
3 ins.	.245	.255	.252	.253	.262	.262
6 ins.	.264	.277	.264	.262	.290	.276
12 ins.	.288	.304	.274	.271	.321	.284
18 ins.	.298	.319	.276	.273	.339	.283

Table 3 gives the current induced per 100 amperes in conductor. Not much comment is necessary in regard to these tables except that the induced voltage and current is proportional to the current flowing in the conductor.

Table 4 gives the impedance per 2,000 feet of cable for different distances with different connections of armor and lead. The calculated values are also given. In making these calculations, it was necessary to estimate the resistance of the lead and armor circuits. The calculated values in the table are not so close as they would have been had the resistance referred to been accurately measured. The formulas for making these calculations were worked out after the cables had been discarded.

The most interesting part of this cable is the fact that the impedance was greater when the lead circuit was connected at both ends of the cable than when the lead covers were not connected. This seemed so contrary to what would be expected that I asked my assistant, R. W. Atkinson, to investigate the subject methematically, and in Part 2 will be found a graphical and mathematical solution of the problem which shows the conditions under which the impedance of the cable may be greater when the lead covers are short-circuited.

[To be continued.]

Tariff Changes on Electrical Goods.

WASHINGTON, D. C., August 3.—The Finance Committee has had prepared a comparison of the rates of duty collected under the present law, the duty as proposed by the House bill, by the Senate and by the Conference Committee report as adopted by the House, and from these comparisons we find the following:

Mica, unmanufactured or rough trimmed: The quantity imported in 1907 was 3,110,029½ pounds, at $1,116,320.25, or an average of 35.9 cents per pound. The duty at present is 6 cents per pound and 20 per cent ad valorem. Each of the proposed measures place it at 5 cents per pound and 20 per cent. This will reduce the equivalent ad valorem from the present rate of 36.72 per cent to that of 33.92 per cent and should the importations remain the same there would be a reduction in revenue from $409,865.81 to $378,765.73.

Mica, cut or trimmed: Present rate, 12 cents per pound and 20 per cent, proposed rate 10 cents per pound and 20 per cent. Importations in 1907, 99,335 pounds, at $73,364, an average of 73.9 cents per pound. The duty collected amounted to $26,593.01, an equivalent of 36.25 per cent. At the proposed rate this would be reduced to $24,606.30, or at the rate of 33.54 per cent.

A new classification will be mica plates, or built-up mica, and all manufactures of mica, which it is proposed shall be dutiable at 10 cents per pound and 20 per cent ad valorem.

Electrodes, brushes, plates, and disks, composed wholly or in chief value of carbon—proposed duty, 30 per cent.

Carbon—proposed duty, 20 per cent.

Carbons for electric lighting, wholly or partly finished, made entirely from petroleum coke—are dutiable under the present law at 90 cents per 100. In 1907 there were 81,792.90 hundreds imported at $157,311, an average of $1.92 per 100. Duty amounted to $73,613.61, an equivalent ad valorem of 46.79 per cent. This is to be 35 cents per 100 feet. In addition to this, the Senate and conference provision for carbons composed chiefly of lamp-black or retort carbon at 65 cents per 100 feet, it is estimated, will make an average duty on the two classes of about 50 cents per 100 feet. This would reduce the revenue to $40,896.45, or to an equivalent of 26 per cent ad valorem. (See letter from K. A. Albrecht on page 256.)

Carbon pots for electric batteries, and without their metallic connections, are to be left where they are at 20 per cent ad valorem. Imports in 1907, $9,149; duty, $1,829.80.

Wires—telegraph, telephone and other wires and cables composed of metal and rubber, or of metal, rubber, and other materials, not at present enumerated, were, by the Senate bill, placed at 45 per cent; the conference bill reduces this to 40 per cent.

Automobiles—The Senate bill proposed to increase the rate to 50 per cent. The Conference bill has placed the rate back at 45 per cent. A. F. T.

Navy Department Supplies.

The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on August 17 for 15,000 feet cable, for delivery at Washington, D. C., and for 575 pounds insulating tape, for delivery at Philadelphia, Pa.

Bids will be opened on August 24 for cable for portable lamps and two electric hoists, for delivery at Washington, D. C., and for miscellaneous lamp cord, conductors, carbon and other electrical supplies, for delivery at various yards. Bids will also be opened on August 24 for constructing a system of heating and electrical distributing mains and concrete conduits for the hospital grounds at the naval station at North Chicago, Ill.

On August 31, bids will be opened for two fire-alarm annunciators, for delivery at Puget Sound, Wash.; for 8,000 carbons and miscellaneous tape, fuses and other electrical supplies, for delivery at Mare Island, Cal.

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The Hudson-Fulton Celebration—An Unprecedented Illumination Scheme for New York and the Hudson River.

For eight nights during the Hudson-Fulton celebration this fall New York city, in all its boroughs, will be the most brilliantly illuminated city in the world and the illumination will be more magnificent and imposing than any illumination ever attempted in any city in the world. The illumination will begin each night at 6:30 and continue after midnight until 12:30.

Conservative estimates place the number of lights to be used, in addition to the regular lighting of the city, at between 1,000,000 and 1,500,000 incandescents; 7,000 arc lights, 3,000 flare arcs, one battery of four searchlights of 100,000 candlepower each and one battery of twelve searchlights aggregating 1,700,000 candlepower, thus making a grand total of approximately 26,260,000 candlepower. This estimate may be greatly increased by electric advertising signs, for which contracts for hundreds of thousands of dollars have already been made by electric-lighting and display-advertising firms.

And this is for Greater New York only, taking no account of the lights along the New Jersey shore and in other places adjacent to but outside the city limits.

This remarkable illumination is a part of the plan of the Hudson-Fulton Celebration Commission, in charge of its illumination committee, of which the Hon. William Berri is chairman.

In addition to the city illumination, Mr. Berri's committee has charge of the lighting of the Hudson River Valley on the last night of the celebration, Saturday, October 9, from New York to Troy, a distance of 170 miles, with huge signal fires on mountain tops.

One of the most remarkable features of the illumination in New York will be the probable use of the immense battery of searchlights, to be located on Riverside Drive, at One Hundred and Tenth Street. This searchlight battery will be first put in operation on the night of Saturday, September 25, and continue until the end of the celebration. It will make the river as light as day for miles each way. When brought together in a single beam, as it will be on the night of October 9, it can be seen for fifty miles.

The Hudson-Fulton Celebration Commission will pay the expense of this battery of searchlights and a small battery of four searchlights which, with an aggregate of 400,000 candlepower, will play upon Grant's Tomb and for approximately 170,000 incandescent lamps, while the balance of the display will be made by private citizens, theatres, banks, corporations, office buildings and advertising firms.

The Queensborough Bridge, Brooklyn Bridge, Williamsburg Bridge, and Manhattan Bridge, crossing the East River, afford a magnificent opportunity for electrical display. They will be outlined from end to end by electric lights.

In Manhattan, the City Hall will be elaborately illuminated, as will be the Memorial Monument at Fourth Street and Fifth Avenue, and the entire routes selected for the parades from Fourth Street up to Fifty-ninth Street, through to Eighth Avenue to One Hundred and Tenth Street, will be lined throughout with festoons of electric lights on the curb line. It was first intended to festoon across the entire streets, but the height of the floats for the historical and carnival parades has made this impossible. These festoons at all the reviewing stands will be made up of floral garlands, interspersed with electric lights and producing a very beautiful artistic effect. This entirely original feature was designed by Charles R. Lamb, chairman of the committee on decorations, and heartily approved by the illumination committee. On Grant's Tomb four immense searchlights will be constantly trained, and the Viaduct Bridge, on Riverside Drive, will be outlined throughout; also the Soldiers' and Sailors' Monument at Ninety-second Street and Riverside Drive.

In Richmond, the new Borough Hall and in Queensborough the Borough Hall Building will be strikingly outlined with electric lights. In Brooklyn, the Borough Hall, the Soldiers' and Sailors' Monument at Prospect Park, the Water Tower and the Museum of Arts and Sciences will be electrically outlined.

In the Bronx, the Borough Hall will be fully outlined by electric lights. The building is on a high elevation and will make a fine showing.

The Martyrs' Monument, at Fort Greene, Brooklyn, will, it is hoped, for the first time have the full intention of Stanford White, the architect of the monument, carried out by the building of a continuous fire in the enormous urn on the tripod at the top of the shaft. Thirty-five persons could stand in the bowl of the urn. This feature is expected to attract the attention of architects of the world, as it is entirely new, and it is anticipated that the effect will be very beautiful from an artistic standpoint.

Contracts have been made with the following electric-light companies: The New York Edison Company, the Edison Electric Illuminating Company of Brooklyn, the United Electric Light and Power Company, the New York & Queens Electric Light and Power Company, and the Richmond Light and Railroad Company.

The large steamship companies are all becoming active in the matter, as are also most of the other occupants of river-front property.

In Manhattan, upon the line of parade, the great clubs and hotels are arranging for their illumination. The Union League Club in particular will have a most beautiful showing.

On the evening of Saturday, September 25, with thirty or forty foreign and American warships anchored off One Hundred and Tenth Street, a grand fireworks display will be given on floats on the New Jersey side of the river in honor of the visiting vessels. The outline lighting up of the warships each night of the celebration will be a wonderful and imposing spectacle.

The illumination committee has practically determined the locations for the signal fires up the Hudson River that are to be placed between New York city and Newburgh in connection with the scheme for illuminating the entire river front on Saturday night, October 9, which will be known as Illumination Night.

Subject to change, the other points selected are as follows: Governors Island, Fort Lee, Fort Washington, Spuyten Duyvil, Alpina, Hastings Point, Staten Island, Hook Mountain, High Top, Stony Point, Dunderburgh, Anthonys Nose, Sugar Loaf Hill, West Point, Constitution Island, Storm King, Bull Hill and Crows Nest.

On October 9 on each of these prominent points an immense signal fire will be constructed, which will burn thirty feet high for four hours. These fires and also all those near and beyond Newburgh to Albany will be started on telegraphic signal by President Taft at the same moment. Signal rockets, bombs and a large display of such fireworks will be kept in operation throughout the evening.

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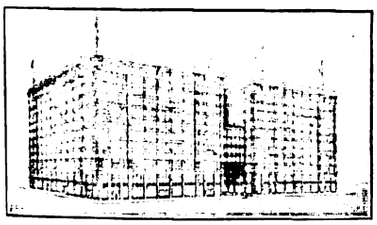
The New $6,500,000 Merchants' and Manufacturers' Exchange Building for New York.

A great step toward increasing New York's facilities and attractiveness as a market for the merchants and buyers of this and other countries has been accomplished in the fruition of the plans of the Merchants' and Manufacturers' Exchange for the erection of two giant commercial buildings, covering the entire blocks from Forty-sixth to Forty-eighth Street, Lexington Avenue to Depew Place. There will be approximately thirty acres of floor space, and it is all to be utilized for the sample salesrooms of manufacturers, so arranged as to enable the visiting buyers to inspect the product of hundreds of factories in a minimum of time and with a maximum of comfort and convenience.

The two colossal twelve-story buildings to be erected for this purpose are, in fact, part of the new $20,000,000 Grand Central Station, the terminal of two great railroad systems, as well as stations of



MERCHANTS' AND MANUFACTURERS' EXCHANGE NEW BUILDING, NEW YORK CITY.

the present subway, of the McAdoo-New Jersey tunnels, the Steinway-Long Island tunnel, and the projected Lexington Avenue tube.

The directorate includes E. P. V. Ritter, of the Nicholls-Ritter Realty and Financial Company, of New York; George C. Smith, of the Westinghouse Companies, and the Carnegie Trust Company and other financial institutions of New York; Alexander M. Stewart, of James Stewart and Company, and the Stewart-Kerbaugh-Shanley Company, engineers and contractors; Liston L. Lewis, of Keener & Lewis, attorneys-at-law, and Charles E. Spratt, of the New York Furniture Exchange, who will be the general manager.

The offices of the Merchants' and Manufacturers' Exchange, during the construction of their great buildings, will be in the Grand Central Palace, Lexington Avenue, at Forty-third Street, New York.

The Exchange's new home will be one of the most striking buildings in the world.

A British Electrically-Equipped Demonstration House.

The well-known firm of Simplex Conduits, Limited, of Birmingham, England, has adopted a plan for advertising the use of domestic electric appliances which is causing quite a stir among the visitors to the White City, Shepherd's Bush, London.

This consists of an electrically equipped house of attractive design, situated in the Elite Gardens in the popular London resort, and presenting with its tasteful exterior finish of colored tiles and rough cast work a strong yet withal pleasing contrast to the dazzling whiteness of the surrounding buildings.

The house contains five commodious rooms, including a showroom, bedroom, kitchen, dining room and drawing room.

In the showroom there is a representative display of electric lighting, cooking, heating and other apparatus, as well as conduits, wires, cables and various accessories manufactured by the company, all properly displayed and ticketed.

The dining room contains a dining table set for four persons, and here are displayed plate warmers, water heaters, entrée dishes, food warmers, coffee machines, etc. Heating is accomplished by means of a four-light electric radiator. A porthole fan, fitted with a shutter automatically opened and closed by the stopping and starting of the fan, provides efficient ventilation. A six-light electrolier depends from the center of the ceiling, and this is agreeably supplemented by small standards on the table.

The drawing room has also a central ceiling lighting fixture, this for four metallic-filament lamps, and efficient distribution is effected by a large cut-glass bowl. In addition there are two "candle" brackets and a portable floor standard, as well as standard lamps for the writing and reading table. An electric kettle on a floor stand is also provided in this room.

The kitchen has an electric oven and an auxiliary fireless cooker, hot plate, toaster, saucepan, spider, stewpan, double boiler, water heater, kettles, sadirons, etc. The switchboard is provided with sunk switches and plugs and is arranged so that the wiring may be readily exposed for inspection, etc. A small red pilot lamp serves to show when any piece is connected. Ventilation is effected by means of an automatic porthole fan and a ceiling fan. Cooking demonstrations are given every day by an expert lady demonstrator, and are well patronized by the visitors. The temperature of the kitchen, even after several hours of continuous cooking, remains at an astonishingly low figure.

In the bedroom are many electric appliances, including a foot warmer, bed warmer, hot-water can, curler, hair drier, shaving pot, towel drier, etc. A specially designed shaving mirror is used in conjunction with an eight-candlepower lamp, and is a great luxury.

The wiring for the house is carried in Simplex conduits, concealed in the walls and between the floors and ceilings. A separate control board is provided for the lighting and is distinct from the one for the heating utensils, etc. Pin plugs are used for connecting up the cooking and other apparatus. These plugs are fixed on the baseboards in the living rooms and on shelves in the showroom.

Copper Reforms Adopted.

The board of managers of the Metal Exchange have adopted the report of the institution's trade committee providing for dealings hereafter in standard copper similar to those on the London Exchange.

The measure is designed to satisfy the criticism made to Governor Hughes. Hereafter minimum quantities of standard must be of twenty-five tons of 2,240 pounds each. All bids or offers to sell shall be made in multiples of this number. Sellers will have the option of delivering each twenty-five tons in four different classes of copper.

Classifications shall be based on the per cent of assay and subject to rebate or premium, as outlined in the report.

Commissions are to be at the rate of $1 per ton when sales are made to persons other than members of the Exchange, and at 50 cents when made for members. Whenever made for a member of the Exchange, whose name is given up and accepted on the day of transaction, they are to be at the rate of twenty-five cents per ton, and a charge of twelve-and-one-half cents per ton is to be made for receiving and delivering.

Copper stored in warehouses in New York will be good delivery, as will be negotiable receipts of the following refineries: Raritan Copper Works, Perth Amboy Works of the American Copper Company, the Nichols Copper Company, the Baldbach Smelting and Refining Company, and the United States Metals Refining Company. All receipts must contain the clause, "Lighterage free to New York."

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THE REGULATION OF POTENTIAL TRANSFORMERS AND THE MAGNETIZING CURRENT.

BY M. G. LLOYD AND P. G. AGNEW.

The formulas for the calculation of regulation now in general use involve the magnetizing current. But since the magnetizing current is flowing both at no load and at full load, and since the regulation depends only on the difference in ratio between no load and full load, we should expect, à priori, the regulation to be independent of the magnetizing current. That it has no appreciable effect will be shown by developing the formula from a consideration of the vector diagram, from a treatment of the problem by the symbolic method, and finally by experimental results.

Regulation is defined as the change in secondary voltage between no load and full load (with constant primary voltage), expressed as a percentage of the secondary voltage at full load. In practice it is sometimes wrongly expressed in per cent of the no-load value, but the error in so doing will seldom amount to more than one-tenth per cent.

The regulation may also be expressed as the change in ratio of terminal voltages $\left(\frac{\text{primary}}{\text{secondary}}\right)$, between no load and full load, divided by the ratio at no load.

The difference between the induced and the terminal voltage of a transformer winding is due to its resistance and its leakage reactance. If these be known for both the windings, the voltage is thereby determined and the regulation may be calculated. Direct measurements of resistance and impedance drop of voltage are easily made by well-known methods, and furnish the required data.

The relations involved may easily be seen by reference to the accompanying diagram, which is a vector diagram of the quantities concerned. Let ϕ represent the magnetic flux, E_2' the voltage induced in the secondary winding, and I_2 the secondary current. The total current-turns $I_0 N_1$ for exciting the core is made up of the secondary current-turns $I_2 N_2$ and those of the primary $I_1 N_1$.

The voltage E_1 applied to the primary is made up of three parts. One of these E_1' opposite in phase to E_2' balances the electromotive-force induced by the core; a second part $I_1 x_1$, in quadrature with the primary current, balances the electromotive-force due to the leakage reactance; the third, equal to $I_1 r_1$, the resistance drop of potential, is effective in sending current. The voltage induced in the secondary E_2' is similarly made up of three parts; $I_2 r_2$ is the resistance drop, $I_2 x_2$ the reactance drop, and E_2 the terminal voltage.

E_2 is less than E_2' except at no load, and is then equal to it; and since E_1 is always greater than E_1', the ratio of primary to secondary voltage is always greater than $\frac{E_1'}{E_2'}$, the ratio of turns.

In computing the regulation it is most convenient to consider the reactance and resistance of both windings lumped in one, say, the primary. The equivalent total resistance of the primary, R, is found by multiplying the secondary resistance by the square of the ratio of turns and adding to the primary. The equivalent total reactance drop is found from the short-circuit test for impedance. Thus, if e be the voltage necessary to send the rated full-load current I through the primary with the secondary short-circuited, the total reactance drop is

$$\sqrt{e^2 - I^2 R^2} = I X$$

Now, for convenience, let us keep in mind that the primary current I_1 can be regarded as made up of two parts, I reversed in phase with the secondary current, and I_0 the exciting current. The primary resistance drop can also be divided into two parts, $I r_1$ and $I_0 r_1$, of which the first is in reversed phase with the secondary resistance drop and may be lumped with it as I R. The difference between the terminal voltage is thus made up of $I_0 r_1$, I R, I X, and the reactance drop of the exciting current, $I_0 x$. Resolve each of these into two components, parallel and perpendicular to E_2', for ease in combining. The parallel components are

$$I_0 r_1 \sin\gamma + I R \cos\theta + I X \sin\theta + I_0 x_1 \cos\gamma$$

The perpendicular components are

$$I_0 r_1 \cos\gamma + I R \sin\theta - I X \cos\theta - I_0 x_1 \sin\gamma$$

If we designate the two components of I_0 as M and F, and the ratio of turns by n, we have

$$E_1^2 = (n E_2 + F r_1 + I R \cos\theta + I X \sin\theta + M x_1)^2 + (M r_1 + I R \sin\theta - I X \cos\theta - F x_1)^2$$

Dividing by E_1^2 and extracting the square root, we get

$$1 = \frac{n E_2}{E_1} + \frac{F r_1 + I R \cos\theta + I X \sin\theta + M x_1}{E_1} + \frac{(M r_1 + I R \sin\theta - I X \cos\theta + F x_1)^2}{2 E_1^2}$$

with close approximation.

For no load we have

$$1 = \frac{n E_{2,0}}{E_1} + \frac{F r_1 + M x_1}{E_1} + \frac{1}{2 E_1^2}(M r_1 - F x_1)^2$$

Since the term in quadrature is always very small in comparison with the total voltage, we get by subtraction of this equation from the previous,

$$\frac{n E_{2,0} - n E_2}{E_1} = \frac{I R \cos\theta + I X \sin\theta}{E_1} + \frac{1}{2 E_1^2}(I R \sin\theta - I X \cos\theta)^2$$

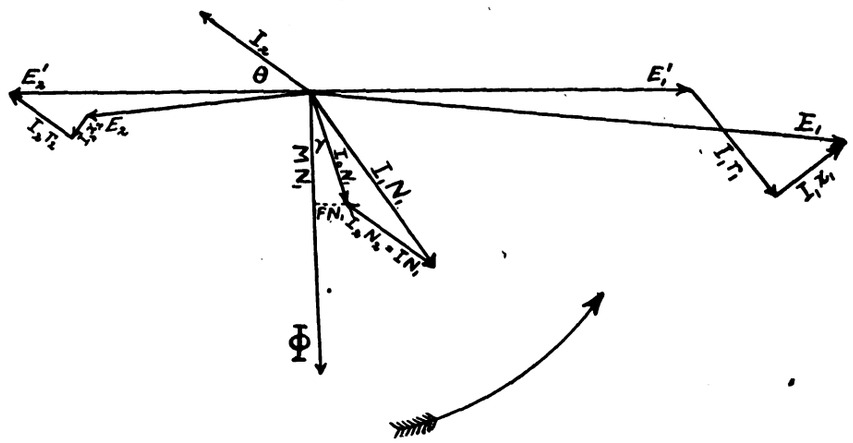
Multiplying by $100\, E_1/nE_2$, we have the regulation expressed in per cent,

$$100\,\frac{E_{2,0} - E_2}{E_2} = \frac{100}{n E_2}\left[I R \cos\theta + I X \sin\theta + \frac{1}{2 E_1}(I R \sin\theta - I X \cos\theta)^2\right]$$

where nE_2 may be substituted for E_1 without appreciable error. For non-inductive load this becomes[1]

$$100\left[\frac{I R}{n E_2} + \frac{1}{2}\left(\frac{I X}{n E_2}\right)^2\right]$$

For approximate work E_1 may be used in place of nE_2 and the reactance term neglected for non-inductive load. If the reactance drop is not over three per cent this term will affect the result to less than



VECTOR DIAGRAM.

[1] This formula is correctly given by La Cour in Arnold's "Wechselstromtechnik," Vol. I.

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0.1 per cent. If it is desired to get the result correct to 0.01 per cent, it is necessary to use nE_2, which requires that the ratio of turns, n, be known, or that the ratio of voltages be measured, and the approximate value of the above expression be used to determine the value of nE_2, which in turn is to be used in a more exact computation. In some transformers, n is the same as the ratio of voltages given on the name plate, but in others, such as instrument transformers (where accurate values are most desired), the turns are slightly altered to give the nominal ratio at full load, or at half load.

For most practical purposes it is entirely sufficient to know the regulation to 0.1 per cent. It is customary in some quarters to compute the values of regulation to 0.01 per cent, whereas the conditions of use are not specified sufficiently closely to warrant it. Thus the cold resistance may be used in the computation, whereas the regulation after being loaded for some time might be the quantity desired. Thus unless the temperature is specified, it is meaningless to consider regulation to 0.01 per cent.

It is evident from the above that although the exciting current affects the ratio slightly, it has an entirely inappreciable effect upon the regulation or change of secondary voltage with load. The formulas published by some of the manufacturing companies are in error in this respect, since they contain the magnetizing current as one of the quantities affecting the regulation. These formulas are generally complicated to an unnecessary extent, also, by retaining the radical sign, instead of simplifying the expression as above. In the *General Electric Review* for December, 1908, one writer computes tables showing the alleged effect upon regulation of different values of magnetizing current, while as a matter of fact the magnetizing current has no such effect. Whatever objections there may be to the large magnetizing currents sometimes observed with cores of silicon-steel, it does not consist in disordered regulation.

An example which recently came to our notice was in the case of an instrument transformer rated at 200 watts, 8660/100 volts, fifty cycles, which required an exciting current of 0.737 ampere on the low-voltage side. The core loss was 35.8 watts; the impedance drop (primary side), 84.8 volts; primary resistance, 1600 ohms; secondary resistance, 0.175 ohm. From these observed values, the following are computed:

$$R = 2910$$
$$IR = 67.2$$
$$M = 0.00744$$
$$F = 0.00413$$
$$IX = 51.7$$

Substituting these values in the above equation for non-inductive load, we get for the regulation, 0.78 per cent.

Turning now to the formula which was used in the tables mentioned above, we have, substituting our notation,

$$100\sqrt{\left(1+\frac{IR}{E_1}+\frac{MX}{E_1}\right)^2+\left(\frac{IX}{E_1}\right)^2}-100 = 1.10$$

The difference is 0.32, which represents the error introduced by using the wrong formula.

The regulation was experimentally determined by measuring the ratio at no load and at full load. A differential null method was used giving an accuracy of about one part in 5,000. The values of ratio found were 86.52 at no load and 87.20 at full load, giving a value for regulation of $100\ \frac{.68}{86.52} = 0.79$ per cent.

In another transformer of the same type and capacity, but higher primary voltage, the exciting current measured on the secondary was 3.92 amperes, and it consequently presents an extreme case. The regulation as determined experimentally on non-inductive load was 0.29 per cent. The value according to our formula was 0.28 and by the other formula 2.56, or nine times as large as the correct value.

In power transformers the exciting current is relatively smaller and the resistance drop relatively larger, and the errors are consequently much less in magnitude. It is probably due to this fact that incorrect formulas have been used for so long without exciting suspicion.

In order to test the effect of varying magnetizing current upon the same transformer, some measurements were made at different voltages upon a 600-watt, sixty-cycle, 120/120-volt transformer. The results are given in the table herewith. At eighty volts the exciting current was 0.27 and the ratios at no load and full load were 1.0007 and 1.0348. At 150 volts the exciting current was 1.33 and the ratios 1.0018 and 1.0199. Full load in each case consisted of lamps carrying five amperes. It is at once evident that exciting current affects ratio, since the latter is not constant for no load. To determine whether the exciting current affects the regulation, we must determine whether the difference in actual drop varies in the two cases. The difference in ratio between no load and full load gives the drop in terms of the voltage; multiplying this by the voltage gives the actual drop. At eighty volts this amounts to $.0341 \times 80 = 2.728$. At 150 volts it is $.0181 \times 150 = 2.715$, an agreement within one-half of one per cent of the value of the drop, or .01 per cent of the total voltage. This makes it evident that if the exciting current could be changed without altering the voltage (say, by changing the core), the ratio of terminal voltages would be changed, but the *regulation would not be changed*, since the change in ratio at no load and full load are of equal magnitude.

TEST OF POTENTIAL TRANSFORMER.

Primary Volts.	Secondary Amperes.	Exciting Amperes.	Ratio.	Regulation Drop.
130	5		1.0220	2.70
130	0	0.752	1.0012	
140	5		1.0207	2.70
140	0	0.973	1.0014	
120	5		1.0236	2.71
120	0	0.580	1.0010	
100	5		1.0281	2.73
100	0	0.354	1.0008	
80	5		1.0348	2.73
80	0	0.27	1.0007	
150	5		1.0199	2.72
150	0	1.328	1.0018	
			Mean.....2.715	

The above difference of .01 per cent may well be attributed to slight changes in resistance from heating during the experiment, although the changes were made as rapidly as possible from one condition to the other. Readings were also taken at other intermediate voltages, in irregular order, and all gave the same result within .01 per cent of the mean.

The derivation of the same formula for regulation by the use of complex quantities, in place of the geometrical or vector method, follows.

Let

$F + j\,M$ = exciting current.

$P + j\,W$ = load current (on primary side).

E_1 = primary terminal voltage.

$E + j\,Q = E_2$ = secondary terminal voltage.

n = ratio of turns.

$r_1\ r_2\ x_1\ x_2$ = primary and secondary resistance and leakage reactance.

$R = r_1 + n^2 r_2$ = total resistance referred to primary.

X = total reactance referred to primary.

Then

$$E_1 - (r_1 + j\,x_1)(F + j\,M + P + j\,W) = n(E + j\,Q) + n(r_2 + j\,x_2)(n\,P + n\,j\,W)$$

Separating the real and imaginary terms, we have

$$E_1 - r_1(F + P) + x_1(M + W) = n\,E + n^2(r_2\,P - x_2\,W), \text{ and}$$

$$-r_1(M + W) - x_1(F + P) = n\,Q + n^2(r_2\,W + x_2\,P)$$ which may be written

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$E_1 - r_1 F - R P + x_1 M + X W = n E$..(1)
$- r_1 M - R W - x_1 F - X P = n Q$... (2)

From (1) we have for the drop in voltage in phase with E_1

$E_1 - n E = r_1 F + R P - x_1 M - X W$

For no load

$E_1 - n E_0 = r_1 F - x_1 M$

From (2) we have for the drop in voltage in quadrature

$- n Q = r_1 M + R W + x_1 F + X P$

For no load

$- n Q_0 = r_1 M + x_1 F$

For regulation it is sufficient practically to take differences of real and imaginary parts before combining. Then for the regulation drop in phase and in quadrature we have

$$n (E_0 - E) = R P - X W$$
$$n (Q_0 - Q) = R W + X P$$

and the regulation in per cent is

$$\frac{100\sqrt{(n E_2 + R P - X W)^2 + (R W + X P)^2} - n E_2}{n E_2}$$

$$100 =$$

$$100\sqrt{\left(1 + \frac{R P}{n E_2} - \frac{X W}{n E_2}\right)^2 + \left(\frac{R W + X P}{n E_2}\right)^2} -$$

$$100 = 100\left[\frac{R P - X W}{n E_2} + \frac{1}{2}\left(\frac{R W + X P}{n E_2}\right)^2\right]$$

For non-inductive load, $W = 0$, and this reduces to

$$100\left[\frac{R P}{n E_2} + \frac{1}{2}\left(\frac{X P}{n E_2}\right)^2\right]$$

It should be borne in mind that the proper algebraic sign must accompany numerical values of M and W when these are introduced into the formula. These will be positive for leading and negative for lagging values. Consequently M is always negative and W usually so.

Electric Pumping Plant at Gatun, Isthmus of Panama.

Authority has been granted for the purchase of a pumping plant to lift water from the reservoir in process of construction near Gatun, to the large tank on the hill in that village. The plant will consist of two three-stage centrifugal pumps direct-connected to a three-phase 440-volt induction motor. Each pump will have a capacity of 1,400 gallons a minute, with a suction lift of twelve feet, and will deliver against a head of 300 feet. The distance from the pumps to the water tank at Gatun will be about 6,800 feet, and delivery will be made through a twelve-inch main. There will be two suction connections, one with the filtered-water sump, and one direct with the reservoir. It is desired to have the pumps operated automatically by a float valve in the tank. A five-ton hand crane will be used in making repairs.

Amsterdam Corporation's Plan for Freight Subway System.

The plan of W. J. Wilgus, former vice-president of the New York Central and now president of the Amsterdam Corporation, to construct an immense freight subway to circle New York and connect with the railroad freight yards of Manhattan and New Jersey, is receiving the careful consideration of the Public Service Commission.

Chairman Willcox, of the board, before his departure for Europe, stated that the commission would devote the summer to the consideration of subway propositions and it was learned yesterday that the plan uppermost in the minds of the presiding commissioner at the present time is the offer of the Amsterdam Corporation.

It is claimed by Mr. Wilgus that his scheme, if put in operation, would offer the following advantages:

1. Solve the west-side problem, securing to the city the benefits on elimination of tracks at grade in city streets, the abolition of steam locomotives and the betterment of the park districts.

2. Release the New York Central from the necessity of an unprofitable capital expenditure estimated at $40,000,000.

3. Render feasible rail connections to industries and the water front.

4. Avoid interferences with the use of the marginal ways for passenger railways.

5. Relieve the city streets from vehicular traffic, thus reducing noise, cost of pavement repairs, congestion of sidewalks, and delays to street cars.

6. Relieve congestion and the uncertainties of harbor navigation.

7. Makes practicable the access to Manhattan of all railroads by rail connections direct to shippers; and

8. Release docks and piers from railroad uses, thus permitting their occupation for the expansion of water-carrier traffic, and thereby facilitating the commerce of the port.

The freight situation in New York is well understood. The congestion and high values of property in Manhattan make large freight terminals impracticable and the cost of transportation transferring the vast tonnage of merchandise from the outlying yards to the city is an important item. It costs the railroads $1.45 a ton to bring their freight from the yards on the west side of the Bergen Hills to their piers in Manhattan, and eighty cents a ton for cartage to warehouse, making a total charge of $2.25 a ton after the freight reaches New York. The bulk of team traffic in New York in 1908 amounted to 19,200,000 tons of merchandise and 4,000,000 tons of coal.

Great Telephone Cable.

New York harbor's largest submarine cable, carrying nineteen pairs of telephone wires between the Broad Exchange of the New York Telephone Company and the immigration station on Ellis Island, was laid last week.

The old cable was placed out of commission late in the afternoon, for the telephones on the island were then connected with the Broad Exchange through the new one, which is 9,000 feet long, three-and-one-half inches in diameter, weighs 86,000 pounds, and cost $17,300. It is made of jute, tar, rubber compound and ground glass, and is designed to stand the hardest of submarine wear. The binding is two layers of quarter-inch wire, wound crosswise to one another, and between them is a coating of jute.

Subway Side-Door Cars.

Side-door cars will be in regular operation in the New York subway by August 15. Under orders of the Public Service Commission, the Interborough is to have forty-two cars so equipped ready by that date, and the commission's inspectors have reported that the cars are nearly ready.

After August 15, the Interborough is under orders to install two side-door trains a month and to have purchased by October 15 enough new cars of the side-door type to maintain a ninety-second service in the subway.

The company has ordered these additional cars, which will cost about $1,500,000, and expects to have them ready on the date set.

A Metropolitan New York City Railway.

Judge Lacombe, of the United States Circuit Court, in an order filed in the suit of the Guaranty Trust Company against the receivers of the Metropolitan Street Railway and New York City Railway Company and more than a dozen others, directs that all defendants who have failed to file assignments of error from the final decision, *i. e.*, that decree of foreclosure entered March 18 last, was in the twenty days allowed them from May 27 to join in the appeal to ask for separate allowances, are deemed to have abandoned their appeal, and to stand as parties appellee.

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The Physical Society of London.

The concluding meeting of the 1908-1909 session of the London Physical Society was held on June 25 last, Dr. C. Chree, the president of the society, being in the chair. Abstracts are given below of the electrical papers which were presented and discussed.

A paper entitled "A Transition Point in Zinc Amalgam" was read by Prof. H. S. Carhart. The paper gave the preliminary results of an investigation which has for its primary object the determination of the heat of dilution of zinc amalgams. This heat of dilution is negative, that is, the dilution of zinc amalgam by the addition of mercury absorbs heat. In the course of the experimental work, which was conducted by Dr. W. D. Henderson, phenomena so extraordinary were encountered that the speaker ventured to call the concentration at which they occur a transition point in zinc amalgam.

The method employed was electrical, by means of a concentration cell, the only difference between the two legs of the cell of H-form being in the concentration of the amalgam composing the electrodes. The ratio of the zinc to the mercury, expressed as a percentage, was in every case twice as great in one leg of the cell as in the other. This relation was secured by weighing out pure mercury in two portions as one to two, and depositing in them the same quantity of zinc electrolytically by connecting the two in series with anodes of pure zinc, and both in series with a silver coulometer. The operation was conducted in an atmosphere of hydrogen, and the concentration cell was exhausted of air and filled with hydrogen to avoid oxidation.

Such a concentration cell is reversible and the Gibbs-Helmholtz equation applies to it.

From a concentration of 0.5 per cent to about 2.2 per cent the electromotive-forces fall only slightly, and all lie on a straight line. But at a concentration of about 2.3 per cent the line denoting electromotive-force abruptly changes direction downward. Also the heat of dilution changes from negative 450 joules per gramme-molecule of zinc to negative 8,500 joules. When zinc amalgam of three per cent concentration is diluted to one-half, the absorption of heat is very nearly 10,000 joules per gramme-molecule of zinc. These abrupt changes indicate a transition point in the zinc amalgam.

A. Campbell read a paper "On the Measurement of Wave Length for High-Frequency Electrical Oscillations." The experiments had for their object the calibration of wavemeters for the measurement of the high frequencies (200,000 up to 1,000,000 cycles per second) used in wave telegraphy. Two wavemeters (A and B) were tested, both being of the type consisting of a series of self-inductance coils used singly (L) in series with a variable air condenser (K) and a thermo-ammeter, the reading of K being obtained by altering the capacity until the circuit shows resonance with the working circuit. The coils of wavemeter A were wound with solid wire, those of B with stranded wire, each strand being separately insulated. The absolute value of the frequency was determined by photographing spark trains in the primary circuit by means of a rotating mirror running at a constant and accurately measured speed. The value of the frequency n_1 deduced from the measured values of K and L with wavemeter B were in close agreement with the actual n deduced from the spark photographs.

With wavemeter A the agreement was naturally not nearly so close, but was much improved when the values of the self-inductances of the solid-wire coils were corrected to the high-frequency values by the formulas of Heaviside and L. Cohen. The results show that the inductances of the stranded-wire coils are practically unaltered for frequencies from 0 up to 1,000,000 cycles per second.

A paper on "An Electromagnetic Method of Studying the Theory of and Solving Algebraical Equations of any Degree," by Dr. Russell and Mr. Alty, was read by the authors. They point out that the problem of finding the roots of an algebraical equation of the nth degree is practically the same as that of finding the positions of the "neutral points," that is, the points where the resultant force due to the earth and definite currents in n long vertical wires is zero. The n wires are arranged at any convenient distances apart in a plane which is at right angles to the magnetic meridian. The currents in the wires are then adjusted to certain values, which are readily found by the methods of partial fractions. If x_1 and y_1 be the co-ordinates of one of these neutral points measured with reference to certain definite axes, $x_1 \pm y_1\sqrt{-1}$ is a pair of roots of the original equation. All the real roots lie on the axis of X, which cuts the wire at right angles. The positions of the neutral points thus determine all the roots, real and imaginary, of the given equation. The peculiar advantage of the method is that we can see, in many cases almost at once, what effect varying the value of the coefficient of any power of x will have on the roots of the equation. A simple apparatus which the authors have devised for students' use is described. The positions of the neutral points are determined by means of a small charm compass. In this way all the roots can be determined with a maximum inaccuracy of one per cent.

Dr. C. V. Drysdale exhibited a new Fery thermo-electric calorimeter. This form of calorimeter can be used continuously and permits the value of the gas produced in a gas works or producer plant to be watched from time to time. The principle of the instrument is that of burning the gas to be tested at a constant rate in a special burner consuming from five to ten litres per hour. This burner heats a recuperative thermopile, of which the cold junction is traversed by the air employed for the combustion, while the hot junction is heated by the products of combustion. The thermopile contains fifteen junctions, which enables a potential difference of 0.2 volt to be obtained. The energy produced is sufficient to obtain a trace with a recording instrument similar to that obtained with the Richard recording apparatus.

A paper by F. W. Jordan, on "An Instrument for Measuring the Strength of an Intense Horizontal Magnetic Field" was read by the author. The method consists in measuring directly the transverse force on a conductor traversed by a current in a direction at right angles to the field. Two copper strips of uniform width, each cut to form three sides of a rectangle, are fastened together and connected by short tinsel leads to terminals, so that the current can be sent in the same direction through each of the insulated conductors. The framework is suspended in the field to be measured from a helical spring of phosphor-bronze. The tension in the spring can be adjusted to bring the framework into a sighted position. To make a measurement the horizontal conductors are arranged at right angles to the field and a known copper weight is suspended from the center. A current is passed through the wires and its strength adjusted until the framework is again in its sighted position. The results obtained with the apparatus using fields from 1,000 to 13,000 gausses agreed with those got by the ballistic method to one part in 400.

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Lamps for Residence Illumination.[1]

The lighting of a residence is necessarily of a somewhat varied character, and is always more or less of a compromise with respect to economy, proper illumination, and artistic effect.

The field of residence illumination is at present chiefly occupied by electricity and gas, at least in the cities and towns, but the electric light offers the greatest opportunity for correct or incorrect use, because of the almost unlimited number of positions in which it may be placed.

It is customary in present practice to design the lamp fixture and subsequently use lamps and shades to accommodate the design. It is commonly customary to place lamp sockets at an angle of about forty-five degrees, thereby often making the illumination far less satisfactory than by placing the sockets pendant. With pendant sockets the selection of shades for the desired distribution of light is more regularly made, the range of selection is increased, and the mechanical strain on shade holders, sockets, and fixtures is reduced to a minimum. A single lamp, supported by a flexible cord, should not be used, however, except when absolutely necessary, and in this case the circuits should be controlled by wall switches rather than by circuit switches.

In the lighting of living rooms the greatest economy will be obtained where the same lamps are used both for reading purposes and for general illumination of the room. A chandelier having its lamps at a moderate distance below the ceiling of the average height room, equipped with shades which will concentrate a considerable portion of the light within the area in which it is desired to read, will at the same time give a satisfactory illumination over the remainder of the room.

The idea so commonly expressed that the portable table lamp is better adapted for reading than a lamp on a chandelier or bracket, is erroneous, because it is practically impossible to secure a reflector for a table lamp that will direct the light where it is needed for reading, as satisfactorily as proper shades on the chandelier will do. The glare can be avoided, and the quality of intensity of the popular oil reading lamp can be obtained, by the use of a frosted bulb or an opal shade.

The chief objections to be considered in connection with the use of inverted Welsbach gas lamps appear to include: (1) The necessary use of matches or automatic lighters; (2) the undesirable effects of drafts of air, both on the intensity of illumination and on the durability of the mantle; (3) the heat produced by the lamp; (4) the breaking of globes and shades by the concentration of heat in one spot from a broken mantle.

In considering the efficiency of illuminants, a distinction must be made between the light and the illumination produced by a given source of light. The most efficient sources of light, considered in watts per candlepower, do not necessarily produce the most efficient illumination, for the following reasons: (1) Very efficient sources of light are likely to be of high candlepower and must be placed comparatively far apart, and the efficiency of distribution is decreased. (2) Light produced at high luminous intensity is more rapidly absorbed by the atmosphere, and therefore, less proportionally reaches the object to be illuminated. (3) The color of the light affects the efficiency as an illuminant.

The author briefly discussed the various standards of intensity, and remarked that the question of economy of illumination would be greatly simplified if all the lamp manufacturers would agree on a definite standard for rating the candlepower of their lamps.

The distribution curves of illumination from different lamps vary greatly in form, and these may be multiplied and changed materially by the use of special forms of shades.

The Nernst lamp without shade projects the major part of its light downward; the carbon-filament, tantalum, and tungsten lamps without shades throw out their light mostly horizontally; the inverted Welsbach burner gives a really uniform distribution in the lower hemisphere, with about sixty-seven per cent of the light below the horizontal plane; and the distribution curve for the upright Welsbach burner is somewhat similar to that for the tungsten lamp, but shows that only about forty-five per cent of the total light is below the horizontal plane.

The mean spherical candlepower would be the most satisfactory standard for commercial work; it is the quantity of light emitted if a standard candle gives its maximum intensity of light in all possible directions.

The author proceeded to demonstrate a graphical method of determining the mean spherical candlepower which checks very closely, with the results obtained by the more tedious analytical methods. This has been described by Prof. A. E. Kennelly, in the *Electrical World*, March 28, 1908.

The desirable amount of illumination for various classes of service is as follows, the figures in the parentheses being the light intensity in foot-candles: Auditoriums (1 to 3); theatres (1 to 3); churches (3 to 4); reading (1 to 3); general illumination of residences (1 to 2); desk illumination (2 to 5); postal service (2 to 5); bookkeeping (3 to 5); stores, general illumination (2 to 5); stores, clothing (4 to 7); drafting (5 to 10); engraving (5 to 10).

Increase of illumination due to reflection from various colored surfaces is given as follows, the first figure in the parentheses being the coefficient of reflection, and the second figure the effective illumination factor: White paper (70-3.33); chrome yellow (62-2.63); orange paper (50-2.00); plain deal (clean) (45-1.82); yellow paper (40-1.67); yellow painted wall (clean) (40-1.67); light pink paper (36-1.56); plain deal (dirty) (20-1.25); yellow painted wall (dirty) (20-1.25); emerald green paper (18-1.22); dark brown paper (13-1.15); vermilion paper (12-1.14); blue-green paper (12-1.14); cobalt blue paper (12-1.14); deep chocolate paper (4-1.04).

The total amount of illumination in rooms is determined by multiplying the illumination obtained directly from the lamps by the effective illumination factor. This method, however, is correct only when the lamps are used without reflectors.

Experiments have shown that the eye can withstand without fatigue a brilliancy of from four to six candlepower per square inch. The relative intensity of light sources in candlepower per square inch is given as follows: Opal shaded lamps (intrinsic brilliancy, one-half to 2); incandescent, frosted (2 to 5); candle (3 to 4); gas flame (3 to 8, varies); oil light (3 to 8); Welsbach mantle (20 to 25 and above); acetylene (75 to 100); carbon incandescent lamps, clear (4.0 watts per candle, 300; 3.5 watts per candle, 375; 3.1 watts per candle, 480); Gem metallized (2.5 watts per candle, 625); tantalum (2.1 watts per candle, 750); tungsten (1.25 watts per candle, 1,000); Nernst, bare (800 to 1,000); enclosed arc (75 to 200, depends on globe); arc, open (10,000 to 100,000 to 200,000 in crater); sun on horizon (2,000); sun at thirty degrees elevation (500,000); sun on zenith (600,000).

The author proceeded to give the methods of manufacture and the principal characteristics of the various kinds of

[1] Abstract of a paper by Prof. Arthur Curtis Scott presented at the fifth annual convention of the Southwestern Electrical and Gas Association, May 21, 1909, at Dallas, Texas.

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incandescent lamps, and also of the inverted Welsbach gas lamp.

He then gave some most interesting particulars, with numerous tables, of the economy of operation of the electric and gas lamps mentioned above. These briefly indicated the results of a life and photometric test of these lamps made under his direction by C. W. Conrad and W. W. McCullough, two of his senior students at the University of Texas.

The comparative cost per kilo-candlepower-hour, for 1,000 hours' operation, with electric energy at ten cents per kilowatt-hour, was as follows: Thirty-candlepower Reflex Welsbach, horizontal candlepower basis ($0.2476 per kilo-candlepower-hour); eighteen-candlepower Reflex Welsbach, on basis of mean candlepower between vertical and horizontal values in lower hemisphere ($0.2108); sixty-watt tungsten ($0.1489); forty-watt tantalum ($0.2642); fifty-watt Gem ($0.3287); 110-volt, sixteen-candlepower carbon-filament ($0.4255); Nernst, 0.6-ampere, horizontal candlepower basis ($0.2644); Nernst, 0.6-ampere, on basis of mean candlepower between vertical and horizontal values in lower hemisphere ($0.1240).

Interborough's Interest in Its Employes.

The Interborough Rapid Transit Company has announced that $50,000 had been appropriated by its directors for the erection and equipment of more commodious quarters for its motormen and conductors at the subway and elevated terminals. Plans have been perfected for six of these club houses at One Hundred and Fifty-ninth Street and Eighth Avenue, One Hundred and Twenty-ninth Street and Third Avenue, the One Hundred and Seventy-ninth Street yard, Bronx Park and Third Avenue, Two Hundred and Forty-second Street and Broadway, and One Hundred and Forty-eighth Street and Seventh Avenue. The buildings will all be sixty-five by thirty-six feet and will contain shower baths, kitchens, restaurants and smoking and reading rooms and such other facilities as may later be determined upon.

Mr. Belmont has added $10,000 personally to the appropriation, to be used in providing books, magazines, and newspapers in the club houses. The plans for the first of the structures have been filed with the Building Department, and it is expected that at least four of them will be completed and opened within a few months.

New Jersey Coast Lines To Be Electrified.

Following the opening of the new tunnel under the Hudson River, connecting Jersey City with New York, comes the announcement that all the railroads entering Jersey City and Hoboken will electrify their roads in the suburban zone in the near future.

The proposed electrification will extend over the lines of the New York and Long Branch Railroad, through Long Branch and Asbury Park to Point Pleasant. The summer travel on this railroad is said to be the greatest in the world, with the exception of the stretch from London to Brighton, England.

As a result of this change in motive power local trains will be run at shorter intervals and at fifty per cent higher speed than the present local steam trains, and electric express trains may be run at twenty-five per cent higher speed than the steam trains.

By virtue of the McAdoo Tunnel opened and the ones yet to be completed all that section of New Jersey lying north of a line from Trenton to Asbury Park becomes physically part of New York city. In all that northern portion of the state the opening of the new system means new hours, new comforts, new enjoyments, new conditions of life and new homes. It brings the business man anywhere in the suburban district practically twenty minutes nearer his office in New York. It opens new suburban districts and enables thousands to go further out into the country.

New Haven's Subway Plans.

Although the New York, New Haven & Hartford Railroad Company is not believed to be the financial backer of the Bradley-Gaffney-Steers Company, it may be stated on high authority that should the subway proposal of the contracting firm be officially approved the New Haven is planning to use the Broadway-Lexington avenue line of its subway system. This it is prepared to do in a manner similar to that in which the Pennsylvania Railroad Company has arranged to utilize the McAdoo North River tunnel system—by means of a "joint traffic agreement." In making the improvement it was the admitted intention of the New Haven to divert to its Harlem River branch its enormous suburban traffic, all of which now enters New York city over the tracks of the Harlem River Railroad Company.

Electricity Supply in Coal Mines.

Some practical suggestions as to the supply of electricity in coal mines are contained in a communication from a correspondent in a recent number of *The Electrical Review*, of London. These are as follows:

Recent accidents point to the absolute unsuitability of direct or continuous-current supply, also direct-current motors, switch-gear, fuses and other apparatus liable to sparking when making or breaking the circuit.

The nearest approach to absolute safety can only be secured by abolishing direct current altogether, and with it all switch-gear not immersed in oil, all fuses of any kind or description, and all junction boxes not filled up solid with insulation.

Make it compulsory to use only three-phase current, of any convenient voltage and periodicity, all phases insulated from earth, with a static leakage indicator permanently connected to each phase.

When any phase is earthed, the faulty section to be cut out of circuit, and not worked until it has been made good.

All cables to be made into one-half to one-mile sections, with an oil-immersed loose-handle overload circuit-breaker at each section point.

All branch cables to have a separate oil-immersed overload loose-handle circuit-breaker at the nearest available point to the main cable.

All circuit-breakers to be so constructed that they cannot be wedged up to prevent opening on the overload setting.

All motors to be of the short-circuited rotor or squirrel-cage type.

All auto-transformers to be immersed in oil; on motors of less than twenty-five brake horsepower the auto-transformer is unnecessary.

All leads to motors to be entirely covered with dampproof insulation.

Telephone communication from each circuit-breaker to the generating station.

Peoria Gas and Electric.

The annual meeting of the stockholders of the Peoria Gas and Electric Company was held last week and the following were elected directors: H. D. Walbridge, New York city; E. G. Schmidt, Springfield; Walter Barker, Frederick H. Smith and William H. Brown, Peoria.

Officers—H. D. Walbridge, New York city, president; E. G. Schmidt, Springfield, vice-president; William H. Brown, secretary; A. P. Colvin, Peoria, treasurer. R. S. Wallace was reappointed as general manager.

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THE SUPPLY OF ELECTRIC CURRENT TO OTHER TOWNS FROM A CENTRALLY LOCATED STATION.[1]

I. BY O. H. HUTCHINGS.
II. BY CLAUDE SMITH.

I.

We do not have to look a great distance into the past to see the time when for its subsistence each community depended almost entirely upon its own productive resources. For instance, take a cross-country ride upon any of our modern interurban lines and you can find picturesque ruins of what was once a very important local industry—the grist mill. While the quality of its output was in most instances good, and we still assume that the cost of producing its limited output was within reason, yet the fact remains that the small grist mill has almost entirely disappeared from the field of active operation.

This was not due to a decreased local consumption of its output, but is wholly accounted for by the fact that, with the limited demand for its output, it could not compete either in the quality or the cost of producing and marketing its output with the larger enterprises of a like nature that were being built and operated at more favorable locations. Also, as a rule, the demands upon the former were such as did not permit of continuous twenty-four hours' operation, resulting in a high fixed charge per unit output, as compared with its more modern competitor, whose output was not restricted to the demands of the one locality.

With these prefatory remarks I hope to show several valid reasons for "The Supply of Electric Current to Other Towns from a Centrally Located Station."

Looking at the question from the standpoint of the smaller central station which we propose to supply, we will find some if not all of the following conditions of operation: (1) Limited hours of operation—no day service; (2) simple, non-condensing prime movers; (3) street lighting operated on moonlight schedule.

It is very apparent that the actual cost of each unit output of a central station in this class is necessarily high, on account of excessive coal consumption per unit output and extremely low load factor, meaning that the investment is returning revenue only a small percentage of the total time.

In a general way, the investment in generators, engines, boilers, pumps, piping and buildings necessary to equip a small generating system of this class, compared with its equivalent capacity in static transforming apparatus, buildings, etc., is approximately in the ratio of five to one, or, in other words, the fixed charges necessary to generate each unit output (assuming no day service) will be much higher than should purchased current be available, and made use of. Other important points greatly in favor of purchased power are: (1) The complete elimination of that portion of labor necessary to operate a generating station; (2) the complete elimination of steam maintenance charges; (3) greatly reduced electrical maintenance charge; (4) the important feature of continuous twenty-four-hour service, permitting taking on what day load may be available without additional expense other than the purchase price of additional units sold.

All of the above items effect a decided reduction in the total running expense of the small central station, and the last item is probably the most important of all.

We will now apply this argument to central stations of larger capacities, say, cities of 15,000 population. In a general way the demand upon a station supplying a city of this size would be occasioned by a limited amount of connected industrial power, together with a small demand for daylight lighting, representing the day load, and the usual amount of commercial and residence lighting, together with the street lighting, representing the night load.

We would not expect more than one theatre in a city of this size, and it giving only an occasional performance during the theatrical season. We would not expect to find a large amusement park to offer a market for current during the summer months. The only object in itemizing the various classes of service as above is to show the very slight opportunity offered for a diversified load.

As it is now generally conceded that the diversity factor is a very potent element necessarily considered in determining the true load factor of individual apparatus, or station capacity, it is very evident that where diversification of service is lacking, high fixed charges per unit output must be the result. It is upon this element, diversity factor, that some of the best arguments in favor of the topic of this paper can be based.

Unfortunately for them, many of the smaller central stations are so located that they cannot attain a total production cost sufficiently low to enable them to compete successfully with private power plants; on the other hand, they do not feel justified in increasing their investment to the amount necessary to correct their general condition. To those of you who may be operating a central station in this class, you should welcome the first opportunity of purchasing your electric service.

A central station designed to supply the service outlined in this paper should be as nearly perfect mechanically and electrically as engineering skill and capital makes possible. It must be arranged so that an interruption of the supply of its output is next to impossible. The transmission lines for delivering its output must be designed for having absolute continuity of service under all climatic and atmospheric conditions. The transmission voltage may be from 6,600 to 60,000 volts; higher, if necessary, depending upon the load and the length of each transmission line; usually about 1,000 volts per mile is considered good engineering practice. In passing through thickly settled rural districts, by installing a lowering transformer at a central, convenient point, it would be possible to supply these districts with, say, 2,300 volts, to be further lowered to a normal voltage of secondary distribution at the points of usage.

The location of a generating station whose output is to supply surrounding territory must be very carefully considered. In a general way the location should be near the electrical rather than the geographical center of the territory to be supplied, and preferably near a large manufacturing center, where a ready market can be secured for a good portion of its output. This will greatly assist in bringing about that very desirable and important point previously mentioned, diversification of service, on account of the great variety of business that is obtainable in any of our larger cities. I may enumerate, for illustration, the following: An endless variety of industrial power; local street-railway system; operating city waterworks electrically; charging electric automobiles, both pleasure vehicles and heavy haulage trucks; municipal lighting; special boulevard lighting; several theatres operating nightly; summer amuse-

[1] Two papers read before the convention of the Ohio Electric Light Association at Toledo, Ohio, on July 13, 1909. Mr. Hutchings is connected with the Dayton (Ohio) Lighting Company. Mr. Smith is manager of the Bradford and Gettysburg Electric Light and Power Company.

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ment parks; sign, outline and decorative lighting; interurban railways.

Do not consider the above as representing an ideal condition, impossible to realize; on the contrary, such business is being developed every day by the progressive or aggressive organizations. A central station enjoying the diversity factor made possible by the above-outlined demand for its output, is in position to produce its output at a cost that, plus the transmission costs, can supply all the surrounding territory within a reasonable radius (that is now being supplied from several smaller central stations), on a basis that will remove all doubt from the minds of the managers of the small central stations regarding the advisability of availing themselves of the opportunity of purchasing, rather than generating, their electric requirements.

As time goes on it will be more and more the best plan for the smaller central stations to purchase their current from the larger companies within proper distance to supply the same economically; and plans for future improvements and enlargements in any central station should be considered with this end in view. It is the spirit of the times to centralize and combine in many lines of effort, and why should it not be equally as good and economical for central stations?

II.

The problem of supplying current for lighting and small power purposes in small towns that are unable to support a local generating station has proven to us to be only a financial problem, and with the financial point as a beacon the mechanical and electrical ends were taken as of secondary importance in the construction of this plant.

The Bradford and Gettysburg Light and Power Company was organized in the fall of 1908 for the purpose of building and operating a transmission line between the towns of Gettysburg and Bradford, Ohio. Ten-year street-lighting contracts were obtained with both towns and a contract for current was entered into with the Greenville Electric Light and Power Company, of Greenville, the county seat of Darke County. Gettysburg is a small farming settlement eight miles east of Greenville, while Bradford is strictly a railroad town twelve miles east of Greenville, at the junction of the Indianapolis and Chicago divisions of the Pennsylvania Railroad. Gettysburg has a population of about 350, practically all of whom own their own homes. Bradford has a population of about 1,600.

The transmission line is built of No. 6 hard-drawn copper and designed for a maximum of sixty kilowatts. Seven miles of the line is built on private right-of-way, just outside the railroad property line. The remaining five miles is on a country road. The substation at Greenville is just outside of the city limits and contains the step-up transformers and the meter. At Gettysburg a 7.5-kilowatt transformer mounted on a pole feeds the three-wire secondary service of 110-220 volts.

A small substation contains a three-kilowatt selective-tap transformer with 220-volt primary and a maximum secondary of 600 volts, the selective taps being for 12.5, 25, 37.5, 50, 62.5, 75, 87.5 and 100 per cent. A small series regulator, ammeter, wattmeter and an eight-day time switch completes the street-lighting equipment. Eighteen seventy-five-watt series tungsten lamps are operated on the streets, the service being all night, and every night from thirty minutes after sundown to thirty minutes before sunrise. The lamps are all permanently hung on 16.5-foot rigid mast arms sixteen feet above the street.

The street-lighting system of Bradford has a capacity of 150 lamps, sixty being in use at present. Three fifteen-kilowatt step-down transformers are in use at the Bradford end and are connected in multiple, feeding a main secondary system of two No. 0000 and one No. 00 lines, the branches being of two No. 4 and one No. 6, the smallest feeders being two No. 6 and one No. 8, which makes the copper loss on the secondaries of such small value as to be imperceptible. The transformers are arranged for the two at the ends to be cut out of service during the day load, which greatly reduces the core losses and keeps up the regulation. The maximum voltage during the daytime being 118 to 120, the minimum at the peak load is 112 to 114. The series tungsten street lights have given excellent service, and during the past four months only two lamps have been lost by burnouts and forty-five by defective joints between the filament and leading-in wires. Many of these lamps failed in the first twenty-four hours of burning.

The lighting company does not handle any supplies or do any wiring, but cooperates with the management in this matter. Tungsten lighting was pushed from the start. The commercial rates charged for current are: The first thirty kilowatt-hours, at twelve cents; thirty to sixty kilowatt-hours, nine cents; sixty to ninety kilowatt-hours, six cents, with a one cent per kilowatt-hour discount for payment in fifteen days. No meter rent is charged, the minimum monthly charge being $1.

The sixty-watt lamp was adopted as the best for fighting gasoline, as the operating cost is less, and in small towns the financial end is the strongest argument that can be produced. In one instance a fifteen-light gasoline plant was displaced by fifteen sixty-watt lamps, one forty-watt lamp and several sixteen-candlepower lamps for use in the basements and storage rooms. The gasoline had been costing $12 per month, with $2 for the oil lamps in the basements and a night lamp. The first month's current (February) was $8.32; March, $6.25; April, $6. In May this firm purchased a power coffee mill, the May bill being only $6. At the present time only three gasoline plants are left, and they are less than a year old. The owners are willing to take on the electric at the first sign of trouble.

The residence proposition has been very easy, as the twenty-four-hour service has been of such character as to commend itself to all. By pushing the twenty-five and forty-watt lamps a large number are coming in under the $1 minimum charge. This makes the introduction of flatirons and heating appliances very easy. The irons are put out on thirty days' free trial. Nothing but high-grade irons are used, and during the past month twenty irons have been sold. The first one to be returned is yet to arrive.

Almost all the wiring has been installed by the management, who from experience has found that but a few people know what they want. For this reason I have always offered my advice as to the proper equipment, and, in fact, have refused to install work that was not standard. For tungsten lighting in many cases it was necessary to agree to make any desired change if the tungsten service was not satisfactory; hence all tungsten lamps have been installed well out of reach with suitable Holophane ware and independent switches, with the result that the breakage has been very small and the service good. Where consumers are timid about trying irons, the outlet is installed free of charge, and who would own a heating outlet and not have anything to put in it? It is a sure thing the neighbors would not

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forget that Mrs. Brown is using an electric iron. When once she has an outlet put in she is unable to find any good excuse to get rid of it, as by actual test the irons we put in are more economical than gasoline, even at an eleven-cent rate.

On June 1, 105 meters were in service and fifty applications are on file. This service has been obtained without the least effort. Our aim is to install 300 meters in the two towns; when we get to the renters we expect to have house wiring to rent. The power question has as yet received but little attention. The gasoline power now in use does not total over fifty horsepower. A small one-half-horsepower motor is being used to demonstrate coffee-mill service. This motor is belted to any old coffee-mill that happens to be handy, and after a few days' use we go around and get an order for a direct-connected outfit, and everyone is pleased. As to the efficiency of the plant, our loss for the month of March was less than eleven per cent, April, ten per cent, and May less than ten per cent.

Tractions Buying Copper.

The Boston (Mass.) Elevated has purchased several years' supply of copper, the amount under contract totaling 3,000,000 pounds. The cost was a fraction less than thirteen cents a pound. This total gives the elevated between two and three years' supply of copper, and allows for the extra requirements incident to the building of the Cambridge subway.

Massachusetts Electric Companies, Boston, Mass., has also purchased about 900,000 pounds of copper, and 230,000 pounds of aluminum. This is equivalent to two years' supply. The annual copper consumption of the Massachusetts Electric Companies is about 500,000 pounds.

The motive of these two traction companies in buying copper ahead is that they are both persuaded that copper prices are on bottom, and that the carrying charge will be much more than offset by the future advance in the price of the metal. It is estimated that the cost of carrying this copper will not exceed three-fourths of a cent per pound for two years.

The Western Electric Company has recently bought 30,000,000 pounds of copper, which it is thought will cover its copper metal requirements for the rest of this year. That big quantity of copper has been bought at around thirteen cents a pound. This large purchase is considered significant.

Assistant Inspector of Electric-Light Plants.

The United States Civil Service Commission announces an examination on August 25-26, 1909, to secure eligibles from which to make certification to fill a vacancy in the position of assistant inspector of electric-light plants in the office of the Secretary of the Treasury, at $1,800 per annum, and vacancies requiring similar qualifications as they may occur in the Treasury Department.

The examination will consist of the following subjects, weighted as indicated in parentheses: 1. Mathematics and practical calculations (comprising algebra to and including problems involving quadratics, logarithms and use of tables, simple applications of the differential and integral calculus, elementary problems in mechanics, interpretation of formulas and the correct working out of results for special cases. A choice of questions will be given in this subject) (15); 2. Drawing (consisting of a test of the competitor's ability to lay out neatly to scale a problem in modern electrical illumination) (20); 3. Materials (comprising all of the materials employed in the construction of boilers, steam engines, electrical generators, and other electrical apparatus) (10); 4. Theory and practice of mechanical and electrical engineering (comprising a knowledge of fuels, the theory, practical computations, and the construction and operation of the apparatus with which modern electric-light and power plants are equipped. A choice of questions will be given in this subject) (30); 5. Training and experience (rated on application) (25).

The duties of the position require expert knowledge in the design and testing of electric-light plants, including boilers, steam engines, turbines, and electrical generators and motors, the installation and design of electric wiring systems and knowledge of illumination with respect to equipping buildings with modern lighting fixtures, and also experience in the selection of fuel for power plants.

Applicants who fail to indicate in their applications that they have had at least five years' practical experience in mechanical and electrical engineering will not be admitted to this examination. Graduation in mechanical or electrical engineering will be considered as equivalent to not less than two years of this period.

The use of a slide rule will be permitted for any part of this examination. Two days will be required for this examination.

Age limit, twenty years or over on the date of the examination.

In accordance with a recent act of Congress an applicant for this examination will be required to be examined in the state or territory in which he resides and to show in his application that he has been actually domiciled in such state or territory for at least one year previous to the examination.

Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any of the local centers, for application Form 1312. No application will be accepted unless properly executed, including medical certificate, and filed with the Commission at Washington. In applying for this examination the exact title as given at the head of this announcement should be used in the application.

Telephone Company Wins.

The Southern New England Telephone Company has won a victory through the disagreeing action of the two houses of the Massachusetts General Assembly in regard to a bill concerning the compulsory extension of telephone lines. The measure provided that the company should be required, on the petition of a certain number of people, to extend a line into a specified district, no matter how sparsely settled. The judiciary committee made an unfavorable report, but the House rejected the report and passed the measure. The Senate rejected the proposal, and the matter was sent to conference, where the measure died through inability of the conferees to agree.

The Society of Wireless Telegraph Engineers.

At the meeting of the Society of Wireless Telegraph Engineers, held at 192 Bay State Road, Boston, Mass., on Monday evening, August 2, there was a discussion of the relative merits of the Telefunken "quenched spark" and the Lepel wireless-telegraph systems.

The society has about twenty-four wireless-telegraph engineers in its membership. The officers are as follows:

President, Dr. Lee de Forest.

Vice-president, John Stone Stone.

Managers, E. R. Crain, O. C. Roos and G. K. Woodworth.

Secretary, E. D. Forbes, 96 Franklin Street, South Framingham, Mass.

Treasurer, C. E. Russell.

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THE COMMERCIAL ORGANIZATION OF AN ELECTRIC-LIGHT COMPANY AND ITS RELATIONS TO THE PUBLIC.[1]

BY W. E. RICHARDS.

A few brief platitudes on this subject seem justified, owing to the general neglect which they have received.

Many of us have almost come to regard our few solicitors as constituting the entire commercial organization of our company, and perhaps they do. This results largely from the efforts of the advertising and business-promoting fraternity, which not infrequently blur our perspective without subsequently clearing it up.

Electric-lighting companies are presumably organized to earn dividends, and succeed best when the capabilities of each employe are most fully utilized. The resultant effect upon the company's business is the algebraic sum of all the individual efforts. Properly directed and combined, they assist each other for the common good. If ignored or misdirected they retard each other.

While opportunity and dividends are now often lost by relying upon only two or three per cent of our forces to promote friendships, sell our products, satisfy our consumers, explain our system, extol our virtues, gloss our faults and preach our doctrines, the other ninety-eight per cent daily shed their allegiance and their interest when they don their coats and hats, all because we tell them nothing of the company's business outside their own dull daily grind. How could we make them less interested and useful?

The universal tendency of employes in any department is to flock together and forget the others. Numberless chances for substantial benefit and assistance to the company are thus lost. The soliciting and the operating forces rarely know the relations of the earnings and expenses to each other. Expenditures or improvements are planned in ignorance of their true desirability, and disgust and disheartenment follow their unexplained curtailment. The clerical force knows little of the difficulties and drudgery of the selling and operating departments.

Few of our employes can explain to their friends the company's attitude on the every-day local, commercial or political questions, and either justify or defend it when necessary. Yet most men are chiefly interested in the vocation which yields the daily bread to them and their families, and welcome opportunities to broaden their knowledge and increase their value therein. A wider acquaintance with his company's business raises the employe's value and strengthens his influence among others. Ignorance of the business condemns both employe and employer.

Each individual associates with many others and influences them just in proportion to his own intelligence and character. Each member of any organization unfailingly impresses his personality, ability and character upon the composite picture which forms the public opinion regarding the company.

Therefore, in reality, every member, from president to coal-passer, is a part of the commercial organization, which makes or breaks the company's business. These diverse elements should be brought together frequently for better mutual understanding, intercourse, instruction and co-operation in matters other than the routine duties of each. No electric-light company is too large or too small to benefit from a policy of broader training for its employes in the local questions affecting its business welfare.

The best and cheapest commercial organization is a united and interested force of employes, who comprehend the general affairs of the concern, the functions and relations of the various departments, and the conditions—whether physical, commercial or political—which enhance or hinder the prosperity of the business. Their knowledge acquired on these matters is rapidly transmitted to the community at large and works for the company's benefit. Printer's ink is far less effective than friendly personal interest in selling goods or pleading causes.

The subjects of instruction such as herein advocated are not at present dealt with by any of the various associations within the writer's knowledge. The relations of such a commercial organization to the public with which it has to deal should and will become largely those of teacher and pupil.

The public will derive its opinions from the most accessible sources and be guided by them in its sentiment and actions. If the attitude of the company's personnel is arbitrary, its policy narrow or secretive, the public becomes naturally suspicious and resentful. If, on the contrary, its attitude toward the community is frank and accommodating, its personnel courteous, intelligent and active in the company's interest, the inevitable result is a favorable public sentiment which the political pirates cannot successfully oppose.

Communities are not unjust, save due to misinformation and misapprehension, and it lies largely in the power of the management to prevent these misapprehensions through the judicious direction and instruction of the employes who form an active element in the community. It is therefore good policy, in the long run, to base and maintain your commercial organization on such principles.

[1] A paper read before the fifteenth annual convention of the Ohio Electric Light Association at Toledo, Ohio, on July 14, 1909. The author is connected with the Toledo Railways and Light Company.

Electric Inspection at Peoria, Ill.

The City Council has passed an ordinance governing wiring, and it has been signed by the mayor and is now being enforced. The old ordinance did not provide for conduit work, while the new one requires all building in the fire limits to be wired in iron conduit, as also all public buildings and dwellings occupied by more than two families, no matter where situated.

It also requires the licensing of master electricians and the journeyman, by taking an examination before a board composed of the city electrician, a master electrician and one journeyman, appointed by the mayor.

The inspection has been changed, requiring a permit to be taken out before the work is commenced. After the wiring is done it must be inspected, and with the hanging of the fixtures the final inspection is made, then the final permit is issued, and the lighting company is at liberty to connect to the wiring.

The inspection charges are all based on the number of outlets. V.

Third Avenue Sale October 27.

Judge Lacombe, in the United States Circuit Court, on July 29, filed an order postponing the sale of the Third Avenue (N. Y.) Railroad under foreclosure of its consolidated mortgage of 1900 from September 2, to which it was previously adjourned from May 7, until October 27. The application for a postponement was concurred in by counsel for the various trust companies interested in the Third Avenue situation as trustees of mortgages, by Receiver Whitridge, by the reorganization committee of bondholders and by a stockholders' committee.

The order and accompanying papers give no reason for the postponement, but it is understood that it was sought because of the uncertainty regarding a reorganization plan.

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HEAT INSULATION AND EFFICIENCY OF ELECTRIC HEATING APPARATUS.

BY J. C. ATCHISON, JR., AND FRED KLEINSCHMIDT.

When using electrical energy for producing heat energy for heating, cooking and baking purposes, we are confronted by the enormous handicap of the inefficiency of the thermodynamic engine. As electric power at the switchboard we get only eight to ten per cent of the energy of the fuel burned under the steam boilers. When this electrical energy is again converted into heat there is some radiation loss, so that only seven to nine per cent of the energy of the fuel is used for cooking. Therefore, it is imperative that the radiation be reduced as much as possible. With this object in mind it was the aim of the authors to find, if possible, means and material for decreasing the radiation from electric heating apparatus.

A thesis on this subject was therefore undertaken. At first tests were made to determine the relative value of various heat-insulating materials. The conditions were kept the same for all the tests. Without going into the method of conducting these tests in detail, the results may be summarized by giving in the order of superiority the following materials that were tested: mineral wool, hair felt, asbestos, sawdust and dirt. It was also found that the tighter the material, the greater was the amount of heat conducted away.

A series of tests of electric heating devices was then undertaken. At first an electric flatiron consuming three-eighths ampere at 110 volts was used. The efficiency of the iron was determined by noting the rise of temperature of a measured quantity of water that was contained in a pan placed in a box of sawdust to reduce the radiation. The iron was lowered into the water so that its working surface alone acted as the heating medium for raising the water temperature. Repeated trials showed that the efficiency does not rise above eighty-five per cent at any time, or, in other words, fifteen per cent of the electrical energy actually used at the iron is lost in radiation. Assuming that it costs seven cents an hour to run the iron, there would be lost one cent an hour.

A similar test was made with the top of the iron wrapped in hair felt, and the result was a greatly increased efficiency, this being about ten per cent better than in the previous test. From this we conclude that by using some kind of insulating material, such as hair felt, the efficiency of the electric flatiron, the most widely used of electric household utensils, could be increased sufficiently to make the saving noticeable. During the cooling of the iron readings were also taken, and it was found that when the iron was insulated its working range, that is, within temperature limits of 150 and 95 degrees centigrade, could be extended about eight minutes.

A number of tests of electric cooking apparatus were made. A known quantity of water was placed in the pan or cup and its temperature noted. Then the current was turned on for a given length of time, and the amount of water evaporated in that time was noted. The same process was repeated with the pan insulated on the bottom and sides. A small frying-pan when thus tested showed that the water heated faster when the pan was insulated. The efficiency tests showed 74.6 per cent as the efficiency without insulation and 79.5 per cent with insulation, an increase of about five per cent. This pan, however, was only five-and-one-half inches in diameter, and hence had a comparatively small radiating surface.

A large frying-pan, when similarly tested, showed a marked increase in efficiency, from 53.1 per cent for the uninsulated pan to 72.8 per cent for the insulated pan, an increase of almost twenty per cent. This pan has quite a large radiating surface.

Heating curves obtained with a chafing-dish show also that the water heats faster in the insulated device. The increase in efficiency in this case was from 50.3 per cent to 76.35 per cent, an increase of about twenty-six per cent, due to the heat insulation.

Another test of a smaller device was made, a shaving-mug being used in this instance. The efficiency tests show an increase of from 73.5 to 76 per cent, due to the heat insulation.

In performing these tests comparative results were the ones chiefly aimed at. As a general conclusion, we would state that insulation against heat radiation is well worth while in the larger electric heating apparatus, such as chafing-dishes, broilers, etc., but it would not be advisable on small apparatus, such as shaving mugs, curling-iron heaters, etc. Our recommendation, in the latter type of apparatus, is not only because the efficiency is not materially increased by insulation, but also because the smaller apparatus is not used for as long periods as the larger devices.

As to the method of insulating electric heating devices, we think it possible to replace the bottom and perhaps part of the side by a stiff asbestos board, the inside of the heater being packed with hair felt, asbestos or mineral wool. It is our belief that if electric heating apparatus were made more efficient, or, in other words, so as to require less power consumption for a given time, the use of the larger heating devices would increase materially.

Niagara Power Company and Its Competitors.

There is a brisk fight on the Niagara power companies going on round London, Ont., just now. The South Western Traction Company, recently purchased by Messrs. McKenzie and Mann, will be a factor in the struggle.

The Electrical Development Company or one of its kindred companies also has a charter for a Hamilton to Windsor railroad, which will pass through London. Electricity from the falls will be used on this railroad, and the intention is to obtain as many of these trolley lines as possible to use power. By having a market for a large portion of their power they will be able to dispose of their surplus at a rate much lower, it is expected, than the Niagara power.

The importance of the road in the scheme has been recognized. It would give the Hamilton road an outlet on Lake Erie, making three important centers at which it could reach traffic on the Great Lakes—Hamilton, Windsor and Port Stanley. It is a paying concern, with plenty of room for development, and it is more than likely that the proposed extensions to Aylmer, and also along the lake shore, will be carried out. The London Electric Company has ordered two 500-horsepower producer-gas engines, and will sell power directly in opposition to Niagara power. Other companies whose interests are centered in large enterprises in and around London will not take Niagara power, but will obtain power elsewhere. London will consequently be in the throes of great electrical struggles, and on the outcome of it depends the success or failure of the Niagara Power scheme, not only in London, but in the power zone. It has been generally understood heretofore that power from the falls was controlled by five companies.

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Chicago Electric Club.

At the regular Wednesday luncheon and meeting of the Chicago Electric Club, held on July 28, Harold Almert, of H. M. Byllesby & Company, made a very interesting address on the subject "Public Utility Fortune Telling." In the business world only about twenty-five per cent are professional men who have received special training. The balance are what are ordinarily termed "business men," who, without special training, are making the most of their opportunities. It is a well-known fact that about ninety-seven per cent of commercial projects do not survive more than five years of existence. Most failures of public utilities occur in the smaller towns, and due to ignorance of business methods. Failures among large companies are due generally to over-capitalization; in the smaller companies to under-capitalization.

The steady consolidation of isolated plants into central plants has been going on for a great many years. There has just developed a tendency toward the consolidation of small central stations into large networks. This policy has the advantage, from one point of view, in that the securities of large companies are more favored by investors than those of small companies. This is due to the fact that large companies require men of training and experience to guide their affairs economically, and are more apt to have proper management than the smaller companies, of whose exact state of affairs the investor is apt to be ignorant. Furthermore, consolidation brings reduction in the rates of interest required, particularly in bond issues, and makes a more favorable investment all around.

The examination of public-utility projects has recently been reduced to a science. It has been done mostly by large and well-known engineering firms. A small engineering organization that had been properly trained could, no doubt, do as well in an investigation of this sort, but its report would not carry as much weight with large financial houses. There has been a tendency to give pessimistic reports on new projects. In a great many cases a careful investigation of all aspects of the situation frequently discloses that they are good propositions if properly financed and operated.

The control of public utilities by the various state public-service commissions has so far been very beneficial to the companies engaged in this industry. In general, government regulation is better than continual local petty interference, although there is the danger that if politicians gain control of these commissions a great deal of havoc is apt to result. There has been a decided change in the character of central-station managers. First, there were lawyers and business men at the head of these companies; later they were followed by the technical men, who managed the properties excellently from the engineering standpoint, but who lacked the commercial progressiveness that is so imperative. In late years the commercial men who have also a good technical training have taken the upper hand. Throughout Mr. Almert's address he illustrated his more important points by a number of very good stories.

Homer E. Niesz was called upon to discuss the subject as a central-station manager. He talked on the last topic of Mr. Almert's address and stated that formerly most of the papers read at electric-light conventions were technical papers because of the extremely rapid development in this branch of the industry. As the engineering features have become more standardized, the commercial end of the business is receiving more just appreciation, and this is evidenced by the large number of papers relating to the commercial side that are now presented at such conventions.

E. A. Bullock, former president of the Nebraska Electrical Association, also addressed the meeting briefly, emphasizing a number of points that had been made by Mr. Almert, and also illustrating these points by other good stories.

It was decided to have no technical addresses at the meetings of the club during the month of August and to make the gatherings as informal as possible. Many members are away and the attendance is comparatively limited.

Union Railway Company.

Judge Lacombe, in an order signed on July 15, permits the Union Railway Company, New York city, to execute such confessions of judgment as its counsel may deem advisable and may recommend for execution for the purpose of liquidating and settling claims for damages to property and injury to persons now pending against the railway company.

Such confessions of judgment, Judge Lacombe says, shall not be deemed to be a violation of the injunction of March 31, 1908, made when Frederic W. Whitridge was appointed a receiver of the railway company.

Street-Railway Convention — Accountants' Programme—Convention Trains.

Robert N. Wallis, president of the American Street and Interurban Railway Accountants' Association, has announced the tentative programme for the Denver convention during the week of October 4, next. The following papers are to be presented: "Relation of the Accountant to Electric Railway Organization," by W. B. Brockway; "Storeroom Accounting and Inventory," by E. S. Pattee; "Timekeeping and Payrolls," by N. E. Stubbs; "Interurban Statistics," by S. C. Rogers; "The Census and Electric Railway Statistics," by W. M. Steuart, of the United States Census Bureau.

Reports will be presented by the Committee on Interline Accounts, the Classification Committee, and the Joint Committee of the Accountants' and Engineering associations.

Special trains to Denver for the convention are announced as follows: A special train leaving New York over the New York Central & Hudson River Railroad will run via the Lake Shore from Buffalo to Chicago, and over the Chicago, Rock Island & Pacific Railroad from Chicago through to Denver. The other special train from New York, over the Pennsylvania Railroad, will run from Chicago to Denver via the Chicago, Burlington & Quincy Railroad.

The Avogadro Centenary.

An international committee of prominent chemists and physicists has been formed to celebrate the centenary of the publication of Avogadro's memoir on the molecular constitution of gases. The numbers from the different countries having more than one representative, and not including Italy, are: Germany, 23; France, 19; Great Britain, 17; United States, 10; Austria, 8; Holland, 8; Russia, 7; Switzerland, 6; Sweden, 4; Belgium, 3; Denmark, 2, and Norway, 2.

Baltimore to Test Electric Meters.

The city of Baltimore, Md., has passed an ordinance authorizing the testing of electric meters and also providing for the compulsory inspection of all electric meters before installation, a charge of ten cents per meter being imposed for this latter service. On complaint of a patron an inspection will be made at any time, and a charge of $1 is made, to be borne by the company if the error is ascertained to be more than four per cent and by the patron if less.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

Annual Report of Westinghouse Electric and Manufacturing Company.

At the annual meeting of the stockholders of the Westinghouse Electric and Manufacturing Company, held on July 28, no business of fresh importance was taken up. In addition to the presentation of the annual report, these directors were re-elected: Richard Delafield, E. C. Converse, Anthony N. Brady, New York, and J. D. Callery, Pittsburg.

The annual report, presented by President George Westinghouse, was substantially as follows:

There is presented herewith the balance sheet of your company as of the 31st of March, 1909, and the statement of income and profit and loss for the fiscal year ended on that date.

As you know, the affairs of your company were taken out of the hands of the receivers December 5, 1908. The present board was elected by you at the meeting held November 30, 1908, your officers were appointed December 7, 1908, and an executive committee elected January 5, 1909, but the board was not permanently organized until the election of Robert Mather as chairman January 19, 1909.

The intervening time has been required to complete the adjustments resulting from the receivership and the readjustment of the debt of the company, and to determine the reductions to be made with reference to the company's business in America.

As will be noted, there was a decrease in the surplus account during the year of $2,992,661.80, which is made up of the following items:

Loss from operations of the business after providing for all interest charges and making fair allowances for depreciation	$ 918,682.91
Expenses incurred in connection with the adjustment of the debt which existed on October 23, 1907	460,490.16
Compensation and expenses of receivers and their attorneys	265,883.32
Sundry amounts charged off to reduce the book value of the company's assets, such as discount and expenses incurred in connection with bond issues of previous years: Depreciation of patents, depreciation of various stocks and bonds, provision for possible losses on inactive finished parts and machines on hand at the close of the year, and other minor items of similar nature	1,347,605.41

The loss during the fiscal year of $918,682.91, after providing for interest on the debt and all expenses, is chiefly accounted for by a small volume of business, the utilization of high-priced material, by sales at reduced prices, and by very considerable extra expenses incurred in completing the departmentalizing of the manufacturing operations of the company and in the rearranging of the machinery, which work was carried on without interruption by the receivers. The results of these important changes in manufacturing methods have been to greatly reduce the amount of material, raw, in process and finished, required to be kept in stock for a given amount of output (as will be noted in the balance sheet, the amount of material in stock, work in progress, goods on consignment and apparatus with customers, on March 31, 1909, was $9,961,182.32, as compared with $17,740,178.32 on October 23, 1907, when the receivers were appointed), and also to greatly increase the space available for manufacturing operations.

The company received from stockholders, merchandise and other creditors, subscriptions to capital stock at par amounting to $12,778,825, to five per cent convertible bonds at par amounting to $3,586,000, and to four, five, six and fifteen-year notes $1,392,150, making a total of new capital raised at par by the sale of stock and securities of $17,756,975.

Your officials estimate that the plants of the company have an annual output capacity of $50,000,000, and that the cash capital provided as above is ample for conducting a business of that magnitude.

Under the provisions of the convertible bond indenture, the company is required to provide a sinking fund of $500,000 annually and to invest the same in its convertible bonds. Since the termination of the receivership, the company has turned into the sinking fund $1,500,000, covering the requirements up to the end of the present calendar year. This sum was invested in convertible bonds yielding a profit of $105,478.76.

While there has been a decided improvement in the business of the company since the beginning of the year, it has not yet nearly reached normal proportions, although the outlook and inquiries indicate that in the near future the full capacity of your various works will be required to meet the demand.

You have an efficient staff of officials who have shown their loyalty to their company under trying circumstances, and the board takes this occasion to expressly commend them for the valuable services they have rendered in preserving the property of the company to its stockholders.

In view of the fact that the company is entering upon a new period and that so many circulars and statements were sent to the stockholders during the period of the readjustment of the debt of the company, it has not been deemed necessary to go into the details of the business of the company at greater length in this report.

CONSOLIDATED GENERAL BALANCE SHEET, MARCH 31, 1909, OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY AND SUBSIDIARY MANUFACTURING COMPANIES IN THE UNITED STATES.

Assets.

Property and Plant:		
Factory plants, including real estate, machinery, equipment, etc.		$14,578,389.62
Sinking Fund:		
With trustee for redemption of convertible sinking fund, 5 per cent, gold bonds		48,234.38
Investments:		
Stocks, bonds, debentures and collateral trust notes of other companies, including affiliated European and Canadian Westinghouse companies		29,844,288.62
Current Assets:		
Cash	$10,297,934.52	
Cash—Special deposit	1,535,120.00	
Cash on deposit to pay bond coupons	24,040.00	
Notes receivable	3,650,999.10	
Accounts receivable	6,951,790.09	
Due from subscribers to capital stock	1,166,280.19	
Total current assets		23,626,163.90
Working and Trading Assets:		
Raw materials and supplies, finished parts and machines, work in progress, goods on consignment and apparatus with customers		9,961,182.32
Other Assets:		
Charters, franchises, patents, insurance and taxes paid in advance, etc		6,827,212.10
Total assets		$84,885,470.94

Liabilities.

Capital Stock:		
Preferred	$ 3,998,700.00	
Assenting	36,636,125.00	
Non-assenting	600.00	
Total capital stock		$40,635,425.00
Funded Debt:		
Convertible sinking fund, 5 per cent, gold bonds, due January 1, 1931	$20,532,251.75	
Debenture certificates, 5 per cent, due July 1, 1913	1,969,000.00	
Total funded debt		22,501,251.75
Collateral Notes:		
Six per cent collateral notes, due August 1, 1910	6,000,000.00	
Five per cent collateral notes, due October 1, 1917	2,702,702.70	
Total collateral notes		8,702,702.70
Four, Five, Six and Fifteen Year 5 Per Cent Notes:		
Issued under readjustment plan		1,392,150.00
Subscription:		
To capital stock of Societe Electrique Westinghouse De Russie		347,500.00
Current Liabilities:		
Notes payable	$ 125,000.00	
Accounts payable	1,168,790.66	
Interest, taxes, wages and rebates accrued, not due	481,681.93	
Total current liabilities		1,775,472.59
Reserve:		
For inactive materials and supplies, adjustments of production orders and accounts receivable		550,634.21
Profit and Loss:		
Surplus		8,980,334.69
Total liabilities		$84,885,470.94

Note.—The company has a contingent liability, as guarantor, of $850,000 bonds, of the Walker Company, due 1916, secured by mortgage on the property and plant of the Walker Foundry Company, Cleveland, Ohio.

CONSOLIDATED STATEMENT OF INCOME AND PROFIT AND LOSS FOR YEAR ENDED MARCH 31, 1909.

Gross Earnings:		
Shipments billed		$20,606,592.04
Cost of Shipments:		
Factory costs, including all expenditures for patterns, dies, new small tools and other betterments and extensions; also inventory adjustments and all selling, administration, general and development expenses		19,955,808.51
Net manufacturing profits		$ 650,783.53
Other Income:		
Interest and discount	$362,383.85	
Dividends and interest on sundry stocks and bonds owned	782,315.75	
Miscellaneous—royalties, etc.	170,775.52	
		1,315,475.12
Total income		$ 1,966,258.65
Deductions from Income:		
Interest on bonds and debentures	$ 1,056,807.95	
Interest on collateral notes	496,515.19	
Miscellaneous interest	647,448.17	
Property and plant depreciations charged against income	513,316.14	
Miscellaneous	170,854.11	
		2,884,941.56
Net income, deficit.		$ 918,682.91
Profit and Loss Credits:		
Profit and loss—surplus, March 31, 1908	$11,972,996.49	
Profit on bonds purchased and retired through sinking fund	105,478.76	
Miscellaneous	27,994.33	
		12,106,469.58
Gross surplus		$11,187,786.67
Profit and Loss Charges:		
Compensation and expenses of receivers and attorneys: Expenses in connection with adjustment of debt; depreciation of patents; proportion of discount on bond issues of previous years written off; reserve for possible losses on accounts receivable and inactive machines and parts, and other items appertaining to prior years or of an extraordinary nature		2,207,451.98
Surplus, March 31, 1909, per balance sheet		$ 8,980,334.69

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LONDON UNDERGROUND.

The Underground Electric Railways of London report earnings for the week ended July 17, and for two weeks ended July 17, 1909, compared as follows:

	1909.	1908.
Bakerloo	£ 3,105	£ 3,150
Picadilly	5,430	5,405
Hampstead	3,350	3,280
District	10,136	9,530
Tramways	6,631	6,968
Total	£29,152	£28,333
Two weeks:		
Bakerloo	6,470	6,240
Piccadilly	11,105	10,825
Hampstead	7,840	6,585
District	20,484	18,952
Tramways	13,619	14,606
Total	£59,518	£57,248

ELMIRA WATER, LIGHT AND RAILROAD.

The report of the Elmira (N. Y.) Water, Light and Railroad Company for the quarter ended March 31, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$51,477	$53,301
Total railway operating expense.	37,954	40,100
Net railway operating revenue.	$13,523	$13,200
Net revenue from outside oper..	65,367	47,117
Total net rev. from operation.	$78,890	$60,318
Taxes accrued	8,350	6,090
Operating income	$70,540	$54,228
Total deduc. from gross income.	53,383	46,976
Net corporate income	$17,156	$ 7,251

FORT WAYNE & WABASH VALLEY.

The report of the Fort Wayne & Wabash Traction Company for the month of June and six months ended June 30 compares as follows:

	1909.	1908.
June gross	$115,981	$110,035
Expenses	70,688	65,442
June net	$ 45,293	$ 44,593
Six months gross	643,655	615,200
Expenses	390,835	360,594
Six months net	$257,820	$254,606

MASSACHUSETTS ELECTRIC.

The report of the Massachusetts Electric Companies for the quarter and nine months ended June 30, 1909, compares as follows:

	1909.	1908.
April 1 to June 30:		
Gross	$2,040,177	$1,993,216
Expenses	1,322,978	1,212,081
Net	$ 717,199	$ 781,135
Charges and taxes	458,477	466,191
Surplus	$ 258,721	$ 314,943
October 1 to June 30:		
Gross	$5,425,967	$5,325,463
Expenses	3,858,671	3,659,865
Net	$1,567,296	$1,665,598
Charges and taxes	1,346,070	1,366,944
Surplus	$ 221,226	$ 298,654

NORFOLK & PORTSMOUTH TRACTION.

The report of the Norfolk & Portsmouth Traction Company for the month of June and six months ended June 30, 1909, compares as follows:

	1909.	1908.
June gross	$164,511	*$164,526
Expenses	97,269	98,622
June net	$ 67,242	$ 65,904
Six months gross	$923,527	*$875,619
Expenses	547,490	547,535
Six months net	$367,037	$328,084

*Includes gross earnings of Norfolk County Ferries, which averaged about $17,000 per month. Ferry lease expired April 1, 1909, and assumed by other interest.

RIO DE JANEIRO TRAMWAY.

The report of the Rio de Janeiro Tramway, Light and Power Company for the month of June and six months ended June 30, 1909, compares as follows:

	1909.	1908.
June gross	$ 625,793	$ 576,203
Expenses	367,099	369,555
June net	$ 258,694	$ 206,648
Six months gross	3,635,879	3,339,915
Expenses	2,240,048	2,103,609
Six months net	$1,395,831	$1,236,306

UNITED RAILWAYS OF SAN FRANCISCO.

The report of the United Railways of San Francisco for the month of June and six months ended June 30 compares as follows:

	1909.	1908.
June gross	$ 597,484	$ 551,193
Expenses	344,800	347,037
June net	$ 252,684	$ 204,156
Six months gross	3,568,904	3,341,452
Expenses	2,085,333	2,209,116
Six months net	$1,483,571	$1,132,336

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of June and six months ended June 30 compares as follows:

	1909.	1908.
June gross	$ 593,101	$ 553,500
Expenses	260,881	270,018
June net	$ 332,220	$ 283,482
Charges, tax and preferred dividends	140,251	128,250
June surplus	$ 191,969	$ 155,232
Six months gross	3,250,066	2,982,849
Expenses	1,622,482	1,535,589
Six months net	$1,627,584	$1,447,260
Charges, tax and preferred dividends	827,758	749,428
Six months surplus	$ 799,826	$ 697,832

The company has completed its construction work for the season, having expended $1,000,000, and has maintained its property at the usual high rate. This year the principal needs were in St. Paul. In Minneapolis new paving was laid in accordance with an arrangement with the city, for several miles. One hundred new cars were turned out from the company's shops. The fourth interurban line was attained through the construction of a mile of track through the Fort Snelling reservation, thus connecting Minneapolis and St. Paul. The three older interurban lines were well kept up.

DETROIT STREET RAILWAY COMPANY.

The report of the Detroit United Railway Company for the month of June and six months ended June 30 compares as follows:

	1909.	1908.
June gross	$ 698,485	$ 635,792
Expenses	423,826	*384,191
June net	$ 274,659	$ 251,601
Other income	12,171	4,665
Total income	$ 286,830	$ 256,266
Charges and taxes	156,997	137,179
June surplus	$ 129,833	$ 119,087
Six months gross	3,639,058	3,285,428
Expenses	2,251,359	*2,110,307
Six months net	$1,387,699	$1,175,121
Other income	71,079	28,609
Total income	$1,458,778	$1,203,730
Charges and taxes	926,334	812,973
Six months surplus	$ 532,444	$ 390,757

*Includes taxes.

INTERBOROUGH RAPID TRANSIT.

Preliminary figures of the earnings of the Interborough Rapid Transit Company for the fiscal year ended June 30 have been made up, and show that the period was an exceptionally profitable one for the company. Its returns, derived from the operation of the subway and the Manhattan Elevated, were equal to 13.11 per cent on the $35,000,000 of Interborough Rapid Transit Company stock.

The progressive character of earnings, increasing month by month through the year, is well displayed by the fact that thus far in July gross earnings exceed those of the same month a year ago by $246,748, promising a new high record. This is the company's annual income account:

	June 30, 1909.	June 30, 1908.	Inc. P. C.
Gross earnings.	$25,775,392.44	$24,059,299.40	7.13
Gross income..	16,412,592.97	14,556,775.29	12.75
Fixed charges..	7,622,769.85	6,656,115.93	14.52
Net income....	8,789,823.12	7,900,659.36	11.25

To this total the subway contributed gross $11,917,313, an increase of $1,896,774 over last year, and net $7,369,692, a gain of $1,772,468. The Manhattan Elevated itself not only earned the full amount of the guarantee of $4,200,000, which the Interborough has to pay upon its lease of the property, but over and above this obtained $579,537. The figures of the Manhattan make it clear, the company holds, that further express service upon its lines is essential to any large gain in its income, for it was lack of facility for such enlarged service upon the Manhattan which threw over to the subway an express business which very largely accounted for the gain of almost $2,000,000 in the gross of the subway division.

For the fiscal year which closed with June the elevated and the subway in conjunction report 514,680,000 passengers, as against 483,285,000 in 1908. The daily average this year is 1,410,000.

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The Tariff on Carbons.

TO THE EDITOR:

Dear Sir: In your issue of July 24, in the article on the tariff and its relation to the electrical industry, that regarding the tariff on carbons, I find that your Washington correspondent, also the Senate and Conference committee, seem to use quite uncontrollable figures.

Now, we wish you would do some figuring yourself, in order to satisfy yourself about the situation. You know that the present rate is ninety cents per 100 carbons, or $9 a thousand carbons. Let us take as an example the most used, one-half-inch by twelve inches, which is imported in double length (twenty-four inches). One thousand carbons of single length cost accordingly $4.50 duty.

According to the Senate bill, this duty for 1,000 carbons would be $6.50 (sixty-five cents per 100 feet). You have, therefore, $4.50 of the present rate against $6.50 of the proposed rate.

The increase is around forty-five per cent.

You may make a similar computation for flame carbons, and we wish to say, in order to give as correct as possible figures, that the majority of flame carbons which are imported and will be imported, are 600 millimetres long.

With these data, you will be able to figure that the flame carbon will have to stand an increase of about forty per cent in case the Senate has its way in burdening all carbons composed chiefly of lampblack or retort carbon, with sixty-five cents per 100 feet.

The effect of the increase in duty simply means absolute control of the carbon trust; the importer is actually driven out of business, and the public as well as the dealer are at the mercy of the monopoly. The development of the electric-lighting field, especially that of flaming-arc lamps, which aroused such a rapidly increasing desire for more light, is to be crippled, as the domestic carbon is bound to prove disastrous to the lamp mechanism.

You know how things are interconnected today, and how such radical changes in economical conditions influence a series of different industries; there must come serious reactions to such an immense change of policy.

K. A. ALBRECHT.

Milwaukee, Wis.

Hudson Tunnel Service.

Regular train service through the Hudson tunnels was instituted August 2.

Outlook in the Tungsten Mines.

Advices from Boulder, Colo., state that not since the financial depression has the outlook for the tungsten industry been so promising as at present. Plans are being made for extensive improvements in milling facilities, with other arrangements which will lead to an activity only equaled when the county was producing at the rate of $750,000 worth of the black metal per annum.

Announcement from Washington that the tariff bill provides for a fifteen per cent duty on the ore, twenty-five per cent on the metal or ferro-tungsten, and thirty-five per cent on manufactured steel, has greatly encouraged the operators, particularly owners of small mines, and after the water, which is now giving great trouble in the smaller mines, subsides, it is predicted that there will be more men working than at any time during the last eighteen months.

At a meeting of the Primos Company, one of the largest operators in the field, held at Boulder the latter part of July, the building of a mill on the Boulder County ranch was authorized. This is to be one of the most complete and up-to-date tungsten mills in the world. The company is one of the largest refiners and dealers in the country and owns some of the most valuable tungsten claims in that part of Colorado, now turning out some thirty tons of concentrates monthly, worth about $10,000.

The Wolf Tongue Company, at Nederland, is another large operator and is contemplating important improvements in the mill, which will increase its capacity and saving. This is a custom mill and the company is the principal buyer of ores around Boulder at this time. Its product is used by the Firth Stirling Steel Company, of McKeesport, Pa., and Washington, D. C.

Electric Fans Popular in the Philippines.

In 1898 there were only two electric desk fans in Manila. In fact, the Spanish concern that furnished the current was opposed to their use, but an energetic American came into the field and successfully pushed the sale of electric fans and appliances.

The company then took up their installation, and today, in Manila, Cebu, and Iloilo, there are many hundreds of these aids to comfort, their efficiency having ousted the old-fashioned "punkah," which is still so common in India.

Transportation Engineer for New York Public Service Commission.

The Civil Service Commission having created the position of transportation engineer, the New York Public Service Commission announced on July 29 the appointment of E. G. Connette to that office. His salary will be $8,000 per annum.

Mr. Connette is now general manager of the Worcester (Mass.) Consolidated Street Railway Company and of the subsidiary companies, with a total mileage of 273 miles. Prior to that he was vice-president and general manager of the Syracuse Rapid Transit Railway Company. Before that he served in various positions in the engineering and transportation offices of steam railroads until 1890, when he became superintendent and afterward general manager of the United Electric Railway, of Nashville, Tenn., and was in charge of the electrification of the lines of that company, which was the fifth road in the United States to be electrically equipped.

Traction Action Upheld.

Supreme Court Justice Hendrick has overruled a demurrer interposed by Adrian H. Joline and Douglas Robinson, as receivers of the Metropolitan Street Railway, in the suit brought against them by the People of the State of New York through the attorney-general, who sought to recover a judgment for $7,000, being a penalty of $100 a day for not having, on or before September 30, 1908, made or filed the annual report of the operations of the road for the year ended June 30, 1908.

The defendants contended that the complaint did not contain sufficient facts to constitute a cause for action, maintaining that no penalties have accrued because no statute requires the filing of an annual report. After citing that part of the Public Service Commission's act bearing on the question, Justice Hendrick said he thought it provided for the filing of such a report, independent of the railroad law.

Interborough-Rapid Transit.

Judge Lacombe, in the United States Circuit Court, has signed an order limiting the time for taking of testimony for the Interborough Rapid Transit Company, defendant in an action brought by the Sundh Electric Company, until September 15. This action is for alleged infringements of patents for electrical controller and has been standing in the Federal courts since July, 1908.

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QUESTIONS AND ANSWERS.

USE OF ALTERNATING CURRENT ON DIRECT-CURRENT FAN MOTORS.—Kindly tell me whether it is possible to change the windings on a small direct-current fan-motor armature, in order to use alternating current? The armature has thirteen slots and there is available single-phase, sixty-cycle, 110-volt current.—S. A. J., Charleston, S. C.

It is not advisable to attempt to use alternating current on a motor of the description given unless it is particularly designed for alternating current. This is on account of the vicious sparking that will result when alternating current is supplied. One essential in overcoming this and other troubles is that all of the magnetic circuit of the motor, that is, all of the iron, be laminated. This is not usually the case in direct-current motors, so that it will be better to purchase a motor built for alternating-current service.

MAGNETIZING A DYNAMO FIELD.—In some recent experiments of mine I must have demagnetized the small one-half-horsepower dynamo that I used, and I could not start it up again. The wires seemed to be intact. What would you recommend?—F. M., Johnstown, Pa.

A complete demagnetization of the dynamo field is unusual, but when it does happen it is a very simple matter to remagnetize it. If the field circuit is intact all that is necessary is to apply a very feeble current to the field terminals. For example, a number of dry cells connected in series would supply sufficient current to magnetize the field partly, and if the machine is started up at this time the dynamo will unquestionably begin to generate some voltage.

USE OF ARC FOR CUTTING STEEL.—I have heard that an arc can be used to cut steel plates or other material of that nature. How is this done and what advantage is there in it?—B. A. F., Springfield, Ill.

The use of an arc for cutting steel plates and columns has been found very advantageous in rapidly clearing wreckage, particularly a steel-constructed building that has collapsed. Other uses for this method are in cutting the ends of steel piling. The manner of carrying this out is very simple. One side of the circuit is connected by a wire or cable to the steel that is to be worked upon. The connection should preferably be by means of a bolt. The other side of the circuit is connected to a carbon electrode. This should be of at least one inch in diameter and should be securely clamped to the terminal of the cable leading to the circuit. The operator should wear an asbestos mask and gloves to protect himself from the heat. In the mask there should be double black-glass goggles to protect the eyes from the glare of the arc. It is desirable not to use a pressure exceeding fifty volts on this circuit. The advantage of this method is that it permits of a very rapid clearing away of any tangled mass of wreckage and at a very low cost.

LOAD FACTOR.—What is meant by the term "load factor?" Why is so much importance given to this matter?—E. H. H., Chicago, Ill.

The term "load factor" is used in a number of different ways. Generally, however, it signifies the ratio of the average current consumption, in a plant or installation, to the maximum consumption, within any definite period. The average is almost invariably considered to be the total energy in kilowatt-hours divided by a number of hours in the period under construction. The maximum consumption is figured sometimes from the sum of the rated capacity of the apparatus connected in the plant; more commonly, the maximum is taken as the actual maximum current, registered by a maximum-demand indicator. A load factor may be considered for a day, for a month, or for a year. The importance of the load factor is its relation to the cost of supplying the energy. Where this ratio of average to maximum load, that is, the load factor, is very low it seems that there is necessary an investment in machinery to supply this maximum demand whenever it develops. When the load factor is large the machinery is utilized for a large per cent of the time, and, therefore, the item of investment becomes of less importance. In central stations where there is a high load factor, the cost of production is materially less than in one which has a low load factor. Now, when what are called the fixed or investment charges are properly taken into account, the importance of the load factor is being more fully appreciated.

SINGLE-PHASE OR THREE-PHASE MOTORS.—In laying out a system for a small town is it better to use single-phase or a three-phase current? I am told that three-phase motors are much better. Is it advisable on this account to put in a three-phase system instead of the simpler single-phase?—J. S. C., Cedar Rapids, Iowa.

Three-phase motors are much to be preferred in place of single-phase motors for the larger sizes. The three-phase motor is a simpler machine than the single-phase, and it has decidedly better starting ability than the latter; therefore, if the system is likely to have in the future a considerable number of large motors, say, exceeding five horsepower, it would be better to install the three-phase system. If the community is small and there is likely to be but small demand for motors in excess of this size in comparison with the demand for the smaller machines, it will be better to use the single-phase system. The three-phase system will not be found very much more complicated than the single-phase, and in view of the possibility of development in any community, particularly due to the location of manufacturing industries using electric drive, it will be well to consider the three-phase system as the preferable one.

Spirits?

In a recent letter to the editor of *Nature*, Sir Oliver Lodge, the distinguished English physicist, proposes an ingenious explanation for the occasional mysterious ringing of house bells. This was suggested by an observation sent him by a correspondent to the effect that during a thunderstorm drops of water leaking through the ceiling assumed a pear shape and jumped nine inches, almost horizontally, to the curtain rings above the window. This phenomenon might account for the occasional ringing of non-electric bells in the following manner—to use Sir Oliver's own words: "I picture the process as follows: The bell wires collect atmospheric electricity, by induction or otherwise, which the walls are insufficiently conducting to carry off freely; consequently the bells get charged, are attracted to a neighboring wall or pipe, and released suddenly by a spark. This little lateral jerk rings the bell. I put the simple suggestion on record because I sometimes hear of an inclination to attribute the phenomenon to less familiar causes."

General Electric Company to Improve Plants.

Improvements to the plants of the General Electric Company calling for an outlay of $100,000, are being started, and the company is advertising for help in Rochester, Syracuse, New Haven and other centers. This seems to indicate a return to better business conditions.

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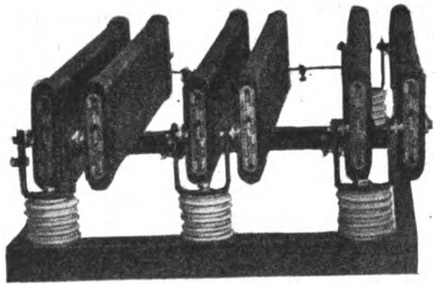
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

A CLASS OF ELECTRIC WAVE-DETECTORS BASED ON THERMO-ELECTRIC PHENOMENA.

During researches on detectors consisting of bodies in imperfect contact, Lieut. C. Tissot studied a detector consisting of a metallic point resting on a piece of copper pyrites. A detector of this kind behaves at first sight like an auto-decoherer of indifferent sensitiveness, when it is connected in the circuit of a battery and telephone; but it was found that it possesses the peculiar property of receiving signals even without the battery. Electrolytic detectors have the same property, and in their case it is explained by a polarization which gives rise to a dissimilarity of the electrodes. In the case of the metallic point and copper pyrites electrodes, however, the explanation was looked for in the production of an electromotive-force due to a thermo-electric effect at the point of contact. The author demonstrated the correctness of his theory by numerous experiments and made a methodic study of bodies of different thermo-electric powers. It may be assumed that, in order to produce an appreciable electromotive-force, the contact surface must be as small as possible so as to localize the electrical energy generated, and one is thus led to make the bodies forming the detector rest on each other on points or edges. It was also found that the sensitiveness varied with changes in pressure at the contact point. The least sensitive coherers were those with the lowest contact resistance. This is natural, for a low-resistance contact is at a disadvantage in a ventral region of tension, but it must work well in a ventral region of current. This hypothesis was also verified. In general, therefore, thermo-electric detectors should be placed in a ventral region of current. The advantages of such detectors are that they operate without auxiliary battery and that they may be used either in a ventral region of tension or of current by varying the contact resistance; furthermore, they are sensitive to the total effect of the oscillations and not to the amplitude of potential, like most auto-decoherers. This latter property makes them particularly suitable for obtaining syntonic effects and for use in wireless telephony. Lieutenant Tissot has received messages transmitted from the Eiffel Tower and from battleships in the Mediterranean to Brest with detectors of this kind.—*Translated and abstracted from La Revue Electrique (Paris), June 30.*

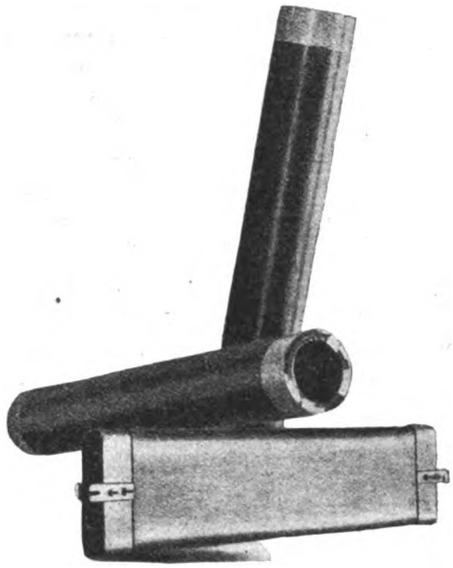
MEIROWSKY HIGH-TENSION CONDENSERS.

It is an admitted fact that many difficulties in the application of alternating currents could be easily overcome by inserting a capacity in the circuit at the proper place. In spite of this, the condenser is not extensively employed in practice, and the reason for this is that so far it has not been possibile to manufacture such apparatus of a given capacity cheaply, of small dimension and sufficiently strong to be reliable in operation. The firm of Meirowsky and Company



CONDENSER BATTERY OF PLATE-SHAPED ELEMENTS.

seems to have developed a process that will overcome these obstacles. Several years ago this firm patented a machine originally intended for manufacturing tube-shaped insulating bodies of paper, but which is also excellently suited for the manufacture of condensers. The operation of the machine is as follows: Prepared paper is passed over heated plates to a winding arbor, which rests under heavy pressure against two rotating cylinders that are also heated. The high heat takes all moisture from the paper and the great pressure removes the air from the layers in winding. The finished tubes are so solid that they may be worked like wood. In order to make condensers with the same machine, tinfoil sheets of suitable size are laid as smoothly as possible on the prepared paper while it is moving over the heated plates, and are then wound together with the paper. The length of the tinfoil sheets is chosen so that they will reach once around the circumference of the winding arbor with respect to the direction of movement. Their width is made a fraction of that of the paper, so that there remains a margin bearing a proper relation to the operating tension that is to be applied. The tinfoil sheets receive leading-out strips alternately on the right and left. The result is a tube-shaped condenser, in which the metallic sheets



TUBE AND PLATE-SHAPED ELEMENTS FOR HIGH-TENSION CONDENSER.

are perfectly enclosed on all sides. It is well known that the tubular form of condenser is best adapted to prevent rim discharges. The tubes may also be pressed into plates, which occupy less room. Condensers for any desired tension may be easily manufactured by increasing the successive layers of paper at will, in which case the distance between the sheets of tinfoil is made a multiple of the circumference of the winding arbor.—*Translated and abstracted from Elektrotechnische Zeitschrift (Berlin), July 1.*

A REGISTERING COMPASS.

A record of the exact route traversed by a vessel is frequently of the greatest importance. The object of the apparatus described by M. Heit in a note to the French Academy of Science is to record automatically all the evolutions of a ship and to furnish a means of controlling

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them. The mechanism is simple and consists of three chief parts—the compass, the registering organs and the recording apparatus. The compass comprises a wooden column containing the collector for the electric currents which transmit the indications of the compass to the recorder. This column is surmounted by a copper dome in order to protect the basin containing the rose and its magnetic needle. The movements of the compass are registered periodically by an arrangement which does not at all interfere with the play of this delicate device, and the periodical indications of the compass are recorded on a sheet of paper unrolled with constant speed by clockwork. The paper sheet passes between the teeth of two metallic combs. Each pair of teeth is in connection with one of the insulated segments of the limb transmitting the movements of the compass. A contact between a stylus, the rose and the transmitting limb closes the circuit of a small induction coil and a spark passes between those two teeth of the comb that are in connection with the segment touched by the rose, and the paper ribbon is thus perforated. This simple arrangement makes it possible to produce a faithful record of the vessel's maneuvers as well as of its general direction. A record of this kind is of great importance for placing the responsibility in case of accidents.—*Translated and abstracted from L'Industrie Electrique (Paris), July 10.*

CAUSES OF ERROR IN ELECTRICAL MEASURING INSTRUMENTS.

The sources of error in electrical measuring instruments are as numerous as they are various, but a definite kind of error is inherent to each type, says J. F. van Lonkhuyzen. In the construction and manufacture of measuring instruments an effort must therefore be made to take all sources of error into account and to remove their influence or make it as small as possible. Some firms are more successful in this respect than others. But besides these known causes of error there are others that are difficult to avoid on account of their occasional occurrence, and it is these that are dealt with. The glass cover of a measuring apparatus may be easily electrified by friction and will then affect the position of the indicating needle. The extent of the effect depends chiefly on the degree of atmospheric moisture and the material producing the friction, its duration and the nature of the glass; it depends only in a small measure on the insulation of the needle from the ground. The sensitiveness of the instrument to these influences is the greater, the smaller the force directing the needle, the greater the length of the needle and the smaller the distance between the same and the glass. By a single stroke with chamois leather the author has produced variations of one to five per cent in the indications of standard as well as switchboard instruments. In a hot room it was even possible to produce variations of ten to twenty per cent from correct indications by friction with the dry hand. It requires from ten minutes to one hour for the needle to return to its true position; in any case frequently long enough to cause incorrect indications when graduating or controlling instruments. Particularly in the process of manufacture disagreeable consequences may thus arise. The best expedient for safely preventing all disturbances by an electrical charge of the glass is to breathe on it before making a measurement. Also in other ways static charges may frequently give rise to incorrect indications, as for instance when an instrument is connected to the secondary of a measuring transformer which is insulated from the ground. It is easily possible that the winding of the system will assume a different potential than that of the casing, and entirely erroneous deflections will be shown. For this reason it is always best to ground the instrument and secondary windings of measuring transformers. It is probable that in practice a great many more errors are produced by the latter cause than by a static charge of the glass cover, which usually disappears in a comparatively short time.—*Translated and abstracted from Elektrotechnische Zeitschrift (Berlin), July 8.*

RESEARCHES ON THE NEW HOPFELT INCANDESCENT LAMP.

Exhaustive tests of the Hopfelt lamp have been made by U. Bordoni. This lamp was described in the issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for November 21, 1908. It consists of a U-shaped carbon filament in a glass tube of the same form containing a drop of mercury, the glass tube in turn being enclosed in a bulb like those of ordinary incandescent lamps. The light of the lamp increases gradually during the first few minutes of its operation. After having experimentally studied the value of the light as well as the process taking place during the initial period, the author discusses various hypotheses by which the detail of the working of the lamp might be explained. He arrives at the conclusion that the phenomenon is probably one of luminescence of the carbon filament. The lamp is at present of limited value and its importance resides in this phenomenon, for it is possible that the lamp constitutes the first step in a new direction. The author shows how the phenomenon of luminescence might be explained on the basis of the kinetic theory of electrical conductivity.—*Translated and abstracted from Atti della Societa Elettrotecnica Italiana (Milan), March-April.*

FAIR CHARGES FOR ELECTRIC SUPPLY.

While practical engineering is necessarily a question of finance at all times, probably never before has the profession of electrical engineering been so much absorbed in monetary considerations. For the public services of traction and supply, plant and apparatus have become standardized at least to such an extent that there are no important developments in prospect. For the time being the only questions of general interest are commercial and financial. Yet it is a somewhat academic point whether new customers of an electric-supply undertaking should pay such a price as will cover capital charges in respect of obsolete plant. The price of electricity, like most other things, is what it will bring. Consequently, if desirable business presents itself, the undertaking should not lose opportunities merely because it has in the past accumulated a burden of unremunerative capital. On the other hand, older customers are obviously entitled to the benefit of the new price; but if their claim is conceded the revenue account must show a loss. The question becomes more complicated when there is an electric-railway load. In numerous towns plant has been laid down especially to supply the electric railways, and it is fair that the price of current should represent the capital cost thus incurred until there has been reasonable time to provide for its redemption.—*Abstracted from the Times (London) Engineering Supplement, July 21.*

Independent Telephone Companies Plan Merger.

A meeting of the long-distance independent telephone companies in western Pennsylvania, Ohio and West Virginia was held last week, and plans for the merger of the companies in these states were considered.

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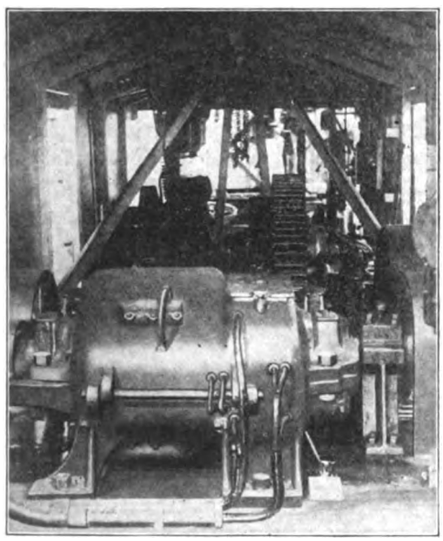
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Two Giant Electrically-Driven Power Shovels.

The largest electrically operated power shovels ever constructed, having buckets of four cubic yards capacity, and equipped with Westinghouse motors and automatic control, have recently been placed in the service of the Dolese & Shepard Company, of Chicago, for mining rock in its limestone quarries.

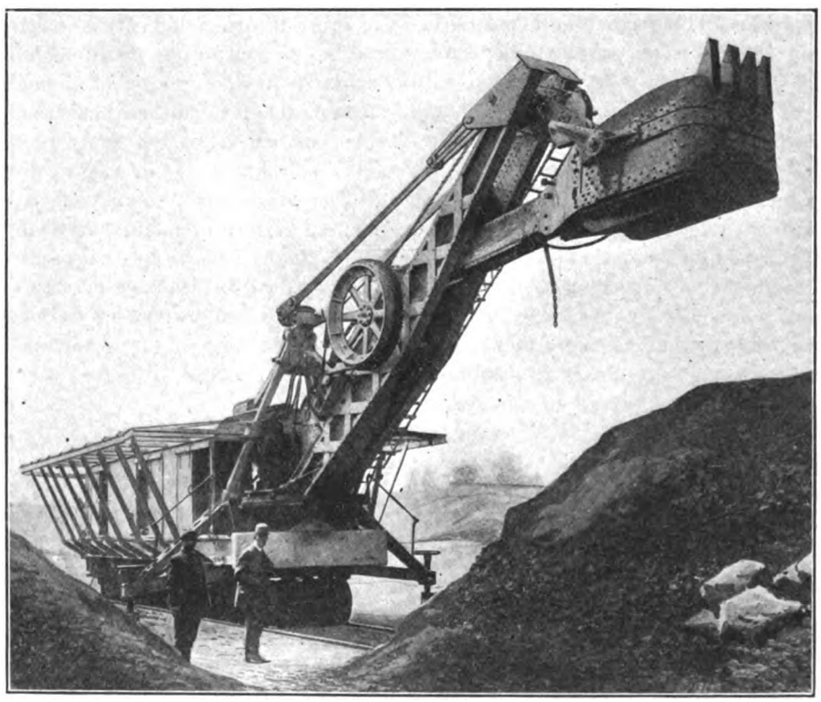
The hoist movement of these two 110-ton machines is actuated by a 200-horsepower, 220-volt, series-wound, direct-current, Westinghouse type M. T. mill motor running at 415 revolutions per minute; the thrust motor, controlling the movement of the dipper handle, is an eighty-horsepower machine of similar type, while the swing boom is operated by an eighty-horsepower motor.



200-HORSEPOWER HOIST MOTOR OF ELECTRIC POWER SHOVEL.

Each of these powerful motors is controlled independently by Westinghouse type "A," automatic, magnetic-switch controllers, which secure the greatest nicety of operation of the heavy bucket. This form of control protects the motors from any heavy overloads which may result from the bucket striking solid rock or other obstruction, by opening switches to introduce resistance into the motor circuit. The control panels and resistances are mounted in the rear of the cab, while the controller handles are conveniently placed under the hand of the operators.

The hoist and swing-boom motors are mounted within the car, as shown in one of the accompanying illustrations, which shows the installation of the 200-horsepower hoist motor in the foreground. The thrust motor is placed out on the boom, communicating its motion to the bucket staff through reducing gearing connected to a pinion engaging a rack on the staff. The power circuit to the shovel is completed through a feed cable, carried on a retractile reel on the shovel-cab, and through the rails on which the shovel advances. The shovel may also be fitted with a standard trolley for deriving power and for propulsion on ordinary electrified track. The machine may then attain a speed of five miles an hour.



THE LARGEST ELECTRICALLY-DRIVEN POWER SHOVEL, IN THE SERVICE OF THE DOLESE & SHEPARD COMPANY, CHICAGO.

Compared with the steam shovel, the electric-driven excavating apparatus has been found to present marked advantages of simplicity, economy and ease of operation. The hauling of water and coal is avoided, fewer operators are required to handle the machine, and a considerable saving of time is noted. For example, the cost of operating a certain electric shovel with seventy-five-horsepower hoist, thirty-horsepower thrust and fifty-horsepower swing-boom is $0.0164 per cubic yard of gravel, clay and sand, while similar work performed by steam shovels would cost from three to four cents per cubic yard.

A Unique Boiler and Stoker Equipment.

A single boiler of unusual capacity, 2,274 horsepower, has been placed in the Delray power station of the Detroit Edison Company. This boiler, a "Stirling Special," has a grate measuring twelve-and-a-half by eleven feet, and is served with bituminous coal by four Roney stokers installed underneath the one boiler. This exceptional installation is in the first section of the Detroit Edison Company's No. 2 power house at Delray, and in the construction of the plant allowance has been made for extending the outfit with similar units as the station's lighting load increases. George W. Cate is superintendent of the plant. The engineering design and construction was carried out by Westinghouse, Church, Kerr & Company.

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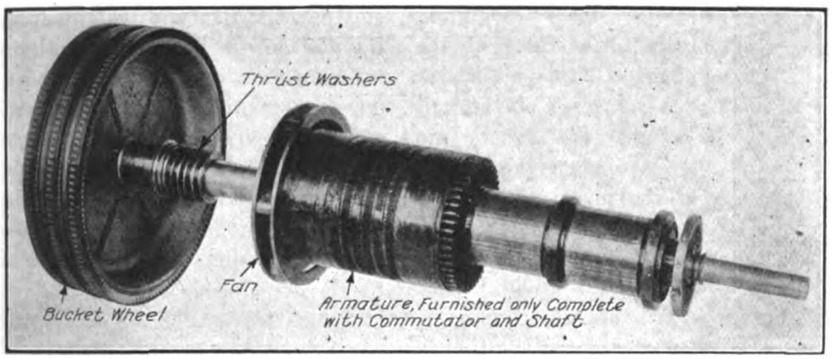
Turbo-Generator Sets for Train Lighting.

The accompanying illustrations show the turbo-generator set which has been successfully adopted as standard by the Chicago, Burlington & Quincy Railroad on its suburban service between Chicago and Aurora, Ill., a distance of about forty miles.



REVOLVING ELEMENT OF THE TWENTY-KILOWATT CURTIS TURBINE GENERATOR SET, LOCOMOTIVE TYPE.

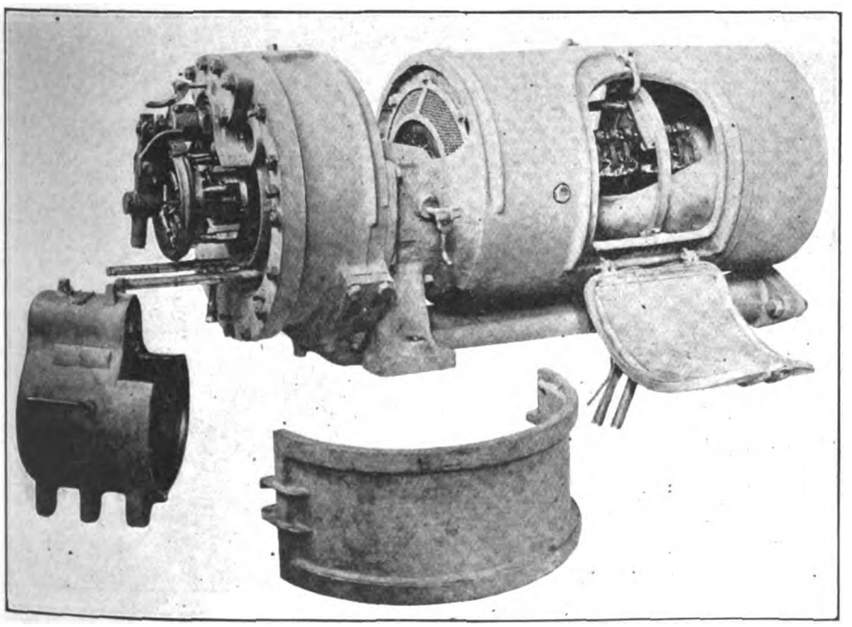
The generator set is mounted on the locomotive, with the turbine end toward the cab. It is rated at twenty kilowatts and consists of a horizontal Curtis steam turbine direct-coupled to a two-pole, 110-volt, direct-current dynamo. As may be seen from the illustration, the whole machine is entirely cased in with iron and is both waterproof and steam-proof. The steam is taken direct from the boiler through a governor to the turbine, which runs at 4,500 revolutions per minute. The total weight is 2,300 pounds, the over-all length is five feet six inches, the height two feet eight inches, and the width one foot eleven inches.

The generator set is controlled from the locomotive cab, where there is a marble panel on which are mounted a voltmeter and a rheostat, the latter being used for varying the resistance in the dynamo circuit to accommodate a variable number of cars in the train. The usual number of cars to a train is nine, in addition to the headlight and the lamps in the locomotive cab. Each of the cars is lighted by twenty-one sixteen-candlepower incandescent lamps; the locomotive headlight is a fifty-candlepower carbon lamp, and there are four lamps in the cab.

Gibbs connectors are used throughout the length of the train on the dynamo circuit; no storage batteries are used, and no other means of illumination are provided, thus placing entire reliance on the turbo-generator set.

The turbo-generator set, which is made by the General Electric Company, Schenectady, N. Y., is extremely efficient and economical in operation, and firemen say that they notice practically no difference in firing a locomotive with the generator set on it, as compared with one which is without it.

C. B. Young, mechanical engineer of the Burlington, states unequivocally that this is the best and simplest train-lighting system for suburban service.



TWENTY-KILOWATT CURTIS TURBINE GENERATOR SET, LOCOMOTIVE TYPE, WITH PARTS OF THE CASING DISASSEMBLED.

Acheson Graphite Company's Hydro-Electric Plant.

The International Acheson Graphite Company is enlarging the output capacity of its branch works in Niagara Falls, Ontario.

This company has long operated a Canadian branch with facilities far in excess of the demands of the Canadian trade. It recognizes, however, in the hydroelectric development, now so active throughout the Dominion, and the new trade spirit and energy everywhere present throughout Canada, an indication of additional industrial enterprise, and it is to meet the prospective demand for its product, that it is increasing the size and output capacity of its existing plant in Niagara Falls, Ontario, Canada.

A new furnace room, providing for a 1,000-horsepower unit, is being built, and on completion the new furnace installation will be placed in operation. This will be an important aid in the development of Canadian resources, particularly now that so much attention is being paid to new processes, which mean much for the future of the Dominion. Especially is this true of electrometallurgy and electrochemistry, the product of the enlarged works of the International Acheson Graphite Company at Niagara Falls placing all such industries in close touch with a ready supply of electrodes.

It may be noted that the International Acheson Graphite Company is the only maker of artificial graphite in the world. The Acheson graphite is made in the electric furnace. All other graphite is mined.

The Westinghouse Magnetic Brake.

A recent order of the London (Eng.) County Council to equip the 200 electric cars recently ordered, with Westinghouse magnetic brakes, says *The Tramway and Railway World* (London), may be taken as standardizing the magnetic brake for London cars. All the cars of the London County Council are now provided with this brake, which, so the motormen say, enables the cars to be run safely at higher speeds than when they were equipped only with hand brakes.

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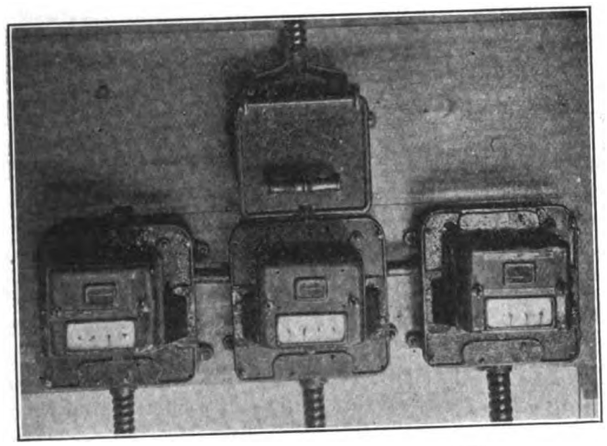
The Hemere Combined Meter Panel and Cut-Out.

The Hemere specialties, now being introduced by William Charnley, agent, 59 Leonard Street, New York city, have to do particularly with the installation of electric meters on consumers' premises, in such manner that tampering is impossible and the theft of current an unlikely possibility.



HEMERE COMBINED METER PANEL.

Reference to the accompanying illustration shows the device to consist essentially of two parts, viz., the No. 1 unit occupying the center position, consisting of the main service cut-out below and the meter panel above; on either side are No. 2 units, these being additive, depending on the number of meters in the installation.

An examination of the interior will reveal the service entering from below and passing through a fused main cut-out; then up and connecting with a two or three-wire bus line running through the boxes horizontally, each meter being connected to the bus through a fused branch block, the removal of these fuses allowing the cutting out of any particular consumer without interfering with the others.

The meter connections, where they pass from the panel, in and out of the meter, are protected by metal hoods, blanked apertures being left at top and bottom of the face of the panel to accommodate other types of meters than that shown.

Above each meter is seen the connection to the proper main block, controlling the individual installation. Not a wire is visible.

The fastening of the meter, hoods, etc., is done from the inner side of the cover of the meter panel, this being, in turn, held in place by sealed wing nuts, at diagonal corners of the box, thus insuring absolute protection against tampering.

It is claimed for this device that it positively enables the central-station management to make its meter installations uniform, as practically all of the work may be done in the meter department, under the close supervision of the man in charge, there remaining little to be done at the premises other than to put the panels on the wall so that the meters are level, connect the service to the main cut-out and connect the leads from the top of the panels to the respective main blocks.

All this may be done by unskilled labor and, when done, there is no doubt as to the work meeting the requirements of the municipal and fire-insurance authorities.

Motor-Driven Wire-Testing Machines.

The latest improved tensile-testing machine for wire tests is that developed by Tinius Olsen and Company, Philadelphia, manufacturers of testing apparatus. The machine, illustrated herewith, consists virtually of two separate mechanisms, performing the straining and the weighing functions, respectively. The straining mechanism consists of a crosshead drawn by four screws, providing a steady, straight motion. As the screws do not rotate, all moving parts are enclosed below the base cover. The straining nuts in the base are of comparatively great length to insure a large wearing surface and consequent durability. The crosshead is driven in its vertical travel by a one-third-horsepower, type R, Westinghouse motor, various speeds being obtained by change-gearing, friction drives and motor regulation. The machine is equipped with a dial vernier screw beam, long column, and counterbalance-wedge grip for holding the wire. This type of machine is made in sizes up to 20,000 pounds; 30,000 to 60,000 pounds for strand tests, and 100,000 to 600,000 pounds for rope tests.

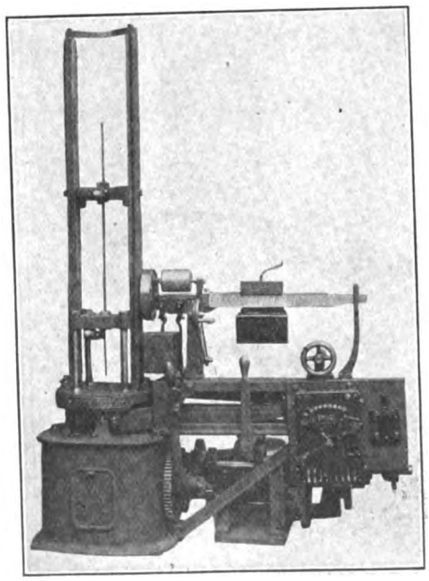


FIG. 1.—WIRE TENSILE-TESTING MACHINE.

The Moore wire-tester, shown in an accompanying illustration, is used to apply a bending strain to the wire while under a tensile stress. The wire to be tested is gripped at either end and a stress of one-quarter the tensile strength of the wire is applied; meanwhile one of the pair of grips, connected to a swinging arc, bends the wire backward and forward through an arc of ninety degrees around the bending jaws, which are curved to a radius equal to the diameter of the wire tested. This machine, which has been found especially useful in the tempering shops of wire-cable and rope manufacturers, is motor-driven, and applies the bending action until the wire breaks. It is obvious that the wire which will bend the greatest number of times without rupture is the best for rope-manufacturing purposes. The Westinghouse motor drive of this machine secures convenience and accuracy to a degree not attainable in the hand-driven tester.

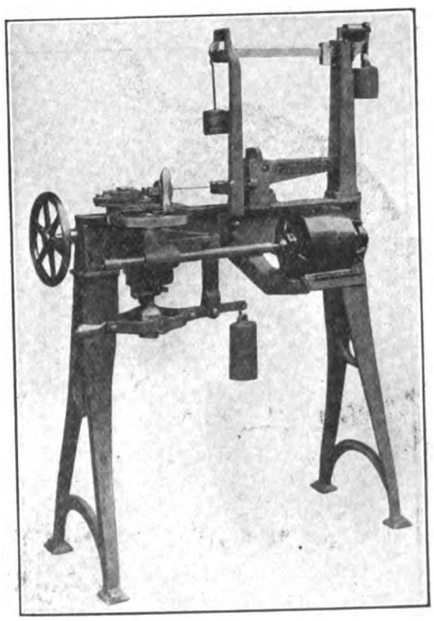


FIG. 2.—MOORE WIRE TESTER APPLYING BENDING STRAIN TO WIRE UNDER TENSILE TEST.

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The Roebling Exhibit at the Alaska-Yukon-Pacific Exposition.

A notable feature of the Alaska-Yukon-Pacific Exposition at Seattle, is a comprehensive exhibit in Machinery Hall of different kinds and sizes of wire and wire products made by John A. Roebling's Sons Company.

The changes undergone by metals in the production of wire are shown by a display in regular order of iron ore, pig iron, ingots, steel billets, rolled rods and drawn wire, the samples of wire beginning with the coarser sizes and running down to a diameter of one-thousandth of an inch.

In contrast with the delicate films of wire, there are displayed many samples of large wire ropes and full-size sections of the supporting cables of the Brooklyn Bridge, the Williamsburg Bridge and Manhattan Bridge, in all of which Roebling wire is used.

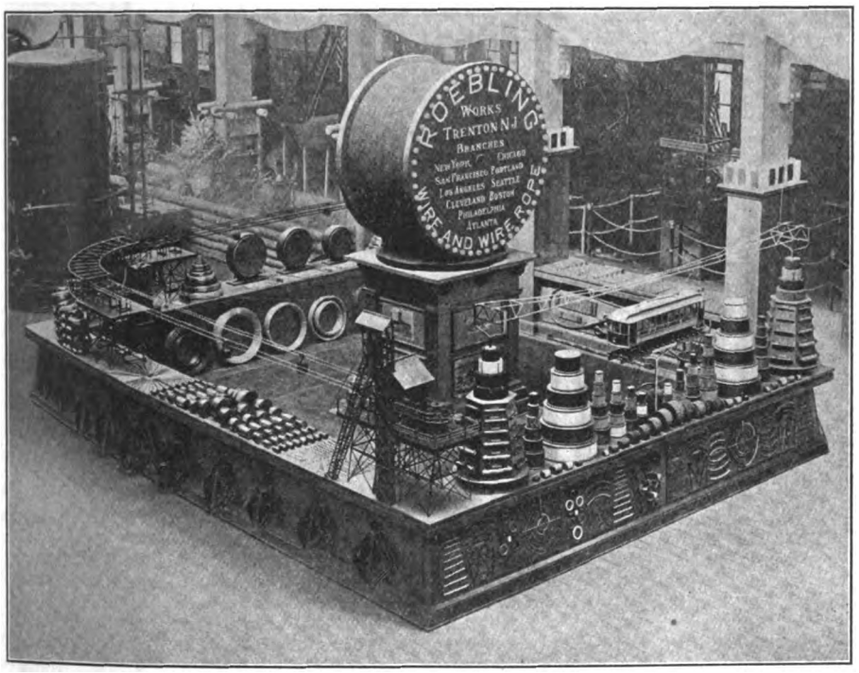
There is a complete exhibit of electrical wires and cables, ranging from the finest magnet wire to the largest lead-covered cables.

Different sections of trolley wire are also shown, while catenary construction is graphically illustrated by a model overhead span with a miniature trolley car beneath.

A reel of wire rope seven feet in diameter and mounted upon a pedestal seven feet high, occupies the center space of the exhibit. An even hundred electric lights with frosted globes are placed around the circumference of two sides of the reel, which revolves continuously upon its pedestal.

A model tramway which transports miniature buckets, loaded with shot, is also shown in motion, both the reel and tramway being electrically operated.

The exhibit was planned by the engineering department of the Roebling Company and all the mechanical work necessary to prepare it ready for installation was done at the company's works.



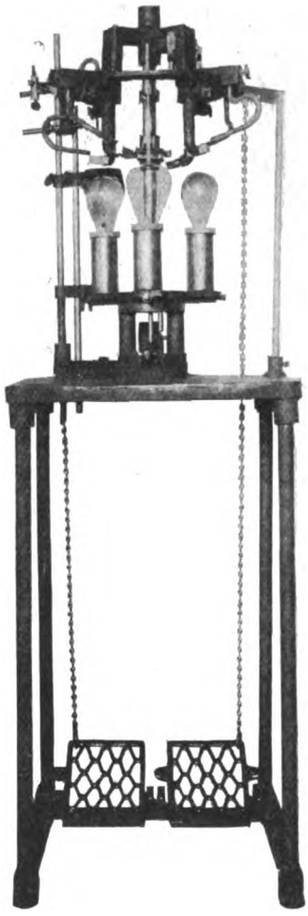
ROEBLING EXHIBIT AT THE ALASKA-YUKON-PACIFIC EXPOSITION.

The Dwyer Tubing Machine.

The machine herewith illustrated, which is manufactured by the Dwyer Machine Company, Lynn, Mass., is offered as an improvement in incandescent lamp-tubing machines.

This machine performs both the operations of perforating and tubulating, and is one of a series of new models of lamp-making machines the makers are putting on the market.

The bulbs are placed in rubber bushings on a rotating table and the turning of this table carries the bulb from one operation to the next, thus saving considerable time. An important feature of the perforating part is that the bulb is accurately centered as the flame strikes the glass. As soon as the bulb is perforated the releasing of a foot treadle moves the fire away from the glass and thus saves the rubber bushing from the heat. The machine is mounted on an iron table to which are attached the necessary foot treadles, and it is recommended that the machine always be set up in this manner.



DWYER ROTARY TUBING MACHINE.

$25,000,000 Cement Merger.

Announcement has been made that plans have been completed for the consolidation in one company of all the cement companies in Canada.

The new company will include all the principal cement manufacturing companies in Canada, and the consolidated company, which will be known as the Canadian Consolidated Cement Company, will have a capitalization of $25,000,000. Application has been made to Ottawa for a charter for the company. The organization and underwriting arrangements are in charge of Rodolphe Forget.

More Electrical Projects in Brazil.

A new company, composed of Americans and Brazilians, is negotiating for a franchise to operate a line of street cars in Santos, to be constructed up Monte Serrate and to the beach. The greatest difficulty in the project seems to be in obtaining motor power from the City Improvement Company and the Dock Company.

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The C.M.B. Continuous-Current Rotary Converter.

A new rotary converter for continuous current, with the important additional feature that the secondary pressure can be automatically regulated for specific purposes, has been invented by J. C. Macfarlane and H. Burge, two English engineers.

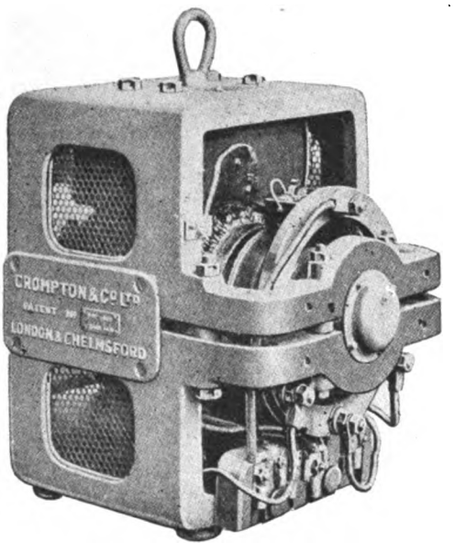


FIG. 1.—GENERAL VIEW OF THE C.M.B. AUTO-CONVERTER.

This machine, which is manufactured by the firm of Crompton & Company, Ltd., of London and Chelmsford, Eng., under the name of the C.M.B (Crompton, Macfarlane, and Burge) "auto-converter," is especially suitable for reducing supply voltages for the economical working of low-voltage metallic-filament and cinematograph arc lamps, for battery-charging, gun-fire, and navy-telephone circuits, for balancing three-wire circuits, and for the control of electric vehicles, mine hoisting machinery, rolling mills, printing machinery, etc.

The Crompton company recently gave a special demonstration of the C.M.B. machine before representatives of the English technical press. We are indebted chiefly to the London *Electrician* for the following particulars and diagrams:

As will be seen from Fig. 2, the C.M.B auto-converter consists (in its simplest form) of a ring-wound armature with a single commutator, and a two-pole field system divided into two parts. Being provided with ball bearings, it will run for lengthy periods without special attention, while it occupies much less space than a motor-generator. The machine is free from vibration and runs practically silently and sparklessly. The voltage reduction is controlled by the arrangement of the two independent magnetic circuits and also by the position of the secondary pair of brushes relatively to the armature winding. The commutator is of large diameter and the positions of the carbon brushes are fixed by the pressure transformation required, no further adjustment then being necessary.

The most striking feature of the machine is its extremely high efficiency, to which are added the advantages of low cost, simplicity of construction, small weight, and small floor space required. With a thirty-kilowatt machine an efficiency of ninety-two per cent is guaranteed at full load, and eighty-eight per cent at half load, while with a fifty-kilowatt machine an efficiency of ninety-four per cent has been obtained. Even a one-kilowatt set, which is intended mainly for use with metallic-filament lamps, shows an efficiency of seventy-five per cent at full load, and sixty-five per cent at half load.

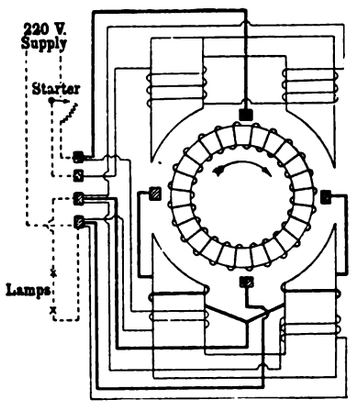


FIG. 2.—DIAGRAM OF CONNECTIONS OF C.M.B. AUTO-CONVERTER.

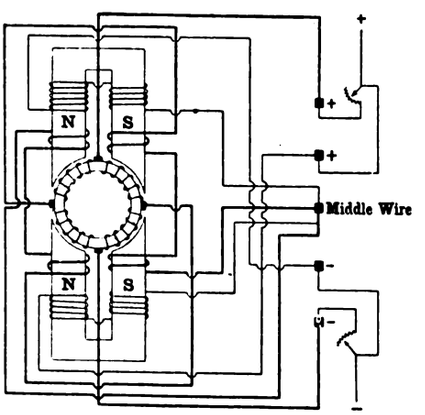
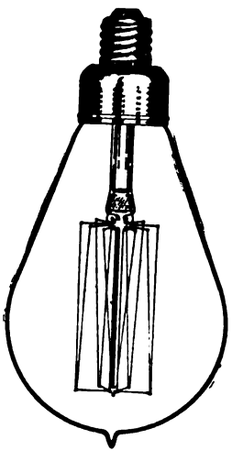


FIG. 3.—DIAGRAM OF CONNECTIONS OF C.M.B. MACHINE USED AS A BALANCER.

Although at first sight the machine would appear to be somewhat opposed to existing theories of design, there is no doubt as to the results which are obtained, both as regards sparkless and quiet running and efficiency.

The C.M.B. auto-converter, it may be pointed out, is not intended for use by small consumers with metallic-filament lamps, but rather for shops where a large number of lamps are required, and these practically for the same length of time. In such cases the machine would be run only at times of considerable load, and any lamps required to be used throughout the day would be connected direct to the supply mains.

We hope to publish in a later issue an account of the application of the C.M.B. auto-converter to a (patented) system of control for electric vehicles.



NEW 150-WATT TUNGSTEN.

The New 150-Watt Tungsten.

The General Electric Company has just listed a new 100 to 125-volt tungsten lamp. It is rated at 150 watts and supplied in three-and-three-eighths-inch pear-shaped bulb.

The lamp is designed to supply an intermediate unit between the 100-watt and the 250-watt types. Many central stations desire this lamp to replace gas arcs, for which the 100-watt lamp is too small and the 250-watt too large.

This new lamp has all the well-known and excellent characteristics of the General Electric's tungsten lamp—the same reliable method of mounting and the special anchoring support for the filament, which insures a maximum of mechanical strength and ability to withstand usage and permitting its satisfactory operation in any position.

International Congress on Mining and Metallurgy.

The next international congress of mining and metallurgy is announced to be held in June, 1910, at Dusseldorf, Prussia. The last congress was at Liége, Belgium, in 1905.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JULY 25.—The event of the week has been the passage, through the House of Commons committee stage, of the Electric Lighting Acts (Amendment) Bill, the result of which has been the withdrawal of much of the opposition of the electric supply companies. The object of the bill, as has been previously explained, endows the Board of Trade with wider powers in dealing with electrical undertakings, which will have the effect of cheapening the cost of securing Parliamentary powers for carrying on such undertakings. The bill also removes certain further difficulties which have been experienced in connection with the working of the Electric Lighting Acts. One of the most important provisions in the bill from the point of view of municipalities owning electricity undertakings, was that permitting them to hire out fittings, etc., and to borrow money for the purpose of wiring consumers' premises. When the bill was before the House of Lords an amendment was inserted stipulating that, although municipalities might borrow money for these purposes, all the work must be given to contractors; the object, of course, being to prevent competition between the corporation and the wiring contractors, who were also ratepayers. The House of Commons, however, somewhat ruthlessly cut out this amendment, and it may be that the further passage of the bill will be imperiled unless negotiations can be opened up with the Lords to get them to agree. The position is somewhat anomalous, inasmuch as no less than seventy-five municipalities have already obtained these powers in private Acts of Parliament, and it seems somewhat illogical to deprive others of them. There is, however, another side to the argument, but for the present the National Electrical Contractors' Association, who were instrumental in securing the passing of the amendment in the Lords, have the worst of the agreement. For the rest, the bill makes one law for all, so to speak, to the extent that general powers are made to apply to the whole of the electrical industry, which hitherto have been the subject of piecemeal and expensive legislation in private Acts of Parliament, and have had the effect of giving one supply authority an advantage over another.

The annual accounts of the London County Council Tramways to March 31 show a surplus of receipts over working expenses of £645,762. After meeting capital charges, there is a net surplus of £107,570, the whole of which is carried to reserve for renewals fund.

Arrangements have been made between the London County Council and the various London tube railway companies for the Chief Fire Office of the Council to annually inspect the fire appliances on the railways, in view of the fires which took place last year. This is really a precautionary measure to allay public excitement.

Some striking examples are coming to light of the reduction in revenue of electric supply undertakings due to the use of metal-filament lamps. At Sheffield the bill of the Town Hall lighting has been reduced by practically fifty per cent, while at Bristol the saving in one case was as much as sixty-seven per cent. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, JULY 24.—An aerial cableway is now in operation in the neighborhood of San Sebastian, Spain, which presents some novel features, this being the second cableway of the kind to be installed on the Continent, after the Wetterhorn incline in Switzerland. Like the former one, it is electrically operated by a motor-driven cable drum placed in the upper station. The present line runs upon the height of Mont Ulia, a much-frequented point, and starts from the terminus of an electric tramway which climbs up a part of the slope. The cableway has a short length of 920 feet, and is designed to reach the elevated point known as Peña del Aguila. It has a difference of level of ninety-three metres. In the present case the Torres system is used, and there is a carriage which rolls upon a set of three stretched cables at each side. From the carriage is suspended the fourteen-place passenger car. The tractive cable attached to the carriage passes to the upper station and is wound upon a drum, this latter being driven by an electric motor. The current comes from the station which supplies the electric tramway line. About 13,600 passengers were carried on the new cableway in 1908.

We note the recent decease of M. Henri de Parville, who was well known in scientific circles at Paris and was connected with the journal "La Nature," in which he held one of the chief positions. He left all his fortune, amounting to $70,000, to the Académie des Sciences, in order to found two prizes, which are to be awarded annually, the first of these for mechanical sciences and the second for popular scientific publications.

An interesting performance in the way of wireless messages was made when the international fleet was stationed near Constantinople during the recent events. The French battleship "Victor Hugo" was designated to communicate with the center of Europe, as it was found to have the longest range. It could send messages from Constantinople to the battleship "Patrie," the latter lying near Toulon, over a distance of 1,190 miles, and a straight line connecting the two is found to pass over the Balkan Peninsula and Italy, being for the most part on land. The antenna used on the vessels is of the standard 100-foot height, and the apparatus is of the new Carpenter-Gaiffe-Rochefort type. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, AUGUST 2.—By-laws, granting aid to the Dunnville, Welland & Beamsville Electric Railway have been carried in the Ontario townships of Moulton and Gainsboro. The Canadian trade agent in Japan reports to the department here that a large company of English and Japanese financiers has been formed to carry through a gigantic hydroelectric scheme in Japan. The company, he states, is to be incorporated under Canadian law. A rumor, which has been current to the effect that the Canadian General Electric Company was about to be taken over by the American General Electric Company, has been given an unqualified denial by the general manager of the Canadian company. The Central Ontario Power Company has reduced the price of Burleigh Falls power rights to the city of Peterboro, Ont., from $125,000 to $120,000. The City Council has decided to have an engineer's report upon the power before proceeding further. Representatives of the Ontario municipalities of Brampton, Acton, Milton and Georgetown, recently waited on the Ontario Hydro-Electric Commission and proposed to form a power union to take power from the commission. They propose to have a common receiving station, from where power will be distributed among the towns forming the union. The Dominion government has made a formal request to the government of Ontario to state the reasons why the hydroelectric power legislation, passed by the Ontario Legislature last session, should not be disallowed as a result of petitions against such legislation received by the former government.

Contracts to the value of $82,700 for the construction of two transformer stations have been signed by the hydroelectric commission. The stations, which are the subject of the contracts, are the proposed step-up transformer station at Niagara Falls, at which the power delivered from the generating companies will be stepped up for transmission to the various municipalities under the provincial government's electric-power scheme, and the transformer and interswitching station which is to be erected at Dundas, Ont. John Hayman & Sons, of London, Ont., were the successful tenderers. Tenders for the remaining ten stations have been closed.

Interests connected with one of the leading ice companies of the city of Montreal, and the Montreal Light, Heat and Power Company, are formulating plans for the manufacture of ice on a large scale, which, it is claimed, can be done more cheaply artificially than by taking it out of the St. Lawrence River in the winter time. It is proposed to utilize electricity at such hours as there is a considerable diminution in demand owing to its nonuse for lighting or other manufacturing purposes. The ice will be made from artesian well water.

The recent heaviness in Mexican Power stock is thought to be due to reiterated reports that the company has minimized the loss it sustained through the Necaxa dam disaster. In some quarters there has been a disposition to regard the recent declaration of the usual dividend on the common stock, since the accident to the dam, as evidence that the injury was not important, but there is another consideration which indicates that only in case of extreme necessity would the dividend be passed. Control of Mexican Power is now vested in Mexican Tramways, which, according to that concern's recent annual report, had 84,000 shares of the Mexican Power stock in its treasury. Five per cent on that means a revenue of $336,000 this year to the Mexican Tramways Company, and the Mexican Tramways reports indicate that the money will be needed. Last year, the Mexican Tramways Company earned a little over seven per cent on the stock, and paid out six per cent. By reason of the exchange of Tram stock for Power stock, there are now 48,000 more Tram shares to get dividends this year than last. Unless the Tram Company's

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earnings largely increase over last year, the 5 per cent on Mexican Power stock will be needed to prevent a cut in Tramways dividends.

There are now over twenty wireless telegraph stations in Canada, of which five are situated on the Pacific coast. The latter will shortly be increased by two or three more stations, with the object of giving complete and continuous communication all along the coast between Vancouver and Prince Rupert, B. C. The principal wireless stations on the Atlantic and St. Lawrence are: Cape Race and Cape Ray, on the Newfoundland shore; Belle Isle, Point Amour, Whittle Rocks and Point Rich, in the Gulf of St. Lawrence; Father Point, Heath Point, Fame Point and Clark City, in the River St. Lawrence; Sable Island, Sydney and Pictou, in Nova Scotia, and Partridge Island, in New Brunswick. During 1908, there were received and sent from these stations 13,549 wireless private messages from and to steamers; 13,526 signal service messages and 38,532 messages between government steamers and light stations. Sable Island, off the coast of Nova Scotia, has to its credit the largest number of wireless messages handled during the year. Lying in the route of navigation of the North Atlantic Ocean, this island has long ago earned the significant title of "the graveyard of the Atlantic," its drear expanse of surf-beaten shoals being strewn with the wrecks of scores of ships. Last year, however, no wreck or marine casualty of any kind occurred there, and this unusual immunity from disaster is largely attributed to the utilization of wireless in communicating warning signals to passing ships. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, AUGUST 2.—During the past two weeks an almost inconceivable number of rural and farmers' telephone companies have been incorporated in Alberta and Saskatchewan. The following is a list of some of the most important, with their chief offices or headquarters: Fairview Rural Telephone Company, Regina, Sask.; the Central Rural Telephone Company, Regina, Sask.; the Rose Plain Rural Telephone Company, Regina, Sask.; the Ellisboro Rural Telephone Company, Ellisboro, Sask.; the Farmers' Mutual Telephone Company, Cowley, Alta.

September 1, of this year, is the date set by the courts to hear the application of the town of Kenora, Hudson's Bay Company and Keewatin Power Company re the value of lands expropriated by the town of Kenora for power purposes. The case will be heard at Kenora, Ont.

The British Columbia Electric Street Railway Company is applying for practically the entire flow of the Indian River, near Vancouver, B. C., intending to erect a large auxiliary power plant on Burrard Inlet. The application is for 30,000 miners' inches. R. H. Sperling is general superintendent of the company, with headquarters at Vancouver, B. C.

The contract for the construction of the line for the British Columbia Electric Street Railway Company, between Abbotsford and Miles, B. C., has been awarded to the Puget Sound Dredging and Ditching Company. The last section, viz., between Miles and Chilliwac, has not yet been awarded. This work is in connection with the construction of the company's main line between Chilliwac and New Westminster, B. C., and, it is promised, the line will be completed this year.

The Alameda Telephone Company, Alameda, Sask., has awarded the contract for the construction of the proposed telephone line to M. Misfeldt, of Frobisher, Sask.

That the Ontario government intends to put an end to holding of power leases in the hope of obtaining a purchaser for them is evidenced by the fact that within the last two weeks six power leases, mostly in New Ontario, have been canceled on account of the owners failing to do any development work. The Nipissing Power Company, Ltd., of North Bay, Ont., is constructing a power plant eighteen miles to the south of that city to supply several towns in the vicinity, including North Bay. C. B. Smith, C. E., Toronto and Winnipeg, is president of the company. It is expected power will be delivered to North Bay by December next. The work is being done under the supervision of Smith, Kerry & Chace, civil engineers, Toronto, Ont.

J. S. Bartlemen, Regina, Sask., has received the contract from the Saskatchewan government for the construction of the government telephone line from Prince Albert to Saskatoon. The Fisher Construction Company, Chicago, Ill., is considering the construction of an electric car line from Minot, N. D., to Bosvurvis, Sask. It is understood $150,000 has already been subscribed for the project.

The earnings of the municipal street-railway system owned by the cities of Fort William and Port Arthur, in New Ontario, amounted to $11,455.94 during June, an increase of $1,600 over May. The net earnings for the month were $6,222.27.

Two men were killed by street cars in Winnipeg, Man., on July 24. They were standing on the "devil strip" at a corner waiting for two cars to pass in opposite directions. Investigations made by the coroner showed that on at least eight feet of the curve it is impossible for two cars to pass, the one overlapping the other by about seven inches. When these two men were killed the cars were also damaged. R.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

CHATTANOOGA TRACTION MERGER—Application for a charter has been filed for the Chattanooga Railway and Light Company, comprising the merged corporations of the Chattanooga Railways Company and the Chattanooga Electric Company. The capital stock of the company is placed at $5,000,000.

NEW YORK CONNECTING RAILWAY—The New York Connecting Railway Company has taken title to a strip of land extending from the shore of Astoria, Long Island, through Long Island City to Cabinet Street, the southern line of Trains Meadow, and having frontages on twenty-five thoroughfares. With the last acquisition the company has now purchased a clear right-of-way varying in width from eighty to 150 feet and extending about four-and-three-fourths miles from Astoria to the Glendale section, in the Second Ward of Queens. The total outlay for these holdings is said to have been about $5,000,000. At the last meeting of the directors of the Connecting Railway Company, held at New Haven, the drafting of new plans for the bridge across Ward's Island was considered, and work will soon be in progress on the designing of a structure which will be acceptable to the Municipal Art Commission.

CAROLINA-TENNESSEE COMPANY INCREASES CAPITAL TO $5,000,000—The Carolina-Tennessee Power Company has increased its authorized capital stock from the nominal amount of $250,000 to $5,000,000, and has filed in Cherokee County, North Carolina, a mortgage to the Standard Trust Company of New York, as trustee, to secure an issue of $5,000,000 first-mortgage fifty-year five per cent gold bonds, subject to call on any interest date at 105. The company is preparing to undertake two hydro-electric developments on Hiwasee River, North Carolina, capable of producing 30,000 horsepower. The electricity will be carried thence on its own transmission lines about 100 miles to the works of the Tennessee Copper Company at Ducktown, Tenn., to the cities of Rome, Dalton and Athens, Ga., and other towns in their vicinity. The president of the company is W. L. Church, formerly of Westinghouse, Church, Kerr & Company.

MEXICAN POWER AND IRRIGATION PROJECTS—The Chapala Electric and Irrigation Company, of Guadalajara, Mexico, with a capital stock of $14,000,000, has been organized to take over the waterpower, irrigation and transmission concessions of Manuel Cuesta, of Guadalajara, and the light and power systems and street railway of that city. Fernando Pimental y Fagoaga, of Mexico City, is president of the company, and Emilio Pinxon is general manager. It is stated that Mr. Cuesta, who disposed of his concessions to the new company and is now one of the directors, will do considerable contract work for the company It is planned to reclaim 123,500 acres of land from Lake Chapala by erecting a dike along the eastern end of the lake, from La Palma to Jamay, a distance of twenty-two kilometres. This dike will reduce the area of Lake Chapala from 1,700 to about 1,200 square kilometres. It is estimated to cost about $3,000,000. A contract has been made with the Mexican government for a loan of this amount, to be paid in reclaimed land, at a value of $250 per hectare. According to this, the land to be reclaimed will be worth $12,500,000. The company also intends to reclaim much land by irrigation from Lake Chapala. Mr. Cuesta estimates that fully 494,000 acres of land can be so irrigated. The Mexican government pays a subsidy of $25 per hectare for all land reclaimed by irrigation. The new power plant owned by the company at Tolototlan, twenty miles from Guadalajara, is almost completed. The plant has a capacity of 12,000 horsepower. The company has started on a transmission line between this plant and the mining districts of Etzatlan and Hostotipaquillo. It is estimated that fully 100,000 horsepower can be obtained on the Santiago River under the concessions held. It is planned to transmit this power to mining districts and towns in the states of Zacatecas, Jalisco and Aguascalientes. Water from Lake Chapala can be used to irrigate lands in the states of Guanajuato, Jalisco and Michoacan. D.

LIGHTING AND POWER.

(Special Correspondence.)

MONETT, MO.—The city has voted the issuance of $35,000 in electric-light bonds.

LUBBOCK, TEX.—The Lubbock Light, Ice and Power Company is being incorporated with a capital stock of $25,000.

CLIFTON, TEX.—The Clifton Electric Light and Power Company has been incorporated with a capital stock of $25,000.

HAWTHORNE, CAL.—The Hawthorne Electric and Water Company has been incorporated with a capital stock of $50,000.

MELLEN, WIS.—The Mellen Water and Light Company will make additions and extensions to its plant if granted a fifteen-year contract by the city. C.

BELLINGHAM, WASH.—The Thunder Creek Transportation and Smelting Company has been granted a permit for the erection of a power plant on Thunder Creek at its junction with

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the Skagit River forty miles above Marblemount. The management of the company gives out that construction work will begin this summer.

GRINNELL, IOWA—The Grinnell Electric and Heating Company is expending between $7,000 and $8,000 on the improvement of its plant on Main Street. C.

SAN FRANCISCO, CAL.—The Pacific Gas and Electric Company is planning to extend its transmission line from Marysville through Sutter County to Meridian.

BISHOP, CAL.—The Bishop Creek Mining and Milling Company has placed an order for upward of $5,000 worth of electrical equipment for the Bishop Creek mine.

TOLEDO, ORE.—H. L. Collins, A. C. Smith and J. F. Stewart have been granted a franchise for an electric lighting plant in this city. Construction work will begin at once.

GLENDALE, CAL.—The City Council has passed an ordinance providing for the issuing of bonds to the amount of $60,000 for the construction of electric-light works.

SEATTLE, WASH.—Bids are being received by the Board of Public Works for furnishing, painting, setting and equipping 6,500 poles for the lighting department in this city.

SAN MARCOS, TEX.—The San Marcos Utilities Company has been chartered, with a capital stock of $200,000, to maintain mills, gins, manufacture ice, gas and electric lights.

GILBOA, N. Y.—The Gilboa Electric Light, Heat and Power Company has been incorporated, with a capital of $25,000, by E. E. Billings, E. S. Persons and S. Rivenberg, Gilboa.

ESCONDIDO, CAL.—The City Council will on September 14 sell to the highest bidder an electric-lighting franchise, as per an application filed by Seth Hartley, of Colton, Cal., last week.

VALLEJO, CAL.—Manager Albert Casper, of the Vallejo Electric Light and Power Company, reports that the company is preparing to make considerable extensions in its distributing system.

LOS ANGELES, CAL.—The City Council has ordered $10,000 set aside from the city funds during the next two years to cover the preliminary cost of establishing power plants along the Owens River Aqueduct.

PACHUCA, MEX.—The Compania Electria y Irrigadora, of Hidalgo, is preparing to install a power plant at Tetepango, at a cost of about $2,000,000. The plans are to have the plant in operation in about one year.

LOS ANGELES, CAL.—The Board of Supervisors has passed a resolution calling an election for August 10 in the East Hollywood and Florence sections of the county, to vote on the establishing of a lighting district.

EUGENE, ORE.—Sealed proposals are being received by the mayor for the furnishing of materials and for the construction of a fifteen-mile electric transmission line to connect the city's power plant on the McKenzie River with the city.

CARTHAGE, N. Y.—The Oswegatchie Hydraulic Power Company has been incorporated to manufacture and sell electricity, but not for public purposes, with a capital of $100,000. The incorporators are M. S. Wilder, M. C. Wilder, F. P. Wilder, Carthage.

JACKSON, CAL.—The Crystal Water Power Company, recently organized, has bought all the rights of the Oleto Canal and Power Company, including ditches and water rights on the Cosumnes River and Dry Creek and 320 acres of land, for $40,000.

KILLINGLY, CONN.—The Killingly Power Company, recently chartered by the Legislature, has acquired four water privileges in East Killingly. One of the plans under consideration is the generation of power for some of the electric railways in eastern Connecticut.

DAYTON, WASH.—The Starbuck Electric Company has been incorporated here by E. A. Bryan, Hattie Bryan and A. W. Bryan with a capital stock of $25,000. The new company has bought the plant of the Starbuck Light and Power Company, and will make a number of additions to the plant.

SPOKANE, WASH.—The Washington Water Power Company of this city has secured a franchise for a lighting system in the town of Odessa, Wash. A transmission line will be run to Odessa from the company's Harrington-Sprague line, a distance of about twenty miles. The entire cost of the transmission line and the distribution line will be about $50,000.

NIAGARA FALLS, N. Y.—Sunday afternoon, July 25, while a new 16,000-horsepower turbine in station No. 3 of the Niagara Falls Hydraulic Power and Manufacturing Company was running at a pressure of about seventy-five pounds, the casing burst, flooding the station with water and injuring the operator and an assistant, who at the time were studying the cause of the leak they had discovered. The casing of the wheel has four parts, and it was the smallest one that gave out. It is intimated the accident was due to a defect in the casting. This is the second of the 10,000-horsepower wheels in this station to burst, but the damage of Sunday was not so great as on the occasion of the previous trouble. The wheel had been run at a pressure up to about 140 pounds, and so was moving at comparatively low pressure when the break came.

LUCKY BOY, NEV.—An electric-power plant, costing in the neighborhood of $25,000, is in projection for the purpose of supplying power and light for the camp of Lucky Boy, Nev., and the towns of Hawthorne, Aurora and Masonic. Hon. T. L. Oddie, of Oldfield, is interested in the enterprise. Also Johnnie Miller, J. E. Adams and Ed Haller, of Lucky Boy. U.

KLAMATH FALLS, ORE.—Moore Bros., of this place, are planning to put in a power plant on the Klamath River, at a cost of $75,000, and to extend a transmission line through Butte Valley to furnish power for light and for pumping for irrigation. The towns of Dorris, Macdoel and Mt. Hebron will be lighted. A franchise has just been applied for at Dorris.

LITTLE ROCK, ARK.—The Pike County Water Power Company, of Little Rock, Ark., proposes to build a hydroelectric plant on the Little Missouri River, near Murfreesboro, Ark. The company plans to expend about $500,000 and expects to be able to develop about 10,000 horsepower. The Fuller-Coult Company, Chemical Building, St. Louis, Mo., have been retained as engineers.

FRESNO, CAL.—The Fresno Power Company has recorded deeds from George A. and F. H. Knight to the Fresno Power Company to a power site at the junction of Dinky Creek and the North Fork of the Kings River, to a water right to 30,000 inches in the North Fork of Kings River, to a water right to 50,000 inches in Kings River above the junction with the North Fork, and the rights of way for ditches, etc.

TACOMA, WASH.—Frank C. Kelsey, engineer in charge of the proposed municipal power plant on the Nisqually River, announces that the plans have been changed so that 30,000 horsepower, instead of 20,000 horsepower, as originally intended, will be developed. The plant will require a dam forty-five feet high and forty-five feet at the base. A station will be erected at South C and Twenty-fifth streets, in Tacoma. The total cost of the plant and distributing system is estimated at $2,000,000.

SPARTANBURG, S. C.—Fuller details of the entrance of the Southern Power Company into this city show that the company also proposes to take in Greenville, S. C., and that the power from Ninety-nine Islands will largely supply these cities. Outside this power plant, all of the company's developments are located on the Catawba River. As soon as this development is completed, it is the purpose to proceed immediately with the development of the waterpower at Wateree Shoals. It is said that the company will have branch offices at Spartanburg and Columbia. L.

BURWELL, NEB.—The Burwell Irrigation, Power and Canal Company, a corporation of $40,000, owning a canal thirteen miles long near Burwell, Neb., with a carrying capacity of 100 cubic inches of water per second, will repair and enlarge the canal to use the water for irrigation and generating electric power. An eighty-foot fall is secured. The corporation will be changed to the Loup River Power Company, with headquarters at Ord, Neb., and the capital stock increased to $100,000. The Towle Engineering Company, of Omaha, Neb., will have charge of the engineering work.

NORWICH, CONN.—The Rockville-Willimantic Lighting Company has taken over the Willimantic and Stafford Springs Railway Company. The Rockville-Willimantic Company now controls the electric-light and power business in the towns of Windham and Vernon, including the cities of Willimantic and Rockville, also in the towns of Stafford and Ellington, and upon completion of a pole line from the Uncas Power Company's plant at Scotland station clear through to Stafford Springs it will be in a position to do business in the towns of Mansfield, Coventry and Willington. In addition to the electric-light and power plants it has gas plants in Willimantic and Rockville.

NEW CARLISLE, IND.—The town of New Carlisle, Ind., has closed a contract with the South Shore Route, Chicago, Lake Shore & South Bend Railway, for the supply of electric current for the term of twenty-five years. Until now the town has operated its own electric-light plant, direct current, thirty-five kilowatts, 220 volts, in connection with its waterworks. The current was furnished for five hours in the evenings and on dark mornings in winter time. After running for about three years the capacity of the generator and boilers became exhausted, which made the change necessary. The town will be furnished with current, single-phase, twenty-five cycles, 110-220 volts, from 4:30 p. m. until 1:30 a. m. Series tungsten street lighting will probably be installed. It is hoped that the supply of day current will do much toward an industrial development of this town, which is favorably located on the Lake Shore & Michigan Southern Railroad, the Chicago, Lake Shore & South Bend and the Northern Indiana Electric railways.

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ELECTRIC RAILWAYS.

(Special Correspondence.)

MERRILL, WIS.—The Merrill Railroad and Light Company will shortly commence repairing its railroad at an expense of $25,000. C.

CLAREMONT, CAL.—The City Council will receive bids till August 23 for a fifty-year franchise for an electric-railway franchise in this city.

WAUSAU, WIS.—Construction work on the new interurban line from Nekoosa to Grand Rapids, in which a number of Wausau men are interested as the principal financiers, has been started.

WALLA WALLA, WASH.—The Walla Walla Traction Company is expected to begin work very soon on improvements at this place, which will total $125,000, including $50,000 for a substation here.

NORTH BEND, ORE.—J. R. Smith, secretary of the Coos Bay, Oregon & Idaho Railroad Company, is preparing to ask for a franchise in this place for an electric and steam-railway company and for terminal facilities.

PITTSBURG, PA.—An order for twenty interurban cars has been placed with the G. C. Kuhlman Car Company, of Cleveland, by the Pittsburg Railways Company. These cars will have baggage and smoking compartments.

DES MOINES, IOWA—It is expected that construction work on the interurban road to Sioux City will be started this fall. M. H. Miller, vice-president of the road, states that $3,000,000 bonds will be taken by Boston parties. C.

SHEBOYGAN, WIS.—The Sheboygan, Light, Power and Railway Company is to give its motormen and conductors a percentage of the fares collected. This plan has been successfully carried out by the interurban line in Plymouth, Wis. C.

DES MOINES, IOWA—The Red Oak and Northeastern Promotion Company, which is promoting the construction of the Des Moines and Red Oak interurban road, has plans for 106 miles of road through Montgomery, Cass and Adair counties. C.

FT. WAYNE, IND.—The strike on the Toledo & Chicago interurban road, which began July 18, has been declared off, and cars are again running between this city and Kendallville. Farmers and gardeners tossed their hats for joy when the cars began running again. S.

FT. WAYNE, IND.—The Lake Shore Railroad Company is preparing to test the operation of gasoline motor cars on its road between this city and Buffalo. Considerable interest is attached to the coming trial, and if successful other roads will be inclined to adopt them. S.

SAN FRANCISCO, CAL.—The Presidio & Ferries Electric Railway Company of this city has filed a certificate of the creation of a bonded indebtedness of $300,000, the proceeds of which are now available. The money will be spent for new equipment and for the betterment of the roadbed.

CARLISLE, PA.—The Barnitz and Pine Road Telephone Company is the latest rural telephone company in this section to connect with the American Union Company's exchange. The officers of the new company are: President, S. J. Frehn; secretary and treasurer, J. W. M. Craighead.

ALBANY, N. Y.—The Hornell-Bath Railway Company, formed to operate an electric road from Hornell to Bath, twenty-four miles, has been incorporated with a capital of $250,000. The directors include Charles Adsit, C. H. Armsted and John M. Finch, of Hornell, and J. F. Turk, of Hammondsport.

SAN FRANCISCO, CAL.—The Parkside Transit Company of this city has filed a deed to the San Francisco Electric Railways Company of its electric street-railway company in the Sunset district and all its other properties. The purchaser is under the same ownership as the United Railroads of San Francisco.

TRENTON, N. J.—A certificate of incorporation has been granted to the Railway Building and Operating Company, Camden, with a capital of $125,000. The incorporators are: C. Taylor Leland, C. W. Rambo and William B. Macdonald. The company is to construct railroads, telephone and telegraph lines, etc.

MOUNT JOY, PA.—Work has been completed on the new trolley line between Parkesburg and Christiana, making possible uninterrupted street-car travel between Elizabethtown and Philadelphia. After building a five-mile road between Elizabethtown and Middletown, the state capital will be connected with the Quaker City.

MERIDEN, CONN.—The Meriden, Middletown & Guilford Electric Railway Company, it is announced, is to push work on the new line to Durham. The engineers are meeting with so few difficulties and the interest taken in the project is so keen that there seems little doubt that the efforts of the promoters will soon see realization.

INDIANAPOLIS, IND.—A meeting of the directors of the Columbus, Greensburg & Richmond Traction Company was held in this city July 28 and plans made for the early construction of a traction line connecting the cities named. Bankers, farmers and business men are urging the construction of the road and will lend aid. The right-of-way has all been secured. S.

TIPTON, IND.—A new electric railroad, to run from this city to Frankfort by way of Kempton and other intermediate towns, has been projected, and the work of securing the right-of-way is well on the way. The line when completed will run through a fertile territory and connect a number of towns void of railroad facilities. There is little doubt of its early construction. S.

BLUFFTON, IND.—Bears, Brown & Company have secured the contract of the Bluffton, Geneva & Celina Traction Company to construct a line from Bluffton to Geneva. Work will commence at three different points within a week, and the road rushed to completion. The company is preparing to let the contract to construct the line from Geneva to Celina. S.

OROVILLE, WASH.—H. B. Skinner, general manager of the Okanogan Electric Railway Company, states that work on the new line will be started this summer. The electric road was financed by Col. H. B. Dewey, of Spokane. It will connect with the Great Northern at Nighthawk, running from there through Loomis, Conconully and Okanogan to the head of navigation at Brewster, on the Columbia River.

BERKELEY, CAL.—The San Francisco, Oakland & San Jose Railway Company, operating the Key Route system of electric trains, connecting San Francisco with Berkeley, Oakland, Piedmont, etc., is endeavoring to have the Berkeley municipality open up Walnut Street, so that the company's Shattuck Avenue line can be extended into North Berkeley. The company is also at work on both ends of its proposed Sacramento Street line.

TOLEDO, OHIO—The county commissioners have formally selected Van Renselaer Street, Huron, as the location for the new $100,000 wagon bridge that is to go over Huron River. This is the location desired by the Lake Shore Electric Railway Company, and its selection means that a number of curves this side of Huron will be obliterated as soon as the bridge is completed. The present entrance to the village will be abandoned and a straight cut will be taken through the south end. H.

BOULDER, COLO.—It is stated on good authority that the Denver and Interurban will extend its line from Louisville to La Fayette, and from there to Longmont, building something like twelve miles of double track, one line to be used for freight traffic and the other for passengers. The Colorado & Southern, owner of the electric line, will by this cut-off shorten the present line from Denver to Longmont, Loveland, Greeley and Fort Collins over ten miles, and also eliminate the heavy grade by way of Boulder.

NORTH WILDWOOD, N. J.—If the newly organized company headed by former Mayor Augustus Hilton succeeds in its plans, there will be a trolley line from Wildwood Junction to this place within a year. The line will tap Grassy Sound and little settlements between Anglesea and the mainland, skirt the edge of the meadows down Five-Mile Beach, and connect with the Cape May trolleys near Cold Spring Inlet. The new company is working in conjunction with the Stone Harbor project to build a wagon road and a trolley line to Seven-Mile Beach.

WARSAW, IND.—The Winona Interurban Railway Company has ordered eighteen new and modern cars to be placed in service on the Warsaw-Peru line when completed. Two of the cars are of the combination chair and sleeping type, to be used for through service between Winona and Indianapolis and possibly between South Bend and Louisville by way of Indianapolis. Ten of the new cars will be shipped the first week in August. Superintendent Dickey says the new line will open service with the latest and finest equipment of any interurban in the state. S.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

BRITT, IOWA—A long-distance Western Electric telephone line to Hampton is being installed. C.

DES MOINES, IOWA—The Mutual Telephone Company will expend $100,000 improving its system. C.

TOLEDO, IOWA—The Commercial Telephone Company is about to commence work on installing a new cable system. C.

DULUTH, MINN.—Contracts have been let for equipping the boats of the Tomlinson and Wolvin fleets with wireless telegraphy. C.

MANCHESTER, N. H.—The Winnipesaukee Telephone Company has increased its capital stock from $180,000 to $200,000 and has notified the secretary of state of the change.

LANCASTER, PA.—A charter has been issued to the Strasburg Telephone Company. The capital stock is $10,000, and the value of each share is twenty-five dollars. The directors are H. S. Hunsecker, W. G. Fritz, H. B. Leaman, L. J. Bair, of Strasburg,

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and Enos G. Ranck, of Ronks. The company will build its line through Paradise, Georgetown, White Oak, New Providence, Refton, Lime Valley, Willow Street, Lampeter, Fertility, Greenland, Witmer, Smoketown, Bird-in-Hand, Ronks and Gordonville.

HUNTSVILLE, IND.—The Southern Bell Telephone Company has extended toll lines to several points in Jackson County during the last few days. Woodville, Garth, Holly Tree, Princeton and Trenton are included in the new connections, and service is given about forty farmers and business men in the valley.

CHARLESTON, W. VA.—A charter has been issued to the North Bend & Southern Telephone Company, of Pennsboro, to build a line in Ritchie and Tyler counties. Capital, $5,000. There are twenty-one incorporators from Joseph's Mills, Mole Hill, Pennsboro and Ellenboro, headed by Zadok Ash, of Joseph's Mills.

NATCHEZ, MISS.—The Cumberland Telephone and Telegraph Company has been awarded a right-of-way along the line of the N. O. & N. W. R. R., and also the M., H. & L., by the courts. This is what the people have been clamoring for for the past several years, and what the Telephone Company has been fighting for for five years.

ROCHESTER, N. Y.—The Atlantic Home Telephone Company, of Atlanta, Steuben County, has been organized to operate in the counties of Steuben, Ontario and Livingston; capital, $3,000; directors: B. C. Boothe, R. W. Lander, Charles Honan, John Landed, of Atlanta, Clark Wenermiller, of South Dansville, and Harry Flint, of Clifton Springs.

RUTLAND, VT.—G. A. Clough, of Randolph, president of the Home Telephone Company, which was granted a charter in 1906 by the Vermont Legislature to operate a telephone plant in this state, is seeking a franchise in Rutland. At present the company has about 200 miles of wire strung in Addison, Windsor, Washington and Rutland counties. It has a capital stock of $25,000, and its principal office is located at Randolph.

CLEVELAND, OHIO—The Great Lakes Radio Telephone Company has installed on the Hippodrome Building a combined set for wireless telephone and telegraph work. The tower is 130 feet high, the top spread being 650 feet long. The harp has a twenty-five-foot top and grades down to ten feet at the bottom. The spread is stretched between the tower and a tall steel stack. The wave length is 600 metres and the apparatus has an output of two kilowatts. The efficiency of radiation has recently been doubled and the energy output increased sixteen times by reason of improvements which have been made by O. C. Roos, consulting expert.

NEW MANUFACTURING COMPANIES.

(Special Correspondence.)

HOBOKEN, N. J.—The National Electric Welding Company has been incorporated with a capital of $150,000. The incorporators are W. Meller, M. Smith and F. Buckel, Hoboken.

FREEPORT, ILL.—The Finkbeiner-Turney Company has been incorporated, to manufacture engines and electrical supplies. The capital stock is $25,000, and the incorporators are J. C. Finkbeiner, L. L. Turner, E. J. Kane and R. B. Mitchell, Freeport.

CAMDEN, N. J.—The Electric Accumulator Company has been incorporated, to manufacture accumulators, generators and other electrical machinery, with a capital of $200,000. The incorporators are F. W. Reeves, W. L. Meeks and T. C. Duff.

NEW YORK, N. Y.—The Mystic Dry Battery Company has been incorporated here, to do a general electric and contracting business, manufacture storage batteries, etc.; capital, $5,000. Incorporators: Benjamin Colby, Harry C. Adams, Harry B. Berlinicke, all of New York.

NEW YORK, N. Y.—The Universal Trolley Retriever Company has been incorporated to manufacture trolley appliances, trolley wheels, etc., with a capital of $100,000. The incorporators are Peter J. Minek, Brooklyn; F. C. McLean, Freneau, N. J., and Paul A. Zizelman, New York city.

BIRMINGHAM, ALA.—The American Automatic Railway Switch Company, with a capital of $500,000, has decided to build a factory for the manufacture of an automatic street-car switch, which is the invention of Harold Shemwell. The company has been chartered by some of the wealthiest men in the city.

FT. WAYNE, IND.—The Modern Engineering and Construction Company has been incorporated to do a general construction business, and will give particular attention to the construction and equipment of electric street and interurban roads. Wm. P. Bartling, H. L. Holmes and Arthur M. Bartling are the directors.

TOLEDO, OHIO—The National Electric Display Company, of Toledo, has been incorporated under the laws of Ohio, with a capital stock of $15,000, by Chris F. Wall, L. L. Chapman, E. B. Marshall, Samuel Kohn and William G. Cole. The concern will market a patent lightning arrester and several other electrical devices. The manufacturing end of the business will be cared for by the Re-fill Lamp Company, located in Summit Street, Toledo. H.

ELECTRICAL SECURITIES.

Industrials have been the leaders the past week and have shown continued remarkable strength. General Electric, United States Steel, American Smelting and National Biscuit were among the most prominent in advances and in volume of transactions. Reference was made last week to the great number of securities, particularly industrial securities, being put out at this time, and the manner in which the public is digesting them. During July railroad and industrial corporation issues amounted to $121,486,100 worth of securities, as against $87,309,000 the same month a year ago.

There have been, of course, reactions, and are likely to be in the immediate future, but when it is considered that all offers have been absorbed in a narrow market it is almost safe to assume that in the broader markets of a month or six weeks from now the public will still further help to sustain prices. The fact of the matter is—confidence is well established, and barring unforeseen developments there is nothing to disturb the immediate financial horizon.

DIVIDENDS.

Boston Elevated Railway Company; the regular semiannual dividend of three per cent, payable August 16 to stock of record July 31. Books closed July 31 and reopen August 16.

Northwestern Elevated Railroad Company; a dividend of one per cent on the preferred stock, payable October 18 to stock of record October 9. Books close October 8 and reopen October 19.

Susquehanna Railway, Light and Power Company; a regular dividend of two-and-one-half per cent on the outstanding preferred stock, payable September 1 to stockholders of record at close of business August 14. Books reopen September 1.

The Harris Trust and Savings Bank is offering to investors $300,000 first-mortgage bonds of the Michigan State Telephone Company. The bonds, which are five per cent, dated February 1, 1904, and mature February 1, 1924, are offered at 99½ and interest.

In a circular accompanying the offering of the bonds the earnings for the fiscal year ended May 31, 1909, are given as follows:

Gross earnings	$3,559,741
Operating expenses, including maintenance and taxes	2,594,549
Net earnings	$965,192
Annual interest charge on $8,666,000 5 per cent bonds	433,300
Surplus earnings	$531,892

The bonds of the company are secured, in opinion of counsel, by a first mortgage on the principal properties of the company. Under the provisions of the trust deed, $285,000 bonds are held in escrow to retire an equal amount of Michigan Telephone Company bonds, due 1917.

NEW YORK.	Aug. 2.	July 26.
Allis-Chalmers common	15⅝	14½
Allis-Chalmers preferred	55	52
Amalgamated Copper	84¾	84
American Tel. & Cable	80*	80*
American Tel. & Tel.	143¼	140⅜
Brooklyn Rapid Transit	79¼	78
General Electric	169¾	166½
Interborough-Metropolitan common	15¼	14⅜
Interborough-Metropolitan preferred	47½	45
Kings County Electric	135	135
Mackay Companies (Postal Telegraph and Cables) common	83⅞	81½
Mackay Companies (Postal Telegraph and Cables) preferred	74	73½
Manhattan Elevated	145	145
Metropolitan Street Railway	19	16
New York & New Jersey Telephone	138	140
U. S. Steel common	73⅞	71
U. S. Steel preferred	128	126½
Western Union	76½	72
Westinghouse common	85	84½
Westinghouse preferred	120	121

*Last price quoted.

BOSTON.	Aug. 2.	July 26.
American Tel. & Tel.	143⅛	140¾
Edison Elec. Illuminating	253	248½
General Electric	169¾	166½
Massachusetts Electric common	12½	12½
Massachusetts Electric preferred	74	74
New England Telephone	133¼	132
Western Tel. & Tel. common	11¾	11
Western Tel. & Tel. preferred	89	86

PHILADELPHIA.	Aug. 2.	July 26.
American Railways	45½	45½
Electric Company of America	12¼	12½
Electric Storage Battery common	62½	56⅝
Electric Storage Battery preferred	62½	56⅝
Philadelphia Electric	12	12
Philadelphia Rapid Transit	30¼	29¾
Philadelphia Traction	90⅝	90¼
Union Traction	55	53½

CHICAGO.	Aug. 2.	July 26.
Chicago Railways, Series 1	119¼	117
Chicago Railways, Series 2	38	38½
Chicago Subway	19½	20½
Chicago Telephone	134	132¾
Commonwealth Edison	120⅛	119½
Metropolitan Elevated common	18	18
Metropolitan Elevated preferred	48¾	48
National Carbon common	92	90
National Carbon preferred	119	118

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PERSONAL MENTION.

DR. ELLIS E. LAWTON, of Yale, has been made professor of physics in Denison University.

ROBERT MATHER, chairman of the Westinghouse Electric board of directors, sailed for Europe on July 28.

RICHARD BROWN, of Creston, Iowa, president of the Des Moines-Creston Interurban Company, was recently married at Waterloo to Miss Vida Smith. C.

W. E. WENGER, formerly assistant professor of railway engineering in the University of Illinois, has been appointed associate professor in the department of electrical engineering at McGill University, Montreal, Can.

D. J. BURNS, sales manager of the Ward Leonard Electric Company, Bronxville, N. Y., spent a few days in Chicago, last week, with F. B. Badt & Company, western agents. Mr. Burns is now enjoying a well-earned vacation.

HENRY FLOY, consulting engineer, has been retained by Bion J. Arnold, in direct charge of the appraisal of the street railways in Greater New York and the elevated railroads in Brooklyn, which Mr. Arnold is making for the Public Service Commission of the First District.

C. S. KNIGHT, Jr., manager of the electrical department of the American Steel and Wire Company, Chicago, Ill., has returned in fine fettle from a ten days' tour of the lakes. Mr. Knight enjoyed his outing greatly and is prepared for a vigorous campaign in this enterprising department of this great company.

H. H. DENNIS, credit man for the National Supply Company, of Toledo, Ohio, has resigned to accept a position with the W. G. Nagle Electric Company. He is financially interested in the latter company, and was recently chosen secretary and treasurer. He will assume his new duties this week.

C. G. BARKLA, formerly of Liverpool University, has been appointed professor of physics at King's College (London University), London, Eng. Doctor Barkla is one of Sir Oliver Lodge's "young men," and his important preferment must be especially gratifying to all the former members of the old Liverpool University College.

WILLIAM S. CONE has been appointed assistant general manager of the Great Western Power Company, of San Francisco, to succeed Chester Pennoyer, who becomes manager of the Pacific Coast department of the National Conduit and Cable Company. Mr. Cone was for the past five years with the Edison Electric Company, of Los Angeles, Cal.

STEPHEN A. DOUGLAS, manager of the Douglas branch of the Municipal Filtration Company, Detroit, Mich., was a visitor to Chicago last week. Mr. Douglas reports a very satisfactory number of installations for this excellent system of filtration, and says that negotiations are being made with a large number of municipalities and private interests to install this apparatus.

D. R. STEPHENS, who was in charge of the transportation department of the Illinois Traction Company, and who resigned from that office, has accepted the presidency of the new Peoria and Galesburg Interurban Railway. The route of this line has been surveyed and good progress is being made in the securing of franchises through the towns through which it is purposed to build. V.

DR. RALPH S. MINOR, professor of physics at the University of Nevada, has accepted an associate professorship of physics in charge of the lower division work at the University of California. The position in Nevada has been filled by the appointment of Prof. Leon W. Hartman, who, for the last four years, has been associate professor of physics in charge of the department at the University of Utah.

OBITUARY.

WILLIAM D. McFARLAND, a well-known choral and oratorio singer, of Washington, D. C., and a brother of Walter M. McFarland, acting vice-president of the Westinghouse Electric and Manufacturing Company, died at his home in the capital, July 22, following a recent serious operation at the Johns Hopkins Hospital in Baltimore.

DAVID H. GILDERSLEEVE, mechanical engineer, died July 30, at the home of his mother, 104 Montague Street, Brooklyn, N. Y. He was graduated from Stevens' Institute in 1889 and served as first lieutenant in the United States Corps of Engineers in Cuba during and after the Spanish-American War. He was assistant engineer of the Department of Havana, and had entire charge of the mechanical work there. For five years Mr. Gildersleeve was sales manager for the C. W. Hunt Company, makers of coal-handling machinery, but last winter he became vice-president of the Waters, Gildersleeve, Colver Company, in the shipbuilding and marine machinery business. Mr. Gildersleeve is survived by his widow and two children.

ROBERT PITCAIRN, for fifty-two years connected with the Pennsylvania Railroad Company, and for many years general superintendent of that corporation, died at his home in Pittsburg, Pa., July 26, at the age of seventy-three. He retired three years ago on account of ill health, since which time he had been president of the sinking fund of the railroad company. Mr. Pitcairn was born in Scotland and emigrated to this country with his parents when a young boy, and a few years later obtained a place as messenger boy with the Atlantic and Ohio Telegraph Company. He rose rapidly, and soon became an operator. Later he left this field to engage in railroading, and in 1865 was made superintendent of the Pittsburg division of the Pennsylvania Railroad.

NEW PUBLICATIONS.

THE ELECTROCRAFT ILLUSTRATED LIST—The Electrocraft Illustrated List for 1909 has just been issued. It is greatly increased in size, and the list is much fuller than in previous editions. In addition to the list of approved electrical material, this edition contains a miscellaneous section, which gives the work a wider scope.

THE ANNUAL REPORT OF THE COMMISSIONER OF EDUCATION—The annual report of the Commissioner of Education, for the year ended July 30, 1907, has recently been distributed. The commissioner states that the causes for delay in the issuing of this report have been removed and hereafter it will appear as soon after the close of the year as possible. The report outlines the work completed by the Bureau of Education up to date and also gives a brief history of education in foreign countries.

IRON ORES AND PEAT FUEL IN CANADA—The Department of Mines, Ottawa, Canada, has published a bulletin entitled "The Iron Deposits of Nova Scotia," by Dr. J. E. Woodman, until recently professor of geology at Dalhousie University, Halifax. It consists of 222 pages and sixty-three illustrations and maps. There has also been issued by this department a new bulletin on "The Investigation of the Peat Bogs and Peat Industry of Canada." This is a report giving the investigations made by Erik Nystrom during the season of 1908-09, and supplements a report on "Peat and Lignite, their Manufacture and Uses in Europe," issued a year ago.

THE TECHNICAL INDEX—This comprehensive record of current technical literature, published in Belgium, announces that hereafter it will be represented in this country by the George H. Gibson Company, Tribune Building, New York city. The Technical Index appears monthly and gives a systematic descriptive record of all original articles appearing in over 200 engineering and technical journals and reviews, and also indexes the proceedings of technical societies and technical books issued in all countries. The method of indexing covers, the name of the author, the title of the article in full, an explanatory note stating the contents of the article, the name and date of the publication in which the article appeared and the length of the article, are all indicated. Two editions are printed, one upon both sides of the paper and one upon one side only for card index purposes. It is stated that over 1,000 original articles are indexed each month, covering all lines of engineering and technology. The American agents offer to send free sample copies upon request.

ELECTRICAL SOLICITORS' HANDBOOK—The National Electric Light Association has just published "The Electrical Solicitors' Handbook," which was authorized by the national convention of 1908. It is a book of 236 pages compiled from the manuscripts of twenty contributors, seven of whom were awarded prizes aggregating $2,600 in cash. The editorial committee in charge of its compilation consisted of Arthur Williams, O. A. Kenyon, Norman G. Meade and Adolph Hertz. The handbook is composed of five sections, with the following titles: The Elements of Central-Station Business Getting, Talking Points, Illuminating Engineering, Heating Engineering, Power Engineering. In each of these sections are given data and suggestions of the highest value to the electrical solicitor in the general and specialized lines, the idea being to provide him with detailed information to controvert the arguments of gas, gasoline, isolated plant and other competitors, and to enable him to advance central-station electric service in every possible manner. This handbook contains without question the best ammunition for the new-business getters ever compiled, and no central-station company should neglect to place a copy in the hands of each of its solicitors. Even if there were no other advantages in doing so, the right to secure copies of this handbook would alone justify any electric-light or power company in joining the National Electric Light Association.

NEW PROPOSALS.

POST OFFICE AND COURT HOUSE, NEW ORLEANS, LA.—The office of the Supervising Architect, Washington, will receive sealed proposals until 3 o'clock p. m., September 7, for the mechanical equipment (excepting elevators), including plumbing, gas fitting, boiler plant, heating and ventilating system, electric generating system, conduit and wiring system, vacuum cleaning system and clock system, for the U. S. Post Office and Court House Building at New Orleans, La., in accordance with the drawings and specification, copies of which may be had at the office of the

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architects, Messrs. Hale & Rogers, 11 East Twenty-fourth Street, New York city, or at the Supervising Architect's office. Applications must be accompanied by a certified check for $200, which will be held until the return of drawings and specification.

COURT HOUSE, PORTLAND, ORE.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., August 26, for the installation of a vacuum cleaning system in the U. S. Court House at Portland, Me., in accordance with drawing and specification, copies of which may be had at the office of the custodian, at Portland, Me., or at the Supervising Architect's office.

POST OFFICE, SARATOGA SPRINGS, N. Y.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., September 9, for the construction complete of the U. S. Post Office at Saratoga Springs, N. Y., in accordance with the drawings and specification, copies of which may be had at the office of the Postmaster at Saratoga Springs, N. Y., or at the Supervising Architect's office.

INDUSTRIAL ITEMS.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., has recently received several orders for large alternating-current generators, also several large orders for direct-current generators.

THE D & W FUSE COMPANY, Providence, R. I., announces the issue of a price list (dated July 1) of Deltabeston magnet wire, and further that it is now manufacturing coils made of this wire.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., has issued a pamphlet, entitled "Hints for the Inexpensive Lighting of Stores, Offices and Public Buildings," wherein are shown many attractive fixtures adapted for use with Opalux reflectors.

THE STERLING ELECTRIC COMPANY has contracted to furnish material, equipment, etc., for the complete rebuilding of the Buckland Mutual Telephone Company at Buckland, Ohio, and for a new switchboard for the Fostoria Telephone Company at Fostoria, Ohio. S.

THE AMERICAN ELECTRIC FUSE COMPANY, Muskegon, Mich., has received from the Allis-Chalmers Company, of Milwaukee, Wis., a contract for supplying all the rheostat equipment for the Milwaukee plant, which will mean over $100,000 a year for the American Electric Company.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., had a most successful season, despite the general business depression of the last year or so. The company is preparing to erect a new blacksmith and forge shop, and will put something like three-quarters of a million dollars into plant extensions at once.

MACGOVERN, ARCHER AND COMPANY, New York, N. Y., have issued their July list of second-hand electrical and steam machinery, power-house equipment, cars, etc., which are ready for immediate shipment. Much of this machinery and apparatus has never been used. The July list cancels all previous issues.

THE SPRAGUE ELECTRIC COMPANY mentions that it has two baseball teams, one representing the New York factory and the other the Bloomfield factory. On Saturday, July 17, the New York team, known as the Greenfield Flexconds, defeated the Bloomfield nine with a score of eight to four. The game was played at Morris Park, Newark, N. J.

THE CUTLER-HAMMER MANUFACTURING COMPANY, of Milwaukee, Wis., makers of electric controlling devices, announce the opening of a Philadelphia office at Room 1207, Commonwealth Building. An engineer specially qualified to advise regarding the control of electric motors will be in charge of the new office. The company is already experiencing a genuine revival of business, and in fact this company has been in a fine position all during the recent slump. The company is erecting a new three-story factory in Milwaukee, has recently purchased the entire stock and line of the J. L. Schureman Company, of Chicago, and is adding to its headquarters in New York city.

THE STONE & WEBSTER ENGINEERING CORPORATION has ordered for the Jacksonville (Fla.) Electric Company five closed "pay-as-you-enter" cars. The bodies are thirty-one feet long and are mounted on Standard Motor Truck Company's G-50 trucks, equipped with GE-81 four-motor equipments and General Electric Company's air brakes. The order is placed with the Cincinnati Car Company.

THE PHOSPHOR-BRONZE SMELTING COMPANY, LIMITED, Philadelphia, Pa., announces that all its property has been sold and transferred into the Phosphor-Bronze Smelting Company, a corporation duly organized under the laws of the state of Pennsylvania, which corporation has assumed the performance and discharge of all the obligations and liabilities of the said association, and will hereafter carry on the same business formerly conducted by it, and also that the undersigned have been appointed liquidating trustees to wind up and settle the affairs of said association: Theodore H. Lüders, Thomas L. Lüders, Jr., Philipp E. Lüders.

H. M. BYLLESBY AND COMPANY, Chicago, Ill., announces that it has since August 1 vacated its offices in the American Trust Building and for the present will occupy temporary offices in the banking rooms at the corner of Dearborn and Monroe Streets, Chicago. On October 1 the company will move to the banking rooms at present occupied by the Continental National Bank, and will remain in that location until it can return to the American Trust Building on June 1, 1910. These removals are brought about solely for the purpose of accommodating the merged banks, whose business demands possession of the fifth floor of the American Trust Building, which has been occupied by H. M. Byllesby and Company from the opening of the building to the present time.

DATES AHEAD.

Michigan Electric Association. Annual convention, Detroit, Mich., August 17-19.

Old-Time Telegraphers' and Historical Association. Annual reunion, Pittsburg, Pa., August 17-19.

Indiana Electric Light Association. Next meeting, French Lick Springs, Ind., August 18 and 19.

Northwest Electric Light and Power Association. Annual convention and joint session with Seattle branch, A. I. E. E., Seattle, September 7-9.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8-10.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 14-16.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 18.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) July 20, 1909.

928,245. ELECTRICALLY-CONTROLLED METER SYSTEM. Henry P. Clausen, Chicago, Ill. Filed November 25, 1904. The call register is provided with a manually-operated tally device, operating contacts controlling the restoring magnet of a relay.

928,251. ELECTRIC OUTLET-BOX. Conrad J. Dorff, Chicago, Ill., assignor to Fredric Greer, Chicago, Ill. Filed December 24, 1908. Comprises two sections and means for securing them together.

928,252. CIGAR-LIGHTER. Clarke S. Drake, Milwaukee, Wis. Filed January 23, 1909. A switch for the primary circuit of an induction coil is operated by a movable member forming one of the terminals of the secondary circuit of an induction coil, a spark being formed to ignite combustible material.

928,271. BLOCK SYSTEM FOR RAILWAYS. George W. Nistle, North Muskegon, Mich., and Bernard W. Brady and Edward Inskip, Chicago, Ill. Filed January 2, 1908. Each of a pair of levers pivotally mounted between their ends, adjacent to each other, have one or more track surfaces whereby the levers are oscillated by the traverse thereover of a traversing member carried by a train.

928,272. SWITCH-LOCKING SYSTEM FOR RAILWAYS. George W. Nistle, North Muskegon, Mich., and Bernard W. Brady and Edward Inskip, Chicago, Ill. Filed January 2, 1908. In combination with a pair of contact levers pivotally mounted between their ends (one of the levers being provided with oppositely inclined tread surfaces, whereby it is oscillated twice by the traverse thereover of a traversing member car-

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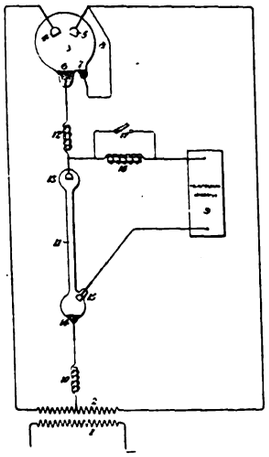
ried by a train) are means for holding the treaded lever yieldably in one or more positions.

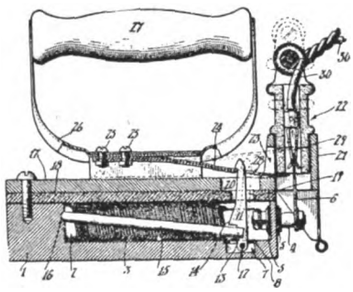
928,273. BLOCK SYSTEM FOR RAILWAYS. George W. Nistle, Muskegon, Mich., and Bernard W. Brady and Edward Inskip, Chicago, Ill. Filed January 2, 1908. Describes a block system for railroad bridges.

928,274. BLOCK SYSTEM FOR RAILWAYS. George W. Nistle, North Muskegon, Mich., and Edward Inskip and Bernard W. Brady, Chicago, Ill. Filed June 15, 1908. In combination with a length of track and a siding, are blocking mechanism associated with the length of track, train-actuated mechanism likewise associated with the track and controlling the blocking mechanism, and other train-actuated mechanism associated with the siding and also controlling the blocking mechanism.

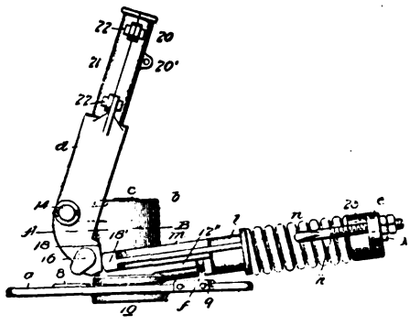
928,282. WEATHERPROOF ELECTRICAL RECEPTACLE. Frank J. Russell, New York, N. Y. Filed August 20, 1908. The body has a plug-receiving socket, with a center plug contact in the socket, a plug holder comprising a narrow band of sheet metal located within the socket, and means engaging the body of the band and securing it to the side wall of the socket.



928,287.—DEVICE FOR STEADYING CURRENTS.



928,402.—CONTROLLING MEANS FOR ELECTRIC HEATER.



928,442.—TROLLEY-BASE.

928,285. CONDUIT FOR ELECTRIC WIRES. Horace N. Speer, New York, N. Y. Filed July 12, 1907. A two-ply inner tube is made of one piece of material folded into two sections, each of which is secured intermediately to the other and folded on itself.

928,287. DEVICE FOR STEADYING CURRENTS. Percy H. Thomas, Montclair, N. J., assignor to Cooper-Hewitt Electric Company, New York, N. Y. Filed September 27, 1905. In combination with an alternating-current supply circuit and a direct-current work circuit, containing a translating device requiring steady current, are a vapor converter and a choke coil for keeping the same alive, and a vapor device in series with the choke coil and in shunt upon the translating device, with a second choke coil in series with the translating device.

928,366. TROLLEY-POLE-CONTROLLING MEANS. Charley E. Cozzens, Toledo, Ohio, assignor of one-half to Harry Groat, Toledo, Ohio. Filed December 16, 1908. A valve is operated by fluid pressure to control admission of fluid to a cylinder to operate a piston controlling movements of the pole.

928,307. GAS-LIGHTING APPLIANCE. Frederick F. Dier, Winnipeg, Manitoba, Canada. Filed November 20, 1908. Describes a device for lighting gas stoves, etc., in which the stove itself is utilized as part of the circuit.

928,345. ELECTRORESPONSIVE DEVICE. Elmer A. Terpening, Geneseo, Ill. Filed February 15, 1906. A coil is axially supported so as to rotate between opposite poles of each of a number of horseshoe magnets.

928,350. MEANS FOR CONTROLLING THE OPERATION OF TRAINS. Jean F. Webb and Jean F. Webb, Jr., Denver, Colo., assignors to the Electric Signagraph and Semaphore Company, Incorporated, New York, N. Y. Filed May 12, 1908. The air-brake valve is operated by an automatically controlled electric motor.

928,355. TIME-LIMIT TRAIN-STOP. William Brewer, London, England, assignor to the Union Switch and Signal Company. Filed November 27, 1908. Means operated by the approach of a train or vehicle cause a train-stop actuator to move the stop to operative position, and a timing device operates to cause the actuator to move the stop back to inoperative position after a predetermined time interval.

928,360. ELECTRICAL RELAY. Edward E. Clement, Washington, D. C., assignor to the North Electric Company, Cleveland, Ohio. Filed August 22, 1906. Comprises a pair of electromagnets having their cores magnetically united at their rear end, a yoke piece carried by the rear end of the core, armature-supporting means carried by the yoke piece, an angular armature having a depending portion extending in front of and across the ends of the cores, a substantially horizontal portion extending over the tops of the magnet spools, and sets of contact springs.

928,371. SIGNALING BY ELECTROMAGNETIC WAVES. Reginald A. Fessenden, Washington, D. C. Filed May 4, 1906. A receiving system for wireless telegraphy comprises an inductive connection with variable primary, a condenser, a detector for electromagnetic waves connected with the secondary of the inductive connection through the condenser, a condenser shunted with the primary, a variable inductance, an antenna connected with the primary through the inductance and connected with the ground.

928,373. SANITARY GUARD FOR TELEPHONES. Sidney E. Florsheim, Chicago, Ill. Filed April 5, 1909. The guard is formed from elastic collapsible material, the outer enlarged portion of the guard being reinforced for engagement with the edge of the telephone mouthpiece, and the bottom wall of the guard normally lying in close proximity to the inner cross wall of the telephone mouthpiece.

928,396. BLOCK-SIGNALING SYSTEM. Daniel J. McCarthy, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company. Filed January 29, 1909. A three-position relay controls the signaling means located at the entrance end of the block.

928,402. CONTROLLING MEANS FOR ELECTRIC HEATERS. Earl H. Richardson, Ontario, Franklin Booth, Alhambra, and Wynn Meredith, San Francisco, Cal., assignors to Pacific Electric Heating Company. Filed April 16, 1908. Comprises a detachable connection plug slidable in the socket into or out of connection with the terminals, and a thermostatic device for sliding the plug a limited distance in the socket to move it out of connection with the terminals but not out of the socket.

928,431. GUARD FOR TELEGRAPH AND TELEPHONE WIRES. Charles J. Elliott, Oxnard, Cal. Filed June 4, 1908. A guard frame (consisting of a grounded conductor) surrounds the wire and means are attached to the pole and extending from the pole lengthwise of the wire, supporting the guard frame in position away from the pole.

928,438. SINGLE-PHASE COMMUTATOR-MOTOR. Valère A. Fynn, Blackheath, London, England. Filed March 3, 1906. Comprises an inducing member, a main winding on the inducing member consisting of two parts displaced by 180/n degrees and connected in series relation, an auxiliary winding on the inducing member, an induced member, means for introducing into the induced member an auxiliary electromotive-force derived from the auxiliary winding, and means for short-circuiting the induced member along at least one axis.

928,442. TROLLEY-BASE. Charles E. Gierding, Newark, N. J., assignor to Sterling-Meaker Company, Newark, N. J. Filed

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August 14, 1908. Has an approximately horizontal buffer spring, and rotates on a vertical roller-bearing stem.

928,464. ARC LAMP. David R. Knapp and Irvin S. Schlesinger, Philadelphia, Pa. Filed July 17, 1907. Describes a feeding mechanism for arc lamps.

928,474. ADAPTER. Harman S. Salt, New York, N. Y., assignor to the Dale Company, a corporation of New York. Filed April 14, 1908. An insulating body has an extension and a face inclined thereto, a threaded tube surrounding this extension, and an insulating bushing engaging a threaded shell to hold the casing for the body in place.

928,476. PROCESS OF MANUFACTURING SILICON NITRID. Alf Sinding-Larsen, Christiania, Norway. Filed March 17, 1909. The process consists in establishing an atmosphere chiefly containing nitrogen gas in a chamber forming part of or connected with an electric furnace, and in feeding material to the furnace for the production of silicon by a reduction process at a temperature causing a vaporizing of the whole or part of the silicon formed.

928,478. TELEGRAPH-POLE. William H. Smalley and Harvey R. Smalley, Corning, Ark. Filed April 22, 1908. Comprises a hollow upright, with a stile movable vertically within it, rungs pivoted to the stile and projecting through the wall of the upright, side stiles secured upon the inner face of the wall of the upright, and means whereby the first-mentioned stile may be moved vertically to adjust the rungs to operative or inoperative position.

928,484. SPARKER. George A. Weidely, Indianapolis, Ind., assignor of one-half to Harold O. Smith, Indianapolis, Ind. Filed January 2, 1908. A rockshaft carries the swinging terminal.

928,505. GAS-LIGHTING APPLIANCE. Frederick F. Dier and Mederic Primeau, Winnipeg, Manitoba, Canada. Filed January 9, 1909. Comprises a battery and a helix, with a hand instrument to close the circuit.

928,510. LIFTING-MAGNET. Arthur C. Eastwood, Cleveland, Ohio. Filed August 10, 1908. The magnet frame has an annular space, a winding, a cylindrical internal support for the winding, a cap plate for the internal support, and means for securing the support in the annular space.

928,516. ELECTROMAGNETICALLY-OPERATED APPARATUS. Rudolf E. Hellmund, Hinsdale, Ill., assignor to Westinghouse Electric and Manufacturing Company. Filed April 4, 1906. Has an electromagnet with opposing curved pole faces, and a rotatable armature of S-shape the outer faces of which are eccentric to the pole faces and the toes of which are nearer thereto than the heels.

928,521. ELECTRIC METER. Dugald C. Jackson, Madison, Wis., assignor to Dugald C. Jackson and William B. Jackson, a copartnership, Madison, Wis. Filed September 14, 1904. Describes a form of mercury motor meter.

928,531. FREQUENCY-RELAY. Daniel J. McCarthy, Wilkinsburg, Pa., assignor to Union Switch and Signal Company. Filed April 24, 1907. Two windings of substantially equal inductance are arranged to produce fluxes, a movable element is subjected to the combined influences of the fluxes, and means are provided to render the circuit of one of the windings resonant under the influence of a current of a predetermined frequency.

928,532. ELECTRIC IRON. David W. McClay, Pittsfield, Mass. Filed April 10, 1908. The heating unit comprises a rod, a series of independent sleeve sections of insulating material surrounding the rod from end to end, and a wire coil arranged upon the sleeve sections, and adapted for circuit connections.

928,547. ELECTRICAL STARTING DEVICE. Jacob L. Schureman, Chicago, Ill., assignor to J. L. Schureman Company, Chicago, Ill. Filed September 20, 1907. An automatically-controlled electrical starter has additional manually-operated means for controlling the switch, etc., in case of emergency.

928,570. SELECTIVE SIGNALING DEVICE FOR RAILWAYS. Selden R. Wright, Rochester, N. Y., assignor to Telegraph Signal Company. Filed August 24, 1908. A master selector comprises automatic selecting means for effecting current change in a conductor on the expiration of any selected one of a number of predetermined time intervals.

928,571. RAILWAY SELECTIVE APPARATUS. Selden R. Wright and Charles L. Deihle, Rochester, N. Y., assignors to Telegraph Signal Company. Filed August 24, 1908. Similar to the preceding.

928,572. ADVERTISING-SHADE FOR INCANDESCENT LAMPS. John de Yongh, New York, N. Y. Filed March 26, 1906. Consists of thin flexible material provided with a projection detachably clamped between a screw-threaded projection of the lamp and its socket.

928,581. TELEGRAPHIC TYPEWRITER. Elmer Burlingame, Laporte, Ind., assignor to the Burlingame Telegraphing Typewriter Company. Filed April 26, 1906. Sliding bars are electromagnetically operated.

928,582. POLARIZED MAGNET. Elmer A. Burlingame, San Francisco, Cal., assignor to Burlingame Telegraphing Typewriter Company. Filed May 11, 1908. Comprises a permanent horseshoe magnet, with a single magnet coil located within it, and having a suitable soft-iron core arranged substantially parallel to the sides of the horseshoe magnet, and an armature movably supported between the core and poles.

928,583. METHOD OF UNIDIRECTING ELECTRICAL CURRENTS. Elmer A. Burlingame, San Francisco, Cal., assignor to Burlingame Telegraphing Typewriter Company. Filed November 11, 1908. A polarized relay magnet is connected in a main-line circuit having secondary circuits in parallel, the secondary circuits are connected with the main-line circuit by action of the polarized relay magnet, magnets are connected across the parallel secondary circuits, and resistance coils are provided in each of the parallel secondary circuits.

928,589. INTENSIFIER FOR TELEGRAPH-SOUNDERS. Ralph W. Crawford, Jr., Ralph H. Beck and Lewis W. Davies, Lamar, Colo. Filed November 3, 1908. A sound box amplifies the sound.

928,592. MACHINE FOR APPLYING TAPE TO ARMATURE-COILS. James S. Downs, Easton, Pa. Filed August 26, 1908. A tape-supporting reel has axial and orbital movement, the axial movement being about an axis radial to the axis of the orbital movement.

928,597. MULTIPLE-PENDANT SWITCH. Charles D. Gervin, New York, N. Y. Filed January 17, 1908. A number of plungers are movable through the insulating base to enter a chamber on one face of the base, and a common central terminal having spring tongues is engaged by the plungers and depressed in the direction of movement thereof.

928,651. SOUND-PRODUCING INSTRUMENT. Felix Gottschalk, New York, N. Y. Filed December 23, 1907. An apertured casing for a telephone or the like supports a diaphragm connecting with a device which extends to the apertures and concentrates all of the sound waves passing through the aperture, toward a certain point of the diaphragm.

928,652. RESISTANCE-CUP. Felix Gottschalk, New York, N. Y. Filed June 3, 1908. A resistance cup for telephones or similar instruments comprises a casing, a pair of electrodes disposed therein and insulated from each other, granular conducting material between the electrodes, and a separating member disposed between the electrodes and comprising a series of partitions made of yielding material and for dividing the conducting material into separated quantities.

928,668. TROLLEY. Friedrich Kompe, Berlin, Germany, assignor to Hanseatische Seeverkehrs Gesellschaft M. B. H., Cologne, Germany. Filed October 10, 1908. The trolley wheel or roller has tapering cone-shaped ends, one threaded right-handedly, the other left-handedly, with a central circumferential groove between them.

928,670. APPARATUS FOR WORKING GLASS IN THE HEAT. Johann Kremenezky, Vienna, Austria-Hungary. Filed September 17, 1908. Describes an apparatus for making incandescent lamp bulbs.

928,680. TELEPHONE SYSTEM. David W. May, Kansas City, Mo. Filed May 18, 1908. Describes a form of common-battery telephone system.

928,702. ELECTRICAL POLISHING DEVICE. Thomas H. Rodman, Chicago, Ill., assignor to G. A. Edward Kohler and Franklin W. Kohler, Chicago, Ill. Filed August 22, 1904. A motor-driven polishing device has means independent of the operating handle for rocking the frame about the axle so as to vary the pressure with which the polishing device is forced against the surface acted upon.

928,701. UNITING THE COMPONENT PARTS OF COMPOSITE SHEET-METAL STRUCTURES. Adolph F. Rietzel, Lynn, Mass., assignor to Thomson Electric Welding Company, Lynn, Mass. Filed February 24, 1905. Two pieces of metal are fastened together by electrically welding them to one another at spots only of their juxtaposed or opposite faces by the application of pressure and heating current localized in such spots.

928,707. CONTROLLER. Harry Smith, Suffern, N. Y. Filed August 5, 1908. Consists of a rotatable drum, a number of resistance windings arranged circumferentially on the drum and separated from each other, a body of metal with which the peripheral surface of the drum contacts, means for rotating the drum whereby to bring more or less of the windings into contact with the metal, a commutator rotated with the

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drum, and a connection between the commutator and the resistance windings.

928,709. INSULATOR FOR THIRD RAILS. Louis Steinberger, New York, N. Y. Filed February 2, 1909. The device comprises a base, a bearing member supported by and engaging the base, means for locking the bearing member to the base, a body of insulating material engaging the bearing member, and a rail-supporting member mounted on the insulating material.

928,734. PROCESS FOR THE ELECTROLYSIS OF ALKALI CHLORIDS. Jean Billitzer, Vienna, Austria-Hungary. Filed January 22, 1907. The process consists in compelling a part of the cathode product to form a thin layer in the electrolyte and the constant removal of this layer as it is formed.

928,763. INSULATING-JOINT. Charles A. Jaynes, East Orange, N. J. Filed May 8, 1908. Comprises a socket member, a reduced end integral therewith and extending therefrom, a number of insulating members secured to the reduced end, a sleeve secured at one end to the socket member intermediate the insulating members thereon, and a socket member secured to the other end of the sleeve.

928,771. DYNAMO-ELECTRIC MACHINE. Fred R. Kunkel, Edgewood Park, Pa., assignor, by mesne assignments, to Westinghouse Electric and Manufacturing Company. Filed January 10, 1908. A sheet-metal casing comprises two telescoping parts severally provided with hemispherical sockets, with substantially spherical bearing sleeves secured in the sockets.

928,799. DYNAMO-ELECTRIC MACHINE. Harold M. Scheibe, Wilkinsburg, Pa., assignor, by mesne assignments, to Westinghouse Electric and Manufacturing Company. Filed January 10, 1908. Renewed May 19, 1909. Comprises a stationary member, terminal devices supported thereby, an end bracket and brush holders carried thereby, which are adapted to be engaged by the terminal devices.

928,824. CIRCUIT-CLOSER. Orville M. Tustison, Bainbridge, Ind. Filed June 30, 1908. A contact member is secured to the lateral extension on the inner end of a rotatable cylinder (having a slot in which a key may be entered to turn the cylinder), and a spring is arranged to bear against the contact member, and to hold the latter in close engagement with the head of one of a pair of binding posts when the cylinder is turned.

928,834. AUTOMATIC SAFETY STOP-SIGNAL. Warrington E. Adams, Chicago, Ill. Filed October 3, 1908. A contact shoe engages a trip rail provided with graduated surfaces; there is an electric circuit in connection with the trip rail and home circuit, also an auxiliary electric circuit in connection with the contact and electromagnet, adapted to be broken at a point on the trip rail, and means are provided for raising the valve rod, restoring the train-pipe pressure, and releasing the brakes.

928,839. TROLLEY SWITCH-PLATE. Ester Bell, Dunbar, Pa. Filed December 26, 1908. Has inverted V-shaped converging grooves, and V-shaped electrical conductors located in the apex of the grooves.

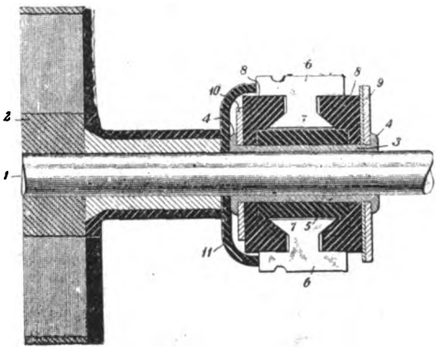
928,857. ELECTRIC-ARC LIGHT. Sidney E. Donnelly, Shreveport, La., assignor of one-fourth to H. Kramer and one-fourth to C. G. Morris, Shreveport, La. Filed January 16, 1909. A holder body has a bifurcation to receive a support and conductor.

928,862. TELEPHONIC APPARATUS. Edwin A. Graham, Brockley, London, England, assignor to himself and Alfred Graham & Co., Brockley, England. Filed October 7, 1907. Comprises a stationary casing having a watertight door and containing a transmitter of the carbon granule type, a receiver, a switch, etc.

928,879. TROLLEY-POLE FOR ELECTRIC-RAILWAY CARS. Thomas Oliver, Chicago, Ill., assignor of one-fourth to J. W. Crouch, Chicago, Ill.; Olga Ottonia Oliver, executrix of said Thomas Oliver, deceased. Filed June 30, 1908. A spring-actuated lifting arm is pivoted eccentrically with respect to the pole.

928,901. AUTOMATIC CIRCUIT-BREAKER. Herbert W. Cheney, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed October 22, 1906. A rotary oil switch has stationary and movable contact members, a rotary drum on which the movable contact member is mounted, a weight on the drum for opening the switch, and means for closing the switch comprising an operating handle and mechanism connected to the handle and to the weight.

928,918. COMMUTATOR FOR ELECTRICAL MACHINES. Fred R. Kunkel, Edgewood Park, Pa., assignor to Westinghouse Electric and Manufacturing Company. Original application filed January 10, 1908. Divided and this application filed October 7, 1908. A commutator cylinder comprises segments having laterally projecting inner ends, opposing insulating clamping members to engage the inner ends, and a supporting sleeve for these parts having integral flanges at its ends for clamping them together.



928,918.—COMMUTATOR FOR ELECTRICAL MACHINES.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired August 2, 1909:

479,781. PROCESS OF PURIFYING LIQUIDS. Courtland W. Brunson, Hamilton, Ohio.

479,786. GALVANIC BATTERY. Martin M. Clark, Chicago, Ill.

479,795. VALVE-CONTROLLER. Charles L. Fortier, Milwaukee, Wis.

479,804. ELECTROMAGNET BOBBIN. Edward B. Hatch and Charles A. Colton, Hartford, Conn.

479,809. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. Edward H. Johnson, New York, N. Y.

479,814. ELECTRICAL WATER-HEATER. Rankin Kennedy, Kilmarnock, Scotland.

479,821. ELECTRIC SWITCH. Andreas P. Lundberg, London, England.

479,849. THERMOSTAT. Thomas W. Shepherd, Peabody, Mass.

479,859. TELEGRAPH KEY. Albert F. Tucker, Auburndale, Mass.

479,886. ELECTRIC CURRENT REGULATOR. Alvaro S. Krotz, Defiance, Ohio.

479,887. GALVANIC BATTERY. Felix de Lalande, Paris, France.

479,928. ELECTRIC SIGNALING APPARATUS. Adoniram J. Wilson, Port Chester, N. Y.

479,932. ELECTRIC METER. Lucien V. Brillie, Paris, France.

479,941. INFLUENCE-GENERATOR OF ELECTRICITY. William Henry, Detroit, Mich.

479,949. ELECTRIC SWITCH. Frank F. Loomis, Akron, Ohio.

479,950. FIRE-ALARM TELEGRAPH INDICATOR. Frank F. Loomis, Akron, Ohio.

479,951. PULSATING CURRENT GENERATOR. Harry N. Marvin, Schenectady, N. Y.

479,960. CONTROLLING MECHANISM FOR RECIPROCATING ELECTRIC ENGINES. Charles J. Van Depoele, Lynn, Mass.

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CONTENTS.

EDITORIAL:
Improving Station Wiring and Minor Piping 275
The Necaxa and Other Dam Failures 276
Electrical Exports 277
Book Reviews 277
Details of Watt-Hour Meter Manufacture 278
Losses, Induced Volts and Amperes in Armor and Lead Cover of Cables 282
International Harvester Company Installs Individual Electric Drive 283
Street-Railway Supervision 283
Work on the Roosevelt Irrigation Project in Arizona 284
Michigan Electric Association 286
Navy Department Supplies 286
Electric Lights for the United States Military Posts 286
Payne Tariff Bill Signed 287
No Increase in Price of Carbons 287
Copper Consumption 287
Electrical Notes from Great Britain 288
BOOK REVIEWS ..... 290 to 297
Electrical Exports for June and for the Past Fiscal Year 297
The Central Electric Railway Association 297
Wireless Telegraphy and Ship Insurance 297
Printing-Press Data for Electric-Motor Salesmen and Engineers 298
Interurban Traffic in Indiana 299
Possible Opportunities in Mexico 299
To Harness Hell Gate 299
Wireless Service Extended 300
Copper Exports 300
Increase in Electric Pumping Plants 300
Boston and Maine to Use Waterpower 300
Practical Accounting for Electrical Companies 301
An Electric Dredge 302
Artistic Possibilities of Electricity 302
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 303
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE 304-305
INDUSTRIAL SECTION:
The Flow Indicator 306
Excello Series Flaming-Arc Lamps 306
Operating Costs of Commercial Electric Vehicles 307
Central Electric Opalux Tungsten Fixtures 307
Storage Batteries and 24-Hour Service 307
Developments in Holophane-D'Olier Steel Reflectors 308
New Direct-Current Portable Meters 308
New 200-Volt Tantalum 308
The Electrical Equipment of Textile Mills 309-310
The Allis-Chalmers Company Reports Good Business 310
CURRENT ELECTRICAL NEWS 311-317
DIRECTORY OF ELECTRICAL AND ALLIED ENGINEERING AND SCIENTIFIC SOCIETIES 317-319
RECORD OF ELECTRICAL PATENTS 319-322

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IMPROVING STATION WIRING AND MINOR PIPING.

At this time of the year many central-station managers are making the most thorough examinations of their generating equipment and its auxiliaries in order to meet the anticipated loads of the fall and winter successfully and economically. During the warm season it takes a good deal of enthusiasm to go over a steam plant with a fine-toothed comb and to carry forward an energetic campaign of improvement in apparatus which at present has no difficulty in meeting the daily demands upon it; but there is no doubt that the company which makes the most of the next few weeks in rehabilitating its station will find that the effort pays when the days of heavy peak loads arrive. It is now getting pretty late in the season to attempt any very sweeping changes in station make-up with the hope of finishing them in time for the forthcoming winter business, although the present summer is much more favorable to prompt deliveries of equipment than many managers realize. A great deal can be done in the line of what might be called secondary improvements, however, and at a cost so moderate that it will make no appreciable difference in the net returns of most companies for the year.

In not a few plants there exists an excellent opportunity to improve the operating conditions by modifications in the wiring and minor piping. Particularly in the older stations is it true that the auxiliary piping is apt to get into condition unfavorable to the most reliable service, and often the wiring is more complicated and inaccessible than is actually required. It is tiresome for the station manager to be told year after year how important it is that his equipment shall be maintained at the highest possible pitch of efficiency; but the recurrence of shut-downs, fires, accidents, and more or less permanent lapses from economical power production, emphasize the necessity of a perpetual study of the conditions in each station. In the wiring field it cannot be too strongly urged that all conductors carrying high-tension current should be run out of the reach of casual passers-by, and it should be difficult under any circumstances to make contact with high-voltage busbars and cables. Not infrequently do owners of old stations look with disfavor upon the investment required to properly safeguard their busbars, leads and feeders inside the plant. There has perhaps never been any trouble; the force is cautious in working behind the switchboard and in the basement, and visitors are kept away from the danger points by the attendants. Space

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need not be taken to emphasize the great risk of such a point of view. Where very high voltages are dealt with, the use of safe construction is so imperative that the danger here is really less than in stations operating at potentials of from 2,300 to 13,200 volts. Even if the routine work of the plant can be carried on with safety, the presence of unskilled labor or electrically untrained workmen introduces a hazard that may result in a very serious situation, through the running of steel drills into live conductors insufficiently protected, the cutting of lead cables by nails or hatchets, or the dropping of machine or other metal parts upon inadequately insulated horizontal conductors. In one station recently visited the generator leads were run across the top of a bare concrete floor to a conduit opening leading to the switchboard, the wires being covered with thin lead tubing. Every time the engineer of the plant walked across the room he was liable to step upon the lead tubing, or to drop some heavy metal piece or sharp tool upon it, thus running the chance of shutting down the street lighting and commercial service of the entire town, if indeed the station itself were not set afire by the short-circuit. This construction was adopted to avoid running wires across the station in sight, but it would have cost little to run a vitrified conduit through from the generators to the switchboard, and to separate the exciter leads from the 2,300-volt wiring, which was not done in the plant cited. The relocation of knife selector switches at a height above the tallest man's head costs little, in cases where they have been installed at too low a level for safety. The insulation of exposed high-tension busbars by oil-treated wooden clamps, or even by special tape, may be effective in time of need.

The improvements possible in auxiliary piping lie mainly in the direction of increased service reliability and operating convenience. Among the specific betterments which suggest themselves are the running of piping of small size at the sides of the engine room or beneath the floor instead of obstructing the working space of the plant with it, the addition of valves permitting the isolation of certain sections of feed pump steam lines, hot water services, and drains without the interruption of the balance of the plant; the removal of compressor tanks in oil engine installations from the middle of the room to the sides; the shortening of auxiliary steam line runs and the installation in some cases of auxiliary headers with sectionalizing valves; the attachment of lighter pipes to better resist vibration; and the separation of piping and wiring. Many fires have been caused in stations by the swinging of wires against gas or oil pipes, through the insecure location of each, even a 110-volt circuit being capable of making considerable trouble in this way. In one basement an unused metal water conductor was stored between the floor timbers in contact with the live terminals of an electric cut-out. The water pipe carried the current to a gas pipe, where a hole was melted and the escaping stream ignited. These incidents are by no means spectacular, but they are just as potent in causing damage or shutdowns of equipment as more impressive casualties. In another case a slight leak in the roof caused a loss of over $3,000 by a fire resulting from leakage of current, electrolytic action, corrosion and an open electric-light circuit, and in another instance a severe personal injury followed the contact of a grounded oil pipe with an opening switch blade. Rigorous inspection in advance of the fall load will eliminate many of these small but potent obstacles to the best quality of service.

THE NECAXA AND OTHER DAM FAILURES.

The astonishing rapidity with which the labors and expenditures of months, or even years, can be brought to naught by the failure of a dam has once more been emphasized. On the morning of May 20, 1909, approximately 715,000 cubic yards of the upstream portion of the great dam at Necaxa, Mexico, slid into the reservoir being constructed above it, in the space of one minute of time. The work of several years was undone in less time than it takes to state the fact.

Just about once each year a dam of more or less prominence will fail, causing losses of time, money and lives, to say nothing of engineering prestige. Why is this so? Do they fail through the same or different causes? Is there no remedy? Must we bow to the inevitable, and admit that any dam is liable to fail at any time? No, we think not. What, then? Let us examine a few recent examples and see what we shall see.

In 1906, a masonry dam at Durango, Mexico, failed from a very simple cause. This dam was of rubble concrete and was concrete faced, which would seem to indicate stability, and yet it "washed out" when overtopped by about one foot of water. In 1907, the dam across the Boardman River, at Traverse City, Mich., was carried away. This dam was also made of concrete, but it failed through scouring of the foundations, or "backwash." In 1908 a dam near Helena, Mont., failed for a seemingly simple reason. This was on the Missouri River, at Hauser Lake, and consisted of a steel frame covered with sheet steel and anchored in place. The middle portion of this dam was built on a gravel bottom and tied to sheet steel piling, which had been driven deep into the river bottom. This is where the dam failed, although investigation also showed that some of the concrete used had been laid in ten feet of water, with but little provision for proper setting. Several other instances of equal importance might be mentioned, but these are a fair assortment and will serve our purpose.

And now has come the failure of the Necaxa hydraulic-fill dam, a structure of gigantic proportions and highly approved type, due to the peculiar conditions with which the engineers had to contend. The peculiar kind of clay used for the core did not drain dry as rapidly as was expected, but remained as a pasty mass, so the great pressure created by the increasing height of the structure simply pushed out the upstream face, and the core "flowed out" after it. If the reservoir had been full of water this would probably have balanced the pressure, but the season has been unusually dry and

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there was but little water impounded. And right here we get the first hint as to the causes of most failures of structures of this class. It is the "unusual" or the "unexpected" condition which occasionally arises that does the damage.

The dams mentioned were of different types, and every known form of dam has failed in at least one instance during the last quarter of a century, so the cause does not seem to lie in the type. Undoubtedly, the wrong type for certain specific conditions has been chosen in some instances and failure has resulted, but these have not been taken into account here. The remedy is too obvious. The great majority of dams do not fail, so we must assume that failures cannot be attributed in all cases to the ignorance of the engineering profession regarding "suitability." An examination of the explanations accepted as final in the cases of failure mentioned also shows a wide variety, there being probably not two failures from the same cause with any one type of dam.

Let us apply the same line of reasoning to structures of this kind that we apply to failures of engineering works of other kinds, and see where we come out. Take the failures of machinery, bridges and other metallic structures, for example, and we find that failure is due to one or more of four causes—bad material, poor workmanship, faulty design, or unfair treatment in service. The latter cause may fairly be omitted in considering our subject, for the service performed by a dam is not capable of variation to any great degree by the operator, and floods of unprecedented magnitude cannot be foreseen, although they might be assumed in laying out the design. But this does not come under the head of "unfair treatment in service."

Looking at the Necaxa failure from these three points of view, we find that, while the bad materials used for the core and for a portion of the upstream face were largely responsible, all three causes contributed to the result. First, as to the materials, the kind of clay used for the core of the dam did not drain dry so readily as other clays used for this purpose heretofore, and the stone (tepetate) used for a portion of the upstream face, where the failure occurred, was of very much less specific gravity than the sandstone originally intended to be used. Second, as to poor workmanship, it is admitted that the crest of the upstream toe was made narrower than that of the downstream toe, whereas it should have been wider, and that this was done to "save time" and material. It is also admitted that a poorly repaired break existed at this point, and might have contributed to the failure. And third, as to faulty design, there can be no question as to the excellence of the design in itself, but under this head we must of necessity include the engineering preliminaries and the supervision of the structure because of its nature. In any undertaking of this kind changes are nearly always found necessary as the work advances, and the engineer is called upon to modify his design as a sort of a "continuous performance." The engineer allowed materials to be used "against his better judgment" in order to save time and apparently did not conduct any very extensive tests to determine the draining qualities of the clay. There were other changes, also.

It might be contended that the engineers could have prevented this failure by doing differently. Possibly, and in other cases also, but there was no precedent to guide them in this case, in many details, and their judgment, even though based upon years of the broadest experience, did not quite equal the requirements. They have been very frank in discussing this affair and have taken all of the blame that can justly be placed upon them, and they are notable exceptions to the rule of "pass it on." Engineers as a class are very careful and take as many factors into account as they can in reaching their conclusions, but they have their limitations, like other human beings, and sometimes fail.

So, while we do not yet know the magic "cure all" for dam failures, or any other kind, we can at least learn the lesson of "Don't do it again." It has been truly said that "the scrap pile is the place to learn," and from the wrecks of dams engineers may learn what to avoid in future works. We believe they will.

ELECTRICAL EXPORTS.

On another page of this issue are given in convenient tabular form statistics on electrical exports from the United States for the last three fiscal years, ending on June 30 in each case, and for the thirteen months preceding July 1 of this year. These tables form an interesting basis for study of the conditions prevailing in the electrical industry. The totals for the three years referred to are as follows: 1906-1907, $17,268,406; 1907-1908, $15,249,436; 1908-1909, $12,524,391. Thus for the last year there has been a slump of $4,744,015 from the banner year, 1906-1907, just preceding the financial panic. This undoubtedly represents the lowest point in the prevailing depression. The monthly figures for the close of the last fiscal year show a fairly general improvement. Now that the tariff situation has been cleared up, there should be a steady upward trend in the electrical industry in keeping with the improved business conditions all round. The fiscal year 1909-1910 should therefore be able to show a decided recovery in electrical exports to the excellent totals of a few years ago.

BOOK REVIEWS.

There is an old phrase which we all learned when we were at school to the effect that "a man is known by the books he reads." In technical literature, as in all other divisions of letters, there are books good and bad, and reviewers ofttimes fall short of grace in commenting upon new books as they appear. There is a demand for books in the electrical field and the publishers have been at work to supply this demand. On other pages of this issue we review a number of the latest offerings—all good books—and to those who are interested in the present state of the art these will be found of interest and profit.

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DETAILS OF WATT-HOUR METER MANUFACTURE.—I.

BY JOSEPH B. BAKER.

GENERAL REMARKS.

The following account was written mainly from notes of inspections of the General Electric Company's meter factory at Lynn, Mass., several years ago, and of the Westinghouse Electric and Manufacturing Company's meter factory at Newark, N. J., more recently. The bulk of the matter on damping magnets, and the notes on sapphire cup jewels, pivots and pivot-jewel step bearings, were obtained at Lynn; and the matter on the cup-sapphire ball jewel, and on the other meter parts referred to, at Newark. There have also been incorporated some data from the trade publications of several meter-manufacturing companies.

A visit to the meter factory of one of the large manufacturing companies impresses one with the enormous amount of care and skill exercised in all details of the making and testing of the electric meter. The emulation of scientific achievement, and commercial competition have resulted in marked improvements in meter design in recent years, and the work of the designers is ably complemented by that of the factory staff.

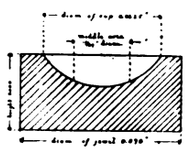

FIG. 1.—GENERAL DIMENSIONS AND SHAPE OF SAPPHIRE JEWEL. DIAMETER OF CUP, 0.0625 INCH; HEIGHT OF JEWEL, 0.04 INCH; DIAMETER OF JEWEL, 0.090 INCH.

One of the most noteworthy things is the system of inspection that permeates the entire process of manufacture from the selection of the raw materials to the final checking of the finished meters. The care that is taken in this inspection at every stage is due to the realization of the fact that every meter sold is a representative of the company that made it, and that its good or bad performance in service adds to or detracts from the reputation of the company.

Another thing is the extent to which modern factory systems have been adopted. The meter factory is in the front rank in the providing of plenty of light, by ample skylights and large windows, and by lavish distribution of the electric light; in the attention paid to such matters as good ventilation, cleanliness, maintenance of tools, systems of cost keeping and of progression of manufactured parts through the different departments of the factory, and discipline of the working force; in the use of individual and group electric-motor drive for the tools, and in many other practices of recognized value.

The meter factory may be equipped with a generating plant of its own (preferably in duplicate), consisting of direct-current and alternating-current motor-generator sets for giving the voltages and currents required to test the factory's production of meters. The alternating-current machinery may include a motor-generator with variable speed or variable number of generator poles, or both, to give different frequencies—for example, frequencies ranging from twenty-five to 133 cycles—to facilitate the testing of meters designed for operation on special frequencies, as in the case of some meters for foreign service, as well as the regular product.

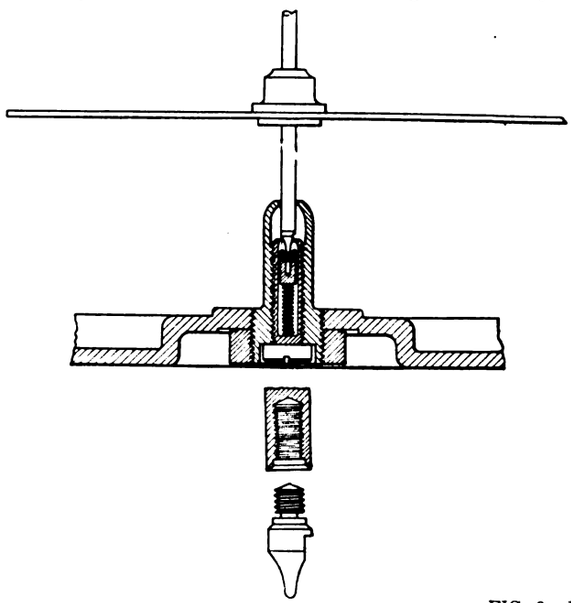

FIG. 2.—PARTIAL VERTICAL SECTION OF METER BASE.

BEARINGS.

As already demonstrated elsewhere, the successful performance of an electric meter requires that the ratio of torque to mechanical friction shall be not only large, but as nearly constant as possible. Step and top bearings, register, and windage of the rotating element, and, in direct-current meters, the contacts between commutator and brushes, are all sources of mechanical friction.

STEP BEARINGS.

The step bearing, on which rests the entire weight of the rotating element, is the seat of a large percentage of the normal mechanical friction of the meter, and of the troubles that may develop in service. In general, the excellence of the design of construction of the lower bearing and the actual weight of the rotating element determines largely a meter's ability to maintain its initial accuracy under service conditions; for it is at the lower bearing that wear first asserts itself, and any wear at this point eventually introduces friction, with consequent inaccuracy, especially at the light loads. The severe requirements thus imposed—that the friction at the step bearing shall be reduced to the smallest possible amount, and that this minimum shall not increase with time—have led to the expenditure of a great deal of pains to develop this detail of the meter.

Experience with step bearings for commercial electric meters has proved that for the bearing surface but two substances will give continuously satisfactory operation as jewels—the sapphire and the diamond.

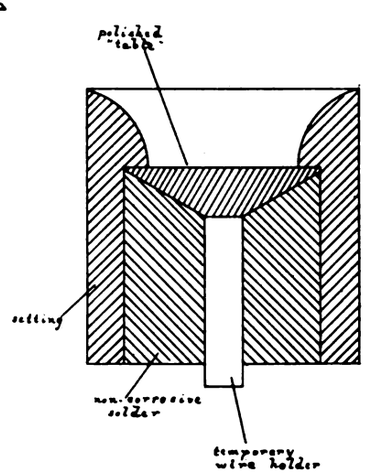

FIG. 3.—VERTICAL SECTION, SHOWING POSITION OF DIAMOND END-STONE AND ITS SETTING.

There are two main types of jewel bearings: the pivot-jewel bearing, exemplified in the T R W meters, and the ball-jewel bearing, employed by the Westinghouse Electric and Manufacturing Company.

Pivot Jewels.—Until within recent years, the sapphire cup jewel was used for most meters. Fig. 1, a drawing of a sapphire jewel that has been used for T R W meters, gives an idea of the general dimensions and shape of this form of jewel. See also Fig. 2, a partial vertical section of a T R W meter base, which shows the jewel mounted in the jewel screw.

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In the T R W meter the cup or ring-stone jewel is inserted in the end of the jewel screw, where it rests on top of a steel-wire, open-coil spiral spring. The open end of the screw is then spun over the jewel mounting, which is thus securely confined between the end of the screw and the spring. The latter serves to protect the jewel from the possibility of injurious effect of blows or vibration through which the meter is liable to be subjected in service. The strength of the spring is so proportioned as to "float" the rotating system, the spring being under a slight compression. The total possible movement of the jewel, against the tension of the spring, is about one-eighth inch. Extensive experiments have determined that the life of the (sapphire) jewel depends upon the adaptation of the stiffness and natural period of the jewel spring to the weight of the moving element. Since the latter varies in the different types of meters, jewel screws having springs of different strengths and periods are provided. In the latest type of meter, the jewel screw is combined with a shipping clamp (sometimes termed "locking device"), not shown in Fig. 2, by means of which the rotating element is automatically locked, out of contact with the jewel, in transportation. The spring support of a meter jewel, in a meter having a fairly heavy rotating element, greatly prolongs the life, by protecting it from the effects of the severe reciprocating or pounding motion caused by local vibration or by the action of the alternating current in alternating-current meters.

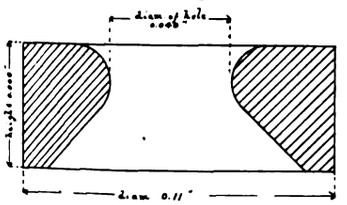

FIG. 4.—JEWEL HOLE.

Without the spring support, ordinary vibration would be liable to break the polished surface of a cup sapphire jewel and lead to serious breakdown of the meter's accuracy long before the jewel could be affected by ordinary wear.

For large meters, having very heavy rotating elements, or for meters subject to considerable vibration, a spring-supported ring-stone jewel, consisting of a flat diamond end-stone with sapphire jewel-hole, has been used. Figs. 3, 4 and 5 are vertical sections showing, respectively, a diamond end-stone and its setting, the general shape and dimensions of a sapphire jewel-hole, with bearing surface ground and polished, and a ring-stone jewel assembled.

It may be stated that commutator meter step bearings having a steel pivot or shaft-end should be spring-mounted, and should be equipped with a shipping clamp for holding the rotating system out of contact with the jewel when the meter is being moved. The need of these devices, and the importance of not moving the meter without setting its clamp, are greater in proportion to the weight of the rotating element, and therefore greater in commutator meters, with their comparatively heavy moving system, comprising a long shaft, and the armature and commutator.

The method of mounting the diamond end-stone in its supporting plugs is to back it with solder. A short piece of tinned phosphor-bronze wire serves to hold the "table" of the diamond (the bearing surface) against the upper or open end of the plug, using a special pair of pliers. A non-corrosive solder is then sweated into the space between the wire core and the inside wall of the plug, thereby holding the stone securely in place. It is necessary to use a non-corrosive solder to prevent creeping of corrosive substance to the table of the diamond and loosening up of the stone in its setting. The bit of phosphor-bronze wire may then be withdrawn, leaving the end-stone setting as shown in Fig. 5.

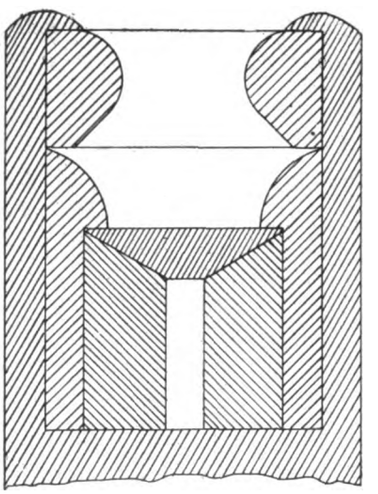

FIG. 5.—END-STONE SETTING.

A method of grinding and polishing diamonds in a concave form has been developed, by means of which a surface is secured that is claimed to be unsurpassed even by jewels having a flat face. Cup diamond bearings were used at first only in meters having heavy moving elements or which were subject to considerable vibration; but this form of jewel may ultimately replace the cup sapphire in meters of ordinary capacity already installed.

The accuracy of a meter equipped with a flat diamond jewel is liable to be erratic at loads under seven-and-one-half per cent of full load, owing to variable friction between the side of the pivot and the sapphire ring-stone. On the other hand, the longer life of the diamond jewel makes it superior to the sapphire cup jewel for use in electric-car meters, which are exposed to very heavy and continuous vibration.

In regard to the life of the diamond jewel compared to that of a sapphire jewel: The life of a jewel is rather an indefinite quantity, depending upon the type and quality of the jewel itself, the weight of the moving element and the amount of vibration to which the meter is subjected at its place of installation. It is generally expressed as the number of rotations made by the meter before the light-load accuracy is affected ten per cent. When the meter is operated under normal conditions, the life of a sapphire jewel in a commutator meter should exceed 600,000 rotations, and will probably average, for a T R W meter, 1,000,000 rotations. On the other hand, cases have been reported of flat diamond jewels running 40,000,000 rotations, in a T R W meter, without any signs of wear. Any jewel in an induction meter will operate longer than the same jewel in a commutator meter, on account of the lighter rotating element of the former.

Severe and prolonged service tests are being conducted by the large central-station companies on meter jewels of all sorts—cup sapphires with pivot and ball bearings, and flat and cup diamonds—to determine their relative "life."

FIG. 6.—JEWEL POLISHER AT WORK.

The making of jewels is one of the most important branches of the manufacture of electric meters. As an industry, it is a definite branch of the ancient art of the lapidary, which is followed in certain families from father to son for generations; but under the modern conditions of electric meter and instrument manufacture, piecework and division of labor have been applied.

In the making of sapphire jewels, to insure a satisfactory bearing, it is necessary that every stone be selected, ground, polished, and tested with the utmost care. Only the finest quality of "Eastern Sapphires" is used, the percentage of rejections from each lot of stones purchased averaging high. The best stones for meter and instrument jewels are the light bluish white; the yellow or the dark-col-

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ored stones being too soft as a rule for use under the rigid requirements of the work.

The first step in the handling of sapphires for jewels, after the rejection of soft or flawy stones, is the cutting of the stones into slices, of thickness suitable for making jewels. This cutting is done by the use of circular copper-leaf saws "charged" on the edge with bort or diamond dust and rotated at high speed. The rough stones, securely mounted on brass holders by the use of melted shellac, are fed against the saws, which are arranged in gangs, the number of saws on each spindle depending upon the size of the stone to be cut. In this work, as in all subsequent rough work on the jewel, a running stream of water—made soapy in some cases—is used to keep the copper tool from heating. The cutting proceeds rapidly, and each stone is transformed in a few minutes into a pile of slices of sapphires.

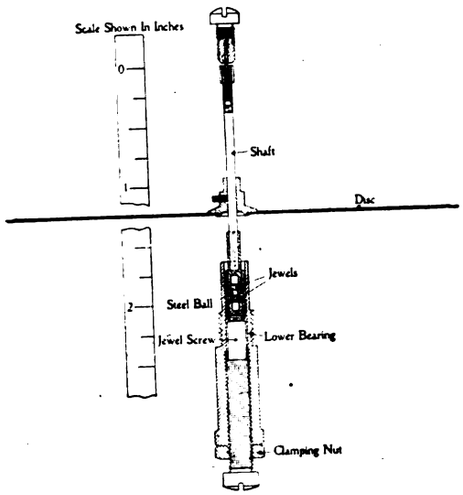

FIG. 7.—BALL-AND-JEWEL BEARING OF WESTINGHOUSE INDUCTION METER.

The next step is the rough grinding, using a revolving copper disk charged on its upper face with the diamond dust, which brings down the thickness of the slices to a nearer approximation to the final thickness of the jewels. The fine grinding is effected by the same process, but using a finer grade of bort on another disk.

The stones must now be "chipped" and turned. The chipping is done by hand, each stone being held securely upon a steel plate and its edges chipped off by the use of a sort of chisel, so as to give a (roughly) circular disk, of minimum diameter a little greater than that of the finished jewel.

After chipping, examination is made by a jeweler's magnifying glass for freedom from flaws, disks containing flaws being rejected at this point, so that polishing labor may not be wasted upon them. In order to pass this inspection, disks must have sufficient perfect stone in the center to permit the grinding of a cup of uniform high polish over its entire surface. The rough disks, mounted by shellac upon the end of a brass arbor which is carried in a small lathe chuck, are then turned down to final diameter —the turning of the edge of the jewel being really a grinding process, using coarse bort applied by a copper tool.

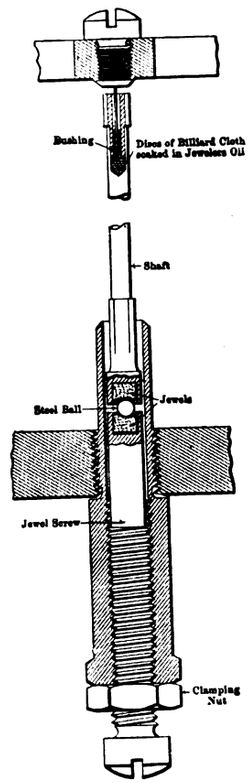

FIG. 8.—UPPER AND LOWER BEARING OF SHAFT.

When the required diameter is reached the stones go to the polishers, each of whom has his own traditional method of work. In making "cup jewels," the cup, or actual bearing surfaces in the meter, is started with a diamond point held at the end of a copper tool. In the minute depression thus made, the polisher works with a sharpened boxwood spindle dipped in bort, the spindle, connected to a flexible shaft, being driven at about 1,800 revolutions per minute in reverse direction to the rotation of the shaft (see Fig. 6). It is upon the quality of this work that the excellence of a meter largely depends, in its ability to stand up in service for a considerable time without showing increasing friction, or actual deterioration of the jewel or pivot. In the polishing of cup jewels and jewel-holes, each workman carries the process through to a finish on the lot of stones turned over to him, from the rough-faced turned disks to the jewel in its final condition, with a top trued with the cup or hole, as the case may be, and with the bearing surfaces of as high a polish and of as perfect a figure as the best grade of the material permits.

Following the polishing of the cups of cup jewels, and the narrow ring surfaces of the jewel-holes, used in ring-stone jewels, the product is tested for flaws.

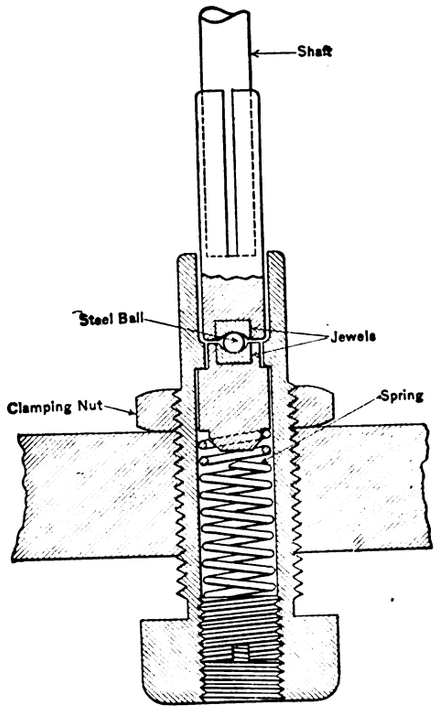

FIG. 9.—SECTION SHOWING DETAIL OF BALL BEARING.

The jewels are first examined carefully with a jeweler's magnifying glass. Next comes the "needle inspection," in which the workman examines each stone with a polished steel needle-point fixed to a handle, moving the needle about in the surface of the jewel so as to detect by the sense of touch any imperfections, either in the work of the polisher or in the stone itself, that might escape visual examination with the glass.

Cup-diamond jewels have been subjected to the following further test, in addition to those already described, to detect any irregularity or "waviness" in the bearing surface that could not be detected by ordinary visual inspection or by the needle test:

The inspector's apparatus is an optical one, consisting of a pair of thin straight metal rods, parallel to each other

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and a short distance apart, supported at a convenient height above his bench and well illuminated by hooded incandescent lamps. The jewel, laid on the bench in a horizontal position, gives in its cupped surface a reflected image of the rods, which he examines closely through a jeweler's glass. The image of the rods, in a jewel having perfect figure—*i. e.*, the cup surface of which is a true surface of revolution—will show as a pair of parallel curved lines, without break or jog, from one side of the jewel to the other; and as the inspector turns the jewel about between his fingers, through a complete revolution, this symmetrical image will remain unchanged. If, however, there be any irregularity in the surface of the cup, it will show up to the inspector's eye as the jewel is turned.

By the use of this apparatus an inspector can sort out imperfect cup diamond jewels very accurately and rapidly. It might be an improvement to hold the jewel in a clutch on the end of a vertical arbor, to facilitate turning smoothly.

Pivots.—In order to realize the antifriction properties of a jewel used as the step bearing of a meter, the top of the shaft which turns upon it, forming the upper member of the step bearing, must be equally as well adapted to its purpose as the jewel upon which it turns.

In most modern meters a removable shaft-end, or "pivot," which may be renewed, when worn or damaged, without having to replace the entire shaft, is used. Such a pivot and its mounting are shown in the section of a T R W meter base, Fig. 2. These pivots are made of the best quality of steel piano wire, 0.034 inch in diameter, drawn under heavy pressure to obtain the finest possible grain. The wire is cut into proper lengths, and the pieces are annealed by roasting them at a red heat, in charcoal, for about half an hour, allowing them to cool naturally. Each piece is next firmly secured in a brass "blank," by forcing it into a hole in the tip of the blank a trifle smaller in diameter. The steel and its holder are then ground to shape, as one solid piece, and the bearing point is finished to proper smoothness by a fine oilstone, followed by Vienna lime, to give it a high polish.

The complete pivot is attached to the end of the shaft by a screw thread, as shown in Fig. 2, using a special pivot wrench, which is furnished with the meter by the maker.

Although the pivots are glass-hardened and highly polished, after they have been operating for any length of time upon a rough or broken jewel this polished surface is broken and sometimes becomes charged with small particles of the stone, which cause the pivot to become a cutting tool. For this reason a new pivot should always be inserted when the jewel is replaced.

Ball-and-Jewel Bearings.—The ball-and-jewel bearing of Westinghouse induction meters is shown in section in Figs. 7 and 8. It consists of a hardened, highly polished steel ball enclosed between a pair of sapphire cup-jewels—an upper jewel held on the bottom of the meter shaft and a lower jewel supported on the meter shield—having a radius of curvature of bearing surface slightly greater than the radius of the ball.

The upper and lower jewels and the jewel mountings are identical, but their arrangement in the bottom of the meter shaft and in the fixed bottom support secured to the shield is different. The upper jewel mounting—hereafter termed simply "the jewel"—is held in a sleeve, which is split to make a good friction fit on the bottom of the shaft, and is retained in the sleeve by an open cap, screwed on over the jewel. The lower jewel is held in the long jewel post by a screw cap also. After the cap is screwed on to retain the jewel, it is pinched by a special pricking tool, which indents the thin shell of the cap and locks it to the sleeve or post.

This method of holding the jewel mounting is claimed to be better than the method by spinning over the end of the jewel post, as employed in some makes of meters that are equipped with a steel pivot or shaft end; as the latter method is liable to get metal dust on the jewel, or to injure the jewel by accidental contact with the tool, etc. It is claimed that when once the jewel is in place in its mounting, no more tool work should be done on or near the latter.

The steel balls used in the form of jewel bearing, one-sixteenth inch in diameter, are said to be imported from abroad. They are additionally polished at the meter factory, and subjected to a rigid inspection, including examination under the microscope. In handling them, a pair of wood tweezers is employed exclusively to avoid the possibility of marring the ball, or depositing dust or other foreign particles upon it. The inside diameter of the sleeve is less than one-sixteenth inch greater than the outside diameter of the upper and lower jewel mountings, so that the ball cannot by any chance slip out of the bearing in any position of the meter.

In assembling the jewels in the meter, the lower jewel post is screwed into the shield and locked in place by a locknut at the desired height, governed by the "play" in the shaft, which is made one-thirty-second inch. The position of the disk is adjusted (to run, in an induction meter, in the middle of the 0.125-inch air-gap between shunt and series fields) by moving the disk up and down on the shaft, and securing it with the set screw that is tapped into its hub (see Fig. 7).

It will be noted that for the Westinghouse induction meter the jewel step bearing is not spring-mounted, and it is claimed that no spring support is necessary on account of the light weight of the rotating element in the type B or C house-service meter. In the Westinghouse commutator meter, however, on account of the much greater weight of the rotating element, a spring support is provided for the lower jewel, as shown in Fig. 9.

Among the advantages claimed for the ball-and-jewel bearing are:

The ball does not remain stationary relatively to either of the cup jewels that enclose it, because, to begin with, it cannot be perfectly centered, since there must be some departure from strict alinement in drilling the bearing holes in the meter shield. Again, in induction meters, it is thrown out of exact alinement by the "pounding" or vibration of the rotating element, due to the alternating current, and by unbalanced lateral stresses from the resultant fields of the meter. Other causes of unbalanced stress on the ball are variation in jewels, lack of perfect leveling of the meter or getting out of level after installation, and unbalanced pull of the damping magnets on the disk. Any one of these causes would operate to turn, or roll, the ball; and it would seem more difficult to prove that the ball does not roll in its seat between the jewels, than that it does roll. It is claimed by the makers that jewels taken apart after a long period of service will show an increased polish all over the surfaces of the ball and jewels. Friction is divided between the upper and lower surfaces of the ball, so that although the pressure upon the jewel is undiminished, the amount of wear upon the jewel is divided, and at the same time the wear upon the ball is evenly distributed over the entire surface of the ball, as it rolls.

[*To be continued.*]

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LOSSES, INDUCED VOLTS, AND AMPERES IN ARMOR AND LEAD COVER OF CABLES.[1]

BY H. W. FISHER.

PART II.

This part deals with tests made on 100 feet of steel-taped armored cable of the following construction: Size of conductor, No. 0, Brown & Sharpe gauge; thickness of paper, eight-thirty-seconds inch; thickness of lead, one-eighth inch; diameter over lead, one-and-one-eighth inches; diameter over armor, one-and-five-eighths inches; dimensions of steel tape, 0.039 inch by one-and-one-half inches (two of such tapes were applied in same direction, overlapping each other); resistance of conductor, 0.0103 ohm; resistance of lead sheath, 0.0300 ohm; resistance of armor, 0.150 ohm.

steel armor, which forms an almost closed magnetic circuit, the curves for this cable are radically different from those of the steel-wire armored cables.

On referring to Fig. 4, which gives the impedance per 2,000 feet at sixty cycles, it will be seen that the impedances are greatest when the armor and lead are not connected, and that a sharply defined maximum is reached with a conductor current of about eighty amperes. There is not much difference in curves A_6 and C_6 except at low current densities, where the greater distance between cables of test C_6 makes the air effect larger proportionally.

Short-circuiting the armor at each end of the cable (see A_8 and C_8) decreases the impedance only slightly. However, when both lead and armor are short-circuited (see A_9 and C_9), the impedance is very much reduced, and only very slightly with resistance per 2,000 feet of circuit may be less when the lead and armor are not connected than when they are connected. The maximum equivalent resistance is about eight times the ohmic resistance when the lead and armor are disconnected. Under practical conditions of operation, the equivalent resistance would be about three-and-one-half times the ohmic resistance.

All this tends to show how advisable it is to use multiple-conductor cables all under one armor instead of single-conductor armored cables. The equivalent resistances given in Fig. 5 were found by means of wattmeter tests.

Fig. 6 gives the volts induced per 100 amperes in 2,000 feet of circuit. These curves very clearly show a maximum rate of induced voltage that corresponds to about eighty amperes in the conductor. As would be expected, the induced voltage

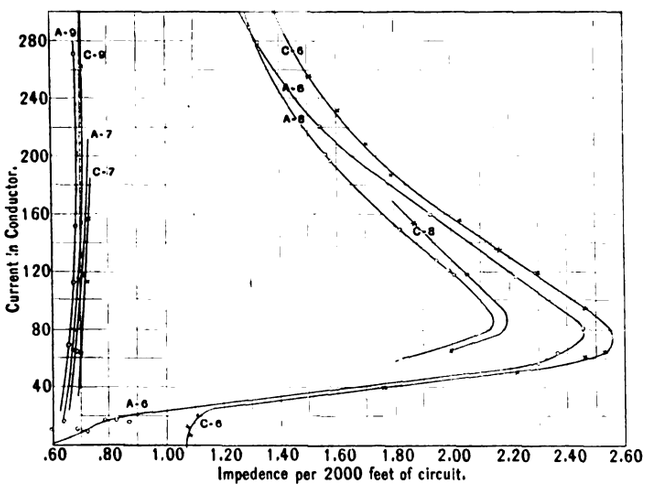

FIG. 4.—IMPEDANCE AND CURRENT CURVES.

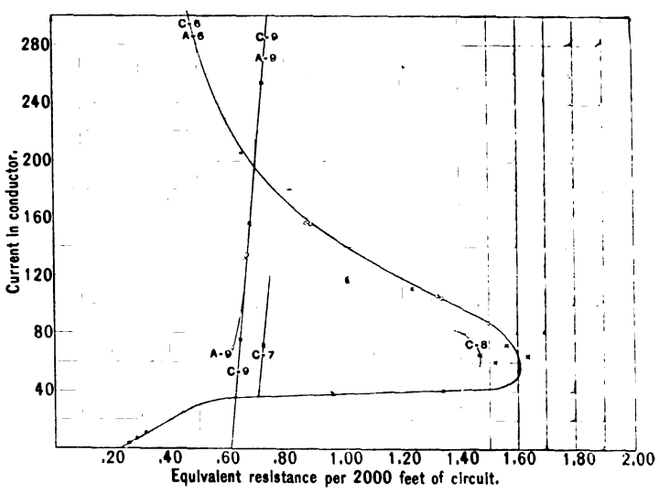

FIG. 5.—EQUIVALENT RESISTANCE PER 2,000 FEET OF CIRCUIT.

To designate the different curves, the following letters and figures were employed:

A indicates that the cables were one-and-seven-eighths inches between centers.
C indicates that the cables were twenty-four inches between centers.
1 indicates induced current or volts in lead.
2 indicates induced current or volts in lead, the armor being short-circuited at each end of the cable.
3 indicates induced current or volts in armor.
4 indicates induced current or volts in armor, the lead being short-circuited at each end of the cable.
5 indicates induced current in armor and lead connected in parallel.
6 indicates lead or armor of each cable not connected or interconnected.
7 indicates lead short-circuited at each end of the cable, armor free.
8 indicates armor short-circuited at each end of the cable, lead free.
9 indicates lead and armor short-circuited at each end of the cable.

On account of the continuity of the the amount of current flowing in the conductor. In this kind of cable, when the lead and armor are disconnected, the impedance may be fifteen times the ohmic resistance. When the lead and armor are short-circuited, as is generally the case in practice, the impedance may be about three-and-one-half times the ohmic resistance.

Fig. 5 gives the equivalent resistance per 2,000 feet of circuit. Here a current of about sixty amperes in the conductor seems to produce the maximum resistance. It is interesting to note that this resistance seems to be practically independent of the distance between the centers of the cables. It is also a striking fact that curves C_6 and A_6 cross curves C_9 and A_9 at points corresponding to about forty and 200 amperes, respectively, so that for small current densities and very large current densities the equivalent is greatest when the cables were furthest apart, and at the maximum point the volts per 100 amperes amounts to about 240, or actually about 190 volts. With a load of 170 amperes, the induced volts would be about 290. When the lead is short-circuited, the electromotive-force on the armor, as given by C_4, is very small. The intermediate curves are in the order that one would expect.

The significant fact brought out by these tests is that it is absolutely necessary to bond the armor and lead of single-conductor cables like the above or else arcs may occur between the cables, or alternating-current electrolysis may tend to destroy the armor or lead. Even when such cables are laid in water, it would be best to bond the armor and lead occasionally.

Fig. 7 gives the induced current per ampere in conductor, and with high cur-

[1] Abstract of a paper presented before the annual convention of the American Institute of Electrical Engineers, Frontenac, N. Y., June 29, 1909.

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rent densities the induced current amounts to nearly eighty-five per cent of the total current. On account of the high resistance of the armor, the current introduced therein is small (see A_3, C_3 and C_4). The other curves are practically very close together, and the greatest current is obtained when the cables are operating under practical working conditions with the lead and armor connected.

The large amount of induced current will not only increase the losses under operation conditions of such a cable, but will also, of course, tend to reduce the safe carrying capacity. Therefore, as previously stated, when armored cables have to be employed for alternating currents, all circuits should be placed in one cable. When it is impossible to do this, the cables must be operated at an induced loss.

A comparison between measured and calculated data is found in Table 5. This will be of interest as an illustration of the accuracy of the practical method given at the close of the paper.

In Table 5, the impedances and effective resistances are for lead covers short-circuited at each end of the cable. The values given in Table 5 are per 2,000 feet of circuit. Only one test was made of effective resistance, and that with seventy amperes flowing in the conductor.

TABLE NO. 5.

Current in Conductor.	Impedance. Measured.	Impedance. Calculated.	Volts Induced on Lead. Measured.	Volts Induced on Lead. Calculated.
300	.73	.716	128	126
156	.72	.73	187	187
70	...	...	...	...

Current in Conductor.	Effective Resistance. Measured.	Effective Resistance. Calculated.	Induced Current in Lead in Per Cent of Conductor Current. Measured.	Induced Current in Lead in Per Cent of Conductor Current. Calculated.
300	...	.68	.815	.83
156	...	.716	.80	.87
70	.72	....	...	...

In order to see if the correction method would give a closer agreement to the measured impedance than the method which is correct for cables without iron armor, the following calculations were made with reference to the steel-wire armored cable mentioned in Part I. The distance between centers of cables was one-and-one-half inches.

Measured impedance equals 0.233; calculated impedance by correction method equals 0.226; calculated impedance by theoretical method for cables without armor, equals 0.283; current in conductor, equals 140 amperes.

The close agreement of the first and second impedances given shows that the correction method should be used in connection with armored cables.

Comparison calculations between the two methods as applied to the steel-tape armored cable showed a fairly close agreement. This, no doubt, is due to the fact that the reactance of this cable is so great that the current induced in the lead is a large percentage of the conductor current and a large change in the reactance will only slightly affect the lead current.

The closing part of this paper, prepared by R. W. Atkinson, gives the methods for making calculations in reference to armored cables.

[To be continued.]

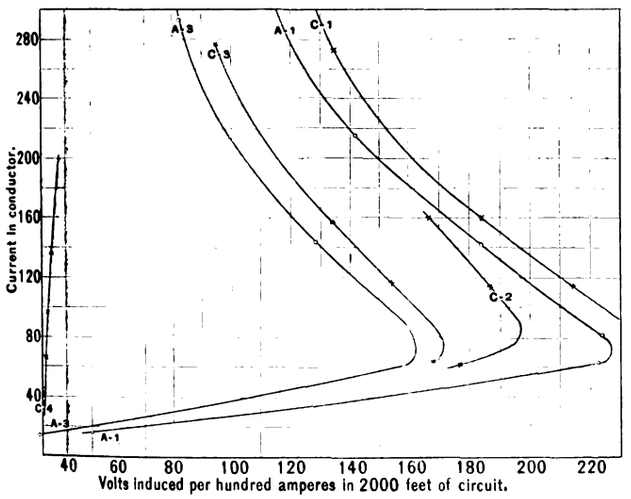

FIG. 6. RELATION OF INDUCED VOLTS AND CURRENT IN CONDUCTOR.

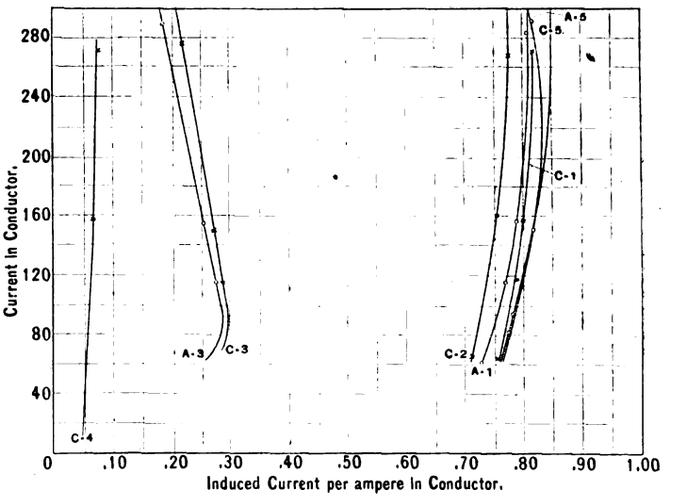

FIG. 7.—INDUCED CURRENT PER AMPERE IN CONDUCTOR.

International Harvester Company Installs Individual Electric Drive.

Starting with next week the entire machine shop of the Keystone works of the International Harvester Company, at Sterling, Ill., is to be electrified. Turbines are now being installed for developing the electric power which is to be transmitted all over the shops to individual motors at the machines. An estimated saving of one-half in power cost is expected.

Street-Railway Supervision.

Supervision of street railways in England and Prussia has been made the subject of inquiry by the New York Public Service Commission of the First District. It finds that in both of these countries prevention rather than correction of abuses is the policy which is successfully followed in the supervision of these enterprises.

Supervision is a state rather than a municipal function, and the state authorities in granting consent to construct street-railway lines set out in detail the conditions under which the franchise can be exercised. In Prussia both the state and the municipality grant franchises. Before the new line is opened a thorough inspection is made, the plans of construction are subject to searching inquiry and every effort is taken to protect public and private interests and to secure the safety and convenience of the public.

The report says further: "This system of regulation has existed from the start. The state did not wait to see if perhaps supervision might be unnecessary. The street railway was a public utility; it was licensed to perform a service of paramount public importance. This was deemed a sufficient reason for taking adequate precautions to safeguard the interests of the public.

"As a result, abuses which are quite common in America scarcely exist at all and the supervising authorities are rarely called upon to exercise their corrective functions. It is true, however, that in general the Prussian and English supervising authorities do not employ inspectors to see that their regulations are enforced but rely almost entirely on complaints from individuals or municipal authorities."

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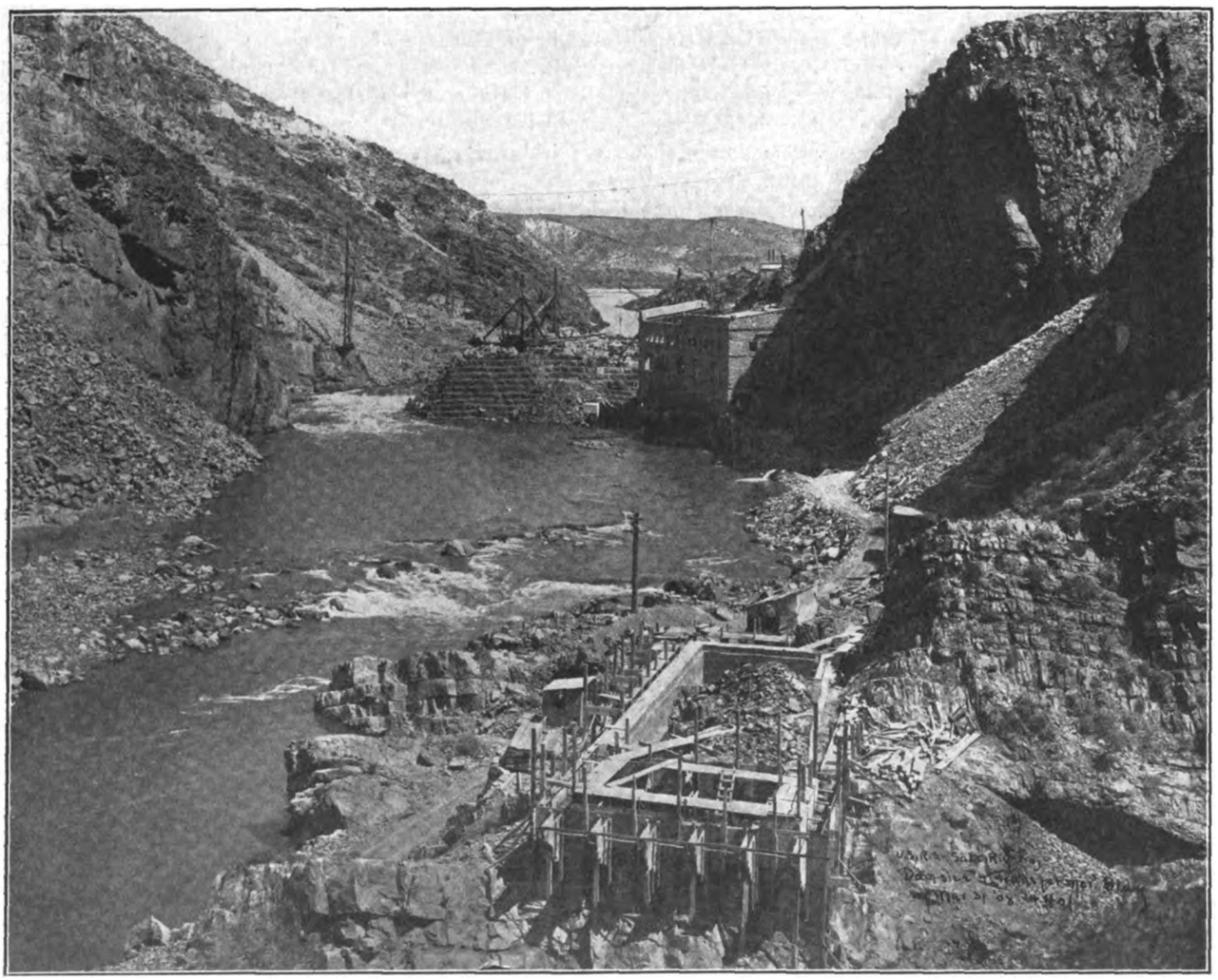
WORK ON THE ROOSEVELT IRRIGATION PROJECT IN ARIZONA.

ELECTRICITY AS AN ADJUNCT IN DEVELOPMENT AND CONSTRUCTION.

BY D. A. WILLEY.

The use of electric power in connection with irrigation projects has been demonstrated in a remarkable way in formation of artificial water supplies would be impossible. In some places it is necessary to lift the water from one level to another by means of powerful pumps actuated by electricity. In fact, irrigation through the medium of the electric pump is one of the most important phases of this development in the West as is shown by the success of what might be called electric irrigation in Kansas as well as in the Salt River valley in first steps taken was to locate a route for a power canal as the head of water which could be obtained was such that the engineers calculated it would furnish ample energy for building operations at a very small expense as compared with steam, owing to the long distance which fuel would have to be carried and the large outlay which must be incurred to obtain an adequate plant of engines and boilers and to transport them the long distance



VIEW OF THE DAM AT ROOSEVELT, SHOWING ONE OF THE CONCRETE BUILDINGS UNDER CONSTRUCTION.

what is known as the Roosevelt Dam in Arizona. Several articles have appeared recently,[1] and the data herewith are presented in the nature of supplementing that already given and adding several illustrations which have just come to hand, indicating the extent and picturesque features of this work. It may be said that without the present development of current for power purposes, many of the schemes which are now being undertaken by the United States government to reclaim the arid lands in the West by the Arizona, where it forms an adjunct of the principal irrigation scheme.

A special feature of the engineering methods at Roosevelt, however, is the many ways in which the electric current is utilized not merely for lighting and for communication, but for furnishing power. The fact is, that the Salt River, which will furnish the bulk of the water for the main reservoir being formed, has played an important part in constructing the enormous dam as well as other works at this point by the system which has been adopted by the engineers. One of the over the country from the nearest railroad station.

The power canal can be well termed one of the most interesting features of the entire project. Waterpower or electric current has before been secured from dams intended for irrigating purposes by utilizing the waste water. Such power, however, is only available when the flow of water into a reservoir is more than sufficient to fill it. The power at Roosevelt is obtained independently of the irrigating scheme, the canal being separate from the reservoir and one of the first

[1] Vol. 53, No. 9, pp. 316. Vol. 55, No. 1, pp. 10

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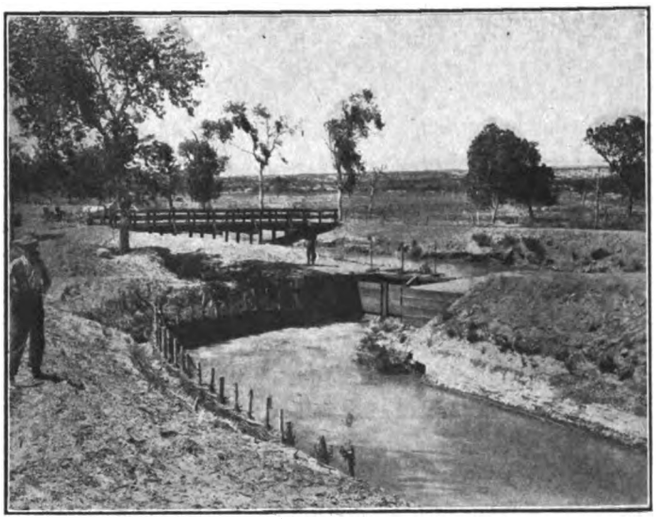
works completed. The head of water secured by means of the canal actuates waterwheels connected to electric generators. From the power station extends a transmission line conveying current to the plant for the manufacture of cement, the stone-crushing plant, for lighting, operating the aerial railway, and for other purposes. Under a head of 250 feet, hydraulic jets with nozzles of eleven inches have been used to wash away the loose formation and accumulation of sump above the bedrock upon which the dam proper is being built, and have greatly facilitated progress. Much of the gravel thus secured has been utilized for construction material. To remove the gravel, elevators have been placed in service.

THE ELECTRICALLY DRIVEN PUMPS SUPPLY THESE IRRIGATING DITCHES.



ONE OF THE SUPPLY CANALS SERVED BY THE ELECTRICALLY DRIVEN PUMPS.

This canal, which is twenty miles in length, is one of the permanent works. Most of it is lined with concrete, and it includes several extensive tunnels, aggregating nearly 10,000 feet in length. It is carried over gulches by concrete pipes. The dams used for diverting the water to the power canal represent a cost of $40,000, while the canal, including its pressure pipe and auxiliary structures, represents a total of nearly $1,000,000. With all of the generating sets to be installed in service, it will develop no less than 4,400 horsepower, which will be used for pumping water for irrigation.

With this supply of power a comparatively small amount of hand labor has been needed on the Roosevelt work, enormous as it is. In fact, it is doubtful if as much material is handled anywhere in the world with the same number of men and placed in position as upon this great Arizona improvement. The dimensions of the dam will give an idea of the magnitude of the reservoir. It will form a storage basin holding sufficient water to flood 1,300,000 acres to an average depth of one foot. This quantity is much larger than the volume held in storage by the greatest Nile reservoir. The supply will be secured from the Verde and the Salt rivers, which drain a watershed of 6,260 square miles. The average yearly rainfall over this drainage basin is not over twenty inches. The annual rainfall upon the territory to be irrigated ranges from three to ten inches; and the rapid evaporation of moisture is indicated by the fact that the temperature in summer ranges as high as 120 degrees, although the elevation varies from 1,000 to 1,300 feet altitude. The dam will impound sufficient water to fully irrigate 270,000 acres of soil.

VIEW ALONG THE FACE OF THE DAM UNDER CONSTRUCTION AT ROOSEVELT.

To provide a structure which would be of sufficient strength to withstand the enormous water pressure, also the force of the rivers when in flood, a dam was planned having the total height of no less than 284 feet above the rock formation of its site. The length of the dam at the bottom is 235 feet, but as the gorge rapidly widens at this point the length at the top will be no less than 1,080 feet when it is completed. The vast quantity of material required can be estimated when it is stated that the thickness of the dam at the bottom is not less than 175 feet while the crest of the work will be wide enough to permit a highway for vehicles from one side of the Salt River to the other.

When the engineers in charge of the project arrived at the site of the main dam, they found themselves in an absolutely desolate country many miles from the nearest railway station and without even a wagon trail. One of the first steps was to build a system of roads over which to haul material. A power house, a cement mill, habitations for the people, a water supply had to be built and the result was, the town of Roosevelt came into existence merely to provide facilities for constructing the dam. Rock was quarried from the vicinity and deposits of sand discovered suitable for the manufacture of concrete, while from a tract of woodland some distance away, timber was obtained. With these bases of supply, work was begun upon the dam in September, 1906, and has been in progress almost continually since that time, consequently a considerable percentage of the great wall is now in position, as is shown by the illustrations.

In the construction, electricity per-

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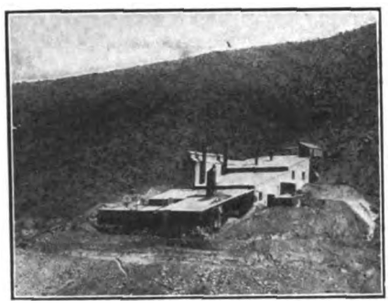
forms a great variety of work, conveying most of the rock as well as the concrete and other material in addition to furnishing power for drills, rock crushers, the machine and blacksmith shops and operating all of the aerial tramways. Rock, set in concrete, is required for filling in behind the face, and boulders as large as can be handled are used. Nearly 400,000 cubic yards of masonry will be placed in position when the dam is completed, and the reservoir which it will create will form a lake twenty-five-and-one-half square miles in area. As soon as the dam is finished, the cement mill and other construction plants will be stripped of all machinery which can be profitably removed, and the buildings abandoned, as they will be many feet under water when the reservoir fills.

While the Roosevelt dam proper is the most important feature of the work, the water in the river accumulating below it



THE CEMENT WORKS WHICH WILL BE ABANDONED AFTER MACHINERY IS TAKEN AWAY. THE WORKS WILL BE SUBMERGED WHEN RESERVOIR IS FILLED.

is also to be conserved for irrigation purposes, and at a point thirty miles below a diversion dam is being constructed. It is intended to keep the water of the Salt and Verde rivers at a certain level, and to increase their depth to the extent of fifteen feet over the present low-water average. An idea of the dimensions of this dam can be gained when it is stated that it will be nearly 1,300 feet long, and will require 40,000 cubic yards of concrete before it is completed. A distributing canal is being built in connection with regulating gates, which will have a flow of at least 2,000 feet per second. This is located upon the north side of the dam. Another canal with the capacity of 1,000 feet per second is being constructed on the south side. The site of this operation is at what is known as Granite Reef, about thirty miles from Phœnix. It will furnish the water which will be served by the electric pumps already referred to, the service covering 40,000 acres.

Michigan Electric Association.

The third annual convention of the Michigan Electric Association will open Tuesday evening, August 17, in the Convention Hall at the Hotel Tuller, Detroit. This first session will be taken up with papers and discussions on tungsten lamps. There will be presented about six or eight short papers and informal discussion following.

The second session will be called to order Wednesday morning at 10 o'clock and will be devoted largely to motor and power business. The third session will be held Thursday morning at 10 o'clock and will be taken up with electric-heating business and appliances.

The Hotel Tuller is located at the corner of Park Street and Adams Avenue, overlooking Grand Circus Park. The rates are $2 per day and upward for single rooms, and for two in a room, $1.50 each, per day.

Delightful entertainment features have been arranged for both delegates and ladies. A boat ride on the fine excursion steamer *Sappho,* followed by a dinner at Bois Blanc Island, will be one feature. A theatre party, baseball game and an automobile ride will be other features. The entertainment committee urges all members to bring the ladies with them. They will be well taken care of during the business sessions.

Delegates will do well to arrive Tuesday afternoon, if possible, and register and get badges at the secretary's office in room 215, on the second floor, as a large attendance is expected. This will leave the evening free for the first business session, which will be called to order at 8 o'clock.

Navy Department Supplies.

The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on August 24 for miscellaneous dry batteries, graphite brushes, 1,500 arc-lamp carbons, 4,000 feet ebonite rod, miscellaneous desk lamps, and two motors, for delivery at Norfolk, Va.; also for miscellaneous fans, armatures and other supplies for delivery at various yards.

Bids will be opened August 31 for insulating a room in basement of Naval Medical School Building, Washington, D. C.

On September 13 bids will be opened for one electrical air compressor, for delivery at the navy yard at Puget Sound, Wash.

Coal Production in Pennsylvania.

The total production of coal in Pennsylvania in 1908, as reported by the United States Geological Survey, was 200,448,281 short tons, having a spot value of $276,995,152. This included 74,347,102 long tons (equivalent to 83,268,754 short tons) of anthracite, with a spot value of $158,178,849, and 117,179,527 short tons of bituminous, with a spot value of $118,816,303.

The production of both anthracite and bituminous coal in Pennsylvania in 1908 was less than in 1907, but owing to the fact that anthracite no longer enters to any great extent into manufacturing industries, it was less seriously affected by the financial depression than bituminous coal. The aggregate production of both kinds in 1908 showed a decrease of 35,299,208 short tons, or 14.97 per cent, in quantity and of $42,252,930, or 13.24 per cent in value from that of 1907.

In the bituminous-coal mines the number of mining machines employed and the percentage of machine-mined coal to the total production increased in 1908, there being 5,103 undercutting machines in use, against 4,940 in 1907, and the percentage of machine-mined coal to the total increasing from 40.48 to 44.76. Of the machines in use in 1908 in the bituminous mines, 3,427 were pick machines and 1,607 chain-breast, the remainder being of other types.

It is estimated that in Pennsylvania 16,970,000,000 tons of anthracite remain yet to be mined, and 109,000,000,000 tons of bituminous coal.

Electric Lights for the United States Military Posts.

Although the United States military posts in the Philippines have long been lighted by electricity, similar posts nearer home are still in the semi-darkness of kerosene.

Governor's Island reformed in 1904, and has ever since had sixteen-candlepower incandescent electric lamps in the buildings and fifty-candlepower electric lamps in the streets—3,000 in all—supplied with current by a Brooklyn Edison cable that runs under Buttermilk Channel from a point near Hamilton Ferry.

Now Fort Hamilton is to be rescued. The government has given an order to the Brooklyn Edison Illuminating Company to furnish current for 2,000 lamps, specified, to light officers' houses, barracks, hospital and streets of the reservation.

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Payne Tariff Bill Signed.

On the afternoon of Thursday, August 5, President Taft affixed his signature to the Payne Tariff Act, asserting that the Republican party had substantially observed its campaign pledges for a downward revision of the tariff. As a result the United States and its dependencies, beginning at midnight on August 5, passed under another customs régime and the Dingley Law had been relegated to history.

Except some considerable discussion of the proposed rates on carbon electrodes for lighting and some discussion early in the tariff negotiations concerning mica, there has been little evidence of anxiety upon the part of manufacturers of electrical apparatus and kindred supplies concerning the tariff revision. While there is ostensibly a reduction in the rate on carbons, this reduction is not in the nature of a saving. The rate on carbons made entirely from petroleum coke has been reduced, while the rate on carbons made chiefly of lamp-black or retort carbon has been changed from ninety cents per hundred *carbons* to sixty-five cents per hundred *feet*. With the seventeen-hour carbons coming in two-foot lengths the rate under the old law was $4.50 per thousand feet, while under the new schedule it will be $6.50 per thousand feet. It is not expected, however, that this increase will materially affect the sale of imported carbons, as the jobbers and distributors will probably make the same price as usual, and as one person interested in this distribution has aptly, if inelegantly, put it, the factories will have to "come over."

The following tabulation has been compiled from the complete list of duties under the new tariff law, and includes comparisons with the duties levied by the Dingley Act:

Classification of Act of 1897.	Rates of Duty Under— Dingley Law.	New Law.
Alumina, hydrate of, or refined bauxite—		
Containing not more than 64% of alumina	6-10c lb.	4-10c lb.
Containing more than 64% of alumina	6-10c lb.	6-10c lb.
Porous carbon pots for electric batteries, without metallic connections	20%	20%
Clays or earths—		
Unwrought or unmanufactured, n. s. p. f., tons	$1 ton	$1 ton
Wrought or manufactured, n. s. p. f., tons	$2 ton	$2 ton
Mica—		
Unmanufactured or rough trimmed only, lbs	6c lb. and 20%	5c lb. and 20%
Cut or trimmed mica plates or built-up mica, and all manufactures of mica	12c lb. and 20%	10c lb. and 20%
Earthenware—		
Common yellow, brown or gray; plain, embossed or salt-glazed common stoneware, and crucibles, not decorated in any manner	25%	25%
Carbon, not specially provided for	(n. e.)	20%
Electrodes, brushes, plates and disks, wholly or in chief value of carbon	(n. e.)	30%
Blue vitriol, or sulphate of copper	½c lb.	¼c. lb.
Carbons for electric lighting, hundred, made entirely from petroleum coke	(n. e.)	35c per 100 ft.
If composed chiefly of lamp-black or retort carbon	(n. e.)	65c per 100 ft.
Bars or rails for railways—		
Iron, tons	$7.84 ton	$3.92 ton
Steel, tons	$7.84 ton	$3.92 ton
Railway fish plates or splice bars of iron or steel, lbs	4-10c lb.	8-10c lb.
Telegraph, telephone and other wires and cables composed of metal and rubber, or of metal, rubber and other materials		40%
Barbed fence wire	(n. e.)	¾c lb.
Wire heddles	(n. e.)	25c M. and 40%
Flexible metal tubing or hose, not specially provided for, whether covered with wire or other material, or otherwise, including any appliances or attachments affixed thereto		30%
Aluminum—		
In crude form (aluminum scrap), and alloys of any kind in which aluminum is the component material of chief value, lbs	8c lb.	7c lb.
Plates, sheets, bar and rods, lbs	13c lb.	11c lb.
Barium, calcium, magnesium, sodium and potassium, and alloys of which said metals are the component material of chief value		3c lb. and 25%
Copper—		
Plates, rolled, called braziers' copper, sheets, rods, pipes and copper bottoms, lb	2½c lb.	2½c lb.
Sheathing or yellow metal, of which copper is the component material of chief value, and not composed wholly or in part of iron, ungalvanized, lbs	2c lb.	2c lb.
Round iron or steel wire, not smaller than No. 13 wire gauge, lbs	1¼c lb.	1c lb.
Smaller than No. 13 and not smaller than No. 16 wire gauge	1½c lb.	1¼c lb.
Smaller than No. 16 wire gauge, lbs	2c lb.	1¾c lb.
But not less than 35% on any of foregoing	40%	35%
All wire of iron or steel, or other metal except gold or silver, covered with cotton, silk or other material, corset clasps, corset steels, dress steels and all flat wires and steel in strips not thicker than No. 15 wire gauge and not exceeding 5 inches in width, and all wire n. s. p. f.	45%	35%
Tungsten bearing ores of all kinds	(n. e.)	10%
Gutta percha	(n. e.)	35%
India rubber, vulcanized, known as hard rubber	35%	35%
Paving posts, railroad ties and telephone, trolley, electric-light and telegraph poles	20%	10%
Bauxite, crude, tons	$1.00 ton	$1.00 ton
Tungsten, tantalum and wolfram	20%	25% when valued at $200 per ton or less; 20% when valued at more than $200 per ton.

The following appear upon the free list under the new tariff law:

Books, maps, music, engravings, photographs, etchings, bound or unbound, and charts, printed more than twenty years at the date of importation, hydrographic charts and publications issued for subscribers or exchanges by scientific and literary associations or academies, or publications for gratuitous private circulation and public documents of foreign governments.

Magnesite, crude or calcined, not purified.

Copper ore; regulus of, black or coarse copper, and copper cement; old copper, fit only for remanufacture, clippings from new copper and copper in plates, bars, ingots or pigs, not manufactured, n. s. p. f.

Gutta-percha, crude.

Philosophical and scientific apparatus, utensils, instruments and preparations, including bottles and boxes containing the same, specially imported for religious, philosophical, educational, scientific or literary purposes.

Platinum, unmanufactured or in ingots, bars, plates, sheets, wire, sponge or scrap, and vases, retorts and other apparatus, vessels and parts thereof, composed of platinum, for chemical uses.

Uranium, oxide and salts of.

Works of art, drawings, engravings, photographic pictures and philosophical and scientific apparatus brought by professional artists, lecturers or scientists arriving from abroad for use by them temporarily for exhibition and in illustration, promotion and encouragement of art, science or industry in the United States, and not for sale.

Professional books, implements, instruments and tools of trade, occupation or employment, in the actual possession at the time of arrival of persons emigrating to the United States.

No Increase in Price of Carbons.

The National Carbon Company, Cleveland, Ohio, announces that economies now under way in the manufacture of high-grade carbons will enable it to make a reduction in price within the next sixty days. During the deliberations of Congress on the Payne bill some apprehension was felt that if the bill were passed the price of arc-light carbons would be advanced. The National Carbon Company made strenuous denials of such a possibility, and pointed out the reductions which had been made, and stated that the fear of higher prices in the event of the bill passing was unfounded.

Copper Consumption.

The head of one of the largest groups of copper properties in the country says: "I am firmly convinced that the consumption of copper in this country and Europe is now running even with production. A further gain in consumption would serve to wipe out surplus stocks of the metal in no time. While stocks of copper have increased here and abroad, it must not be forgotten that consumption has made very rapid strides. Many concerns are consuming more copper than ever before in their history."

Dissolves Advisory Board.

Owing to the fact that the $50,000,000 tube and terminal project of the Pennsylvania Railroad is now so near completion, that company has dissolved the advisory board of engineers, consisting of General Charles W. Raymond, Charles M. Jacobs, Alfred Noble and George Gibbs.

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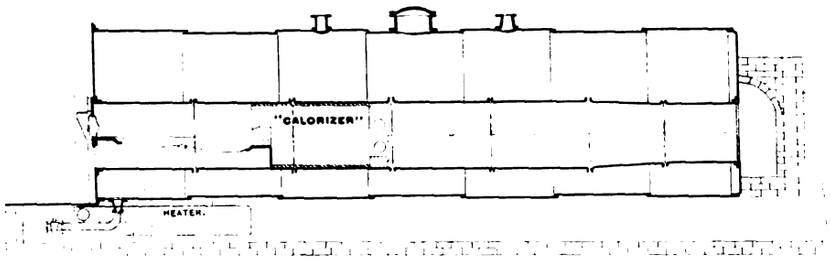
Electrical Notes From Great Britain.

By Our British Correspondent.

India is occupying a very large place in the thought of every Englishman just now. Most of us are hoping that the clouds and rumblings that threaten will end without serious storm or upheaval. We hope this for manifold reasons, but in these notes we are concerned with the serious hindrances to industrial progress which unhappy developments must inevitably produce, hindrances the effect of which would be felt by American as well as British exporters of electrical manufactures. If all goes well India is a land of infinite electrical possibilities, though the progress may continue only gradually for a time, as it has done during the past few years. Already the writer has referred to the headway made in the provision of telephonic service by the Oriental Telephone and Electric Company, and to the undertaking of the Calcutta Electric Supply Corporation. It will now be interesting to allude to the position of electrical affairs in Bombay, where another British company is in possession—the Bombay Electric Supply and Tramways Company—whose report is now receiving attention in London. The company is a member of the Electrical Federation (otherwise the British Electric Traction) group, and its capital expenditure stands at roughly $8,750,000, some $1,160,000 of this having been expended during the past year in tramways electrification and electric-light and power extensions. The tramway route mileage is 20.38 miles, with 162 electric cars. The tramway income was of course affected while the conversion from horse traction was in progress, but it amounted to $635,000, as compared with $525,000 in the previous year. The balance of receipts over expenses was $300,000 as compared with $207,000. There were 30,500,000 passengers carried, and the proportion of expenses to receipts fell from 60.9 per cent to 53.1 per cent. The electric supply produced, exclusive of the revenue from sale of current to the tramway department, about $128,000; there were 803 consumers (588 in the previous year), with the equivalent of 124,856 lamps of eight candlepower connected (84,648 in previous year).

In order to meet demands for energy and reduce generating costs, a new generating station is to be erected at Kussara Basin, where an unlimited supply of sea water is available for condensing, and on a site well placed in regard to facilities for handling coal from either boat or rail. The existing station at Wari Bunder is badly placed, generating costs being high, partly owing to the high cost of condensing water and to the necessity of employing cooling towers because of the distance from the sea. The removal of the generating station to Kussara Basin is expected to produce economies. The Brush Electrical Engineering Company is supplying an additional 4,000 kilowatts of steam-driven plant, and the 4,800 kilowatts will be transferred from Wari Bunder. It is interesting to mention that oil and gas plants were considered in connection with the rearrangement, but it was not thought that these could at present be prudently adopted in substitution for steam plant at Bombay, owing to the large size of the sets required, to uncertainties regarding the price of fuel oil at Bombay, and to other considerations affecting the question of reliability and economy of generation. The London Board has now appointed a local consultative board at Bombay, viz., Sir Sassoon J. David, the Hon. C. H. Armstrong, Shapoorji B. Broacha and Dwarkadas Dharamsi, with the managing director as chairman.

There is being exhibited in London just now the Cowper-Coles "Calorizer," an invention which is being exploited by the firm of Smoke Consumption, Limited, for complete and smokeless combustion of low-grade fuels in Lancashire and Cornish boilers. An incandescent chamber of "Calorizer" bricks is the most important point in the system which received some attention also at the Sheffield coal-smoke abatement exhibition a few months ago. The apparatus aims to prevent the radiation or other loss of heat in the flue gases by means of the bricks mentioned, and the gases and smoke are intimately mixed. The admission of hot instead of cold air to the furnace increases the calorific value of the latter. A certain length of the flue behind the bridge is lined with bricks of a material which is claimed to become incandescent more readily, and at a considerably lower temperature, than ordinary fire clay. At the end of this space (from three feet to six feet from the bridge) a combustion wall is built right across the flue, having a large square aperture serving as a manhole, and built up of a number of specially formed "Calorizer" tiles. As the gases evolved from the fuel pass over the narrow opening above the bridge, they expand into the large and highly heated space between the bridge and the combustion wall, and become well mixed owing to the retardation of their velocity, before passing finally between the incandescent tiles which form the combustion wall.



"CALORIZER" APPARATUS APPLIED TO LANCASHIRE BOILER.

The Marquis of Winchester has recently been in South Africa arranging various matters in connection with the large power contracts, and the general business affairs of the Victoria Falls and Transvaal Power Company, Limited. H. Birchenough, C. M. G., who presided at the meeting of the company in London on July 16, in his absence, put a very optimistic statement before the shareholders. The contract arrangements that have been entered into with the very large and powerful organizations controlling certain of the principal groups of Rand mines for the supply of power to fifteen mines for the next twenty years, enabling him to state that the undertaking which a year ago had a revenue of $800,000, with scope for increase up to $1,500,000, would have a revenue of $4,000,000 a year as soon as the machinery necessary for the supply of the huge demand they had in sight was ready for commercial use. It is stated that the active good-will, and in some cases the powerful financial co-operation, of the great mining groups who see in cheap electrical power a material

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element in their prosperity and success had been secured. The difficulty was now not to find customers, but to cope with the demands for power. Sir Charles Metcalfe, who has recently visited the company's station, was present at the meeting, and he stated that they now had something like 12,000 kilowatts in actual use, and in twelve months' time they would have double that amount. Naturally enough, somebody wanted to know something about the chances of the Victoria Falls being utilized, and Sir Charles speaking on this point said that this had been an enormously difficult matter, owing to the attitude of the people of the Transvaal who supplied coal to various companies, and also of the railway authorities who feared loss of revenue if coal was not used. To meet that opposition long-distance transmission had had to be deferred for the present. The station at Drichock, purchased from the General Electric Power Company, is satisfactorily running at full load supplying power to the Consolidated Gold Fields, Limited, group of mines, and the town of Germeston. The original station at Brakpan, purchased from the Rand Central Electric Works, is now mainly used as a reserve for the new 8,000-horsepower installation which was put to work last September. The 16,000-horsepower station at Simmer Pan is making progress, and half the plant is already in commercial use. Orders are on hand which will require the whole 16,000 horsepower as well as necessitating further extensions immediately. The new transmission lines along the reef which were put into use in October last, are working well.

The annual report just received from the Glasgow Corporation Tramways Department shows that for the past year the total length of electric trolley line was 189½ miles (reckoning single track), with 776 cars, 324 of the latter being top-covered, 339 of standard type, the other 113 being converted horse cars. The average number of cars in service was 547; car mileage, 20,802,797; passengers carried, 222,000,000, or 5,000,000 less than the previous year, owing to the depression of trade, which most tramway authorities are blaming. The total receipts were $4,447,655, a decrease of $90,000. The average receipts per car mile were 20.52 cents against 20.98 cents in the preceding year. As to fares over 132,000,000 of the passengers were two-cent fares (59.65 per cent), while 62,000,000, or 28.04 per cent, were one-cent fares. The working expenses were 11.666 cents per car mile, a decrease of 0.12 of a cent. A new 3,000-kilowatt turbo-alternator has been installed at Pinkston power station. Extensive renewals to the two main engines there have just been completed. In order to cope with the increased load on the eastern section of the system, an additional substation has been equipped at Rutherglen. The Glasgow Committee puts aside $2,500 per mile of single track annually to meet cost of track renewals. This year's report, however, shows a considerable decrease in the actual cost of repairs, and maintenance of permanent way and electric equipment. The capital expenditure on the system stands at $16,536,900. For traction and car lighting 25,944,010 units (kilowatt-hours) were used, or 1.25 per car mile. The total energy issuing from power station to substations was 27,755,312 units; there was used in substations, car works, etc., and lost, 1,811,302; there was also lost in conversion and transmission, 1,750,843 units; so that the total issuing for traction load from substation direct-current busbars was 24,193,167 units. The maximum load on the power station was 8,364 kilowatts; load factor 39.8 per cent; coal consumed per kilowatt-hour generated, 3.16 pounds.

Trade depression and the widespread use of metallic-filament lamps are the prevailing tribulations of electric-light and power suppliers in a number of English boroughs. S. E. Fedden, the city electrical engineer of Sheffield, reports a fall of $23,000 in lighting revenue for the past year, although there is an increase in the number of consumers. On the entire supply, however, there has been a profit of $43,750, and this, the engineer advises, should not be placed in reduction of rates, but should be held in hand as an available surplus to meet a possiible deficiency, owing to a further temporary effect of the new lamps in reducing lighting sales. It is unfortunate that the foregoing effect is being borne at the same time as the general trade depression is hindering the oncoming of the power user. Faraday Proctor, the city electrical engineer of Bristol, also complains of both these hindrances to the full development of his undertaking, though he has increased the motors and heating custom from 7,103 to 10,179 horsepower during the past year. The net result in this case is a deficiency of $1,525 on the year's working, and Mr. Proctor, in reporting, indicates that restricted lighting consumption must be expected during this year also; then, he looks forward to a steady increase in consumption for all purposes. Sheffield and Bristol are among the leading English municipal electric-light and power undertakings, and with their power-supply opportunities could in normal times stand up better than other authorities whose power load is more limited. Their experience may be regarded as typical of that of many like undertakings, but it is only a mild illustration of what small boroughs with little but a purely lighting load must feel.

At this time of the year a batch of annual reports by electrical manufacturers is issued, and a good deal is therefore said regarding the condition of the electrical industry. Perhaps the most astonishing information yet received is the passing of the dividend on the ordinary shares of the Electrical Power Storage Company (E. P. S. accumulators), which until now has had an uninterrupted long series of dividend-paying years. Notwithstanding this fact, however, the Electrical Construction Company, Limited, which owns much of the capital, reports, on the whole, a considerable improvement in business. The depression is thought to be passing away, and while the reduced demand for plant due to that depression and to the metal-filament lamps affected the volume of home orders received, this was to some extent counteracted by an increase in export business. The General Electric Company, Limited, has cleared an additional $92,000 net profit as compared to the previous year and is devoting this amount to the strengthening of its reserves, after paying five per cent dividend on its ordinary stock. The big business that the company has been doing in "Osram" lamps has doubtless greatly helped to secure this result. The lamps are now being manufactured at the Hammersmith factory, where shortly about 1,000 skilled workers will be engaged thereon.

Crompton & Company, Limited, of Chelmsford and London, have also issued a report which, from a shareholder's point of view, is disappointing, for the dividend has been passed. With monotonous reports such as this from manufacturers, small wonder is it that we are all climbing the heights on the lookout for signs of real and lasting trade revival.

ALBERT H. BRIDGE.

London, July 24, 1909.

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Book Reviews.

ALTERNATING CURRENTS.

"Alternating Currents." By Alfred W. Marshall. Spon and Chamberlain, New York, N. Y. Paper, 90 pages (5x7 inches), illustrated. Supplied by the Electrical Review and Western Electrician for $0.25.

This book is written for those who desire elementary information about alternating electric currents. In seven chapters, in non-technical language, the author describes what an alternating current is, how such currents are produced, how they are measured, transformers and choking coils, alternating-current motors, rotary converters and rectifiers. This little book is especially intended for amateurs, both old and young, who take an interest in mechanical and electrical work.

"Practical Alternating Currents and Alternating-Current Testing." By Charles T. Smith. Manchester, Eng.: Scientific Publishing Company. Cloth, 455 pages (5¼x 8½ inches), illustrated.

The third edition of this book should prove of value to students in technical schools and young engineers, engaged in the handling and testing of alternating-current machinery, particularly, on account of the practical, rather than abstract theoretical, manner in which the author handles the subjects being considered. Save for a chapter on curve analysis, the use of higher mathematics has been avoided, using instead an experimental method of treatment. The experiments are described in great detail, so as to enable the conclusions derived from them to be followed by the reader who has not the means for obtaining experimental results of his own. For the present issue, a fundamental revision has been undertaken, and, in order to make room for new matter, a good many sections of the earlier editions have been much condensed. Alterations of this character are especially numerous in the chapters on transformers and alternators, to which many additions have been made. The chapter on induction motors has been largely rewritten, and a chapter on single-phase motors has been added.

ELECTROCHEMISTRY AND ELECTRO-METALLURGY.

"Electric Furnaces." By Wilhelm Borchers. Translated by Henry G. Solomon. Longmans, Green & Company, New York, N. Y. Cloth, 224 pages (5¼x8¼ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $2.50.

This volume is an English version of the second German edition of Die elektrischen Ofen. The recent rapid development, notably abroad, of the electric furnace is sufficient proof of the important part it is playing, and is destined to play in a still greater degree in the near future, in connection with all classes of metallurgical operations. The method of treatment and classification of electric furnaces adopted is from the point of view of the heating system on which their action is based, and their development and application are treated in an authoritative and critical manner. As close a translation of the original as possible has been adhered to, and the English equivalents of the metrical measurements given in the text have been added. The subject-matter, also, has been further arranged under suitable headings in chapters corresponding with the main chapters of the original.

"A Study of Electrothermal and Electrolytic Industries." Part I. By Edgar A. Ashcroft. New York, N. Y.: McGraw Publishing Company. Cloth, 130 pages (5¾x 9¼ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $2.00.

It is the aim of the author, in this treatise, to give the reader the practical information about nearly all industrially successful processes in electrometallurgy and electrochemistry possessed by those practicing the various specialized branches of the industry. The arrangement of the work is novel. The general division is into three parts, the present volume (Part I) dealing with the more general aspects of the subject, such as the theory of electrochemistry, electrochemical and electrothermal calculations, value of electrochemical and electrothermal processes, general designs, for industrial plants and the production of cheap electrical energy.

ELECTRICAL ENGINEERING—GENERAL.

"Heavy Electrical Engineering." By H. M. Hobart. D. Van Nostrand Company, New York, N. Y. Cloth, 338 pages (5¼x9 inches), illustrated. Supplied by the Electrical Review and Western Electrician for $4.50.

This work contains features and calculations of which a sound knowledge should be acquired in order to enable one to effectively engage in electrical engineering. Throughout the book questions concerning the design of apparatus are regarded as subsidiary to those relating to the design of the stations in which the apparatus is employed. Rather than a consideration of the design of electrical machinery, steam boilers, piston engines, steam turbines, gas engines, pumps, condensers, cooling towers, and other apparatus, the author, in the early chapters of the book, aims to have the reader acquire familiarity with the results which can be obtained from the principal among these component pieces of apparatus, and to learn to correctly combine them for efficient service in aggregates which are denoted as generating stations.

The subject matter of the chapters is as follows: The over-all efficiency of generating stations and the relation between coal consumption and outgoing electrical energy, steam-raising plant, piston engines and steam turbines, condensing plant, electric generating plant, the design of generating stations, high-tension power transmission lines, high-tension continuous-current series system, electric traction calculations, and traction motors and electrification of railways.

"Water-Power Engineering." By Daniel W. Mead. McGraw Publishing Company, New York, N. Y. Cloth, 87 pages (5¾x9 inches), illustrated. Supplied by the Electrical Review and Western Electrician for $6.00.

The theory, development and investigation of waterpowers are the subjects treated in this work. The author has endeavored to consider, briefly at least, all fundamental principles and to point out the basis on which successful water-power depends. In current practice, the hydraulic engineer, to determine the extent of a proposed hydraulic development, commonly depends on a study of monthly averages of steam flow and of observed maximum and minimum flows, or, in other cases, the development is predicted on a single or very few measurements of what is believed to be low-water flow of the stream. In chapters four, five, seven and nine a more exact method of studying flow by actual or comparative hydrographs is described. A detailed study of the daily effect of the head available on power is presented in chapters four and five. In chapters five, seven and eight a method is outlined for the consideration of possible variations in flow during periods for which no measurements are available. A study of the effect of pondage on power is discussed in considerable detail in chapters four, five and twenty-six. The author has developed the method of turbine analysis and selection in chapters fourteen and sixteen, and in chapter twenty-eight is outlined his idea on an intelligent report on a waterpower project.

"General Lectures on Electrical Engineering." By Charles Proteus Steinmetz.

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Robson & Adee, Schenectady, N. Y. Cloth, 284 pages (5¾x9 inches). Supplied by the Electrical Review and Western Electrician for $2.00.

This work comprises a set of lectures on electrical engineering, published in a very attractive volume. The lectures are general in their nature, dealing with problems of generation, control, transmission, distribution and utilization of electric energy; that is, with the operation of electric systems and apparatus under normal and abnormal conditions, and with the design of such systems. The design of apparatus is discussed only so far as it is necessary to understand their operation, and so judge of their proper field of application. Due to the nature of the subject and limitations of space, the treatment had to be essentially descriptive, and not mathematical. It comprises a discussion of the different methods of application of electric energy, the means and apparatus available, the different methods of carrying out the purpose, and the relative advantages and disadvantages of the different methods and apparatus which determine their choice. It must be considered, however, that such discussions can be in general only, but as a whole this work should prove of interest both to the student and the engineer.

"A History of the Warfare of Science with Theology." Two volumes. By Andrew Dickson White. D. Appleton & Company, New York, N. Y. Cloth, 415 pages, volume I; 475 pages, volume II (5¾x8½ inches). Supplied by the Electrical Review and Western Electrician for $5.00.

The author, in this work, is simply trying to let the light of historical truth into that decaying mass of worn-out thought which attaches the modern world to mediæval conceptions of Christianity, and which still lingers among us, a most serious barrier to religion and morals, and a menace to the whole normal evolution of society. Behind this barrier a flood of increased knowledge and new thought is rapidly rising, and though it is thin in places, it creates a danger of sudden breaking away, distressing and calamitous, sweeping before it not only outworn creeds and noxious dogmas, but cherished principles and ideals, and even wrenching out precious religious and moral foundations of the whole social and political fabric. The author's aim is to aid, even but little, in the gradual and healthful dissolving away of this mass of unreason, that the stream of "religion pure and undefiled" may flow on, broad and clear, a blessing to humanity.

"How to Understand Electrical Work." By William H. Onken, Jr., and Joseph B. Baker. Harper & Brothers, publishers, New York, N. Y. Cloth, 359 pages (5½x7½ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $1.75.

This book is a simple explanation of electric light, heat, power and traction in daily life. It tells how and why "the wheels go round" when the force that drives them is electricity. The book being intended for younger readers, the explanation and descriptions are given in a non-technical, simple and interesting manner. It is impossible in a book of this size to give detailed descriptions of all the uses to which electricity has been put in daily life. However, the subject has been treated so as to give the youth a fair impression of the universality of its application. The book contains nineteen chapters and a dictionary of electrical terms which is very instructive. Some of the chapters which should prove of general interest are electricity in the home, electricity in farming, electricity in the hospital, electricity aboard ship, electricity in mining, electricity in the manufacture of steel, electric protection, electricity the destroyer and transmission of intelligence.

"The Copper Handbook." By Horace J. Stevens, Houghton, Mich. Cloth, 1,500 pages (5¾x8½ inches). Supplied by the Electrical Review and Western Electrician for $5.00.

In this book copper is considered under a great variety of heads in the preliminary chapters, giving in non-technical language a vast amount of useful information relating to the geology and mineralogy of copper and copper ores. Much space is devoted to mining, milling, smelting, leaching and refining, making the work an encyclopedia of copper. The principal chapter of the book, covering over a thousand pages, is devoted to detailed descriptions of the copper mines of the globe, the author being exceedingly frank in his comments regarding companies he considers dishonest. To the investor or speculator in copper shares, this chapter will prove very helpful. In the present edition this chapter has been completely rewritten, with an addition of more than two thousand mining companies over the number listed in the previous edition. The final chapter is devoted to statistics and is very complete, its authority being recognized by the copper trade.

"An Introduction to the Science of Radio-Activity." By Charles W. Raffety. Longmans, Green & Company, London, Eng. Cloth, 208 pages (5x7¾ inches).

In this book the author gives a clear, concise and popular account of the properties of radio-active elements and theoretical conceptions which are introduced by the study of radio-active phenomena. This work, as its title indicates, is no more than an introduction to the subject, and no attempt has been made at exhaustive treatment. The subject is divided into three parts, descriptive, theoretical, and practical, the last being of interest to those wishing to investigate for themselves some of the remarkable properties of radio-active elements, on account of the comparatively simple experiments described. The first part deals with the rays emitted by radium, the nature of the rays and methods of investigation, in a very interesting manner.

"Hydroelectric Development and Engineering." By Frank Koester. D. Van Nostrand Company, New York, N. Y. Cloth, 454 pages (7¼x10¼ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $5.00.

The student, in this text, will find a practical and theoretical treatise on the development, design, construction, equipment and operation of hydroelectric plants, from their inception to the delivery of power to the substation and consumer. For a clearer comprehension of the subject considered, the author has systematized his discussion by a division of the matter into three parts, namely, the transmission of waterpower into electrical energy, the transmission of high-tension electrical current, and modern American and European hydroelectric developments, the last part comprising the appendix. In Part I the opening chapters deal with the proposition to be considered, giving, briefly, important laws of hydraulics. An interesting study of dams is given showing the conditions and laws that govern the construction of various types of dams. The subjects of headrace and penstocks are discussed fully. The power plant is treated on an extensive plan. The general arrangement and design, excavation and foundation, the superstructure and the structural steel are all given due consideration under the general heading of power plants. The mechanical and electrical equipment is discussed in separate chapters. The author in treating the subjects named above considers the selection from different makes, of an assemblage of machines and devices best fitted to perform its particular function and to have the machines properly combined to form one complete unit rather than the design of the various machines. Under Part II

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the subjects of transmission, substations and line protection are treated. The author is of the opinion that a good illustration may tell more at a glance than a lengthy discussion, hence numerous photographs and cuts are used in illustrating the appendix, which contains many interesting features regarding American and European hydroelectric plants now being successfully operated.

POWER STATIONS—STEAM TABLES.

"Steam Tables and Diagrams." By Lionel S. Marks and Harvey N. Davis. Longmans, Green & Company, New York, N. Y. Cloth, 106 pages (6¼x9 inches). Supplied by the Electrical Review and Western Electrician for $1.00.

This work, which gives the tables and diagrams of the thermal properties of saturated and superheated steam, should prove of value to mechanical engineers. The necessary basis for any determinations of the properties of superheated steam are the investigations of Knoblauch, Thomas and Henning. The authors have subjected these investigations to a careful analysis, both as to the probable errors resulting from the methods of experimentation, and also as to the relation of the experimental results to the values deduced from thermodynamic theory. The properties of superheated steam are tabulated for every pound pressure, and for every ten degrees of superheat, within a range which exceeds present practice. All the information relating to superheated steam of any pressure is given on one double page, an arrangement which permits the immediate finding of any desired quantity. Supplementary tables extend the superheated-steam table to very high temperatures, and give the properties of water, metric conversion factors, Naperian logarithms and other quantities. Besides the tables two large diagrams are given, showing the properties of saturated and superheated steam. These diagrams can be used instead of the tables in several instances, but their chief purpose is to facilitate certain calculations. They should prove very useful to anyone engaged in making calculations which involve saturated or superheated steam.

"Electric-Railway Power Stations." By Calvin F. Swingle, Chicago, Ill. Frederick J. Drake & Company, Chicago, Ill. Cloth, 718 pages (5x7½ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $2.50.

This book, in a plain, practical manner, treats upon the central station, with its modern appliances for the economical consumption of fuel, and the production of heat, its machines of various types, such as steam engines and turbines, gas engines of all kinds, and other forms of prime movers, by means of which this heat is transformed into energy or power capable of turning the dynamos, which in turn transmit this power, in the form of electrical energy, to where it is needed to do the work. The author has taken the standpoint of the operating engineer rather than the designer and touches only the important topics of design and construction. Among the commendable features of the book, are the questions and answers at the conclusion of each chapter. The questions discussed are ones frequently asked regarding the apparatus considered; thus the book is of considerable value in making clear features of a practical and useful nature.

"Boiler-Feed Water." By Fred. A. Anderson. The Electrician Printing and Publishing Company, London, Eng. Cloth, 154 pages (5¼x8½ inches). Supplied by the Electrical Review and Western Electrician for $2.50.

This book brings together much valuable information regarding the questions of corrosion and priming. It embodies a concise account of the most important impurities to be met with in feed waters, especially in land installations, together with the methods for their detection and removal. The details of the analytical part have been given, to show precisely how the data are arrived at upon which the treatment of a water is based, and should prove of value to anyone contemplating such analysis. The subject matter of the chapters is as follows: Scale formation and corrosion, analysis of hard waters, calculation of results, water softening, oil or grease, and steam boilers, discussing their selection, management, cleaning and inspection. The chapter on water softening should afford assistance to anyone contemplating the installation of any water-softening or purifying apparatus.

"Steam Power Plant Piping Systems." By William L. Morris. McGraw-Hill Book Company, New York, N. Y. Cloth, 490 pages (6x9¼ inches). Supplied by the Electrical Review and Western Electrician for $5.00.

As is suggested by the title, this publication treats only such parts of the power plant system as are directly related to piping. Although the design of boilers and engines has not been touched upon, their operation is duly considered in the design of various systems of piping connecting the two. All auxiliary apparatus in the pipe circuit between the boiler and the engine, and in the various piping systems for steam, oil, air, etc., have been treated and their design thoroughly discussed. The first chapter of this work is devoted to the origin and results of improper piping. The author lays much stress on improper piping, asserting that the chief requisite in pipework engineering is so to design as to permit repairs of disabled lines, without interfering with the regular service of the plant, and much trouble in power stations is due to inferior designing in this respect. The author has given a detailed and consecutive treatment of the entire subject of piping, as applied to power stations, taking up the design, installation and operation. A system of reasoning and analyzing has been followed that alone in itself is very instructive.

LIGHTING AND ILLUMINATING ENGINEERING.

"Electric Lamps." By Maurice Solomon. D. Van Nostrand Company, New York, N. Y. Cloth, 321 pages (5¼x8 inches), illustrated. Supplied by the Electrical Review and Western Electrician for $2.00.

In this book the author only attempts to describe the lamps that have been proved to be of commercial use, no attempt being made to treat those in the experimental stage. Starting with the general principles of artificial illumination, in chapter one, the author discusses the production of this illumination in chapter two. Chapter three treats of photometry. The definitions of the five fundamental quantities used in photometry, photometric methods, heterochromatic photometry, illumination photometers, and standards of light are some of the topics discussed in this chapter. Methods of testing is the subject matter of chapter four. As the testing of lamps divides itself naturally under two heads, the author divides this chapter under two heads, namely, the "distribution of the light" and "life testing." Under the distribution of light comes the test of what is generally known as the "efficiency" of the lamp, which is dealt with quite fully in this chapter. The remaining chapters of the book deal with the electric lamps now in use, describing the construction, efficiency and methods of testing each.

"Electrical Illuminating Engineering." By William Edward Barrows. McGraw Publishing Company, New York, N. Y. Cloth, 216 pages (5x8¼ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $2.00.

This book should prove of benefit to illuminating engineers. Throughout the book, the author confines himself to laws, formula and tables, the size of the book

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and the scope covered prohibiting descriptive detail. The early chapters of this work are devoted to units of illumination, light and color, photometry and photometers. The remaining chapters treat in detail the various lamps and reflectors in use today. The final chapter is devoted to illumination calculations.

TRANSFORMERS—INDUCTION COILS.

"Transformers." By Gisbert Kapp. The Macmillan Company, New York, N. Y. Cloth, 364 pages (5½x8¾ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $3.00.

This present volume is the second revised and enlarged edition. It has been the author's aim, in this edition, to show how by a careful study of the thermic condition the output of a transformer of given weight and cost may be increased. He has also considerably enlarged the part dealing with the testing of transformers and iron samples. It is claimed by the author that a thorough scientific knowledge of the principles of the modern testing sets and the ability to do equal or better work by means of apparatus built up for the occasion by using the appliances usually found in the testing of electrical engineering works, should be within the reach of the practical engineer; hence the amount of space he gives to the theoretical side of testing. Another addition is the chapter on the relations between the transformer and its circuits. Although not strictly a question of design, it is still a most important matter, since it involves the safety of extended and, as a rule, expensive networks. In all cases possible, the author has used graphic in preference to analytical methods of description. The examples of modern transformer work, in the final chapter, will be found very interesting.

"Stationary Transformers." By William T. Taylor, New York, N. Y. McGraw Publishing Company. Cloth, 169 pages (4¾x7¼ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $1.50.

In this book the author has endeavored to compile a list of notes, gained from years of practical experience in the connection, installation and operation of transformers. To aid in understanding quickly the phase relations and relative values of the various electromotive-forces and currents involved in a given system, vector diagrams are given with all diagrams of circuit connections. The subject matter of the chapters is as follows: Single-phase transformer manipulations, two-phase connections, three-phase transformation, three-phase difficulties, three-phase-two-phase systems, six-phase transformation, cooling of transformers, auto-transformers, constant-current transformers, series transformers, regulators and compensators, transformer testing and modern distribution systems.

"The Design and Construction of Induction Coils." By A. Frederick Collins, New York, N. Y. Munn & Company, New York, N. Y. Cloth, 272 pages (5½x9 inches), illustrated. Supplied by the Electrical Review and Western Electrician for $3.00.

This work, as is suggested by its title, treats of the design and construction of induction coils. In easily comprehensible language it describes each process in sequence, together with the dimensions of each part. Coils varying in size from small ones giving one-half-inch sparks to large ones giving twelve-inch sparks are treated. In many instances the author, by means of illustrations and diagrams, shows how to accomplish each step in the manufacture of the coils. Chapter nineteen treats of the cost and purchase of materials, which makes it possible for the amateur to buy materials at a minimum cost. Chapter twenty contains many very useful tables, formulas and data, which would be of benefit to anyone interested in induction coils.

TRANSMISSION AND DISTRIBUTION—CABLE NETWORKS.

"The Theory of Electric Cables and Networks." By Alexander Russell, New York, N. Y. D. Van Nostrand Company. Cloth, 269 pages (5¼x8¼ inches). Supplied by the Electrical Review and Western Electrician for $3.00.

In this book the author has given some information concerning the phenomena connected with the flow of current along conductors and across dielectrics, also concerning the dielectric strengths of insulating materials and electric stresses to which they are subjected under working conditions. Questions in connection with the electrostatic capacity and the inductance of cables have not been considered, these being taken care of in another book. In chapter one the fundamental electrical principles are stated and a description is given of the various gauges in use for specifying wires. Conductivity is discussed in chapter two, and special attention is devoted to the effect of the "lay" on the weight and conductivity of stranded cables. In chapter three the standard methods of measuring insulativity are discussed. The design of distributing networks is explained in chapter four, particular stress being laid on "feeding centers" and on the importance of calculating their positions. In chapters five, six and seven methods of measuring the insulation resistance of house wiring and distributing networks are given. The dielectric strength of materials is discussed in chapter eight. In chapter nine the grading, and in chapter ten the heating, of cables is considered. In chapter eleven, the interesting subject of electrical safety valves is considered, and chapter twelve is devoted to the subject of lightning conductors.

"Practical Calculation of Transmission Lines." By L. W. Rosenthal. McGraw Publishing Company, New York, N. Y. Cloth, 94 pages (6x9¼ inches). Supplied by the Electrical Review and Western Electrician for $2.00.

This book should prove a practical help in the rapid and accurate calculation of transmission lines. The arrangement of the formulas, tables and text has been dictated solely by the needs of the rapid worker. All sections save the last include the important effects of temperature and specific conductivity. The section relating to direct-current railways is novel in the form of its tables, and the methods outlined in it have been found rapid and comprehensive. The alternating-current division presents a new and original method for the solution of these problems. The chapter on single-phase railways is in accord with most of the consistent data published on the subject, although further accurate investigations of installed lines may modify to some extent the present accepted values. The scope of this book has been confined to methods of calculation, hence, the most desirable limits of line losses are not discussed. However, the tables are sufficiently extended to cover all cases likely to arise in practice.

"Conductors for Electrical Distribution." By F. A. C. Perrine. D. Van Nostrand Company, New York, N. Y. Cloth, 287 pages (6x9¼ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $3.50.

This book treats quite extensively the subject of conductors for electrical distribution, their materials and manufacture, the calculations of circuits, pole-line construction and underground working. The early chapters of this work are devoted to conductor materials, alloyed conductors, and the manufacture of wire and cables. The chapter on the manufacture of wire is particularly interesting and instructive, it being a hitherto untreated subject. The author gives an extensive report on the methods used in some of the well-known manufacturing plants. Several chapters are required for a thorough study of electrical calculations, such as calculation of circuits, calculation of multiple arc circuits and alternating-

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current calculation. The final chapters describe overhead lines, the pole line, line insulators, and underground conductors.

"Electrical Circuits and Diagrams." Part II. By Norman H. Schneider. Spon & Chamberlain, New York, N. Y. Paper, 74 pages (5x7 inches), illustrated. Supplied by the Electrical Review and Western Electrician for $0.25.

This book contains sixty-seven electrical circuits and diagrams, a brief but instructive note accompanying each.

"Submarine Cable Laying and Repairing." By H. D. Wilkinson. The Electrician Printing and Publishing Company, London, Eng. Cloth, 558 pages (5¼x8¼ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $6.00.

In its present form the second edition of this work should help to maintain and foster the desire for progress and development and prove of assistance to those who are endeavoring to attain greater efficiency in submarine-cable practice. It gives a detailed technical summary of modern practice in manufacturing, laying, testing and repairing a submarine telegraph cable. The early part of this treatise is devoted to surveying the route of a cable, giving detailed information regarding sounding, and the design and use of sounding machines. The testing section and details of practice aboard-ship have been prepared to give further insight to this branch of engineering. The description of the equipment of cable-ships and the mechanical and electrical work carried on during the laying and repairing of a submarine cable will prove interesting to some, not engaged directly in the profession, but who are desirous of informing themselves as to the work which has to be done, from the moment a cable is projected until it is successfully laid and worked.

TELEGRAPHY—WIRELESS TELEGRAPHY AND TELEPHONY.

"Lessons in Telegraphy." By Charles Henry Sewall. D. Van Nostrand Company, New York, N. Y. Cloth, 90 pages (4¾x7¼ inches). Supplied by the Electrical Review and Western Electrician for $1.00.

This book furnishes the student with an elementary course of instruction in the art of sending and receiving Morse telegraph signals. It not only deals with the ordinary instructions necessary to learn the art of telegraphy, but cautions the student concerning what not to do, thereby preventing the early acquirement of bad habits, which, once formed, are difficult to remedy later on. The author endeavors to supply that very important class of information which is too often overlooked in instructing students. In addition to a study of the Morse code and various signals, the book contains many exercises in sending and receiving messages, such as the operator would meet with in the business world today. This book should prove valuable to anyone contemplating the study of telegraphy.

"Making Wireless Outfits." By Newton Harrison. Spon & Chamberlain, New York, N. Y. Paper, 61 pages (5x7 inches), illustrated. Supplied by the Electrical Review and Western Electrician for $0.25.

This little book is written for the purpose of enabling the reader to build a wireless outfit of his own. It gives a concise and simple explanation of the construction and use of inexpensive wireless equipments for capacities up to one hundred miles, including the sending and receiving stations. Full details are given and each step, in sequence, is made clearer, if possible, by drawings of the apparatus, diagrams of circuits, and tables. Many problems are solved and many suggestions are given that avoid a circuitous route.

"Wireless Telephone Construction." By Newton Harrison. New York, N. Y.: Spon & Chamberlain. Paper, 74 pages (4¾x7¼ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $0.25.

In this work the author has been somewhat handicapped in giving a comprehensive explanation of the making of a wireless-telephone equipment, owing to the fact that there are many patents now pending in this field, both in the United States and abroad, which makes it difficult to get points that would prove useful in the construction of an equipment absolutely up to date. In spite of this, however, the work embodies enough features to give one the information needed. The use of electric waves for audible speech transmission and the system by means of which they are employed successfully over distances of many miles are points treated in this work, which should interest the man who wants to know something regarding new inventions and their application. The construction of the transmitting station with its parts, including the wave producer or arc lamp as modified by practice and the receiving station, with its detector, are entered into, so that the main ideas involved are rendered clear. In short, the author has expressed clearly and concisely the information necessary for the making of a wireless-telephone equipment.

ARMATURE AND MAGNET WINDING—TESTING—NAVAL ELECTRICIAN'S HANDBOOK—SMOLEY'S TABLES—RAILWAY ACCOUNTING.

"Practical Armature and Magnet Winding." By Henry C. Horstmann and Victor H. Tousley. Frederick J. Drake & Company, Chicago, Ill. Morocco, 231 pages (4¼x6½ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $1.50.

In this work an effort has been made to supply working electricians with a practical treatise on armature and magnet winding. Special stress has been laid upon the practical side of the subject, so as to enable the student to see clearly the exact manner in which the work is actually performed. Sufficient of the theory of armature winding has been given to enable the student to comprehend fully why certain precautions and methods are necessary. Without this theory, an intelligent understanding of the necessity of complying with these conditions is impossible. The book contains many illustrations and diagrams which simplify the descriptions, making the book valuable both as a text-book for the student and a handbook for the electrician.

"Shop Tests on Electric-Car Equipment." By Eugene C. Parham and John C. Shedd. McGraw Publishing Company, New York, N. Y. Cloth, 121 pages (4¾x7¼ inches). Supplied by the Electrical Review and Western Electrician for $1.00.

This book is the first of two books to cover in a practical manner the testing of electric-car equipment with such instruments and other facilities as may be available or obtainable in a car house. An effort is made to so present the subject that the instructions and information given can be properly used. To this end simple explanations, illustrations and practical examples are frequently used. In the methods given, refinement is at times sacrificed to practicability, with the object of showing how results are obtained rather than how they might be. The book is divided into three general heads, current measurements, voltage measurements and resistance measurements. Each general heading is subdivided, giving detailed descriptions of each method of measuring and testing.

"Naval Electricians' Text Book." By W. H. G. Bullard, U. S. N. United States Naval Institute, Annapolis, Md. Cloth, 976 pages (5¼x9 inches), illustrated. Supplied by the Electrical Review and Western Electrician for $6.50.

This book is the revised and enlarged edition of the Naval Electricians' Text and Hand Book. Many new chapters have been added to the original manuscript and all have been more or less rewritten to such an extent that it has lost its handbook characteristics. There is probably little or nothing contained in the work which could not be found elsewhere, but the author has collected in one volume complete information concerning

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the principles and uses of electricity on our war vessels. Although the information given was primarily intended for officers and enlisted men of the navy, electricians in general should find it useful, as there is much general electrical information given. This is true, particularly in the early chapters of the book, which deal with general principles of electricity, such as the definitions of the units, magnetism and electromagnetism, elementary theory of the electric generator, primary batteries, and theory of motor control. The two final chapters are devoted to the principles of wireless telegraphy and principles of wireless telephony.

"Smoley's Tables." By Constantine Smoley. The Engineering News Publishing Company, New York, N. Y. Flexible morocco, 448 pages (4¾x7 inches). Supplied by the Electrical Review and Western Electrician for $3.50.

In addition to the parallel tables of logarithms and squares of feet, inches and fractions of inches, varying from one thirty-second of an inch from zero to fifty feet and by one-sixteenth of an inch from fifty to one hundred feet, and the tables of angles and logarithmic functions corresponding to given bevels, this fifth revised edition contains a multiplication table for rivet spacing, with a new set of five-decimal logarithmic-trigonometric tables. These tables comprise the following separate tables: Common logarithms of numbers from zero to 10,000, with tables of proportional parts; logarithms of the sine and tangent from zero degree to three degrees and of the cosine and cotangent from eighty-seven to ninety degrees, varying by ten seconds, with proportional parts for single seconds, logarithms of the sine tangent, cotangent and cosine for each minute of the quadrant, with proportional parts for single seconds and the table of natural functions. This book should appeal to engineers and draftsmen who have a variety of computations to deal with.

"Electric-Railway Auditing and Accounting." By William H. Forse, Jr. McGraw Publishing Company, New York, N. Y. Cloth, 157 pages (6x9¼ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $2.00.

This book combines some of the best ideas obtainable, regarding methods of accounting, from many sources. The accounting requirements of interurban railways engaged in local and interline business have been carefully considered, and some special features of city railway accounting are explained. The author has endeavored to eliminate from the methods outlined those which tend to sacrifice the three essential features of any good system of accounting, namely, clarity, accuracy, and comparative economy. Interurban lines have adopted many of the operating features of the steam railway, chief of which may be mentioned the sale of tickets, the establishment of stations and the handling of freight, baggage and express. This development, naturally, has brought many problems to the accountant, and the author has outlined the manner in which some of these problems have been met. The forms illustrated are reproductions of ones actually used by electric railways with the exception that company names are omitted.

"Patents as a Factor in Manufacturing." By Edwin J. Prindle. New York, N. Y.: The Engineering Magazine Publishing Company. Cloth, 134 pages (5¼x7½ inches). Supplied by the Electrical Review and Western Electrician.

This book is written for the avowed purpose of conveying an idea of the nature of a patent, the protection it may afford, the advantages it may possess for meeting certain economical conditions, the safety which may be secured in relation between employers and employes, and the general rules by which the courts will proceed in upholding the patent and in thwarting attempted infringements. It is intended to show the manufacturer, in a general way, what may be accomplished by patents, but not to lead him to attempt such accomplishment without legal advice. The fundamental steps are indicated for the inventor, patentee, or manufacturer, which are usually taken before the advice of counsel is secured. The treatment is lucid and is developed in seven chapters, as follows: 1. Influence of patents in controlling a market. 2. Subject, nature and claim of a ptent. 3. What protection a patent affords. 4. Infringements. 5. Patenting a new product. 6. Patent relations of employer and employe. 7. Contests between rival claimants to an invention. One of the most commendable features of the book is that an index is provided, an unusual departure for books of this type.

"Harper's Machinery Book for Boys." By Joseph H. Adams. Harper & Brothers, publishers, New York and London. Cloth, 373 pages (5¾x8 inches), illustrated. Supplied by the Electrical Review and Western Electrician for $1.75.

This book is on similar lines to Harper's Electricity Book for Boys," by the same author, and comprises an introduction, twenty-three chapters and an appendix. Part I includes the first nine chapters, devoted respectively to: The principles of simple machines; mechanic's tools; power; power transmission; waterpower; windpower; steampower; electric power; hydraulics. Part II includes eight chapters, describing machinery of many sorts. Part III comprises the rest of the book which includes chapters on automobiles, motor boats, the gas engine, shop hints, formulas (alloys, solders, cements, varnishes, etc.) and tables, gauges, and measures. The appendix is a somewhat meager dictionary of mechanical terms. The treatment throughout is necessarily elementary and popular, albeit lucid and graspable. The text and illustrations are both of the best. Any boy at all handy with tools should be able to follow out with ease the instructions in the book to make many useful and instructive working models of mechanical devices, and in so doing should pick up a large amount of practical mechanical information. The book will be heartily welcomed by the American boy with a mechanical turn of mind.

"Social Engineering." By William H. Tolman. New York, N. Y.: McGraw Publishing Company. Cloth, 384 pages (6x9¼ inches). Supplied by the Electrical Review and Western Electrician for $2.00.

The subtitle of this book, "A Record of Things Done by American Industrialists Employing Upward of One-and-One-Half Million of People," explains the main title "Social Engineering." Doctor Tolman describes himself as a "social engineer," and a perusal of the book confirms this nomenclature, as it proves to be a record and discussion of experiments tending toward the betterment of the condition, social, industrial, and utilitarian, of the vast army of what one might term the laboring classes of this country. Apart from the humanitarian and philanthropic side of the question, it would appear that a general improvement of the hygienic arrangements of factories, and an increase of conveniences tending to more comfort of the employes, both in the workrooms and in the places provided for lunches and recreation between times, result in an inincreased efficiency of the working forces and a corresponding increase in the output. Vacations, rewards of various kinds for diligence, conscientiousness, punctuality, and application, the incentives to thrift, the value of safety appliances, the work of educational opportunities given free or at a nominal cost, and many other similar topics, are all treated in a coldly logical manner, yet withal in a most attractive way, as to their beneficial effect,

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and are shown to be of the utmost value even considered from the utilitarian viewpoint of the strictest business proposition. The book is a crystallization of the many efforts recently made in a more or less haphazard fashion by divers writers to show the trend of modern successful business application. An introductory note of commendation is prefixed by Andrew Carnegie, whose knowledge of the subject is unquestionably practical.

"Internal Combustion Engines." By Wm. M. Hogle. McGraw Publishing Company, New York, N. Y. Cloth, 256 pages (5½x8½ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $3.00.

This book brings together much valuable information regarding present practice in designing and operating internal-combustion engines. The author has, as far as practicable, eliminated theory and the more involved mathematical formulas and confined the matter contained to the more practical and applied phase of the subject. In the matter of design, average practice has been considered, and formulas are given, which, if followed, should lead to successful results. Several chapters of this work are devoted to descriptions of different types of gas engines, now obsolete, but which show the development of the internal-combustion engines to the present time. The section devoted to practical operation and troubles and remedies should prove valuable. Full instructions for starting, stopping and caring for the gas engines are given. Every possible cause for trouble is considered and a suitable remedy stated. A thorough discussion of all of the various parts which compose the internal-combustion engine is entered into, the author describing only those parts of machines which are in keeping with actual practice. This book also contains tables and formulas which should fill all of the average requirements, either for the designer or operator.

"Atlas der Elektropathologie." By Dr. S. Jellinek. Berlin and Vienna: Urban & Schwarzenberg. 1909. 92 pages (8x11 inches), with 16 illustrations and 96 special plates, with 230 illustrations. Price, 35 marks.

This book is a pictorial compilation of a large number of cases of severe burns on various parts of the human body due to contact with high-tension circuits or to lightning. In the first part, that relating to accidents on high-tension circuits, thirty such cases are described and copiously illustrated; also one that was self-inflicted, and an experimental test on a rabbit. In every case cited the circumstances attending the accident are stated and also generally illustrated. Photographs of the affected organs, principally of the surface of the body, are given, showing some of the most frightful skin burns directly after the accident and at various later periods to show that gradual healing of the tissues and the nature of the scar, if any, that was left. Some of the apparently worst cases healed up without any scar. In several instances there are shown also photographs of the clothing over the affected parts and of the electrical devices that were concerned in the accident. Most of the accidents were due either to carelessness or to failure of insulation. The worst burns were caused by the impregnation of the skin by particles of fused metal.

The second part of the book is devoted to the reproduction of a large number of typical photographs of cables, conduits, lamps, and other electrical appliances that suffered damage from grounds, short-circuits, corrosion and other faults on high-tension circuits. Following this are charts of good insulating materials, approved methods of fusing circuits, and various forms of insulated gloves, suits and pliers suitable for use by linemen and others that have to expose themselves to high-tension circuits.

In the third part of the book accidents due to lightning are treated similarly to those caused by high-tension circuits as related in the first and second parts. There are also shown a number of cases where lightning-protection equipment had failed and the reasons for the failure pointed out. Throughout the book the illustrations, which are largely colored, seem to have been prepared with great care and fidelity to the original photographs and exhibits that form a division in the museum of the Royal University, Institute for Legalized Medicine at Vienna. The book is of particular value to the physicians of large electrical companies and of others to whom falls the treatment of severe electrical burns. The suggestions given for the thorough protection and insulation of high-tension circuits are of general interest to electrical men who can read German.

"Electric Railway Troubles and How to Find Them." By Paul E. Lowe. Frederick J. Drake, Chicago, Ill. Cloth, 367 pages (5x7½ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $1.50.

This book should prove beneficial to electric-railway operatives and particularly so, to motormen, who wish to master the intricacies of the machinery to which they are entrusted. The motorman should not only be capable of operating his car over a certain route, with all of its apparatus in good working order, but he should be capable to cope with the many emergencies liable to arise in the operation of an electric car. The author has had this in view in compiling a treatise on the best results deduced from the exercise of judgment and experience in the operating and repair of electric-railway apparatus. This applies especially to motors, and the author has treated this subject quite extensively, although a large space of this work is devoted to air-brake apparatus, and car-heating and car-lighting.

"Elementary Electrical Calculations." By T. O'Conor Sloane. D. Van Nostrand Company, New York. N. Y. Cloth, 304 pages (5x8 inches). Supplied by the Electrical Review and Western Electrician for $2.00.

This book is designed to give in simple form what may be termed a foundation for the study of electrical calculations. The operations described require only an elementary knowledge of mathematics. Very few calculations call for the use of algebra higher than that involved in the treatment of Ohm's law, and the arithmetic employed is simpler than that used in commercial calculations. In the solution of networks, where more advanced algebra is required, the matter is placed toward the end. In the appendix some illustrations of geometric, of more involved algebraic, and of simple calculus solutions and demonstrations are given, which should interest those with some knowledge of higher mathematics. For students in electrical engineering this work should prove valuable.

American Street Railway Investments. New York: McGraw Publishing Company. 1909. 498 pages (9½x12¾ inches) with 42 maps. Price $5.00.

The sixteenth annual edition of the "Red Book" on electric-railway investments contains detailed information concerning about 2,300 electric-railway corporations for the use of bankers, capitalists and other smaller investors in their securities. This information in the 1909 volume is compiled in the same manner as has become standard in the recent editions and contains details relative to the charters and franchises, extent of system, subsidiary companies, capital stock and other securities, plant and equipment, officers and directors, as well as in many cases comparative statistics of operation and balance sheet for several years. There

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is also given a table of gross receipts for 1907 and 1908 of companies whose annual gross receipts were over $25,000. Besides American companies, reports are given of companies in Canada, Cuba and other of the West Indies, Hawaii and the Philippine Islands. There are also included lists of the national and state railroad commissioners, and of street and interurban railway associations. Inasmuch as this book gives data on a great many companies that are not street-railway companies, and this number is steadily increasing, a more appropriate title for it would be "American Electric Railway Investments."

Lighting in Exchange for Advertising.

The proposed plan for lighting the streets of the downtown business district of Indianapolis, Ind., adopted by the city a few weeks ago has been abandoned in favor of the scheme offered by the Peacock-Wooley Company, of Chicago, for lighting the streets free of cost, or in consideration of the privilege to conduct an advertising business on the lamps. The sample lamp installed by that company is giving excellent satisfaction and attracting considerable attention. The change, it is stated, will mean a saving of $10,000 a year to the city. The contract will provide for ten lights to the square. This should give excellent service.

American Monorail Company.

Bion L. Burrows, former secretary to the New York Rapid Transit Commission, and now president of the American Monorail Company, has announced that he will begin the construction of his monorail line through Pelham Park, connecting with City Island, early in the fall.

Permission has been granted the company by the authorities of Pelham Park to run through the park, instead of the highway, thus giving the cars an unobstructed headway; and it is asserted by the Public Service Commission's engineers who saw the cars operated at the Jamestown Exposition, that a speed of 135 miles an hour will be attained at this point.

If the road at Pelham Park meets with the approval of the public, an application will be made for permission to double-deck both the Second and Third Avenue elevated lines, and operate the monorail system on the upper tracks.

A considerable improvement on the existing service is expected.

Electrical Exports for June and for the Past Fiscal Year.

The Bureau of Statistics of the United States Department of Commerce and Labor has completed its compilation of imports and exports from and to the United States for the month of June, and, therefore, for the fiscal year ended June 30, 1909. From these statistics the tables of electrical exports given below have been taken.

Electrical appliances are classified under instruments and apparatus for scientific purposes and include telegraph and telephone instruments. Electrical machinery is classed under iron and steel, and manufactures thereof. The ups and downs by months of the past fiscal year are clearly shown by the following table:

Month.	Electrical Appliances.	Electrical Machinery.	Total Electrical Exports.
June, 1908	$421,732	$659,497	$1,081,229
July, 1908	429,080	523,355	952,435
August, 1908	437,690	663,468	1,101,158
September, 1908	430,785	568,525	999,310
October, 1908	432,907	543,188	976,095
November, 1908	463,588	295,915	759,503
December, 1908	611,611	587,559	1,199,170
January, 1909	500,309	452,851	953,160
February, 1909	462,856	598,736	1,061,592
March, 1909	681,083	579,499	1,260,582
April, 1909	490,483	489,026	979,509
May, 1909	539,424	479,951	1,019,375
June, 1909	595,044	667,453	1,262,497

For the fiscal years, 1907, 1908, and 1909, ending with June 30 in each case, the totals were:

Year.	Electrical Appliances.	Electrical Machinery.	Electrical Exports.
1906-07	$8,262,640	$9,005,766	$17,268,406
1907-08	6,754,217	8,495,219	15,249,436
1908-09	6,074,865	6,449,526	12,524,391

Referring back to the detailed figures for the month of June, 1909, a list of the principal countries to which electrical products were sent and the value of these exports is given below:

Exported to—	Electrical Appliances.	Electrical Machinery.
United Kingdom	$42,553	$ 68,890
Belgium	8,299	.....
France	2,400	10,974
Germany	7,422	5,661
Other Europe	6,623	13,064
British North America	207,732	56,890
Central American states and British Honduras	22,424	4,688
Mexico	69,207	67,584
Cuba	20,222	970
Other West Indies and Bermuda	10,242	3,051
Argentina	16,064	13,223
Brazil	87,438	45,080
Other South America	22,873	9,603
Chinese Empire	.....	3,740
British East Indies	.....	2,213
Japan	33,853	291,148
British Australasia	7,583	20,931
Philippine Islands	22,504	21,421
British Africa	1,586	16,838

Wireless Telegraphy and Ship Insurance.

At the forthcoming International Conference of Underwriters at Baden-Baden, Germany, next month, the question will be taken up as to whether the insurance premium on a ship should be lowered when the vessel is fitted with a wireless-telegraphy installation.

The Central Electric Railway Association.

The Central Electric Railway Association, which holds meetings once every two months, will have its next regular meeting at the Cadillac Hotel, Detroit, Mich., August 26 next. This is the first meeting of the association in Detroit, and it is intended that it be made the "banner" meeting of the year.

The programme is as follows: 10 a. m.: Business session and reports of special committees. 10:30 a. m.: "The Growth and Development of Express Business on Interurban Lines," paper by J. H. Crall, of the Indianapolis & Eastern Traction Company. 11:15 a. m.: "Application of Recording Wattmeters on Electric Cars," paper by Thos. H. Henkle, representing the Electric Service Supplies Company. 12:15 p. m.: Adjournment for lunch.—Afternoon Session —1:30 p. m.: "The Development of Long-Distance Passenger and Freight Business," paper by F. D. Norveil, of the Indiana Union Traction Company, Anderson, Ind. 2:15 p. m.: "New Things for the Benefit of Our Members."

The following are the officers for 1909: President, A. A. Anderson, general manager of the Indianapolis, Columbus & Southern Traction Company, Columbus, Ind.; first vice-president, George Whysall, general manager of the Columbus, Delaware & Marion Railway Company, Marion, Ohio; second vice-president, A. W. Brady, president of the Indiana Union Traction Company, Anderson, Ind.; secretary-treasurer, A. L. Neereamer, 306 Traction Terminal Building, Indianapolis, Ind.

Members are invited to bring their friends to this meeting.

New Subway Finance Plan.

The New York Public Service Commission has set down September 8 as a day for a hearing on the question whether an extension of the elevated structure to the proposed Eastern Parkway in Brooklyn shall be erected on the assessment plan, provided in the Travis-Robinson amendment to the Rapid Transit Act.

This is the first matter to come up involving the construction of rapid-transit facilities to the plan of assessing the cost on the property benefited.

The route is one asked for by substantially all the property owners in the neighborhood, and is laid out as an extension of the old Route 12, as projected by the Rapid Transit Commission.

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PRINTING-PRESS DATA FOR ELECTRIC-MOTOR SALESMEN AND ENGINEERS.

BY S. H. SHARPSTEEN.

Motor salesmen and electrical contractors have difficulty in getting reliable data in relation to the horsepower required to drive the different makes of cylinder or flat-bed printing presses.

People inexperienced in printing-press drive and control will sometimes get the motor or motors very much too large for the work to be done, even after making a careful search, thus making the expense of the equipment and space taken excessive. There are cases where the motors installed are too small, thus causing undue depreciation.

If some printing-press builders are asked the proper motor capacity to operate certain presses that they build, the selling department will advise using a motor very much too small, another printing-press manufacturer will almost insist on having a motor fifty per cent too large.

The accompanying tables have been made up from data carefully selected from reliable sources.

The printing-press manufacturers usually think and talk of their machines by the numbers and bed sizes. These appear in the first and second columns. The printer reasons in bed sizes and impressions per hour, but the motor speeds are given in revolutions per minute, which makes it difficult for the motor salesman to get out his propositions. The third column gives the revolutions of the main shafts of each press to one impression.

If a printer wants a motor drive and control for a No. 8 Cottrell two-revolution press and claims that the maximum impressions per hour will be 1,600, multiply the 1,600 impressions by the 9 in in the third colum, since there are nine revolutions to one impression, and divide by sixty, and the result will be 240 revolutions of the main shaft of the press per minute.

This maximum number of impressions is given as 296 in the fifth column, but it is advisable to consult the printer as to the maximum and minimum impressions, as the character of the work to be done often influences the speed of production of the press.

Especially where a plant is to be changed over from shafting to motor drive the tables give information that will save much correspondence and time.

Type of Press.	Press Number.	Size of Bed.	Rev. Per Impress.	Revolutions Per Minute of Flywheel Shaft. Manufacturer's Specified Speed. Min.	Manufacturer's Specified Speed. Max.	Recommended Speed, General Work. Min.	Recommended Speed, General Work. Max.	Press Pulley.	Horsepower.	Further Press Particulars.
POTTER PRESSES.	0	21x27	5	117	233	135	215	.....	1	Two Roll, Drum Cyl.
	1	24x30	5	111	222	128	205	.....	1	Two Roll, Drum Cyl.
	2	25x35	5	105	210	121	195	.....	2	Two Roll, Drum Cyl.
	2½	29x42	5	105	210	121	195	.....	2	Two Roll, Drum Cyl.
	3	32x46	5	99	198	115	185	.....	2½	Two Roll, Drum Cyl.
	4	34x50	5	99	198	115	185	.....	2½	Two Roll, Drum Cyl.
	3	32x46	5	99	198	115	185	.....	2	Two Roll, 2 Rev.
	4	34x50	5	99	198	115	185	.....	2	Two Roll, 2 Rev.
	5	36x52	5	94	187	108	173	.....	2½	Two Roll, 2 Rev.
	6	40x54	5	94	187	108	173	.....	2½	Two Roll, 2 Rev.
	7	42x60	5	88	175	102	164	.....	3	Two Roll, 2 Rev.
	3	32x46	5	94	187	108	173	.....	2½	Four Roll, Two Rev.
	4	34x50	5	94	187	108	173	.....	2½	Four Roll, Two Rev.
	5	36x52	5	88	175	102	164	.....	3	Four Roll, Two Rev.
	6	40x54	5	82	163	95	150	.....	3	Four Roll, Two Rev.
	7	42x60	5	79	158	91	146	.....	3	Four Roll, Two Rev.
	8	44x60	5	79	158	91	146	.....	4	Four Roll, Two Rev.
	2	24x34	5.5	77	154	89	143	.....	3	Lithograph.
	3	30x44	6.125	79	157	90	145	.....	3	Lithograph.
	4	33x48	6	70	140	81	130	.....	4	Lithograph.
	5	38x58	9.33	98	196	113	182	.....	4	Lithograph.
MIEHLE PRESSES.	00000	.....	12	170	340	195	315	24	5	4 Roller, 2 Rev.
	0000	.....	12	170	340	195	315	24	5	4 Roller, 2 Rev.
	00	.....	12	146	360	195	315	18	4	4 Roller, 2 Rev.
	1	.....	12	180	380	215	345	18	3½	4 Roller, 2 Rev.
	2	.....	12	200	400	230	370	18	3	4 Roller, 2 Rev.
	3	.....	12	200	420	238	382	18	3	4 Roller, 2 Rev.
	4	.....	12	225	440	255	410	16	2½	4 Roller, 2 Rev.
	5	.....	7	150	268	160	256	16	2	4 Roller, 2 Rev.
WHITLOCK PRESSES.	000 E	45x62	5	75	125	78	125	24x6	5	2 Revolution.
	00 E	43x56	5	80	133	83	133	24x6	4	2 Revolution.
	0 E	39x52	5	90	154	96	154	26x6	4	2 Revolution.
	1 E	35x47	4.9	100	169	105	169	26x6	3½	2 Revolution.
	2 E	29x42	5	110	184	115	184	26x5	3¼	2 Revolution.
	3 E	27x40	5	130	220	137	220	26x5	3	2 Revolution.
	5 E	27x31	5	150	255	160	255	26x5	3	2 Revolution.
	01 E	39x52	4.9	100	169	105	169	26x6	4	2 Revolution.
	GU	41x52	12.27	190	368	215	350	20x6	4	2 Revolutions.
COTTRELL PRESSES.	3	27 x39	7	128	245	144	230	28x5	3	4 Roller, 2 Rev.
	5	33½x46	8	147	267	159	255	28x5	3½	4 Roller, 2 Rev.
	6	33½x50	8	147	267	159	255	28x5	4	4 Roller, 2 Rev.
	8	39 x55	9	150	278	165	265	28x5	4	4 Roller, 2 Rev.
	9	43 x56	9.6	160	296	175	280	28x5½	4½	4 Roller, 2 Rev.
	10	43 x62	9.6	160	288	172	275	28x5½	5	4 Roller, 2 Rev.
	12	47 x65	10.2	136	260	153	245	28x5½	6	4 Roller, 2 Rev.
	13	50 x74	10.2	136	265	155	250	28x5½	6½	3 Roller, 2 Rev.
	5	33 7/16x45	5.85	87	170	100	160	28x6	6	Flat Bed, Perfecting.
	8	39 ¾x54	6.57	76	148	86	138	28x7	7	Flat Bed, Perfecting.
	9	43 x62	6.86	80	154	90	144	28x7	7½	Flat Bed, Perfecting.
	10	44 ¾x63	7	76	146	85	136	28x8	7½	Flat Bed, Perfecting.
BABCOCK PRESSES.	3[2]	26 x32	5.68	148	284	165	265	24	2	Optimus, 4 Roller.
	4[2]	27 x39	6	140	270	158	255	24	2	Optimus, 4 Roller.
	4[3]	28 x41	6	130	250	145	235	27	2	Optimus, 4 Roller.
	5[4]	30 x43	7.5	160	300	178	285	28	3	Optimus, 4 Roller.
	6[4]	32 x47	8	140	280	160	260	32	3	Optimus, 4 Roller.
	7[4]	36 x52	9	148	284	165	265	32	4	Optimus, 4 Roller.
	8[4]	39 x53	9.6	150	288	168	270	32	5	Outimus, 4 Roller.
	9[4]	39 x55	9.6	150	288	168	270	32	5	Optimus, 4 Roller.
	10[4]	41 x55	9.9	148	284	165	265	32	5	Optimus, 4 Roller.
	11[4]	43 x63	10	135	267	155	250	32	6	Optimus, 4 Roller.
	12[4]	47 x66	10.57	135	264	155	250	32	6	Optimus, 4 Roller.
	2	22 x27	5	110	208	120	195	15	1	Standard, 2 Roller.
	4	27¾x40	5	100	184	110	175	18	1½	Standard, 2 Roller.
	6	33½x48	5	80	150	87	140	19	2	Standard, 2 Roller.
	7	38 x51	5	75	142	85	135	19	2½	Standard, 2 Roller.
	2	22 x27	5	110	208	120	195	15	1	Regular, 2 Roller.
	4	27¾x40	5	100	184	110	175	18	1½	Regular, 2 Roller.
	6	33½x48	5	80	150	87	140	19	2	Regular, 2 Roller.
	7	38 x51	5	75	142	85	135	19	2½	Regular, 2 Roller.
	3	24 x31	3	90	180	105	168	18	1½	Express.
	7	38 x51	7½	175	325	195	310	25	4	Express.
	6	29 x43	3	75	150	87	140	22	4	Dispatch.
	7	39 x52	3	70	140	81	130	22	5	Dispatch.
	8	43 x57	3	60	120	70	112	22	6	Dispatch.
HUBER-HODGMAN PRESSES.	000	52 x70	12	160	300	178	285	24x6½	6	4 Roller, 2 Rev.
	00	49 x66	12	160	320	184	295	24x6½	5½	4 Roller, 2 Rev.
	0	46½x62	12	170	340	195	315	24x6½	5	4 Roller, 2 Rev.
	1	46½x56	12	170	340	195	315	24x6½	5	4 Roller, 2 Rev.
	2	42 x52	9	135	270	155	250	24x5½	4	4 Roller, 2 Rev.
	3	38 x48	9	135	278	155	250	24x5½	3	4 Roller, 2 Rev.
	4	31 x43	7½	125	262	150	240	24x4½	3	4 Roller, 2 Rev.
	5	28 x33	7½	138	275	160	256	24x4½	2	4 Roller, 2 Rev.
	0	46½x62	12	160	250	160	250	30x6½	8	4 Roller, 2 Color.
	2	40 x52	12	160	300	187	300	26x6½	6	4 Roller, 2 Color.
SCOTT PRESSES.	C-1	17 x22	4	93	186	107	172	14x4	1½	Two Roll, Drum Cyl.
	C-5	38 x51	5	84	167	97	155	17x5	2	Two Roll, Drum Cyl.
	C-6	33½x47	5	75	150	87	140	17x5½	2½	Two Roll, Drum Cyl.
	C-7	30 x42	5	67	133	78	125	20x5½	3	Two Roll, Drum Cyl.
	D or DT-3	24 x29	5.09	102	204	118	189	15x4	2	Two Roll, Drum Cyl.
	D or DT-4	26 x34	5	92	183	106	170	17x4½	2½	Two Roll, Drum Cyl.

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The salesman who has spent days in a hot print shop getting speed data will realize the importance of having the revolutions per impression given in the tables, together with the press pulley sizes and required motor sizes.

Type of Press.	Press Number.	Size of Bed.	Rev. Per Impress.	Revolutions Per Minute of Flywheel Shaft. Manufacturer's Specified Speed. Min.	Manufacturer's Specified Speed. Max.	Recommended Speed, General Work. Min.	Recommended Speed, General Work. Max.	Press Pulley.	Horse-power.	Further Press Particulars.
SCOTT PRESSES—Continued.	D or DT-5	29 x42	5.07	85	169	97	155	20x5	2½	Two Roll, Drum Cyl.
	D or DT-6	32 x47	4.96	75	149	86	138	22x5½	3	Two Roll, Drum Cyl.
	D or DT-7	35 x51	5.06	68	135	78	125	22x5½	3½	Two Roll, Drum Cyl.
	E-2	21½x25	6	180	360	208	332	16x4	2	Two Roll, Drum Cyl.
	E-3	24½x31	6.52	174	347	200	325	16x4	2½	Two Roll, Drum Cyl.
	E-4	27½x36	7.56	180	359	208	332	18x5	3	Two Roll, Drum Cyl.
	E-5	30½x42	8.08	175	350	202	325	18x5	3½	Two Roll, Drum Cyl.
	HN or HF-4	26 x36	7.4	160	320	184	296	18x5½	3	Four Roll, 2 Rev.
	HN or HF-5	29 x42	7.8	156	312	180	290	18x5½	3½	Four Roll, 2 Rev.
	HN or HF-6	33½x46	8.06	148	295	170	274	22x6½	4	Four Roll, 2 Rev.
	HN or HF-7	36½x48	8.43	148	295	170	274	22x6½	4½	Four Roll, 2 Rev.
	HN or HF-8	40 x52	8.81	147	293	170	274	22x6½	5	Four Roll, 2 Rev.
	HN or HF-9	43½x56	9.37	148	296	170	274	24x7½	5½	Four Roll, 2 Rev.
	HN orHF-10	47 x62	9 75	146	292	170	274	24x7½	6	Four Roll, 2 Rev.
	HN orHF-11	48½x66	9.75	138	276	160	255	24x7½	6	Four Roll, 2 Rev.
	M-2	38 x51	5.33	147	293	170	274	24x5	5	Rotary, 2 Rev.
	M-3	46 x60	5.66	142	283	163	262	24x6	6	Rotary, 2 Rev.
	M-4	46 x70	5.66	142	283	163	262	24x6	6½	Rotary, 2 Rev.

Interurban Traffic in Indiana.

Public feeling over the numerous recent collisions and wrecks on the interurban roads of Indiana prompted the Railroad Commission to call a meeting of the committee on rules last week and suggest a revision of certain rules. The members who responded to the call were: H. A. Nichols, general manager of the Indiana Union Traction Company; F. M. Durban, general manager, Evansville & Southern Indiana Traction Company; C. K. Jefferries, district manager of the Terre Haute, Indianapolis & Eastern Traction Company, and A. A. Andersen, general manager, Indianapolis, Columbus & Southern Traction Company.

The commissioners were inclined to criticize the Indiana Union Traction Company for attempting to run cars on a fixed schedule in the absence of train orders, in direct violation of Rule 162. Mr. Nichols said that during a sleet storm in January their telephone wires were all down and they could not receive train orders for four days. They operated on schedule time, otherwise the entire system would have been tied up. This rule was modified. Rule 134 was amended so as to require conductors to leave a car from the rear platform, and before doing so securely fasten the rear vestibule door on the opposite side from which he leaves to flag the crossing and not give signal to motorman to proceed until after he is positive no one is attempting to board or leave the car.

Rules 82, 162, 151 and 269 were revised in a way deemed advisable to make operation of trains more safe.

The commission suggested that Rule 151 B be so amended as to make it imperative for both the conductor and the motorman to receive the train orders over the telephone and that the dispatcher recognize the different voices of the train crew. The commissioners believe if this plan had been required at least two of the recent wrecks due to men failing to observe orders would not have occurred. The committee will take this suggestion up at its next meeting. The commission is determined that interurban travel in Indiana shall be made safer and the responsibility placed on the general managers to make it so. S.

Possible Opportunities in Mexico.

Concerning electric power in Guadalajara, Mexico, and the ordering of all wires to be placed underground, United States Consul Samuel E. Magill reports as follows:

The placing underground of all wires in this city will be accomplished by the union of two strong local corporations—La Compania de Tranvias, Luz y Fuerza de Guadalajara, with La Empresa Irrigadora y de Produccion Electrica de Guadalajara. The former corporation now has a monopoly of the electric power and lighting of this city, and the latter corporation has valuable concessions from the state of Jalisco and the government of Mexico, through which it controls rights to irrigate a large tract of land in this state and immense waterpower in nearby rivers, and also to enter Guadalajara with its wires to compete with the former in selling light and power in the city. This will prevent a possibly dangerous competition and will certainly result in benefit to Guadalajara, although prices will probably be kept up to the present standard.

Just what opening this change will offer to American manufacturers is at present uncertain, as while the Compania de Tranvias has heretofore purchased American-made electric machinery, the Compania Irrigadora is said to have made a contract with a large German concern to use German goods exclusively in return for financial aid given by the German company about a year ago, at a time when it was difficult to interest American capitalists in Mexican enterprises.

Offerings of materials for the conduits and for the trolley underground addressed to either of the above companies will no doubt receive consideration, and may result in business.

American Telephone and Telegraph Takes Over Central District.

The Central District and Printing Telegraph Company, which operates all the Bell lines in Western Pennsylvania, Eastern Ohio, and a part of West Virginia, has been taken over by the American Telephone and Telegraph Company. The deal involves about $13,000,000. The deal was brought about by the acceptance of the proposal of the American Telephone and Telegraph Company to exchange its stock for the stock of the Central District and Printing Telegraph Company on the basis of one share of the former for one-and-one-half shares of the latter.

Much of the stock of the Central District and Printing Telegraph Company has been delivered to the treasurer of the American Telephone and Telegraph Company, and all of it will be in his hands by August 31.

Forty-second Street Road to be Sold.

Judge Lacombe, in the United States Circuit Court at New York, has granted the application of the Union Trust Company for a decree of foreclosure and sale, under the second or income mortage, of the Forty-second Street. Manhattanville & St. Nicholas Avenue Railroad Company, of New York city, and others. At the final hearing held there was no opposition to the application.

To Harness Hell Gate.

Experiments are under way to determine the feasibility of utilizing the powerful currents which daily swirl through Hell Gate, off the port of New York. Secret testing operations are being performed in an attempt to discover a method of changing the force of the tides at this point into electric power. The backers of the project are not known.

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Wireless Service Extended.

The Netherland Chamber of Commerce in America, 136 Water Street, New York city, announces that it has received a communication from the governor of the Colony of Curaçao, Dutch West Indies, containing the information that the wireless telegraph station at the port of Willemstad, Island of Curaçao, has been opened for the public, and the following rates will be charged:

From 1 to 10 words, 40 cents; for every additional word, 4 cents; delivery of message in Willemstad, 10 cents; delivery on board of a vessel not moored alongside the quay of Willemstad, 20 cents.

These charges are collected from the sender or receiver of the message on land, while the ship rates charged on board of the vessel are paid by the sender or receiver on board.

Messages from vessels to the land station, destined to be forwarded by submarine cables, will be delivered to the agent in Willemstad of the steamship company owning the vessel sending the message and who will have to take charge of the forwarding to destination of such message.

The station will be open on week days from 5 a. m. until 7 p. m. and at 12 midnight. On Sundays and holidays, from 5 a. m. till 6 a. m.; at 12 noon; from 6 p. m. till 7 p. m.; and at 12 o'clock midnight.

The nominal distance which the land station can reach is 500 kilometres, but no difficulty has been experienced in sending or receiving messages at a distance of 800 kilometres.

$50,000,000 Steel Plant Planned for Mexico City.

A gigantic steel plant will be established in Mexico City within the coming year by French and American capital. The initial outlay will be $50,000,000. Victor Belanger, of Paris, is the head of the concern. It is understood that a large part of the capital will come from Paris and Boston. Coal and iron mines in Mexico will be acquired later by the company. It is reported that the steel will be manufactured by a new and secret process.

Copper Exports.

Exports of copper for the week ended August 5 were 6,604 tons. Since August 1, they were 5,377 tons compared with 6,132 tons the same period last year.

Indiana State's Attorney Objects to Electric Signs.

Every overhanging sign in South Bend, Ind., must come down, according to State's Attorney C. E. Pattee. His edict includes electric signs, illuminated arches and all devices extending over the sidewalk, representing an expenditure in that city of over $20,000.

Prosecutor Pattee announced his crusade when he filed an affidavit against John Platt and Richard Perkey, proprietors of a clothing store in South Bend. Mr. Pattee said that every overhanging sign in the business district of South Bend is a violation of the state law. He declared them to be dangerous to the public.

Increase in Electric Pumping Plants.

In connection with the decision of the Providence, R. I., city officials to install electric pumps at the city water supply stations, they were informed as to the great increase in the use of electric motors for this purpose. In this case power is to be furnished from a central station, that of the Narragansett Electric Lighting Company. The fact was brought out that many other cities, Duluth, Minn., in particular, was instanced, are doing away with a steam equipment for water service and are operating their pumping plants by electricity.

The Narragansett Electric Lighting Company has estimated that it could install a motor for the operation of a turbine of the 10,000,000 gallons per diem capacity required by the conditions for about $10,000, which could be operated by electric current at a very low cost to the city. This, the company stated, would effect a saving of $30,000 to the city of Providence.

Mackay Companies' Plans.

The new cable which the Commercial Cable Company has laid between New York and Newfoundland will be duplicated in the near future. The Commercial Cable Company finds that it must have a second cable by this new route or else lay a new cable over the entire distance to England if the present volume of business is to be properly handled.

This means that two out of the present five Atlantic cables are to have direct Newfoundland connection with New York, with a gain in speed of transmission of fully thirty-five per cent, and as great a probable increase in accuracy of transmission.

Urges Subway Construction.

Samuel Rea, second vice-president of the Pennsylvania Railroad and president of the Pennsylvania Terminal Company, which is building the new station at Seventh Avenue and Thirty-third Street, New York city, and the series of tunnels from Jersey to Long Island, has sent to the Public Service Commission a letter urging the immediate approval and construction of the proposed Seventh Avenue subway. Mr. Rea's communication places great emphasis on the fact that the new Pennsylvania terminal will be opened to the public next year and declares that the city should appreciate the necessity of subway connections with it.

Boston & Maine to Use Waterpower.

By a deed recorded in Concord, N. H., Alvah W. Sulloway, of Franklin, conveys to the Boston & Maine Railroad the waterpower and privilege and electric plant recently purchased by him at Eastman Falls, on the Pemigewassett River. The transaction includes also undeveloped waterpower in the same river in the towns of Bristol, Hill, New Hampton and Sanbornton.

Boston & Maine officials state that plans have not been definitely made, but that the railroad company has need of power, inasmuch as it has large shops in the vicinity and also operates trolley lines.

Special Price on Lights.

By a plan agreed upon by the officials of the various lighting companies having in charge the illumination of New York at the coming Hudson-Fulton celebration the most continuously brilliant spectacle ever offered by a community is assured.

The present retail rate for Manhattan current is ten cents a kilowatt-hour. As the New York Edison's contribution to the celebration it has been decided to make the charge for electricity supplied in the territory it serves during the period of festivity five cents per kilowatt-hour. This will necessitate special meters for temporary installation.

Representatives of the New York Edison Company have started out on a systematic canvass among the citizens, looking to a general lighting up, not only of stores and office buildings, but of private dwellings as well. The company will place decorators at the service of all who are disposed to help brighten the city during the Hudson-Fulton times, but don't know just how to go about it.

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PRACTICAL ACCOUNTING FOR ELECTRICAL COMPANIES.[1]

IMPORTANCE OF UNIFORMITY IN BOOKKEEPING—CLASSIFICATION OF INCOME ACCOUNTS—A TYPICAL BALANCE SHEET.

BY R. F. PACK.

The subject of accounting for electrical corporations is one that is attracting a considerable amount of attention at the present time. Many of the state governments, through their public-service commissions, have issued orders calling for uniform systems of accounting, and these systems require a very detailed classification of accounts. Moreover, the companies themselves are feeling, instinctively, a growing need for a greater knowledge only to be obtained by a careful and scientific arrangement of income and operating accounts. It is, of course, evident that the public-service commissions require this detailed classification in order to obtain comprehensive reports of the affairs of the companies for the benefit of the public, whose servants they are; but it may be said that this "interference" by the state has benefited the companies as much as, or perhaps more than, it has served the state.

Up to the present, we, in Canada, have not been compelled to make drastic changes in our systems by any process of law, but directors and officers, in charge of our companies, are realizing more and more the advantages to be gained by a more elaborate classification, and should the time arrive when our provincial Legislatures require reports similar to those prescribed by the state governments in the United States, and by the Board of Trade in Great Britain, it would be much to our advantage if we had already decided on a uniform system, and could thus present a united front in meeting any committee, appointed by the provincial government, to discuss and to formulate a definite system.

Furthermore, we stand very much in the position of manufacturers, and no manufacturer today can hope to reap a full measure of financial success unless he has an accurate knowledge of the exact cost of both manufacturing and distributing his commodity. The day is long past when we can charge for our commodity—electric current—"the highest price that the traffic will bear." We have to meet on all sides the keenest competition, and it is now necessary for us to be prepared to supply electric current at the lowest possible price, consistent with financial safety, and this cannot be done unless we have an absolute knowledge of the exact cost of production and distribution.

At the meeting of the National Electric Light Association, held in Chicago in May, 1908, the committee appointed to consider "A Uniform System of Accounting," presented its report. This committee had drawn up a classification of accounts which they wished to have adopted by the National Electric Light Association, in order to strengthen the hands of the electric-light companies in presenting their views to the Public Service Commission, of New York state, and as the system adopted by this commission (to take effect on January 1 last) so closely approximates the system proposed by the National Electric Light Association, it is evident that the companies concerned were able to convince the commission that their classification would give the state all the information it required, and, at the same time, meet the needs of the companies.

The Railroad Commission of the state of Wisconsin has also prescribed a uniform classification of accounts for electric companies, and this system is very similar to that adopted by the state of New York. Other states, through their public-service commissions, have the matter under consideration, and there is little doubt that this system of accounting, having already so wide an application, will extend its field, and that, sooner or later, all companies will be influenced by it.

It must, of course, be understood that it is impossible for all companies, whether large or small, to have an exact uniformity of accounting to the minutest detail, and the aim and object should be to secure uniformity in essentials; in other words, to agree on the basic principles; and then, as local conditions require or permit, to build a superstructure to satisfy the most exacting demands. Assuming that the average income of electrical companies to be $3 per inhabitant, of the territory served, it was estimated that seventy-five per cent of the companies doing business in the United States, earn, on the average, less than $15,000 per annum; similar conditions, no doubt, obtain in Canada, which make it impossible for the smaller companies to carry out a very elaborate system, and the aim of this paper is to suggest those main accounts which can be kept, and which most certainly should be kept, and then to show how each company can provide sub-accounts to satisfy its own requirements.

The form which follows is the foundation upon which every system should be built:

BALANCE SHEET.

Assets—
Property and Plant: Franchises and patent rights. Land. Buildings and fixtures. Power plant equipment. Transmission and transformation system. Storage battery equipment. Distribution system. Utilization equipment. General office and stores equipment. Miscellaneous.
Treasury Securities: Stocks and bonds.
Investments: Stocks and bonds of other companies. Other investments.
Reserve, sinking and special fund assets:
Current Assets: Cash, materials and supplies. Bills receivable. Accounts receivable. Interest and dividends receivable. Other current assets.
Prepaid Accounts: Taxes prepaid. Insurance prepaid. Rents prepaid. Other prepayments.
Open Accounts: Deficit.

Liabilities—
Capital: Capital stock, preferred. Capital stock, common. Funded debt.
Mortgages: Real estate mortgages. Other mortgages.
Current Liabilities: Notes and bills payable. Accounts payable. Consumers' deposits. Sundry current liabilities.
Accrued Liabilities: Insurance accrued. Taxes accrued. Interest on funded debt accrued. Sundry liabilities accrued.
Open Accounts:
Reserves: Amortization reserve. Special and general reserves.
Surplus:

INCOME ACCOUNT.

Operating revenues—		
Commercial lighting earnings	.....	
Commercial power earnings	.....	
Municipal street lighting earnings	.....	
Municipal building lighting earnings	.....	
Miscellaneous earnings from operation	.....	
Total operating revenues		.....
Operating expenses—		
Generation expense	.....	
Transmission and transformation expenses	.....	
Storage expense	.....	
Distribution expense	.....	
Utilization expense	.....	
Commercial expense	.....	
New business expense	.....	
General expense	.....	
Undistributed charges	.....	
Total operating expenses		.....
Net operating revenue		.....
Non-operating revenues—		
Profit on wiring and sales	.....	
Rents	.....	
Interest receivable	.....	
Total non-operating revenues		.....
Gross income		.....
Deductions—		
Interest on funded debt	.....	
Interest on mortgages	.....	
Interest on floating debt	.....	
Miscellaneous deductions	.....	
Total deductions		.....
Net income		.....
Sundry appropriations	.....	
Stock dividends	.....	
		.....
Surplus		.....

As a guide to the main expense account, it may be said that:
Generation includes—Cost of electric current delivered to station terminal board.
Transmission and transformation includes—Cost of conducting current to substations and cost of transforming and making ready for delivery to distribution system.
Storage includes—Cost of storage battery.
Distribution includes—Cost of conducting current from substation terminal boards to customers' premises.
Utilization includes—The trimming and inspection of lamps, customers' premises expenses, lamp renewals and the like.
Commercial expenses include—Cost of reading meters and all office expenses in connection with consumers' accounts.
New business expense includes—Cost of securing new business.
General expense includes—Administration and miscellaneous general expenses.

We have here the skeleton only of a good system of accounting, and there are but few companies that will not require a more detailed classification; it must be borne in mind, however, that the details, no matter how numerous, must be treated as sub-accounts of the

[1] Paper read before the Canadian Electrical Association, Quebec convention, June 16-18, 1909.

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main accounts, and in no case should the general plan be materially altered.

The property and plant accounts may be further divided as follows:

Land—
Occupied by generation stations. Occupied by outside substations. Used for other purposes.

Buildings—
Steam power plant buildings. Hydraulic power plant buildings. Substation buildings and transformer stations. Buildings used for general corporate purposes.

Power Plant Equipment—Furnaces, boilers and accessories:
Steam Plant—Furnaces, boilers and accessories. Steam engines. Gas Plant—Gas producers and accessories. Gas engines. Hydraulic Plant—Dams, canals and pipe lines. Turbines and water wheels. Miscellaneous power plant equipment. Electric generators. Accessory electric power equipment.

Transmission and Transformation System—
Transmission overhead system. Transmission underground system. Substation and transformer station equipment.

Storage Battery Equipment—

Distribution System—
Overhead distribution system. Underground distribution system. Line transformers and devices. Services. Meters. Municipal street lighting system.

Utilization Equipment—
Commercial lamps and equipment. Municipal lamps and equipment. General utility equipment.

General Offices and Stores Equipment—

Miscellaneous—
Electrical tools and implements. Electrical laboratory equipment. Stable equipment. Miscellaneous charges during construction.

The revenue accounts cannot be arbitrarily classified. A broad generalization has been suggested, and local conditions must govern a further classification.

The expense accounts should be kept in fuller detail and the following sub-accounts will serve the purposes of the majority of the companies:

Generation Expense—
Operation: (Steam power generation.)
Superintendence.
Boiler labor.
Engine labor.
Electrical labor.
Miscellaneous labor.
Fuel.
Water.
Lubricants.
Miscellaneous supplies and expenses.
Maintenance and repairs:
Boiler equipment.
Steam equipment.
Electric generators.
Accessory electric equipment.
Building and fixtures.
Miscellaneous station equipment.

Corresponding or appropriate accounts. (Gas power generation or hydraulic power generation.)
Electric current purchased. (Gas power generation or hydraulic power generation.)

Transmission and Transformation Expense—
Operation—Inspecting and patroling transmission system. Substation labor. Substation supplies and expenses. Maintenance and Repairs—Transmission line. Substation buildings. Substation equipment.

Storage Expense—
Operation—Labor. Supplies. Maintenance and Repairs—Batteries. Accessories.

Distribution Expense—
Operation—Superintendence. Distribution office expenses. Setting and removing meters and transformers. Connecting and disconnecting services. Meter testing and inspecting. Meter department supplies and expenses. Miscellaneous labor and expenses.
Maintenance and Repairs—Overhead system. Underground system. Services. Line transformers. Meters.

Utilization Expense—
Operation—Trimming and inspecting lamps. Lamp supplies. Incandescent lamp renewals. Miscellaneous supplies and expenses. Consumers' premises expenses.
Maintenance and Repairs—Lamps. Consumers' installations. (Sub-accounts should be kept separating commercial and municipal expenses.)

Commercial Expense—
Reading meters—salaries and expenses. Collection department—salaries and expenses. Customers' department—accounting, salaries and expenses. Miscellaneous supplies and expenses.

New Business Expense—
Salaries. Canvassing and soliciting. Advertising. Demonstrations. Supplies and expenses.

General Expense—
Salaries and expenses of general officers. Salaries and expenses of general office clerks. General office—supplies and expenses. General law expenses. Miscellaneous general expenses. Maintenance and repairs of general office buildings and fixtures. Maintenance and repairs of general office equipment.

Undistributed Charges—
Insurance. Juries and damages. Store expenses. Stable expenses. Taxes. Uncollectable bills. General amortization.

The remaining accounts, having to do with deductions from income, such as interest on funded debt, and miscellaneous appropriations to reserve accounts, etc., are self-explanatory, and can be classified to suit varying conditions.

It is manifestly impossible to satisfy every requirement of every electrical company; the aim has been to give, as briefly as possible, a general outline of the main features of a system of accounting that could be made, more or less, uniform in Canada, and the companies themselves must remedy deficiencies, and supply additions, to suit their own requirements, as it will be readily understood that a very lengthy paper would have to be written to set forth a system comprehensive enough to suit all conditions.

In regard to depreciation, or amortization, of property and plant, it is advisable that a certain amount be charged, month by month, to operating expenses through a general amortization account, the amount so charged to be credited to an amortization reserve account, and to be sufficiently large enough to cover the ordinary wear and tear, and obsolescence, that have taken place during the month, in the property and plant of the company (less the amounts charged to the various repair accounts in the operating expenses), and to provide a reserve, estimated to be sufficient to cover the cost of property destroyed by extraordinary casualties. At the end of the fiscal year a proper amount should be written off the various property and plant accounts to cover ordinary depreciation and extraordinary casualties, the total of the amounts thus written off being charged to the amortization reserve account.

Great care should be taken to identify all additions made to the property and plant accounts, and it should be possible at the end of each month to state, with much particularity, the exact nature and extent of the additions, or betterments, made to the plant, and to point to the exact cost of such addition, or betterment, in the appropriate property and plant account. For this purpose the "Work Order" system is strongly recommended; by means of this system an order, having a serial number, is given for each item of work required to improve, or to add to, the property of the company, and all material and labor used for this work is charged to this particular work order, and the total amount so charged on the completed work order can be entered in the appropriate property and plant account, with a description of the work done, thus giving a ready means of identification.

It is obvious that the accounting records, by themselves, have only a limited value, and they must be studied in conjunction with the data supplied by the engineering department in order that their greatest usefulness may be realized. To mention this phase of the subject is probably sufficient, and common sense will suggest the many ways in which the engineering records may be analyzed, and used, with the figures provided by a scientific system of accounting.

There is little doubt that the electrical companies of the Dominion will be compelled in the near future, by force of circumstances, to adopt a classification of accounts affording the maximum of analysis, requiring work of a very high character on the part of the accountants.

Artistic Possibilities of Electricity.

Under the above caption and in a quite gracefully written article appearing in the August number of the *Fine Arts Journal*, published in Chicago, the various uses of electricity in refined homes are discussed and beautifully illustrated. The Commonwealth Edison Company's artistic and now famous "Electric Shop" is described at full length as affording the best possible example of the artistic possibilities of electricity in this direction. The comely and charming young miss or matron is shown dispensing hospitality at breakfast, lunch, or the after-theatre supper in an electric and altogether inviting manner, be it with a toast rack under her hand or the electric chafing-dish beside her.

This "electrical number" of the publication should do quite a lot in stimulating interest in the use of the latest conveniences and appliances of the day, alike in the cozy corners of polite society and in the studios of sophisticated art coteries.

An Electric Dredge.

The first big dredge to be operated entirely by electricity began work last week clearing out Stockton channel, Stockton, Cal., for the United States government. All of the machinery aboard the suction machine will be moved by electricity. The Pacific Gas and Electric Company has the contract for furnishing 600 horsepower from the Standard line, and a special line is being constructed along the south side of Stockton Channel, crossing Mormon Channel under water. An electric power line also is to be constructed soon across the islands to supply the reclamation plants and pumps.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

MASSACHUSETTS STREET RAILWAYS TO ISSUE NEW STOCK.

Several street-railway companies have been authorized by the Massachusetts Railroad Commission to issue new capital. The Boston & Northern and Old Colony Street Railway companies are authorized to issue, respectively, 5,883 and 4,042 shares of preferred stock at $115, to supply working capital, the price of $115 having been fixed by directors in accordance with act of the recent Legislature. The Worcester Street Railway may issue $3,182,000 twenty-year, five per cent bonds, proceeds to refund bonds previously issued for taking over the Worcester & Marlboro, Worcester & Clinton and Leominster & Clinton companies. The Berkshire Street Railway Company is authorized to issue $190,000 bonds to pay floating indebtedness and cost of permanent additions.

JERSEY TRACTION BOND SALE.

The Public Service Corporation of New Jersey will soon take up its outstanding notes, covering this by an issue of bonds amounting to $8,000,000, which will be the first instalment of a $50,000,000 issue authorized by the concern a year ago.

The bonds will be secured by a blanket mortgage and will bear interest at the rate of five per cent. The underwriters are J. Pierpont Morgan & Company of New York city and Drexel & Company of Philadelphia. The Fidelity Trust Company, of Newark, will handle the issue. The bonds, it is said, will be placed on the market at ninety-two-and-one-half.

NASHVILLE RAILWAY AND LIGHT.

The report of the Nashville Railway and Light Company for the month of June and six months ended June 30 compares as follows:

	1909.	1908.
June gross	$143,644	$130,191
Expenses	67,368	61,606
June net	$ 76,276	$ 68,585
Six months gross	826,414	754,343
Expenses	411,574	394,858
Six months net	$414,840	$359,485

AMERICAN CITIES RAILWAYS.

The report of the American Cities Railway and Light Company for six months ended June 30 compares as follows:

	1909.	1908.
Gross	$2,775,747	$2,629,523
Expenses and taxes	1,608,763	1,584,747
Net	$1,165,984	$1,044,776
Interest and sinking fund	637,073	621,067
Six months surplus	$ 529,911	$ 423,709

BIRMINGHAM RAILWAY, LIGHT AND POWER.

The report of the Birmingham Railway, Light and Power Company for the month of June and six months ended June 30 compares as follows:

	1909.	1908.
June gross	$ 175,180	$ 193,767
Expenses	100,757	107,148
June net	$ 74,423	$ 86,619
Six months gross	1,093,296	1,062,046
Expenses	609,906	615,177
Six months net	$ 483,390	$ 446,869

FONDA, JOHNSTOWN & GLOVERSVILLE.

The report of the Fonda, Johnstown & Gloversville Railroad Company for the month of June and twelve months ended June 30 compares as follows:

	1909.	1908.
June gross	$ 69,715	$ 63,622
Expenses	30,683	28,490
June net	$ 39,032	$ 35,132
Twelve months gross	773,849	777,475
Expenses	355,588	379,041
Twelve months net	$418,261	$398,434

CINCINNATI COMPANIES MERGED.

The Columbia Gas and Electric Company has taken over almost forty per cent of the common stock of the Union Gas and Electric Company. The Columbia company was already a holder of about sixty per cent of the stock. It has also obtained enough additional preferred stock to give it sixty per cent of that issue, the deal representing between $7,000,000 and $8,000,000.

NORTHERN ELECTRIC COMPANY.

The report of the Northern Electric Company, of Sacramento, Cal., for the past year shows a gross income of $442,712.27; operating expenses, $356,489.37; profits, $85,252.90; interest, $105,508.70; leaving a deficit of $19,305.80.

COMMONWEALTH EDISON COMPANY.

Earnings of the Commonwealth Edison Company, of Chicago, are understood to be substantially ten per cent greater than one year ago. This growth may be taken as indicative of improved business conditions. But there also is to be considered the fact that the company has pursued a campaign of advertising. By this it is meant that the company has taken steps to bring to the attention in one way and another of possible patrons the uses and benefits of electric current.

The business, in consequence, is beginning to reach such a volume that the company has announced a reduction in the cost of current, beginning with August. In this instance both the advertiser and the consumer appear to have been benefited.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY.

There has been placed upon the Philadelphia Stock Exchange regular list $605,000 additional capital stock of the American Telephone and Telegraph Company, issued in exchange for $810,000 four per cent convertible bonds of the company, making the total amount of said stock listed at this date $238,617,600, and reducing the amount of said bonds outstanding to $72,058,000.

UNITED RAILROADS.

The earnings of the United Railroads of San Francisco for May have just been made public. The report shows total earnings amounting to $634,169, or $27,745 less than last year for the same month. For the five months ended May 31, the earnings were $2,971,421, as compared with $2,790,260 for the same period last year.

REORGANIZE SECOND AVENUE ROAD.

Stockholders of the Second Avenue Railroad Company, New York city, held a meeting on July 21 and selected a bondholders' committee, consisting of J. W. Castles, president of the Union Trust Company; A. J. Hemphill, secretary of the Guaranty Trust Company; George Amer, Henry S. Redmond and George G. Amer, Jr.

Under the supervision of this committee a plan to reorganize the Second Avenue Railroad Company, which was suggested at the meeting, will be definitely formulated. A majority of the stockholders are said to have expressed their willingness to join in an assessment payment to free the road from the financial difficulties which at present surround it.

May Invest in Electric-Railway Securities.

According to the attorney-general of Ohio, insurance companies may invest their capital in first-mortgage bonds of electric railroads. This is the opinion given to State Insurance Commissioner Lemert.

The law says that they may invest in railroad bonds and this is construed to mean electric as well as steam roads.

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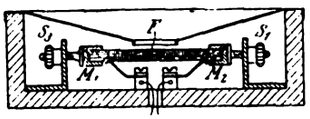
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

CONDENSER TELEPHONE RECEIVER.

It has been known since some years that paper condensers, when operated with high-tension currents, are set into vibration and emit sounds of considerable strength. A number of attempts have been made to utilize this phenomenon in the construction of a telephone receiver, but in all of them a high-tension battery was necessary for the operation of the receiver. Carl Ort and Joseph Rieger have made experiments with "speaking" condensers and have succeeded in transmitting speech intelligibly with pressures of only four to six volts at the condenser. In the original experiments the condenser was charged by current from a dynamo, and the sound vibrations were transmitted



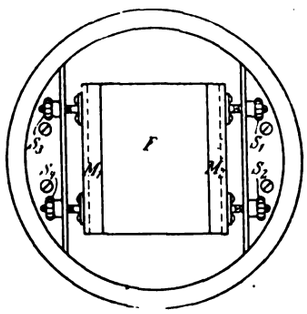


FIG. 1.—CONDENSER TELEPHONE RECEIVER.

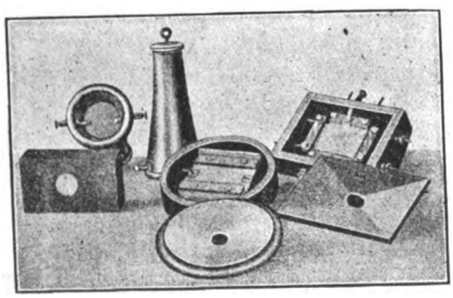


FIG. 2.—CONSTRUCTED CONDENSER TELEPHONE RECEIVER.

to the condenser by a circuit comprising a microphone, a battery and the primary of a telephone transformer, the secondary of the latter being contained in the dynamo circuit. It was found that the condenser did not speak clearly with a low tension—ten to twenty volts. This led to a special construction of the condenser, namely, a mechanical stretching of the condenser sheets, which made the employment of lower tensions possible. The edges of the loose sheets vibrate very irregularly and render the sounds unintelligible. Fig. 1 shows the telephone receiver in section, and Fig. 2 represents a number of these receivers as constructed. The condenser sheets are clamped in two devices M_1 M_2, and uniformly stretched by means of screws S_1 S_2. In many cases paper may be entirely dispensed with, a coat of shellac on the foil taking its place. In the circuit arrangement shown in Fig. 3 each of the condensers C_1 C_2 is connected to a battery of two to three cells contained in the microphone circuit, so that no special battery is required for the condenser. This arrangement was tested on a line eight kilometres in length with

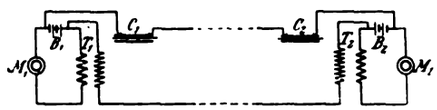


FIG. 3.—CIRCUIT CONNECTIONS FOR CONDENSER TELEPHONE RECEIVER.

perfectly satisfactory results. In order to make the transmitted sounds louder the condenser is charged to a higher pressure (about twenty volts), and in order to produce sounds that are audible throughout a large room a condenser tension of about 100 volts is necessary, a dynamo being conveniently employed as the source of current in this case. An advantage of this apparatus is that it can be operated under a tension at which the diaphragm does not vibrate its natural period, and this obviously renders the sounds transmitted much clearer and more distinct. The condensers used for ordinary telephonic transmission are four by six centimetres in size and have a capacity of about 0.015 to 0.04 microfarad. It was also observed that the larger the apparatus for a given tension, the louder will be the sounds emitted, since much greater masses are set in vibration. The fact that the currents of the earth's magnetism do not affect the apparatus often makes it more reliable than the electromagnetic receiver.—*Translated and abstracted from Elektrotechnische Zeitschrift (Berlin), July 15.*

A LARGE ELECTRIC POWER STATION FOR NAPLES.

The law of July 8, 1904, regarding the creation of an industry for Naples, provided, as one of the means to this end, the erection of a large electric power station for furnishing cheap motive power. It was intended to utilize the waterpowers of the Volturno River, but the conditions of ownership were not perfectly clear, and the city of Naples has succeeded in securing the water rights only recently after long negotiations. Following is the plan adopted for their exploitation: The water of the sources situated between the villages of Rocchetta and Castellone Volturno, in the province of Campo Basso, is to be collected by special installations, among which is a large dam. From the reservoir the water will be conducted through an open canal 2,500 metres in length and through three high-pressure pipes to the turbines of the power station situated at the confluence of the Rochetta and Volturno rivers. The dynamos connected to the turbines will generate three-phase current of 5,000 volts, which will be raised by transformers to a tension of 45,000 volts. Electrical energy of 10,000 kilowatts will thus be produced and transmitted a distance of ninety kilometres to the city of Naples. At the receiving and distributing station in Naples the tension will be lowered to 6,000 volts. The distribution is to be accomplished by three-main nets; an overhead line is to transmit current to the factories of the free zone, armored underground cables will go into the city, and a second overhead line is to be provided for supplying the West, especially the vicinity of Bagnoli, where the enormous Ilva iron and steel works, which will be a heavy consumer, are being erected. The central station in Naples will be equipped with a 6,000-horsepower reserve installation in order to meet the requirements in times of heavy consumption. The Azienda Autonoma del Volturno is being intrusted with working out the details of this plan, and it is conservatively estimated that the work will require at least three years for its absolute completion.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), July 15.*

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ERECTING OVERHEAD MAINS IN DIFFICULT PLACES.

When commencing to erect overhead mains in shipyards, dock estates, railroad sidings, and other difficult places, the best way is to walk over the ground and make a plan of the positions of the poles, or drive wooden pegs into the ground where the poles are to be erected; after doing so, plan out how the mains are to be run, taking particular care to note where the strain is likely to be, the number of mains on each pole, and where telephone guard wires are to be erected. When erecting mains in such places, the author (William Copeland) recommends poles of not less than twenty-four feet from the ground level to the first arm. Wooden poles are to be preferred on account of cheapness. They should be of red fir, free from large knots, and creosoted, and care should be taken to select them with a good taper. When erecting the arms, cap finial and earth wire, care is to be taken that all are connected together at the top, and the wire brought down to the bottom of the pole, and twisted two or three times round the butt to make a good earth. Wooden arms of sound oak, well seasoned, are to be recommended rather than iron arms when using bare copper mains. Where there is any likelihood of any strain on the insulator, twin oak arms should be fitted on the pole, each fitted with an insulator on each side of the pole to take the strain, and when heavy mains are erected, the arms ought to be strengthened by an oak lath erected in a perpendicular position between the arms on each side of the pole; iron should not be used; it is expensive to maintain. For foundations on such places, concrete is not good on account of so many alterations occurring; it is too expensive to take out the poles, which have to be cut down and spoiled. The best and cheapest way, in the author's experience, to erect poles in these places, is to dig a hole about six feet deep or so, according to the height of the pole, and have four nine-inch wooden deals five feet long placed vertically at the sides of the hole, then place the pole to be erected in the center of the hole, fill into the hole about a foot of earth, and place a nine-inch deal on each side of the pole, a tight fit. Afterward fill in the earth and ram well up to five feet, then place a nine-inch deal on each side of the pole, a tight fit, and afterward fill in the earth and ram well up to the ground level. The author has found this to give every satisfaction where heavy strain has come on the pole. Where this is likely to be the case a good way is twin a pole and so erect them that the poles are at an angle to each other, so as to divide the strain equally between them; the poles should not be erected in parallel. The author's experience in such places with heavy mains has been to erect four poles, and he has found they are better on an angle than square. Insulators and bolts should be strong; three-fourths-inch bolts are considered quite small enough. Guards need not be used when wooden laths are employed. The P. O. insulators have been greatly used, even for high voltages, but the binders are some trouble and expensive to maintain, and are not to be relied on. The author has invented a bindless and practically unbreakable insulator, which can be used for any class of wire or cable. It can be employed for aluminum wires; with a porcelain cover, such an insulator is badly needed for such wires, as great troubles are experienced, owing to the action of the binders on the aluminum wire. The insulator is carried on an ordinary bolt, which has a square collar, in order to hold or turn it by means of a key or otherwise. The body is a porcelain insulator, with the usual sheds, and has a horizontal groove round it which contains the wire, the latter projecting somewhat from the groove. In the top of the insulator is a screwed socket for a stud bolt, this socket being entirely separated from the socket for holding the bolt by a sufficient thickness of porcelain. The stud bolt has an ordinary right-handed screw on each side of a central collar, and there is a cap, which can be made of porcelain, or of cast-iron, or other like metals. This cap is provided with two slots, so that it can pass over the wire when placed in position, and comes down tight on to the wire. The cap and insulator are preferably somewhat conical in shape, but the cap is rounded at the top. The mode of erection is as follows: The bolt being screwed into the insulator in the usual manner, and the stud being also screwed into the insulator, the bolt is put in its supports, but not tightened up. The line wire is placed in the groove, and the cap dropped over, resting on the stud. The cap is now held by the hand and guided centrally, and the bolt turned round until the upper screw of the stud screws tight into the cap and holds the latter tight against the wire. The wire is now firmly fixed There is a special value attached to this insulator, for it can be used for a shackle insulator or on a curved or straight line, which is a great consideration when erecting overhead mains in such places; one class of insulator is all that is required. Bare copper wires are recommended for mains; they are approved of by the Board of Trade, and are much cheaper and lighter, and stand the atmosphere much better; insulated wires are expensive to purchase, not so easy to work with, and carry coal dust, snow and ice, which all give trouble. When using bare copper mains, the arc-lamp poles should not be used to carry them, as they are dangerous to pass through when attending to the arc lamps. Connections from the mains should be made of bare copper, preferably solid copper wrapped with Blackley tape and varnished; these are more suitable to withstand the winds. It is not uncommon to use insulated wire with coils of a pretty spiral form, about twice the length they should be, and when the wind blows a few weeks afterward the connections break and the lights go out. Bare copper connections are much stronger, and will last for years if properly made. When a number of connections are taken off the mains and the mains are long, a joint box or double-pole or triple-pole switch should be used for testing purposes, etc., and on larger installations the ring type of mains is a good idea, and has been found to be very valuable. A main starting from the substation is run round the estate and back to the substation, with a switch half-way to break the ring, and, say, two or three more switches in the ring, as the case may be. In the case of a breakdown, only one-third of the system or so, according to the number of switches used, is out of use at a time until all is repaired.—*Abstracted from The Electrical Review (London), July 23.*

Electric's Long Trip.

George W. Daly, who has just accomplished the great feat of driving the Woods electric victoria automobile from Philadelphia to Pittsburg and return, was given a very enthusiastic welcome by the Quaker City Motor Club members and a large party of his personal friends interested in motoring. Notwithstanding the generally rough roads which the sturdy little Woods car had been driven over during the past two weeks, the pretty vehicle looked little the worse for wear, and Mr. Daly stated that he had experienced absolutely no trouble from the time he left Philadelphia till he returned.

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INDUSTRIAL SECTION

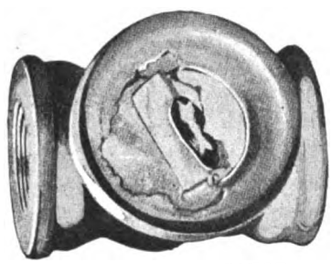
ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Flow Indicator.

The Flow Indicator, as its name implies, is used for insertion in pipe lines to indicate at a glance that flow is taking place therein. It may be used to indicate the flow of boiler feed water, water discharging from a pump, the gas intake of an internal-combustion engine or the flow of jacket water for the same, the flow in circulating oil systems, or the like.

The device is made of brass, and comprises a valve body, with inlet and outlet connections for piping. In the valve body, and facing an aperture in the side, is a pivot ring carrying an indicator or flap. The pivot ring can be moved into any position, allowing the device to be operated in either a horizontal, vertical or angular position.

A glass disk in the aperture, held by a ring nut, allows a clear sight of the flap at a distance of twenty-five feet or more; and from the position of the flap (the flap having on its edge a red face with black arrow), is shown at a glance whether the liquid is flowing. If the liquid is not flowing, the flap will fall to a position at rest on the bottom of the body, and can readily be seen in this position.



THE FLOW INDICATOR.

This device has found many applications in steam power plants, in isolated plants, in breweries and similar works.

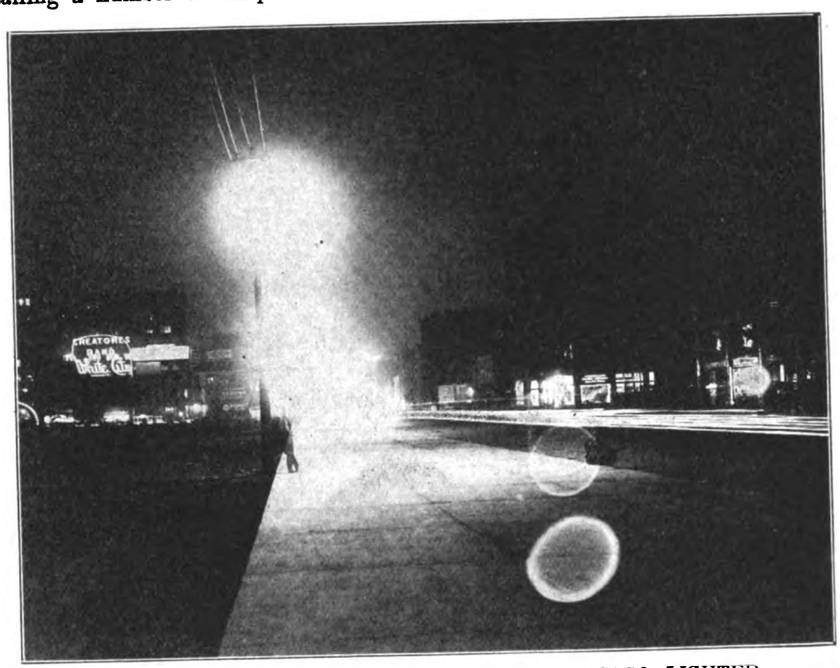
If desired, the device can be furnished with an electrical contact, which, when connected through a battery or other source of power, will close a circuit which will light a lamp or operate a buzzer, when the flow of the liquid, etc., through the indicator is stopped.

Free flow of the liquid is in no way impeded by the use of the indicator.

The agent for the Flow Indicator in this country is A. W. Von Lilienthal, 25 Broad Street, New York, N. Y.

Excello Series Flaming-Arc Lamps.

The Excello Arc Lamp Company, Chicago, Ill., has perfected a series flaming-arc lamp, the saving in operating costs of which, according to its engineering department, makes it a leader in this field of illumination. The company is demonstrating the features of this lamp to the Chicago South Park commissioners, and has been granted the privilege of installing a number of lamps in the direct-current 9.6-ampere circuit located on Michigan Boulevard near Twelfth Street, Chicago.



NIGHT VIEW OF MICHIGAN BOULEVARD, CHICAGO, LIGHTED BY SERIES FLAMING-ARC LAMPS.

The lamps are hung twenty-two feet from the ground. They are fitted with the prismatic inner globe, giving a maximum distribution at thirty degrees from the horizontal. The current consumption of these lamps is forty-seven volts and 9.6 amperes. The yellow flame produces a penetrating light, which is particularly adapted to a thoroughfare such as Michigan Boulevard.

This series lamp is differentially wound and when used for constant-current operation is fitted with a pair of starting coils and cut-out contacts, which operate as follows: When the current is turned on, the contact is closed, short-circuiting the lamp. The moment the carbons come together a current is established through the starting coils, which are in series with the carbons. This energizes a pair of poles, attracting the iron bar which breaks the short-circuiting contact. A safety contact is also provided, located on the rocker, so that when the voltage becomes excessive, due to the carbons burning out, or faulty operation of same, shunt coils pull the rocker down, causing the auxiliary cut-outs to operate. The auxiliary cut-out simply short-circuits the starting coils, causing them to be de-energized. This releases the iron bar, causing the starting contact to close and again short-circuit the lamp. It will be noticed that the operation of this lamp is similar to that of the old open arc, but the distinct feature on which patents have been based is that the auxiliary cut-out is used to de-energize the starting coil, which heretofore has not been taken advantage of.

Engineering Department Promotions.

The New York Public Service Commission passed a resolution providing for the promotion of about twenty men in the engineering department to grades which will secure for them an increase of salaries ranging from $150 to $300 annually.

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Operating Costs of Commercial Electric Vehicles.

In the æsthetic desire for clean cities, better streets and more room in them, we turn to the electric vehicle. But, partly on account of its comparatively recent adoption and partly because of apparently bewildering figures the electric vehicle for trucking and delivery service in the every-day conditions of modern business has not been as generally adopted as its record of service warrants.

One of the strong features in favor of the electric vehicle, but one which is rarely given commercial consideration, is that a surprisingly large number of deaths in the larger cities are caused by diseases transmitted in germ-laden dust, and most of this dust is caused by the litter from the large number of horses in the streets.

When the cost for housing a delivery equipment is high, it pays to consider the advantages of the electric vehicle. It has been stated by firms which have used both the electric and horse-drawn vehicles, that one electric in service does the work of two horse-drawn wagons of the same capacity and eliminates extra horses which must always be available. One-fifth the amount of stable room is necessary. Another item of expense which is eliminated is that of feeding and caring for the horse while not in service. If one-half the amount of care would be taken of the electric when not in service it would always be in good operating condition.

The heat of summer and the snow and ice of winter do not interfere with the operation of the electric, while on the other hand horses are always encountering difficulties during inclement weather.

	Capacity.	Purchased.	Per Month.	Per Day (26 to Month).
Globe-Werneke Co., Cincinnati, O.	Two 2-ton trucks.	Aug. 11, 1905.		
W. H. Harrison & Co., Cincinnati, O.	Oct. 6, 1906.	$ 69.83	$2.79	
G. E. Markley & Co., Cincinnati, O.	2,000-lb. wagon.	June 5, 1905.	78.47	3.14
Wilnegar Furniture Co., Grand Rapids, Mich.	4-ton truck.	Sept. 20, 1905	119.17	4.58
Valley City Mill Co., Grand Rapids, Mich.	2-ton truck.	April 20, 1905	71.48	2.86
Warfield, Pratt, Howell Co., Des Moines, Ia.	5-ton truck.	June 17, 1905.	95.95	3.80
	5-ton truck.	July 22, 1905.	151.43	5.82

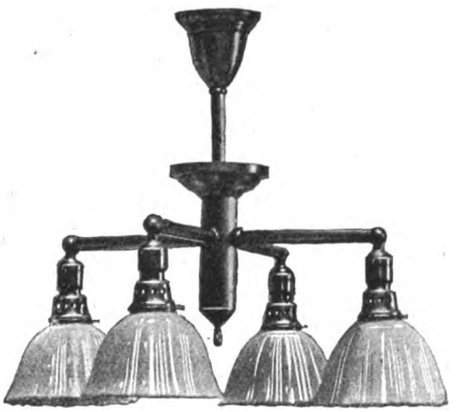
Herewith is a table of interesting figures compiled by C. P. Chrysler, western manager of the General Vehicle Company, showing the expense of maintaining electric trucks manufactured by the General Vehicle Company. The figures are taken from itemized statements submitted by firms which have been using the electric trucks for a period of four years and should prove interesting to those now using the horse-drawn wagons.

For the above firms these trucks replace two teams of horses, so an idea of the saving can be gained. The figures include such items as storage, replacements of every description, insurance, painting, accidents, depreciation, and, in the case of Warfield, Pratt, Howell Company, the salary of the driver.

Central Electric Opalux Tungsten Fixtures.

Up to the present time comparatively little attention has been devoted by manufacturers to the production of moderate-cost lighting fixtures which, in addition to taking advantage of high-efficiency lamps and reflectors, would also have an artistic appearance comparable with the more expensive creations.

In the past, it has too frequently been the custom of the fixture manufacturer, as well as the dealer, practically to ignore the vital relations of the various elements, and the result has been a combination of fixtures, reflectors and lamps, which, while reasonably efficient from an illuminating standpoint, were frequently little short of hideous from an artistic standpoint.



CENTRAL ELECTRIC OPALUX TUNGSTEN FIXTURES.

Appreciating the demand for a well-balanced, moderate-priced lighting fixture for use with tungsten lamps, the Central Electric Company, Chicago, Ill., in conjunction with the Price-McKinlock Company, Boston, has developed a complete line of "Opalux" tungsten fixtures, consisting of seven distinct designs, one of which is shown in the accompanying illustration.

The construction of the fixture is substantial, and the design balanced in all its details.

The Opalux reflector is particularly well adapted for use with high-efficiency lamps, as it not only transmits sufficient light to prevent deep shadows on the ceiling, but, owing to its diffusing surface, gives a distribution free from glare. Another advantage of the Opalux reflector is its comparative freedom from tendency to collect or retain dust. Again, it has been demonstrated by actual test that Opalux reflectors suffer the less from a deposit of dirt for the reason that the reflecting surface is entirely on the inside of the bowl, so that any deposit of dirt and dust on the outer surface has practically no effect on the efficiency of the reflector.

An illustrated circular, descriptive of the above fixtures and reflectors, is being distributed by the Central Electric Company and should prove interesting to central-station managers, architects and consulting engineers.

Storage Batteries and 24-Hour Service.

In 1907 the Sisseton Mill and Light Company, of Sisseton, S. D., decided that it would be distinctly advantageous to maintain a day circuit, if it could be accomplished without a prohibitive expense, as it was felt that it would result not only in giving better service to the existing customers but would enable them to obtain a number of new customers who would not consider electricity unless a twenty-four-hour service could be promised.

It was out of the question to give this service by operating the generating equipment, as the additional cost of fuel and labor would have been excessive. Consequently, in September, 1907, a battery of 134 "chloride accumulator" cells, manufactured by the Electric Storage Battery Company, of Philadelphia, with a capacity of twenty-five amperes for eight hours, was installed. The battery jars were of such a size that the capacity of the battery could be increased forty per cent at any time by the installation of additional plates, thus providing for the natural growth of the day service. This battery has now been in service nearly two years.

The gross business has increased twenty-five per cent. The total expenses have only increased five per cent. The net receipts have increased by an amount equal to approximately twenty-five per cent of the cost of the battery.

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Developments in Holophane - D'Olier Steel Reflectors; Campaign to Delevop Industrial-Plant Lighting.

With the issuing of a new bulletin (No. 23), devoted to Holophane-D'Olier steel reflectors, the Holophane Company launches upon what will be a very aggressive campaign to develop industrial-plant lighting.

As is well known, such lighting has not received much attention from the scientific standpoint. Illuminating engineers and manufacturers of lamps and lighting equipment, with one or two notable exceptions, have let this important branch of lighting take care of itself. The Holophane Company, having perfected its line of steel reflectors, will devote a considerable portion of its attention to this work in future, applying to it the same skill and engineering ability that has marked its advance in other departments of illumination.

Beginning September 1, the steel-reflector department of the Holophane Company will have several engineers working exclusively upon factory and shop lighting. These engineers will be prepared to undertake any problem in industrial lighting that may be offered, and their services are placed, without charge, at the disposal of central stations, electrical contractors, supply dealers, and others who may be able to utilize their expert knowledge in this line of work.

HOLOPHANE-D'OLIER STEEL REFLECTOR.

The new line of Holophane-D'Olier steel reflectors is well worth careful study. Every detail of design and manufacture has been improved. A new type of ventilated holder has been adopted which does away with overheating and deterioration of lamps. A better reflecting surface has been developed, which not only improves the efficiency, but completely eliminates objectionable streaks or striations and gives practically perfect color-value to the light.

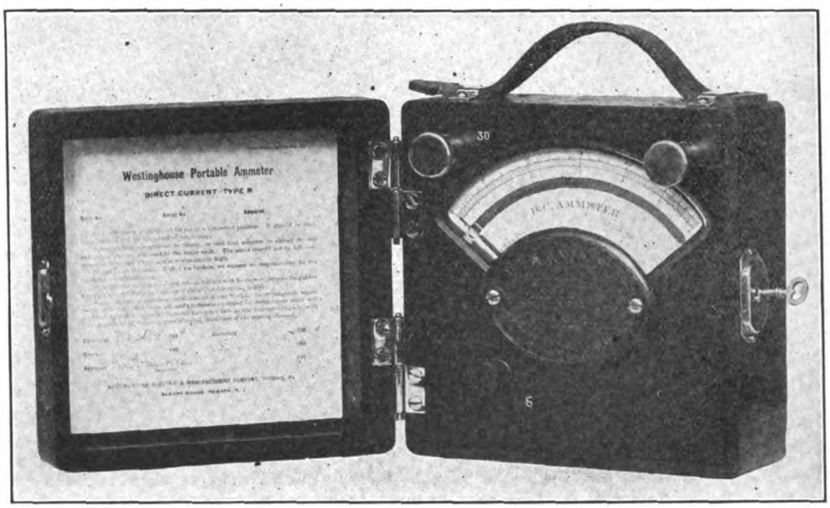
The reflector herewith illustrated is the new No. 72, which is specially designed for tungsten lamps.

New Direct-Current Portable Meters.

All authorities agree that meters working on the D'Arsonval principle, with a current-carrying coil moving in the field of a permanent magnet, are superior to any other type. Heretofore it has been impossible to obtain moderate-priced meters of this type, owing largely to the high cost of manufacturing the delicate moving elements.

The Westinghouse company has refrained from putting on the market portable meters of the cheaper "moving-iron" type, because of their inherent disadvantages, but for some time it has been perfecting designs and methods of manufacture in order that meters of the moving-coil type of high-grade construction could be produced at a reasonable price.

The Westinghouse type R meters are for direct-current measurements and can be supplied for any current or voltage. Some of the interesting features embodied in these instruments are their excellent dead-beat qualities, practically uniform scale, polarity indication, freedom from effects of temperature change or external field, adaptability for use with shunts, and absence of residual errors.



NEW DIRECT-CURRENT PORTABLE METER.

The single air-gap construction enables the moving coil to be moved without opening the magnetic circuits, and thus permanently weakening the magnets. This facilitates the making of repairs by the meter user. The construction is especially suited for portable meters, because the coil and pointer balance each other on the moving element. There is ample clearance between the magnet pole-tips for the moving coil, while the reluctance of the single gap is not high. The ammeters are either self-contained, with double range, or have separate shunts, the large sizes, of course, having external shunts. These shunts are interchangeable, and are made of a special alloy which has zero temperature coefficient and avoids all error due to the thermo-electric effect of difference in temperature between the alloy and copper terminal junctions.

The meters are put up in walnut cases six-and-one-fourth by six-and-one-fourth by four inches, and weigh about five pounds.

The New 200-Volt Tantalum.

The demand which recently led the General Electric Company to extend its production of tungsten lamps into voltages from 200 to 250, also included the other metallic-filament lamps.

In response to this demand, the company has formally listed and is now producing tantalum lamps adapted for the higher voltages, thus obviating the inconvenience of having to operate two tantalum lamps in series.

These 200 to 250-volt tantalum lamps —fifty and eighty watts, respectively— have given most excellent results on service tests, their life averaging fully up to that of the regular 100-130-volt tantalums of the same efficiency, two watts per candle.

They are, respectively, two-and-five-eighths and three-and-three-fourths inches in diameter.

Mechanical Stoking.

While mechanical stoking is an undoubted advantage in large plants, the use of mechanical stokers in small central stations is not to be recommended as a general rule. The exception is when the grade of fuel available is one specially adapted for automatic stoking.

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THE ELECTRICAL EQUIPMENT OF TEXTILE MILLS.

BY D. H. BRAYMER.

The accompanying illustrations show the method of installation of electric drive in a new textile mill of the most modern construction. This mill, which is one of the largest in North Carolina, is located at Belmont, N. C., and operated by the Majestic Manufacturing Company. All the motors used are three-phase, sixty-cycle, 2,200-volt Hawthorn induction motors of the Western Electric Company's manufacture, and connected to the machines by what is known as the four-frame drive.

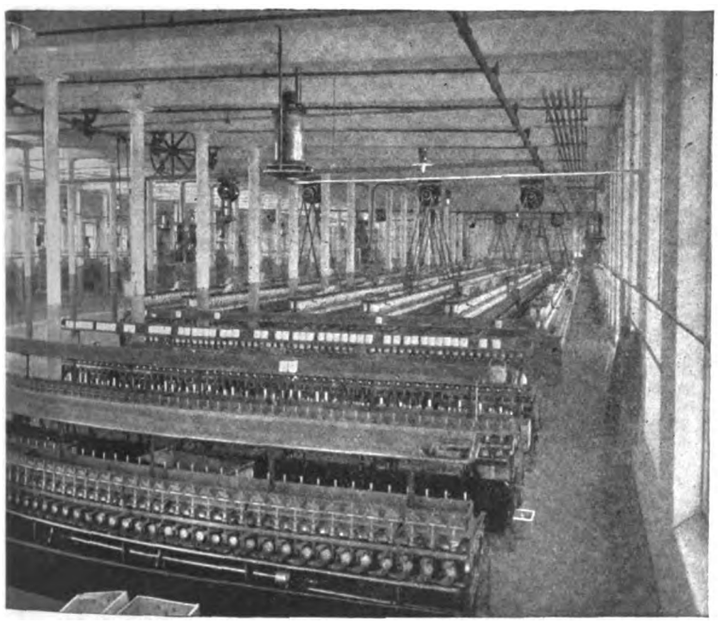

FIG. 1.—GENERAL VIEW, SPOOLERS IN FOREGROUND, SPINNING FRAMES IN BACKGROUND, MAJESTIC MANUFACTURING COMPANY.

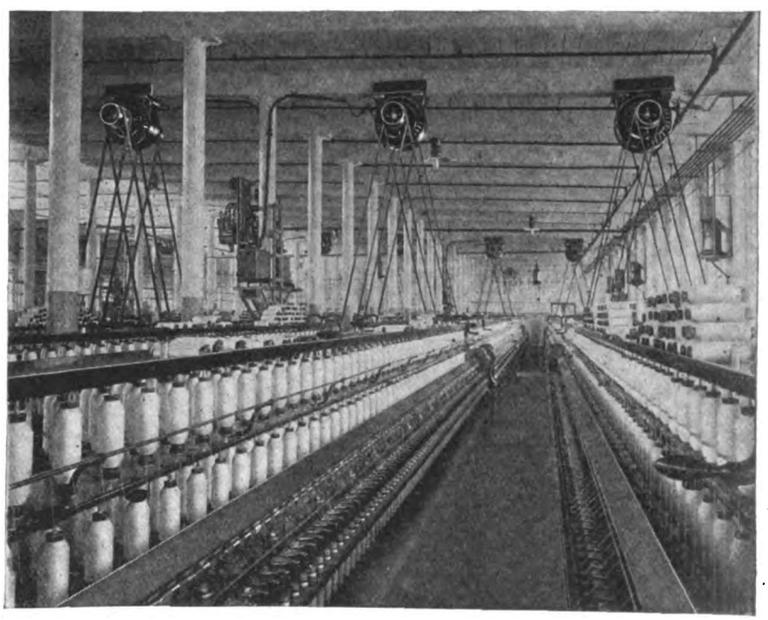

FIG. 2.—SPINNING ROOM, SHOWING EACH 20-HORSEPOWER MOTOR DRIVING FOUR FRAMES, MAJESTIC MANUFACTURING COMPANY.

The application of power to the textile industries has its peculiar features inherent in the nature of the material worked with. The material differs in elasticity and strength, and it is therefore necessary that the driving power provide an even and steady torque, that it be governed by a controlling device which is as sensitive as the most sensitive thread, and that it run with the least possible friction.

The question of whether direct or group drive is to be used, is answered by each individual case. No general and broad sweeping statement can be made as to which system shall always be applicable: still, for all this, direct drive is always advised wherever it is possible. There are comparatively few machines which do not lend themselves to individual drive, and where such is used, mechanical losses are reduced to the least possible amount, and belts, line shafting and gear wheels are dispensed with. In brief, the main advantages for individual drives are as follows: Increased output; saving in power due to elimination of frictional losses in shafting and belting, and corresponding saving in labor and attendance; convenience of placing any machine wherever desired without reference to shafting or crane location; increased light; convenience and freedom from dust and dirt due to the elimination of shafting and belting; increased safety and freedom from accidents to employes; the ability to operate a single machine overtime without the necessity of operating any other machine; elimination in loss of power for running idle machines and shafting.

When several machines are operated by one motor, there is, of course, a smaller first cost. This, however, is not the principal reason for this method of drive, for there are certain conditions of operation in the textile mill which demand a group drive. It is often required to stop and start certain machines frequently, and on this account a motor sufficient to carry the load without injury is altogether too large and expensive for steady running at a load smaller than the one for which it was designed. By grouping a number of these machines so as to be operated by one motor, the demand on the motor can be evened up and it be made to operate at its usual and most efficient load.

Flexibility and steadiness of the driving machines are absolutely essential for the best quality of textile products. The flexibility of electric-motor applications is one of the features which is always readily admitted. It is easily seen that a machine with individual drive need not interfere or have any running relations with any other, and that the shut-down of its neighbors affects it not in the least. Any change may easily be made, and additions to any part of a system or department may be made while all the machinery is operating. Individual motor drives are sometimes questioned on account of the greater initial cost of their installation. This, however, is not an objectionable feature, for if a mill be designed at one time for a certain capacity, the flexibility of the installation allows not only the maximum load to be carried, but a very light load at exactly the same power efficiency.

The electric motor has already established its reliability; this no one questions. Every mill owner has seen it working under the most trying conditions of all classes of work. The textile mill presents no radically new features as to the load. It cannot differ greatly or present a more varying load than that of a machine shop with its cranes and elevators, the motors of which may be overloaded one minute followed by a decided underload, and next perhaps a reversal of rotation. In these cases, motors are more reliable and are generally depended upon for the power of such installations.

Under the head of economy, motor drives score a strong point. The efficiency of the most modern means of mechanical transmission, with the use of scientific

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lubrication by oils of suitable viscosities, is far from being equal to that of the group drive using electrical power. With the motor drive, an increased efficiency is introduced, first between engine and generator, then in the distributing mains and finally in each individual motor. A large amount of belting and gearing is dispensed with, which means eliminating line shafts and clearing the atmosphere in which the machines are worked.

As to the general or main items of saving for small plants in a vicinity where electrical power is easily obtained, the reduction is first in the capital outlay effected by the elimination of engine houses,

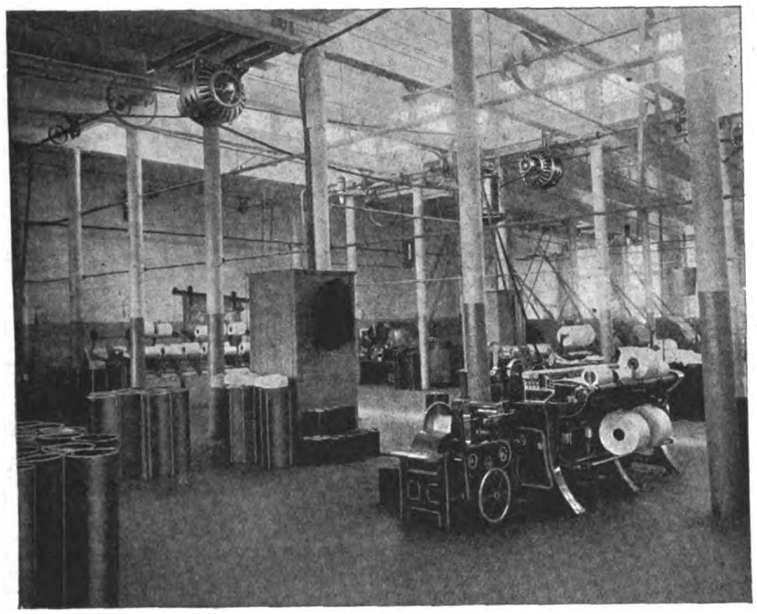

FIG. 3.—CARD ROOM, MAJESTIC MANUFACTURING COMPANY.

boiler settings, flues, chimneys, etc., and next by the capital invested in equipment.

As already stated the motors installed in the Majestic Manufacturing Company's new mill are of three-phase induction-motor type. In the spinning and spooling departments (Figs. 1 and 2) the four-frame drive is used; that is, each motor drives four separate frames. Two pulleys are mounted on each end of the rotor shaft, and each is connected to a frame by a belt. In all cases the motors are rigidly suspended from the floor beams and arranged in rows. For starting there is mounted near each motor a line panel and auto-starter, the line panel being equipped with a three-pole, single-throw, automatic oil switch.

The equipment in this mill is typical of the modern tendency toward the economical powering of all mills and factories and also shows in a general way the adaptability of the induction motor.

The Allis-Chalmers Company Reports Good Business.

The following are only a few out of a large number of recent sales of Allis-Chalmers (Milwaukee, Wis.) electrical apparatus, exclusive of combined generating units, which constitute a large list in themselves:

Merchants' Heat and Light Company, Indianapolis, Ind., two 1,000-kilowatt, synchronous, motor-generator sets, three-phase, 2,300-volts, sixty-cycle, alternating-current, 250-volts shunt-wound direct-current, and one 200-kilowatt, shunt-wound balancing set, consisting of two 125-volt machines on a common cast-iron base; San Francisco Gas and Electric Company, San Francisco, Cal., two 1,000-kilowatt, synchronous, motor-generator sets, three-phase, 11,000-volts, sixty-cycle, alternating-current, 275-volts compound-wound direct-current; Great Northern Railway Company, St. Paul, Minn., nine induction motors, aggregating 220 horsepower, 440-volts, three-phase, sixty-cycle; Joseph Light and Power Company, Joseph, Ore., one 225-kilowatt, alternating-current, waterwheel-type generator, 2,300-volts, three-phase, sixty-cycle, with exciter and switchboard; Portland Railway, Light and Power Company, Portland, Ore., one 500-kilowatt, vertical, direct-current generator, 600-volts, with switchboard; Victor Talking Machine Company, Camden, N. J., eight type "K" motors, aggregating 530 horsepower, 220-volts, direct-current; Goodyear Lumber Company, Tomah, Wis., nineteen induction motors, aggregating 925 horsepower; Crane Company, Chicago, Ill., one 300-kilowatt, synchronous, motor-generator set, 440-volts, sixty-cycle, alternating-current, 250-volts, direct-current, and three 100-horsepower induction motors, 440-volts, sixty-cycle; Illinois Steel Company, Joliet, Ill., one 1,250-kilovolt-ampere, synchronous, frequency-changer, changing from three-phase, 2,200-volts, sixty-cycle, to three-phase, 6,600-volts, twenty-five-cycle, 300 revolutions per minute; one 200-kilowatt, synchronous, motor-generator set, three-phase, twenty-five-cycle, 6,600-volts, 2,200-volts direct-current, together with switchboard; Pacific Lumber Company, Wilmington, Cal., seventeen induction motors, aggregating 510 horsepower; Royal Weaving Company, Pawtucket, R. I., thirteen O. F. S. C. transformers, aggregating 1,200 kilovolt-amperes, 2,200 to 220 volts; city of Ellensburg, Wash., one 550-kilowatt, waterwheel-type alternator, three-phase, sixty-cycle, 6,600-volts, together with switchboard, exciter, and three 200-kilovolt-ampere, O. F. S. C., 6,600-volt transformers; National Casket Company, Pittsburg, Pa., twenty-four induction motors, 440-volts, three-phase, sixty-cycle, aggregating 275 horsepower; Franklin Power Company, Farmington, Me., two 200-kilowatt, 600 revolutions per minute, 2,300-volt, three-phase, sixty-cycle alternators, together with exciters and switchboard equipment; Lowland Worsted Company, Woonsocket, R. I., thirty-one induction motors, 550-volts, three-phase, sixty-cycle, aggregating 350 horsepower, together with textile switches; Daniel D. Weschler and Sons, Inc., Milwaukee, Wis., one 300-kilowatt, 200 revolutions per minute, 240-volt, three-phase, engine-type alternator, one 150-kilowatt, 200 revolutions per minute, 240-volt, three-phase, engine-type alternator, together with exciters, and six induction motors, aggregating 200 horsepower; Chicopee Manufacturing Company, Chicopee Falls, Mass., sixty-eight type AN induction motors, aggregating 484 horsepower; Apache Cotton Oil and Manufacturing Company, Chickasha, Okla., three type AN induction motors, aggregating 350 horsepower; Steptoe Valley Smelting and Mining Company, McGill, Nev., five type AN induction motors, aggregating 400 horsepower; Armour and Company, Chicago, Ill., one 250-kilowatt, engine-type alternator, 200 revolutions per minute, 1,150-volts, three-phase, sixty-cycle, together with exciter, one 500-kilowatt, engine-type alternator, 150 revolutions per minute, together with exciter.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, JULY 30.—Some further facts have come to light which emphasize the obstinacy with which the City of London Corporation is treating the question of public lighting. As I have already pointed out, the original arc-lighting contract was at $130 per lamp, and some hundreds of these old-fashioned lamps are still burning at this high price. Yet the Corporation has been made an offer by the City of London Electric Lighting Company to light the whole of the city at a reduction of thirty per cent, equal to £4,000, by being allowed to substitute flame-arc lamps. This offer, and two later offers on an even more advantageous basis, have been ignored. It is common knowledge that the gas company is carrying out a small amount of high-pressure gas lighting at a price which does not include at any rate all the capital charges, yet if the electrical companies were to do this, they would run the risk of being pulled up by the Board of Trade, or somebody else, for breaking the electric-lighting acts by giving preferential treatment. A fact which has also been overlooked in this controversy is that at Berlin, where the gas lighting very much impressed the committee which recently visited there, the municipal authority charges for public lighting less than one-half the price charged for private supply.

An important statement was made by the Postmaster-General this week to the effect that the Postoffice authorities would be willing, on equitable terms, to acquire all the land stations of the Marconi Wireless Telegraph Company. He stated that the Government had come to the conclusion that the principal wireless stations should not be in the hands of private individuals, and in order to prevent the growth of any monopoly, all the licenses, which would expire in three years' time, would then be taken over. An earlier acquisition, in fact, was desirable if possible. From a subsequent interview, it appears that pourparlers to this effect have already been set on foot with the Marconi company.

October 1 is announced as the date of opening the single-phase railway in London of the London, Brighton & South Coast Railway Company. Meanwhile, experimental runs are being made. In this connection, may be mentioned an interesting statement by the chairman of the East London Railway Company. He stated that the question of electrification, which has been under consideration for several years, the company being more or less derelict, must still remain in abeyance, as the results of working with third-rail continuous current system had proved unsatisfactory and no data were available as to the practical working of the single-phase system.

The unsatisfactory condition of the British electrical manufacturing industry during 1908 has been commented upon at several annual meetings during the past week, and complaint has been made that the Victoria Falls Power Company, operating as it does upon British soil, should have placed the major portion of its orders for the necessary electrical machinery in Germany.

A special conduit-cleaning machine has been devised by the tramways staff of the London County Council, by the use of which a saving of $10,000 per annum is anticipated over the present hand methods. The machines cost $1,500 each. G.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, AUGUST 7.—While the United Wireless Telegraph Company has made an offer to the Dominion Government for the acquisition of the Government's wireless stations on the Pacific Coast, it is learned at the Marine Department that it is not the policy of the Government to sell. On the contrary, the Government, in addition to the five stations there, proposes to build three more this summer, and the whole system will be adapted to commercial uses as well as the signal service.

Mr. J. W. Willard, of California, president of the Ottawa & Morrisburg Electric Railway Company, states that the first survey of the proposed new line has been made, and the route has been staked out. An additional survey is, however, being made for the purpose of deciding on which side of the road it is best to run. Work will be well under way on the line before winter sets in.

The Toronto Electric Light Company is endeavoring to forestall delivery of power in the city of Toronto by the Hydro-Electric Commission in December next. The company, with the aid of a force of expert canvassers, has already secured good contracts to supply light to a number of institutions for the next five years, and is engaged in installing equipment on the premises of many of its customers which cannot be utilized by the city when the latter gets its lighting department in operation.

Contracts for the remaining ten transformer stations, required for the provincial government's transmission system, have been let. The Toronto station will be built by Witchall & Son, of that city, whose tender was $36,500. Hyatt Bros., of London, Ont., will build the London station for $26,500, and John Hayman & Sons, of London, will construct the remaining eight buildings situated at Woodstock, St. Mary, Preston, St. Thomas and Guelph. The latter firm put in a bulk tender of $148,000, or $18,500 for each station. The erection of transmission towers and the telephone lines is progressing rapidly, the contractors now being able to set in place at least fifteen towers a day.

Strong advocacy of the electric smelting of iron ores in Canada is made in a report issued by Dr. Haanel, director of the Department of Mines, at Ottawa. Following the experiments undertaken by the Dominion Mines Department at Sault Ste. Marie, Dr. Haanel made investigations in Sweden and elsewhere on the Continent, and it is upon the result of these inquiries that he bases his report. Within the past four years, sixty electric furnaces have been established, and Dr. Haanel is of the opinion that they are well adapted to Canada, where waterpower is cheap while the coke required in the old style of furnace is high. The cost of production in Sweden is $12.40 per short ton, but Dr. Haanel thinks that it will be considerably less in Canada. By the electric process it has been demonstrated that certain foreign elements can be eliminated which cannot be got rid of in the ordinary blast furnace method. W.

LIGHTING AND POWER.

(Special Correspondence.)

GLENDALE, CAL.—Bonds are to be issued for an electric-light plant.

ALBION, NEB.—The Albion Electric Light Company has been incorporated with a capital stock of $30,000.

PRESCOTT, WIS.—The Prescott Light and Power Company has been granted a twenty-five-year franchise.

STARBUCK, WASH.—The Starbuck Electric Company has been incorporated with a capital stock of $25,000.

SUPERIOR, NEB.—The Superior Electric Light Company has been incorporated with a capital stock of $50,000.

SANTA BARBARA, CAL.—The Pacific Improvement Company has been granted an electric franchise in this city.

FORT FAIRFIELD, ME.—The Maple Grove Electric Company has been incorporated with a capital of $50,000 by I. Conant and C. M. Waldron.

LYONS, N. Y.—The Public Service Commission has granted permission to the Syracuse Lighting Company to execute a mortgage for $2,500,000.

HAMILTON, MONT.—W. O. Fisk announces that the electric-light plant at this place is to be remodeled and made more modern in every respect.

PETERSON, IOWA—A franchise has been granted to an electric-light company to light both Peterson and Sutherland from a single plant at Peterson. C.

MENOMINEE, MICH.—The Commercial Club has arranged for the installation of a street-illuminating system, consisting of thirty arches of incandescent lights. C.

PRAIRIE DU SAC, WIS.—The secretary of war has approved the application of the Southern Wisconsin Power Company to construct a dam across the Wisconsin River. C.

SHEBOYGAN, WIS.—The Milwaukee Bridge Company has let the contract to the Acker Electrical Company for the electrical equipment of the Pennsylvania Avenue bridge. C.

VALIER, MONT.—An electric-light and power plant is to be built at once, and poles are on the ground for a telephone system, it being stated that cables and material are on the way to the site.

WENATCHEE, WASH.—The Wenatchee Electric Company has let a contract for the raising of the walls of its Columbia Street plant house sixteen feet. Bird & Holmes have the contract.

LOS ANGELES, CAL.—The first steps in the developing of electrical power on the Owens River aqueduct were taken here last week, when the City Council approved the recommendation of the Board of Public Works asking for $10,000 per year for

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the next two years, to be spent in the preparation of plans for power development and arranging to bring the electricity to the city at the same time as the water.

GREELEY, COLO.—Incorporation papers have been filed by the Fort Lupton Utility Company, capital $50,000, divided into 50,000 shares. The company will operate an electric-light and power plant.

PORTLAND, ME.—The Sierra Pacific Electric Company has been incorporated to deal in electricity, with a capital of $11,500,000. President, C. M. Drummond, Portland; treasurer, E. H. George, Boston.

ANTIGO, WIS.—The Antigo Electric Company has been incorporated, with a capital stock of $125,000, by John Manser, Chas. M. Cleveland and F. A. Hecker, to construct street and interurban railroads and to acquire and develop waterpowers. C.

CINCINNATI, OHIO—The Public Service Corporation, of Glen Jean, W. Va., has been incorporated; authorized capital stock, $20,000; incorporators, R. J. Stegall, J. S. Staton and E. E. Thacker, of Glen Jean; R. H. Dickinson and C. S. Phipps, of Fayetteville, W. Va.

GLASGOW, MONT.—The city is contemplating the building of an addition to the present electric-light station for boiler room and pump pit; installing one steam boiler, two 500,000-gallon steam pumps, with all necessary steam and water connections, and further construction.

WORCESTER, MASS.—A big mortgage has been recorded here whereby the Milford Electric Light and Power Company mortgages to the American Trust Company its plant in Milford and Hopedale, to secure an issue of $200,000 five per cent gold bonds, payable June 1, 1929.

HELENA, MONT.—Governor Hauser reports that between $1,600,000 and $2,000,000 will be spent within the next fourteen months on the third dam at Wolfe Creek, work on which will be started within sixty days. The Stone & Webster Engineering Corporation have the matter in hand.

JACKSONVILLE, ORE.—The county of Jackson has granted a franchise to the Jackson County Electric Light and Power Company to erect pole lines for transmiting power, heat and light. The company promises to begin construction of its railway in Rogue River Valley immediately.

BELLINGHAM, WASH.—It is reported that a permit has been granted by the Forestry Department of the United States to the Thunder Creek Transportation and Smelting Company, to build a large power plant on Thunder Creek, where it flows into the Skagit River, forty miles above Marblemount.

ANTIGO, WIS.—The Antigo Electric Company will expend about $150,000 on a new plant, including, besides the equipment, a new building, 55x140 feet, of solid brick construction. The company also expects to develop the waterpower of the Eau Claire River, owned by one of its principal stockholders.

ALBANY, N. Y.—Niagara and Erie Power Company, of Buffalo, has been incorporated; capital, $100,000. Organized to furnish electricity for light, heat and power in the towns in Erie, Cattaraugus and Chautauqua counties. Directors: Charles F. Blair, M. J. Binkley, A. F. Tideswell, all of Buffalo.

RAPID CITY, S. D.—The Dakota Power Company has consolidated the Richards, Duncan and Mansfield water rights along Rapid Creek, thus securing six miles of stream with a fall of 1,009 feet, capable of developing 8,000 horsepower. The company will spend about $1,500,000 in the development of the plant. C.

FITCHBURG, MASS.—The Fitchburg Gas and Electric Light Company has petitioned the Gas Commission to be allowed to increase its $385,000 capital stock by $308,000 (3,850 shares, par $50), at $80 per share, to fund $275,000 debts incurred for construction and improvements and to furnish $33,000 to complete the work.

JOLIET, ILL.—The new street-lighting scheme planned by C. A. Munroe, general manager of the Economy Light and Power Company, is assured, as already considerably over a hundred merchants have agreed to assist in promoting the system. The order for the new ornamental and combination poles will be placed at once.

ALBANY, N. Y.—The Public Service Commission, Second District, has authorized the Nassau & Suffolk Lighting Company to issue $420,000 six per cent preferred stock, the proceeds to be used for extensions and improvements, additional working capital to the amount of $25,000, and for payment of obligations amounting to $87,500.

HUNTINGTON, W. VA.—The construction of street-car lines on either side of the Ohio River, between Huntington and Point Pleasant and Gallipolis and Ironton, by a combination of Pittsburg capitalists interested in the development of this particular part of West Virginia and Southern Ohio, is announced. A trust deed has been recorded at Point Pleasant by the parties interested guaranteeing the payment of $750,000 of bonds, which have been floated in New York city. One of the Huntington banks will act as trustee, with a deposit from the people who are pushing the development, of $200,000, and this amount is now in the hands of Huntington bankers.

INDIANAPOLIS, IND.—The Peacock-Wooley Lighting Company, of Chicago, has offered to contract with the City Council to light the downtown portion of the city with modern lamps free of cost, or in consideration of the privilege of placing advertisements on the glass panels of the lamps. The contract will save the city $10,000 a year. S.

TOLEDO, ORE.—The City Council has granted a twenty-five-year franchise to H. L. Collins, A. C. Smith and J. F. Stewart for the erection and maintenance of an electric-light system. The same company will also operate a cold-storage plant and creamery, and later a cannery. The light plant is to be erected at once, and to be in operation within six months.

ANDREWS, IND.—The Andrews Electric Light Company has notified its subscribers that service will be discontinued for several weeks to enable the company to remodel the power plant building and install additional machinery and equipment. The company has enjoyed a good business from the start and the steadily increasing business compelled the enlargement of the plant. S.

TOLEDO, OHIO—The Citizens' Heating and Lighting Company has asked for another franchise on Toledo streets. A few weeks ago an extensive right was granted, the company to pay one per cent of its gross receipts to the city. The present franchise is asked for on a similar basis, and seeks the privilege of laying conduits on several streets, for electricity for lighting and heating purposes. H.

TORRINGTON, CONN.—The Torrington Electric Light Company is adding a 500-kilowatt Westinghouse turbine-generator set to its power station equipment, which has hitherto comprised a 300-kilowatt General Electric Curtis turbine set and a 500-horsepower Harris engine, direct-connected to a Stanley generator. The station supplies a lighting and power service, with sixty-cycle, three-phase current, at 2,300 volts.

CHARLOTTE, N. C.—W. E. Holt, Jr., C. A. Hunt and C. A. Hunt, Jr., representing the Decotah, Nokomis and Winonah cotton mills of Lexington, have contracted for approximately 2,000 horsepower of electricity from the Southern Power Company. It will supplant steam in the operation of the mills named. The necessary machinery has been ordered and the change will be made as soon as it can be installed.

MANTI, UTAH.—If the plans now under completion are carried out, Gunnison Valley will have, within a short period, a large power plant. It is the object to install two power plants, one in Six-Mile Canyon and one in Salina Canyon, for the purpose of generating electricity. It is the desire of the promoters to secure enough power to furnish light for all of the different towns in Sanpete and Sevier counties.

WHEELING, W. VA.—A charter has been filed at the office of the clerk of the County Court, certifying to the incorporation of the Warwod Water and Light Company. The chief works of this company will be located near Warwood, and is for the purpose of providing water and light for that town. The capital stock of the company is $50,000, the incorporators being B. W. Peterson, R. J. McCullagh, John A. Moore, James W. Ewing and Edmund P. Hunter.

VANCOUVER, B. C.—The Vancouver Power Company and British Columbia Electric Railway Company are spending approximately $1,000,000 over their new power plans, which means that the Coquitlam plant will be more than doubled in capacity, being increased from 30,000 horsepower to 70,000 horsepower. In addition, the Vancouver power syndicate is making plans for development of the power of the Jordan River on Vancouver Island. A large plant is to be built on the island soon, probably with a capacity of 25,000 horsepower.

MADISON, WIS.—Word has been received here that the secretary of war has approved the application of the Wisconsin Hydro-Electric Power Company for permission to build a dam across the Wisconsin River at Prairie du Sac. The conditions imposed are that the power company shall construct a lock, maintain it free of cost to the government, keep the river open for navigation at that point and remove the dam and lock if they ever fall into disuse. Magnus Swenson, of Madison, made the application. It is the construction of this dam that it is figured will furnish electric power for the cities of Southern Wisconsin.

INDIANAPOLIS, IND.—The Indianapolis Heat and Light Company has fully equipped and beautifully furnished a five-room cottage in which is shown how a family can live by electricity. In the reception room there are electric lights, electric fans and an electric grate to light, cool and heat the room. The parlor contains an electric piano, which produces excellent music when the button is pressed. The dining-room contains electric chafing dishes, coffee percolators, toasters and other electric contrivances. The kitchen is equipped entirely with electrical apparatus, in-

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cluding the range, a washing machine and wringer, an ice-cream freezer, irons and other devices for baking and cooking by electricity. A sewing machine in the dining-room is operated by electricity. S.

COLORADO SPRINGS, COLO.—It is stated, on excellent authority, that the Manitou Electric Company will immediately pass into the hands of the Pikes Peak Hydro-Electric Company. The papers have been prepared, the terms agreed upon, and the signatures of the parties will be affixed in the next few days. The consideration is understood to be about $20,000, although the option of taking stock in the Hydro company will be offered to stockholders in the Manitou company.

WHEELING, W. VA.—The Hydro-Electric Development Company, of Great Cacapon, W. Va., has been incorporated, to manufacture electricity from the power of the rapids in the Great Cacapon River in Hampshire and Morgan counties, West Virginia. The authorized capital stock is $100,000. Incorporators: Wm. B. Osler and Morris A. Ornduff, of Great Cacapon; Wm. F. Disher, of Berkeley Springs, W. Va.; Samuel R. Boyer, of Hanover, Pa., and Albert Holland, of Baltimore, Md.

BERLIN, MD.—Muralt & Company, engineers of New York city, have been awarded the contract for furnishing and installing the electrical equipment of the new municipal lighting and pumping plant. Power will be generated and transmitted throughout the city by means of a 2,200-volt, two-phase alternating-current system. The alternators will be of the belted type and will be driven by gas engines supplied by producer gas. Step-down transformers reducing the line potential to 110 volts will be provided at the centers of distribution, from which the city lighting circuits will be fed.

MINNEAPOLIS, MINN.—The special committee recommends to the City Council that, before it be granted a franchise, the Northern Heating and Electric Company, of St. Paul, be required to put up a cash bond of $10,000 and a surety bond of $15,000; that it submit a statement of its finances for the six months ending July 1, 1909, and that it give information as to the new corporation which ultimately expects to take over the franchise. It has been stated that the company is backed both by the Westinghouse interests of Pittsburg and the American District Steam Company, of Lockport, N. Y. C.

POUGHKEEPSIE, N. Y.—By permission of the Public Service Commission, the Poughkeepsie Light, Heat and Power Company will construct the proposed addition to the local plant, using $250,000, or larger portion of that amount, to be realized by bonds issued by the Newburgh Light, Heat and Power Company. Power will be transmitted by cable across the Poughkeepsie Bridge, to Newburgh. The Commission has given its approval to the execution of a contract between the Poughkeepsie Light, Heat and Power Company and the Newburgh Light, Heat and Power Company, pursuant to which the Newburgh Company will install upon the premises of the Poughkeepsie Company, in Poughkeepsie, additional electrical generating apparatus.

MUSKEGON, MICH.—A purchase of a large quantity of poles has been made at Shelby by the Interurban Electric Light and Power Company, which has construction rights across Mason and Oceana counties from Hamlin Lake to Shelby. The company, which was organized to furnish electric power to Ludington, Pentwater, Hart, Shelby and smaller places along the right-of-way, has almost completed work on the lower dam at Hamlin Lake and promises to be furnishing electric power within a month. Wires are being strung from Ludington to Pentwater, and arrangements have been made to take over the Pentwater lighting plant. The company is said to have power rights on the Pere Marquette River capable of developing 30,000 horsepower.

BOSTON, MASS.—On petition of the Orange Electric Light Company for the approval of an issue of additional capital stock of the par value of $155,000 for payment of a part of its outstanding debts and the cost of subsequent additions to plant, the gas and electric-light commission has issued an order approving the issue of 1,550 shares at the price of $100, or par, per share. The proceeds are to be applied, as follows: Of 400 shares to pay the entire bonded debt of $40,000; of 200 shares to pay the full amount of $20,000 of coupon notes outstanding; of 85 shares to pay obligations represented by an equal amount of promissory notes outstanding on April 30, 1909, and of 865 shares to pay an equal amount of obligations for additions to plant since April 30.

BUFFALO, N. Y.—The plant of the Niagara Pulp Board Company in Niagara Falls was destroyed by fire July 24. It is supposed the fire started on the cable of a rope drive that was being operated. There was little or no wind, but the flames swept through the plant with surprising rapidity, despite the efforts of the firemen to stop them. The loss is about $50,000, on which there is said to be insurance of $35,000. The company's output was a pulp board used for box making. The works were being operated at full capacity to meet existing contracts. The plant will be rebuilt, possibly on the same site, which is the site formerly occupied by the Acker Process Company, on the lands of the Niagara Falls Hydraulic Power and Manufacturing Company.

ELECTRIC RAILWAYS.

(Special Correspondence.)

CHICAGO, ILL.—For the year ended June 30 last the Northwestern Elevated carried 40,955,795 passengers. This is an increase of 3,536,509 over the previous year.

GRAND RAPIDS, WIS.—Work has been commenced on the construction of the interurban line to Nekoosa. It will be seven-and-a-half miles long and power will be furnished by the water-power of the South Centralia paper mills plant. C.

CARMI, ILL.—Preliminary steps have been taken by Kansas City, Mo., capitalists for the building of an electric railway from Carmi to Fairfield. The survey will be taken in a few days and the line will be used for both passenger and freight traffic.

EXCELSIOR, MINN.—In its fight to compel the St. Paul & Suburban Railroad Company, the Lake Minnetonka line of the Minneapolis Street Railway Company, to stop its cars at street crossings, the state Supreme Court has decided against the village. C.

LEWISTON, ME.—The decree of the railroad commissioners approving the location of the proposed new electric road from Lewiston to Portland via Gray is expected to be made soon. Immediately thereafter, it is said, the work of building the road will begin.

BOSTON, MASS.—Forty-four standard semi-convertible cars have been ordered by the Boston & Northern Street Railway Company, twelve of them to be used by the Old Colony Street Railway. They are being built by the Laconia Car Company and will be delivered in September.

CASEY, ILL.—Work has been started on a traction line into the Illinois oil fields from Oblong, Ill., to connect with the McKinley system at Charleston, Ill. The preliminary work of surveying the line was completed last year. It is promised that the road will be ready for operation in about three months.

DES MOINES, IOWA—At a meeting of local and business men living along the proposed route, held at the Savery Hotel, it was decided to enlist the support of Congressman Wm. B. McKinley, who has recently purchased the Des Moines Electric Company, in the construction of an electric line to Red Oak, via Adel. C.

PINE BLUFF, ARK.—General Manager Parker, of the Arkansas, Louisiana and Gulf Railroad, has been in Pine Bluff conferring with the Board of Trade, with reference to the bonus of $100,000 which Pine Bluff is to raise for the extension of his road from Hamburg to Pine Bluff, and thence north to the Rock Island. It is stated the bonus will be forthcoming.

BROOKLYN, N. Y.—Permission has been received from the Public Service Commission to change the motive power to electricity on the Montague Street cable line, and the Brooklyn Rapid Transit Company will lose no time in remodeling the line. The decision was given on condition that the company submit plans for approval, and consent of property owners and local authorities be obtained.

DETROIT, MICH.—Articles of incorporation for the Detroit, Lansing & Grand Rapids Railway Company have been filed in Lansing. The company is capitalized at $25,000, for the purpose of constructing an electric line from Detroit, via Lansing, to Grand Rapids, and the stockholders are Oliver H. Lau and Henry M. Wallace, of Detroit, William T. Utley and Raymond G. St. John, of Chicago, and George Valentine.

FAYETTEVILLE, N. C.—The Consolidated Street Railway & Power Company has been placed in the hands of a receiver here by Judge Lyon, of the state court, W. D. McNeill, president of the company, being named receiver. This step follows the institution of several suits, while the company has been unable to float certain bonds issued, hence the acceptance of the court's protection. The operation of the road is not affected. L.

YSLETA, TEX.—The ancient town of Ysleta is soon to be connected with El Paso by an electric interurban railway. The El Paso & Fort Hancock Railroad Company has been organized to build an electric railway down the Rio Grande Valley from Fort Bliss to Old Port Hancock, passing through the towns of El Paso and Ysleta. The proposed line will be about sixty miles long and will do both a passenger and freight business.

PHILADELPHIA, PA.—Foreclosure sale of the Southwestern Street Railway Company and the Philadelphia & Chester Railway Company, which has been advertised for July 22 and 30, respectively, has been postponed by Judge Holland, of the United States Circuit Court, until September 21 and 22. The court also fixed the minimum price at which the Southwestern Company's property may be sold, at $300,000, and the lowest price at which the Philadelphia & Chester Company's property may be sold, at $225,000. The two companies form the trolley line extending from Front and Jackson Streets, this city, to Chester, and are part of the system of the Interstate Railways Company, the reorganization plan for which, as just announced, provides that the United Power and Transportation Company

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agrees to pay all advances made on the bonds, which it is proposed to deposit for five years, in case the Interstate Company does not do so, and agrees to deposit securities as a guarantee for the proposed payments.

EL PASO, TEX.—The El Paso Electric Railway Company has contracted with the Stone & Webster Engineering Corporation for the construction of 7,180 feet of double track on Boulevard Street and for the double-tracking of 2,100 feet of park line, in El Paso, Texas. Eighty-pound seven-inch tee-rail will be laid on concrete foundation on Boulevard Street and Park Line will be laid with sixty-pound tee-rail. The contract includes the removal of 14,360 feet of old track.

LOGANSPORT, IND.—The Indiana Union Traction Company is measuring all of its lines from one end of the system to the other. The work was started from Muncie north, and the track measurements have been completed as far north on the Muncie-Bluffton line as Eaton. The work will require a good part of the summer, but when it is done the company will know definitely just how much trackage it owns. It is stated that the trackage is between 360 and 365 miles, single track.

DOYLESTOWN, PA.—Starting with $200,000, the upset price fixed by order of court, the property of the Philadelphia, Bristol & Trenton Street Railway Company, was knocked down at $380,000 to Carl N. Martin and John Redmond, of Philadelphia, representing the bondholders' committee, which holds $627,000 of the issue of $650,000 of bonds of the company. The sale means, it is said, a reorganization of the company and an improvement of the line from Philadelphia to Trenton.

CHARLESTON, W. VA.—A charter has been issued to the Kanawha and Ohio Valley Traction Company to build a line from Kanawha Falls, on the north side of the Kanawha River, to a point near Point Pleasant. The company is now having a survey made between Charleston and Kanawha Falls and construction of a line from Charleston to Dunbar, five miles northwest of this city will begin at once. The incorporators are Fred Paull Crosscup, George S. Couch and other prominent capitalists of this city.

NORWICH, CONN.—The Norwich, Colchester and Hartford Traction Company has completed all surveys and is ready to go ahead with construction work, which it expects to do within a month. It is hoped to have the first fifteen miles of the line in operation next year, and to complete the whole line in 1911. This will give a direct express trolley route between Norwich and Hartford in almost an air line. The distance will be forty miles, which is ten miles less than the steam-road distance between the two cities.

KANSAS CITY, MO.—The grading for the double-track steam and electric short line between Kansas City and St. Joseph—to be constructed by the Townsend-Enright syndicate—has been started near Lineville, in Platte County. It is also announced that work on the terminal system that is to be a part of the Kansas City-St. Joseph connecting railway will begin in September in the North Bottoms, above Kansas City, Kan., where the proposed Missouri River bridge is to be built. The plan includes a series of dikes to protect the property that has been acquired for railway purposes.

SEA VIEW, R. I.—For additional power on its railway lines, and for lighting several adjoining towns, including Narragansett Pier and Wickford, R. I., the Sea View Railroad Company has installed in its Hamilton, R. I., power station two 400-kilowatt Westinghouse turbines, driving Westinghouse three-phase, sixty-cycle, 360-volt alternators. This equipment is additional to a set of horizontal, cross-compound, reciprocating engines, driving Westinghouse generators, already installed. The plant is supplied with Westinghouse LeBlanc condensers, which preserve a vacuum of twenty-eight inches.

GUTHRIE, OKLA.—Work will be started on construction of the Mountain Valley and Plains Railroad at Cimmaron, N. M., on October 1; at Dalhart, Tex., on October 15, and at Guthrie on November 1. This announcement is made by H. S. Wannamaker, general manager, in charge of construction work at Aimstad, N. M. The people of Guthrie have raised a $75,000 bonus for this road. It was chartered last February, with $50,000, to build 195 miles from Higgins, Tex., to Guthrie, at an estimated cost of $2,000,000, providing an extension from Higgins, Tex., to Cimmaron, N. M., in the coal and timber fields of that section. C. M. Cogan, of Canton, Ohio, is one of the main promoters and backers of the new line.

NEW BRUNSWICK, N. J.—An electric road from New Brunswick to the Delaware is one of the possibilities under the plan of electrifying the New Brunswick and East Millstone Railroad, which has been discussed by the stockholders in this vicinity. The local stockholders have, it is said, received indirect intimation that the Pennsylvania Railroad Company, which owns a majority of the stock of this line, would not be averse to the plan if the expense could be met by bonding. At present the road extends only from this city to East Millstone, and while it runs through a well-populated section, is hardly long enough to get much passenger traffic. The railroad, however, owns a right-of-way twenty-four miles long, extending from East Millstone to the Delaware, following pretty closely the route of the Philadelphia & Reading line.

SPARTANBURG, S. C.—There is a proposition afoot for the building of an interurban trolley to connect Glenn Springs, fifteen miles distant, and Union, thirty miles distant, and General Manager F. H. Knox of the local electric power concern, J. B. Lee, president of the Glenn Springs hotel, and others are now formulating plans for the work. The road can be built with little grading and its construction is more probable at this time than most such companies at this early stage of the work. The route would open up a much traveled and popular line, used both in summer and winter seasons. L.

NORWALK, O.—Persistent rumors are being heard to the effect that negotiations are to be made which will result in the taking over of certain sections of the Cleveland, Southwestern & Columbus Railway by the Lake Shore Electric. It has been stated in Cleveland that it is proposed that the Lake Shore Electric shall take over the "green line" in Lorain, and that the latter would maintain its present main line through Elyria, but that the Lake Shore would operate the line between Lorain and Elyria, the west side belt line and the road to Amherst and Elyria connecting with the "green line" at the junction.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

RIPLEY, OKLA.—The Olive Grove Telephone Company has been incorporated here.

SALINA, KAN.—Frank Hageman has been granted a twenty-year telephone franchise here.

WALLHALLA, N. D.—J. F. Mager will put in over eighty miles of telephone line out of this city.

WELSH, LA.—The Planters' Telephone Company has been incorporated with a capital stock of $25,000.

ALBION, NEB.—The Albion Electric Light Company has been chartered with a capital stock of $30,000.

GILLETT, TEXAS—The Harmony Telephone Company has been incorporated by William Patton and others.

WEATHERFORD, OKLA.—The Farmers' Mutual Telephone Company has increased its capital stock to $10,000.

HAMMOND, OKLA.—The Hammond Central Telephone Company has been incorporated with a capital stock of $3,000.

STILLWATER, OKLA.—The Payne County Rural Telephone Company has been incorporated with a capital stock of $15,000.

LA PORTE, MINN.—The Farmers' Mutual Telephone Company has been incorporated as the La Porte and Vola Rural Telephone Company.

MILES CITY, MONT.—The Rocky Mountain Bell Telephone Company will shortly have long-distance connections with Butte, Helena and the West. C.

LEE, MASS.—A telephone line is being built into the town of Mount Washington from Copake, and a line is to be run from Great Barrington to the new Berkshire schools.

GREAT FALLS, MONT.—The Great Falls Automatic Telephone Company is having plans prepared for the erection of a two-story, reinforced concrete, fireproof exchange building to cost $25,000. C.

HUNTSVILLE, ALA.—The local branch of the Southern Bell Telephone Company is extending its line to many parts of the country, and in a short while the entire Tennessee Valley will have been webbed with telephones.

RALEIGH, N. C.—A charter has been granted today to the South East Guilford Telephone Company, of Greensboro. S. C. Jones, of that city, is a prominent stockholder, and numerous farmers in all parts of the country are subscribers.

JANESVILLE, WIS.—A deal is on foot here for the purchase by the Wisconsin Telephone Company of the Rock County Telephone Company with a view to consolidating the two exchanges. It is expected that the sale will be completed in the course of a few days.

PINE RIVER, MINN.—The wires have all been strung on the telephone line from this point to Emily and Outing, and the crew are installing telephones along the route. The total number of telephones includes those installed at Swanburg, Emily and Outing. It is expected that everything will be in working order within thirty days.

CHAMBERSBURG, PA.—The Garfield Telephone Company, composed of residents of that section of the county lying between Cheesetown and Salem Church, has been organized. The following are the officers: President, A. S. Thompson; secretary, Aaron Snoke; treasurer, John Ebersole. The company decided to build its line at once. This will make the seventh rural line connected with the Chambersburg exchange of the American

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Union and the fifteenth in the county, Fayetteville having three, Shippensburg three, Waynesboro one and Greencastle one. During the week two other companies were started in Montgomery township.

MARSHALLTOWN, IOWA—At a meeting of the Farmers' and Merchants' Telephone Company the following officers were elected: A. G. Hawley, Clinton, president; B. F. Cummings, Marshalltown, vice-president; C. B. Cheadle, Joliet, Ill., secretary, and J. P. Cooper, Marshalltown, treasurer. The company will start work August 15 on improvements aggregating $50,000. C.

SHERIDAN, WYO.—H. Vance Lane, president of the Rocky Mountain Bell Telephone Company, after inspecting the proposed route from an automobile, has decided on the construction of a toll trunk line from Basin to this place, the line coming via Dayton and Shell Creek. This line, which is to be built this year, will for the first time give Sheridan direct trunk line telephone communication with Cheyenne.

SCOTTSBORO, ALA.—A farmers' telephone line will soon be connected with the telephone exchange of the Southern Bell Telephone Company at Bridgeport. The line will be constructed by R. C. Glover, and he has signed a contract with the Southern Bell Company. It will extend from Carpenter, where it connects with the Bell line, to Bryant, and later on to Smilax and Eliza on Sand Mountain, and will furnish service to about 1,500 subscribers when completed.

HOUSTON, TEX.—In accordance with the provisions of the charter by which the franchise secured by the Automatic Telephone Company was extended for a period of sixty days, the company has paid to the city the sum of $2,500. Under the terms of the extension this money was to be paid within thirty days after the passage of the extension ordinance, and the measure also provided that actual construction on the plant should begin within sixty days.

JACKSON, MISS.—The Mississippi Home Telephone Company, whose incorporation was reported some time ago, will immediately start active construction of its plant in this city, together with the toll lines to Meridian, Hattiesburg and other points. Plans are now being prepared for the main exchange building, which will be located at Pearl and Congress streets, and which will be of fireproof construction, adapted to the needs of the company. The apparatus and equipment throughout will be of the latest design in the telephone field.

HARRISBURG, PA.—The board of directors of the West Shore Telephone Company has elected the following directors: Dr. J. C. Stem, of Lemoyne, chairman; C. S. Willis, Lemoyne; Jacob Reiff, New Cumberland; S. S. Rupp, Shiremanstown, and Ernest H. Greenwood, Camp Hill. Mr. Greenwood announces that the switchboard and all the central-station apparatus had arrived, and that as soon as the switchboard is installed all present subscribers will be cut in to the West Shore exchange and the business handled over the present lines until the cable lines are completed. The company should therefore be in operation soon after the first of the month.

NEWBURYPORT, MASS.—In connection with the handsome new building of the Newburyport Central office of the New England Telephone and Telegraph Company just being erected, some very interesting figures of growth and development are given. In January, 1903, there were but 102 stations connected to this office; in January, 1909, the number of stations had increased to 1,241, or more than 300 per cent; and on the first of this month there were 1,352 stations. The present board is handling about 8,000 originating calls and about 700 toll calls per day. The new switchboard, which will be installed just as soon as the building is ready to receive it, can handle about 12,000 local calls per day and about 1,150 toll calls. By making additions to the board this number may be increased to 21,000 originating local calls and 1,900 toll calls per day—just about the growth that is figured for the next ten years.

TOLEDO, OHIO—The board of public safety of the city of Tiffin, Ohio, recently entered into a contract with the Central Union Telephone for a decided extension of signal service for the police department. A number of signal boxes will be installed at a rental of $2.25 per month. Negotiations are under way whereby it is expected that the control of the Lancaster Telephone plant, of Lancaster, Ohio, will be transferred in the near future to the Columbus Citizens' Telephone Company, of Columbus. A delegation of officials have completed an inspection of the plant and decided favorably to the purchase. Should the change be made extensive improvements will take place. Walter Wilcox, of Columbus, has been chosen general manager of the Home Telephone Company, of Portland, Ore., and with his wife will remove to that city about August 15. He was formerly teller at the Commercial Savings Bank, Columbus. The employes of the Toledo Railways & Light Company held their annual field day exercises on August 1 at the Casino, Toledo. Two performances were given in the theater and free tickets furnished to all employes and their families. The night men spent the morning and afternoon at the park and the day men enjoyed the evening. About 10,000 people were in attendance. H.

ELECTRICAL SECURITIES.

Industrials have still continued the feature of the market and have maintained strength right along with hardly any recessions in spite of the fact that professional traders have been inclined to hammer prices in a mild way, having discounted the chief bull features of the immediate moment, the settlement of the tariff, the certainty of bumper crops and the increase in business now going on.

The public, however, has not really appreciated these things and the results from them are yet to come. Consequently, although there may be setbacks for a while there is still bound to be further strength. This is well illustrated by the copper situation. Copper has been the weak spot in the market for quite a long time past. It is now likely to be one of the strong spots, owing to the increased consumption and diminished stocks. The outlook is quite healthy from every standpoint at the present moment.

General Electric stock has touched the highest point in the last four years. The company's gross sales are running at the rate of slightly better than $55,000,000 per annum, an improvement of forty per cent compared with a year ago. In regard to copper, the company has on hand sufficient stocks of copper to cover its requirements for fully six months to come. The company was a very heavy buyer of copper for two or three months in the spring, but has bought no large amounts of copper during the last three or four weeks. At the present rate of output the company requires between 50,000,000 and 55,000,000 pounds of copper per annum.

DIVIDENDS.

American Telegraph and Cable Company; regular guaranteed quarterly dividend of one-and-one-quarter per cent, payable September 1 to stock of record August 31.

Butte Electric and Power Company; the regular quarterly dividends of one-and-one-half per cent on the common stock and one-and-one-quarter per cent on the preferred stock of the company. Dividend on the common stock is payable October 1 to stockholders of record on September 15, and the dividend on preferred stock is payable November 1 to stockholders of record on October 15.

Kings County Electric Light and Power Company; a regular quarterly dividend of two per cent, payable September 1 to stock of record August 20.

Philadelphia Company; the regular semi-annual dividend of two-and-one-half per cent on the preferred stock, payable September 1 to stock of record August 10.

Gross earnings of the Brooklyn Rapid Transit for July showed a gain in gross of $189,000, a daily average of $6,300. This is the largest month's increase in several years.

NEW YORK.	Aug. 9.	Aug. 2.
Allis-Chalmers common	15¾	15⅝
Allis-Chalmers preferred	56¼	55
Amalgamated Copper	85⅜	84¾
American Tel. & Cable	....	80*
American Tel. & Tel.	....	....
Brooklyn Rapid Transit	142½	143⅛
General Electric	80½	79¼
Interborough-Metropolitan common	171¾	169¾
Interborough-Metropolitan preferred	15½	15¼
Kings County Electric	48½	47½
Mackay Companies (Postal Telegraph and Cables) common	....	125
Mackay Companies (Postal Telegraph and Cables) preferred	83½	83⅞
Manhattan Elevated	74⅝	74
Metropolitan Street Railway	144⅝	145
New York & New Jersey Telephone	....	19
U. S. Steel common	142	138
U. S. Steel preferred	77⅜	73⅞
Western Union	126¾	128
Westinghouse common	75½	76½
Westinghouse preferred	88¾	85
	....	120

*Last price quoted.

BOSTON.	Aug. 9.	Aug. 2.
American Tel. & Tel.	142¾	143⅛
Edison Elec. Illuminating	....	253
General Electric	....	169¾
Massachusetts Electric common	13	12½
Massachusetts Electric preferred	74½	74
New England Telephone	....	133½
Western Tel. & Tel. common	....	11¾
Western Tel. & Tel. preferred	90	89

PHILADELPHIA.	Aug. 9.	Aug. 2.
American Railways	47	45½
Electric Company of America	12½	12¼
Electric Storage Battery common	61¾	62½
Electric Storage Battery preferred	61¾	65½
Philadelphia Electric	12½	12
Philadelphia Rapid Transit	31⅜	30¼
Philadelphia Traction	91¼	90⅝
Union Traction	55⅜	55

CHICAGO.	Aug. 9.	Aug. 2.
Chicago Railways, Series 1	112	....
Chicago Railways, Series 2	39	39¼
Chicago Subway	23½	19½
Chicago Telephone	135	134
Commonwealth Edison	120⅛	120⅛
Metropolitan Elevated common	....	18
Metropolitan Elevated preferred	50	48¾
National Carbon common	98	92
National Carbon preferred	120	119

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NEW MANUFACTURING COMPANIES.

(Special Correspondence.)

PIERRE, S. D.—The Hill Electric Welding Company has been incorporated with a capital stock of $25,000.

ST. LOUIS, MO.—The Gas and Appliance Company has been incorporated. Incorporators: Oliver H. Fyfe and Joseph S. Lehman, one share each; Irwin Lehman, 498. Capital stock, fully paid, $20,000.

WILMINGTON, DEL.—The Electric Ampliphone Company has been incorporated, with a capital of $250,000, by G. M. Wallace, Camden, N. J.; P. J. Dougherty, Philadelphia, Pa., and T. Ritchie, Wilmington.

NEW YORK, N. Y.—The Universal Trolley Retriever Company, Manhattan, has been incorporated, to manufacture trolley wheels, etc.; capital, $100,000. Incorporators: Peter J. Minck, Brooklyn; F. C. MacLean, Freneau, N. J.; Paul A. Zizelman, New York city.

NEW YORK, N. Y.—C. F. Splitdorf has been incorporated to manufacture electrical machinery, ignition apparatus, automobile parts and sundries, with a capital of $500,000. The incorporators are: C. F. Splitdorf, J. Splitdorf, New York city, and P. J. W. Kelley, Jersey City, N. J.

CAMDEN, N. J.—The Electric Accumulator Company, 419 Market Street, Camden, N. J., has been incorporated to manufacture electrical accumulators, undulating current generators and electrical machinery, etc.; capital, $200,000. Incorporators: F. W. Reeves, W. L. Meck and C. Duffy, all of Camden.

NEW YORK, N. Y.—The Electric Installation Company has been incorporated to do electrical work of all kinds; capital, $20,000. Incorporators: William C. Pratt, 30 Pine Street; Arthur J. Pates, 51 West One Hundred and Sixth Street; Phanor J. Eder, 80 William Street, all of New York.

LAFAYETTE, IND.—The George L. Fish Electric Company has been organized and incorporated to manufacture all kinds of electric appliances and devices; also, equipment for electric power plants. The company's factory is being installed in this city and will be ready for operation in a few days. George L. Fish, John F. McHugh and W. F. Frey, directors. S.

TACOMA, WASH.—Articles of incorporation of the Northwestern Electric Company have been filed in the county auditor's office by City Electrician F. H. Lauzon, E. L. Hollingshead, H. D. Nowlin, F. McFarland and J. P. Covert, who are named as members of the board of directors. The stated purpose of the corporation is to conduct a general manufacturing business, buying, leasing and acquiring patents and patent rights, the products of manufacture and maintaining factories and foundries. The capital stock is $500,000.

PERSONAL MENTION.

F. STEINHARDT, of the Cuban General Electric Company, arrived in New York from Havana last week.

L. B. CRAMER has succeeded H. Milliken as electrical engineer of the Oregon Electric Company, of Portland, Ore.

WALTER G. OAKMAN, president of the Hudson Companies, sailed for Europe last Tuesday on the Kaiser Wilhelm II.

J. LUNT, astrophysical assistant at the Cape Observatory, has been given the honorary degree of D. Sc., by the University of Manchester.

FREDERICK W. WHITRIDGE, receiver of the Third Avenue Railroad Company, of New York city, was a passenger on the Lusitania last week.

CHAIRMAN WILLIAM R. WILCOX, of the New York Public Service Commission, will sail for New York, August 24, on the Kaiser Wilhelm der Grosse.

PROF. KARL RUNGE, of the department of mathematics in the University of Göttingen, Germany, has been appointed Kaiser Wilhelm professor at Columbia University for next year.

HERR S. EYDE has been awarded a silver medal by the Royal Society of Arts, London, Eng., for his paper on "The Manufacture of Nitrates from the Atmosphere by the Electric Arc."

W. E. ELLIOTT has been elected treasurer of the Pacific States Electric Company, of San Francisco. Mr. Elliott was formerly secretary and treasurer of the California Electrical Works of the same city.

J. T. WOOD, president of the South Shore Traction Company and prominently identified with a number of other corporations, was married by special license at Holy Trinity Church, London, on August 3, to Mrs. Joseph Hicks-Beach of New York city.

LIEUT. TREVOR DAWSON delivered the first Gustave Canet lecture on June 30 last, at the twenty-fifth anniversary meeting, in London, Eng., of the Junior Institution of Engineers. The lecturer is the recipient of the first gold medal, which is to be awarded every fourth year by Madame Canet in memory of her husband, the award being made through the council of the institution.

A. N. FOX, manager of the publicity department of the Benjamin Electric Manufacturing Company, of Chicago, has returned from a two weeks' invasion of the lakes in Michigan. He reports good fishing. Incidentally he has collected a few good stories and taken on a four-ply coat of tan.

J. H. McGILL, president of the Crescent Company, Valparaiso, Ind., returned to Chicago last week after a trip East looking after his large lines there. Mr. McGill reports business good and has taken on the agency for two strong lines, the American Conduit Company, of Pittsburg, and the Lowell Insulated Wire Company, of Lowell, Mass.

OBITUARY.

JOHN C. FREY, Red Bank, N. J., secretary to Vice-President Hall, of the Bell Telephone Company, for the past twenty-four years, died on August 5, after a brief illness. He was forty-six years old. He is survived by his widow. Before coming to New York he was a court stenographer at his home in the city of Wilkesbarre, Pa.

WILLIAM WARREN LYON, JR., an electrical engineer of the New York Public Service Commission, died on July 31, at the home of his parents, 157 West Ninety-second Street, New York city. He was graduated from Columbia in 1906. Mr. Lyon was a member of the Theta Chi fraternity and the American Institute of Electrical Engineers.

INDUSTRIAL ITEMS.

THE NEW YORK INSULATED WIRE COMPANY, New York, N. Y., is distributing two advertising blotters giving some timely hints on the selection of wires and insulating tapes.

ROBERT WHELAN & COMPANY, 839 Monadnock Block, Chicago, Ill., are the manufacturers of a very practical and ingenious form of shaking and dumping grate. Information concerning this grate will be sent to those interested upon request.

THE AMERICAN PLATE GLASS COMPANY, at Kane, Pa., is installing a 700-horsepower Westinghouse horizontal gas engine for power purposes, and has also just contracted for a sixteen-inch by twenty-six-inch, twin-tandem, horizontal Westinghouse engine, to be direct-connected to a 400-kilowatt generator.

THE DU BOIS IRON WORKS, Du Bois, Pa., has issued Catalogue No. 32 on Du Bois steam and power pumps for every service. These comprise steam, electric, gasoline-engine and air-driven types. The catalogue is handsomely illustrated and is replete with much useful information of value to pump users.

THE HILL CLUTCH COMPANY, Cleveland, Ohio, has just published a booklet, entitled "A-B-C Engineering," the first of a series of similar publications, this one being devoted to line-shaft bearings in general and to the Hill collar oiling bearing in particular. Copies will be forwarded by the company on request.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a new flyer descriptive of its automobile electric-lighting specialties, consisting of connectors, flush receptacles and plugs, limousine switches and two-point round switches. This flyer should be of interest to all owners or users of automobiles.

THE CENTRAL LABORATORY AND SUPPLY COMPANY, J. W. Esterline, manager, has secured a contract for the installation of an engine and generator, including the equipment, and for 848 motors in the C. H. Campbell Company's factory in Shelbyville, Ind. This is one of the largest contracts this quite new firm has undertaken. S.

THE H. T. PAISTE COMPANY, Philadelphia, Pa., has issued the July number of its monthly bulletin and price list (Bulletin 68), which goes by the name of "Paistery," describing and illustrating the Paiste "Triple-Six-Fifty" sockets and Paiste "Panelettes," types A, B and C, etc. All these products are National Electrical Code standard.

THE CHARLES L. KIEWERT COMPANY, Milwaukee, Wis., has issued two booklets describing its two flaming-arc lamps, the "Aurola" and the "Alba." Some of the features emphasized in these booklets are the feeding mechanism on top, completely isolated and protected against products of combustion; the simple carbon holder suspension, and arc in fixed position and very small feeding periods insuring steady light and maximum of luminous efficiency.

THE AMERICAN ELECTRICAL HEATER COMPANY, Detroit, Mich., has issued Catalogue 25 on "American Electric Heating Devices." These devices include air heaters, annealers, baking ovens, bar urns, branders, bust formers (for corset manufacturers), chafing dishes, cigar branders, coffee pots, cooking ovens, cork branders, curling-iron heaters, disk stoves, foot warmers, glue pots, griddles, hair driers, hot plates, hot-water urns, instrument sterilizers, irons for all purposes, percolators,

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plate warmers, radiators, soldering irons, solder pots, sweating blankets, teakettles, warming pads, water heaters, wood benders, and many other electric apparatuses and accessories too numerous to mention. A price list is inserted.

THE LORD ELECTRIC COMPANY, New York, N. Y., has just received a very substantial order for Earll catchers and retrievers as the result of a service test of eight months. This is added to the list of other large properties using these devices exclusively. Those interested in retrievers and catchers will be furnished information as to this equipment or as to other representative users.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., is distributing a booklet entitled "Gray Registers for Measured Telephone Service," which tells why Gray registers reduce the operator's load, their possibilities, why they pay, etc. These registers are made by The Gray Telephone Pay Station Company, Hartford, Conn., for which the Western Electric Company is the accredited selling agent.

THE OKONITE COMPANY, New York, N. Y., has issued an instructive folder entitled "Economy." Starting with a dissertation on the meaning of the word economy the folder proceeds logically to demonstrate the economy of using Okonite and Manson tapes, with especial regard to the low cost of making joints and the greatly reduced necessity for renewals. An illustrated article gives explicit instructions for making an Okonite joint.

THE HURON LIGHT AND POWER COMPANY, of Huron, S. D., has given the contract to the Minneapolis Steel and Machinery Company for furnishing the new engines for its electric-light plant. It will install one 100-horsepower and one 150-horsepower Muenzel producer-gas engine, together with two 150-horsepower Muenzel gas-producers, to replace the present steam equipment. Both of the engines will be belted to alternating-current generators.

THE SPENCER WIRE COMPANY, Worcester, Mass., has just contracted to duplicate its present installation of a 200-horsepower Westinghouse vertical gas engine and a 250-horsepower Westinghouse suction producer plant, to meet the power needs of its factory. The engine will be direct-connected to a 135-kilowatt, three-phase, 440-volt, 60-cycle alternator, similar to that now running. The initial equipment was but recently installed and is representative of the most improved producer-plant practice for a moderate capacity.

THE MANUFACTURERS' PUBLICITY CORPORATION has been formed in New York, N. Y., to take charge of the advertising interests of the clients of the respective parties who have organized the new company and in order to widen the scope and strength of their activities. The officers of the corporation are Benjamin R. Western, president; Walter Mueller, vice-president and general manager; W. H. Denney, treasurer; W. Hull Western, secretary. The offices are located at the Hudson Terminal Building, 30 Church Street, New York city.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the second issue of each month.)

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary, Lloyd Lyon, secretary and auditor Mobile Light and Railway Company, 158 Government Street, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis Avenue, New York city.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York city.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th Street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, Flatiron Building, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, secretary and treasurer Tri-City Railway Company, Davenport, Iowa.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

AMERICAN STREET AND INTERURBAN RAILWAY TRANSPORTATION AND TRAFFIC ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, superintendent of lighting Hot Springs Light and Railway Company, Hot Springs, Ark.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF CAR-LIGHTING ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Chicago, Ill.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, D. L. Huntington, second vice-president and manager Washington Water Power Company, Spokane, Wash.

ASSOCIATION OF EDISON PURCHASING AGENTS. Secretary, J. W. Brennan, Edison Illuminating Company, Detroit, Mich.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, Frick Building Annex, Pittsburg, Pa.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Minnesota, St. Paul & Sault Ste. Marie Railroad, Chicago, Ill.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Ploda, Oak and Broderick streets, San Francisco.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 33 Melinda Street, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Traction Terminal Building, Indianapolis.

CENTRAL ELECTRIC TRAFFIC ASSOCIATION. Secretary, J. T. Brittson, assistant claim agent Chicago, South Bend & Northern Indiana Railway Company, South Bend, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Colo.

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CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Conn.

ELECTRIC CLUB OF CHICAGO. Secretary, Wm. S. Taussig, 204 Dearborn Street, Chicago, Ill.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CLUB OF CALIFORNIA. Secretary, Russell D. Holabird, Argonaut Hotel, San Francisco, Cal.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, George William Russell, Jr., 500 Fifth Avenue, New York city.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine Street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, San Francisco, Cal.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York city.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau Street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt Street, New York city.

ENGINEERS' CLUB OF PHILADELPHIA. Secretary, H. G. Perring, 1317 Spruce Street, Philadelphia, Pa.

ENGINEERS' SOCIETY OF MILWAUKEE. Secretary, W. Fay Martin, Milwaukee, Wis.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, G. F. Doig, Gainesville, Fla.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Ottawa, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Preston S. Millar, Engineering Societies Building, 33 West Thirty-ninth Street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Frederic Leslie, Muncie, Ind. Next meeting, August 18 and 19, French Lick Springs, Ind.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Allen J. Paylow, Rockport, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Annual convention, Atlantic City, N. J., September 14-16.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis, Parkersburg, W. Va.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, Des Moines, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich. Annual convention, Detroit, Mich., August 17, 18 and 19.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, B. W. Copperthwait, Faribault, Minn.

MISSISSIPPI ELECTRICAL ASSOCIATION. Secretary, J. Abbott, manager Jackson Electric Railway, Light and Power Company, Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATERWORKS ASSOCIATION. Secretary, Claude L. Clary, Sikeston Electric Light and Power Company, Sikeston, Mo.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George W. Schwerer, Windsor, Mo.

MUNICIPAL LIGHTING ASSOCIATION OF MASSACHUSETTS. Secretary, J. C. Norcross, Reading, Mass.

NATIONAL ARM, PIN AND BRACKET ASSOCIATON. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago, Ill.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, Frank M. Tait, Dayton, Ohio.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 60 State Street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass. Meetings held on fourth Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

NEW YORK RAILROAD CLUB. Secretary, H. D. Vote, 95 Liberty Street, New York, N. Y.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD-TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, Frank J. Scherrer, 195 Broadway, New York city. Annual reunion, Pittsburg, Pa., August 17-19.

ORDER OF THE REJUVENATED SONS OF JOVE. Mercury, C. B. Roulet, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, E. L. Smith, Towanda, Pa. Annual convention, Eagles Mere, Pa., September 8, 9 and 10.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

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PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa. Next annual meeting, Louisville, Ky., October 12-14, 1909.

SOCIETY OF AUTOMOBILE ENGINEERS. Secretary, Alexander Churchward, 30 Church Street, New York city.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer. E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York city.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. A. Gould, Ennis, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Addison County, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Chairman, William B. Jackson, 115 Adams Street, Chicago, Ill.; secretary, J. H. Warder, Monadnock Block, Chicago, Ill.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 382 Ohio Street, Chicago, Ill. Annual convention, Detroit, Mich., October 26-28, 1909.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

DATES AHEAD.

Michigan Electric Association. Annual convention, Detroit, Mich., August 17-19.

Old-Time Telegraphers' and Historical Association. Annual reunion, Pittsburg, Pa., August 17-19.

Indiana Electric Light Association. Next meeting, French Lick Springs, Ind., August 18 and 19.

Northwest Electric Light and Power Association. Annual convention and joint session with Seattle branch, A. I. E. E., Seattle, September 7-9.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8-10.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 14-16.

Kansas Gas, Water, Electric Light and Street Railway Association. Next meeting, Wichita, Kan., September 23-24.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Railway Signaling Association. Annual meeting, Louisville, Ky., October 12-14.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 18.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) July 27, 1909.

928,933. LOW-WATER ALARM FOR STEAM-BOILERS. Charles Brent, Brandon, Manitoba, Canada. Filed November 5, 1906. A thermostatic device surrounding a head in open communication with the boiler is adapted when the head is converted into a steam head to ring an electric alarm.

928,934. CONTACT DEVICE. Charles Brent, Brandon, Manitoba, Canada. Filed November 5, 1906. A loop-shaped thermostatic bar when heated makes an electric circuit.

928,936. ELECTRIC HEATER FOR CURLING-IRONS. Mary M. Buck, Machias, N. Y. Filed August 12, 1908. In combination with electrical heating means, are coin-controlled circuit closing means and thermostatic devices for opening the circuit-closing means.

928,937. GAS-SUPPLY ALARM. Louis C. Bulkley, Benton, La. Filed November 20, 1908. Operates when a thermostatic member expands through heating.

928,963. BATTERY-CONTACT. Julius H. Gugler, Minneapolis, Minn., assignor to the Battery Company, Milwaukee, Wis. Filed July 25, 1908. The electrode has a metallic contact cup seated therein, and electroplating electrically connects the upper portion of the cup to the upper portion of the electrode.

928,989. TELEPHONE-CABINET. Alfred Larsson, Buffalo, N. Y. Filed August 21, 1907. Has a back constructed of sheet metal to form a flat upper part, a rearwardly dished lower part and a rearwardly projecting marginal flange, and a movable hood arranged in front of the dished part of the desk.

928,998. ELECTRIC-FUSE CASE. Thomas E. Murray, New York, N. Y. Filed September 28, 1908. A wrapping of non-combustible material surrounds the fuse over a portion of its length, and a body of inert and refractory pulverized material completely fills the case of fictile material and surrounds the fuse and wrapping.

928,999. ELECTRIC CUT-OUT. Thomas E. Murray, New York, N. Y. Filed December 30, 1908. Comprises a base having a socket and circuit terminals therein, a fuse plug constructed to enter and fit the socket and make contact with the terminals, a fuse-plug holder closing the socket, and a device for detachably connecting the plug and holder.

929,001. RHEOSTAT. Ralph E. Noble and Louis E. Mitchell, Chicago, Ill., assignors to Morgan-Gardner Electric Company, Chicago, Ill. Filed February 5, 1909. Resistance grids are mounted in slides adapted to engage in slideways in a rack or frame.

929,011. ELECTROMAGNETIC WINDING-GEAR FOR CLOCKS AND THE LIKE. Karl Puttkammer, Gross-Lichterfelde, near Berlin; Friedrich Orthmann, Charlottenburg, and Julius Schindler, Berlin, Germany, assignors to the firm of Normal-Zeft Gesellschaft mit beschränkter Haftung, Berlin, Germany. Filed December 5, 1907. Power is transmitted to the clock work-spindle driving member by a U-shaped armature.

929,017. METAL-DEPOSITING APPARATUS. James K. Reynard, East Elmhurst, N. Y. Filed February 14, 1906. A vacuum chamber has a bottom with an opening, a rotatable stem passes downwardly from the interior of the chamber and is adapted to support a record, and a cup on the stem contains a fluid sealing the opening.

929,025. TELEPHONE-STAND. Charles R. Schafer, Syracuse, N. Y. Filed March 24, 1908. The receiver is clamped to a vertical arm supported by a horizontal arm.

929,041. CONTROLLER ATTACHMENT. John Sontag, West New York, N. J. Filed October 17, 1908. The contact finger has a contact face, provided at its end with a recess containing an insulating material.

929,043. SELECTIVE MECHANISM. Louis B. Spencer, Ogden, Utah. Filed October 29, 1908. Comprises a number of operating devices, a greater number of selectively operated devices, each corresponding to a different one of the groups in which the operating devices may be actuated, and means by which movement of any group of the operating devices causes movement of the corresponding operated device.

929,055. PRESSURE-GOVERNING APPARATUS. Walter V. Turner, Edgewood, Pa., assignor to the Westinghouse Air Brake Company. Filed November 1, 1907. In combination with a supply pipe and two or more reservoirs for supplying air to it, is an electric regulating mechanism governed by pressure in the supply pipe for controlling the supply of air from the reservoirs to the supply pipe.

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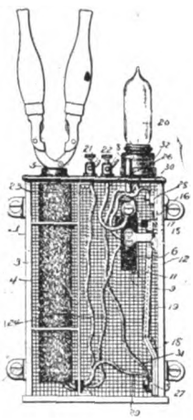
929,069. ELECTRIC-LIGHT-CONTROLLING DEVICE. Arthur L. Wood, Jacksonville, Ill. Filed July 8, 1908. A clock is arranged to make electric contacts at certain times.

929,094. ILLUMINOUS ELECTRIC HEATER. Frank Kuhn, Detroit, Mich., assignor to American Electrical Heater Company. Filed December 12, 1908. A series of electric lamps project upwardly from a base.

929,095. ELECTRIC HEATER. Frank Kuhn, Detroit, Mich., assignor to American Electrical Heater Company. Filed March 22, 1909. An electrical heater comprises a hot plate having a heating unit secured to its under side, and a casing surrounding the unit and spaced therefrom has a marginal supporting bearing for the plate, and forming an air chamber on its under side.

929,097. OUTLET OR JUNCTION BOX. George A. Lutz, New York, N. Y., and Clarence C. Sibley, Perth Amboy, N. J. Filed November 29, 1905. Has a number of socket members having open tops and ends and extending inwardly from the wall of the box adapted to receive conduits, and a cover for the box.



928,936.—ELECTRIC HEATER FOR CURLING-IRONS.

929,118. BATTERY-SUPPORTING MECHANISM. Tracy V. Buckwalter, Altoona, Pa. Filed January 20, 1909. A frame for holding the battery has elastic hangers having three points of connection with the frame above the center of gravity thereof.

929,121. STORAGE BATTERY. Rufus N. Chamberlain, Depew, N. Y., assignor to Gould Storage Battery Company. Filed October 9, 1906. The battery plates are arranged alternately positive and negative, an outside plate being a positive and having substantially greater capacity than either side of the inside positive plates of the cell.

929,123. ELECTRIC METER. Thomas Duncan, La Fayette, Ind., assignor to Duncan Electric Manufacturing Company, La Fayette, Ind. Filed February 1, 1909. An integrating wattmeter is supplied with a supplemental field winding normally forming no field coil portion of the meter, and manually controlled means are provided for bringing the supplemental field winding into and out of operating relation with the meter armature, in order that the meter may be operated to test its speed.

929,128. TELEPHONE ATTACHMENT. Howard F. Hansell, Jr., Philadelphia, Pa. Filed February 4, 1909. In combination with an upright support, is an elongated bracket or arm fixedly secured thereto between its ends, and a receiver is fixedly secured at one end of the bracket and a transmitter fixedly secured at the other end thereof.

929,132. INSULATOR. Ernest R. Hill, East Orange, N. J. Filed May 25, 1908. Describes an insulator of the form shown in the illustration.

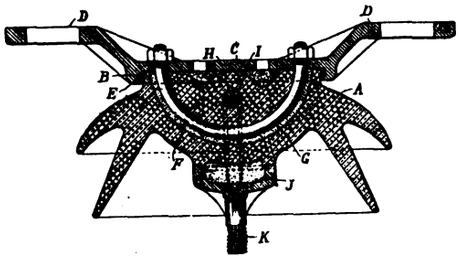
929,133. ELECTRIC SELECTING MECHANISM. Henry C. Horstmann, Chicago, Ill., assignor of one-fourth to Samuel Evans and one-fourth to John Howard McElroy, Chicago, Ill. Filed September 16, 1908. In combination with a cylinder and means for rotating it, are a number of electrically-controlled clutches adapted to grip the cylinder, actuating elements attached to the clutches, a number of circuits, one for each clutch, and means for selectively energizing the circuits to engage the various clutches with the cylinder and move the associated actuating elements.

929,151. AUTOMATIC REFRIGERATING APPARATUS. Robert F. Massa, Chicago, Ill. Filed July 9, 1906. An electrically-actuated thermostatically-controlled device controls means located between the condenser and refrigerating coil for controlling the admission of the refrigerant to the coil.

929,185. ALTERNATING-DIRECT-CURRENT SYSTEM OF CONTROL. Howard L. Beach, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed March 3, 1906. A change-over switch is provided whereby the circuits of the system may be arranged for operation of a device by either alternating or direct current, also relay switches whereby the circuits of the controlling magnet windings are governed.

929,186. SYSTEM OF ELECTRIC-MOTOR CONTROL. Howard L. Beach, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 26, 1907. Means, dependent upon the interruption of the circuit in which a transformer is included, are provided for automatically affecting the separation of the current-collecting device (connecting one extremity of the transformer with the supply circuit) from the supply circuit.

929,187. CONTROL SYSTEM FOR ELECTRIC MOTORS. Howard L. Beach, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed November 8, 1907. In combination with a number of motors, are control switches therefor, operating magnets for the switches, secondary batteries to energize the magnets, means for charging the batteries from unlike sources of energy, and automatic means for selecting one of these means.



929,132.—INSULATOR.

929,256. ELECTROMAGNET. Albert E. Sink, New York, N. Y. Filed January 25, 1909. An electromagnet coil is provided with a composite wire comprising a number of insulated strands intertwined longitudinally, this composite wire being wound to form a coil, and a resistance is provided in closed circuit with one of the strands.

929,262. ELECTRIC IGNITER FOR EXPLOSION-ENGINES. Walter C. Thornhill, Minneapolis, Minn., assignor of one-half to Charles W. Gardner, Minneapolis, Minn. Filed August 26, 1907. A movable spring-influenced electrode carries an arm positioned to be engaged by a part of the piston and also an arm to contact with the stationary electrode.

929,269. ELECTROMAGNET FOR CLOCKS AND MOTORS. Carolus Arnold, Hamburg, Germany. Filed May 11, 1908. Has a resistance arranged in the form of an inductionless double coil of opposite directions upon the magnet coils directly, to minimize the effects of induction set up in breaking the circuit.

929,276. ELECTROLYTIC DIAPHRAGM AND METHOD OF MAKING THE SAME. Anson G. Betts, Troy, N. Y. Filed January 7, 1909. A diaphragm for use in aqueous electrolytes is composed of asbestos having its fibers cemented together with sulphur.

929,280. LAMP. Edward C. Broadwell and John A. Lyons, Chicago, Ill. Filed March 18, 1905. The filament comprises a thread of porous metallic chromium and metallic oxides contained within the pores of the thread, and a mantle of earth oxides inclosing but out of contact with the same.

929,284. THIRD-RAIL OR OTHER ELECTRICAL CONDUCTOR. William J. J. Burch, Chicago, Ill. Filed January 7, 1907. Has central parallel, downwardly directed flanges, supporting means engaged between the flanges (the flanges having concaved contact faces), the outwardly directed supporting flanges integral with the rail and an insulating covering thereon.

929,312. ELECTROPLATING PLANT. Willis R. King, Newark, N. J., assignor to the Hanson and Van Winkle Company. Filed November 13, 1908. Describes in detail a plant for electroplating extraordinarily long pieces of metallic material.

929,319. RELAY. Frank R. McBerty, New Rochelle, N. Y., assignor to Western Electric Company. Filed September 5,

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1908. In combination with an energizing spool provided with a core having a slotted projection, are an armature mounted at the side of the projection, and a contact terminal extending through the slot in the projection in position to be closed by the actuation of the armature.

929,332. ELECTRODE-SUPPORT FOR FLAMING-ARC LAMPS. Ralph Scott, Newark, N. J., assignor to Scott Electrical Company. Filed July 27, 1907. A stop for an electrode of an arc lamp comprises a button of substantially equal parts zinc and aluminum.

929,336. REFLECTOR AND LAMP-RECEIVING SOCKET THEREFOR. William H. Spencer, Brooklyn, N. Y., assignor to George Frink Spencer, Newark, N. J. Filed May 19, 1908. A reflector comprising a main reflector-body is provided with a trough-shaped portion forming a receiving member for the reception of electric wires.

929,338. CURRENT-CONTROLLING MECHANISM FOR RAILWAY-MOTORS. Arthur B. Stitzer, Philadelphia, Pa. Filed February 18, 1909. In combination with a set of motors and a controller, is an electric circuit in which the armature and field of a motor are normally arranged in series and in which the motors are normally arranged in a loop to permit their operation in parallel, and means controlled by the controller are provided to open and close the circuit at a point in the loop including the several motors.

929,339. CURRENT-CONTROLLING MECHANISM FOR RAILWAY-MOTORS. Arthur B. Stitzer, Philadelphia, Pa. Filed February 18, 1909. The motors are normally arranged in parallel, and means exterior to, and controlled by, the controller open and close the circuit at a point in the circuit including the several motors.

929,349. WIRELESS TELEGRAPH SYSTEM. Charles R. Underhill, Providence, R. I., assignor to Underhill Telegraph Translator Company. Filed August 10, 1904. A local circuit is controlled by relay (actuated by electric wave signals) and embodies a low-resistance circuit-controlling winding, and a second local circuit controlled by the first local circuit comprises receiving means only, the latter including low-resistance circuit-controlling contacts and one or more translating devices with low-resistance winding.

929,353. INTERRUPTER. Reinhold H. Wappler, New York, N. Y., assignor to Wappler Electric Controller Company, New York, N. Y. Filed December 9, 1907. An interrupter for electric circuits adapted for use in alternate-current service comprises separable contacts at which an electric circuit may be made and broken, a magnet coil, a rectifier, and means actuated by the varying magnetic flux when at its maximum for actuating the separable contacts to make and break an electric circuit thereat.

929,354. GAS CHAMBER FOR ARC LAMPS. Ernest P. Warner and Carl Wiler, Chicago, Ill., assignors to Western Electric Company. Filed September 12, 1906. The gas cap comprises two concentrically arranged cup-shaped members having alined openings in their bottoms.

929,363. ELECTRIC SIGNAL FOR RAILWAY SWITCHES. Frank Zele, Cleveland, Ohio. Filed March 8, 1909. Circuit-closing mechanism for a railway signal comprises a contact member carried by a bell crank, which is engaged with a pivoted lever, and a slide connected with a railway switch has a cam channel and a link engaged at one end with the lever and having a roller at the other end in the channel.

929,371. ASYMMETRIC CELL. William C. Arsem, Schenectady, N. Y., assignor to General Electric Company. Filed March 18, 1908. Has electrodes, at least one of which will form an insoluble film having a chemical radical in common with the electrolyte.

929,386. TOOL OR MACHINE FOR MAKING STORAGE-BATTERY GRIDS. Rufus N. Chamberlain, Depew, N. Y., assignor to Gould Storage Battery Company. Filed January 5, 1906. Describes a cutting, spinning or rolling tool for the forming of lead storage-battery grids of large capacity from flat blanks.

929,393. RELAY. Fred B. Corey, Schenectady, N. Y., assignor to General Electric Company. Filed March 20, 1909. A metallic contact piece normally resting freely on the surface of a non-fusible contact block in electric contact therewith has a shank relatively movable into and out of engagement with the contact piece.

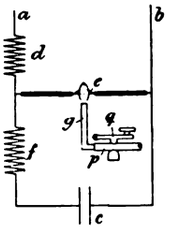
929,404. TELEPHONE ATTACHMENT. Benjamin E. Detrick, New Albany, Ind. Filed February 14, 1908. A wire bracket has means for holding it in fixed position and is provided with a laterally-extending coil, and a wire frame has seats for retaining the receiver of the telephone and passing through the coil of the bracket.

929,458. AUTOMATIC SIGNAL AND STOPPING DEVICE FOR RAILROAD TRAINS. Frank J. Miller, Cincinnati, Ohio, assignor of one-fourth to Edward A. Brockmann, Cincinnati, Ohio. Filed July 10, 1908. An electromagnet is located in the roadbed; an armature with trip devices is carried on the car and controls two terminal contacts; a throttle-valve lever is provided with a pivoted retaining pawl having a movable pin arranged to engage a rack member for locking the throttle lever, and an electromagnet is also carried by the lever and arranged when actuated by the closure of the terminals to withdraw the pin and to release the throttle lever.

929,463. ELECTRIC-LAMP SOCKET. James McGavin, Springfield, Ill. Filed December 14, 1907. Describes a ball-and-socket connection for electric lamps.

929,469. ELECTROLYTIC CELL. John McPhail, Carteret, N. J., assignor of one-third to William J. Burke and one-third to Harry R. Nelson, Carteret, N. J. Filed February 5, 1909. An inner vessel mounted within a containing vessel is provided with portions abutting against projecting portions of the containing vessel.

929,487. WIRELESS SIGNALING SYSTEM. Valdemar Poulsen, Copenhagen, Denmark. Filed December 24, 1906. Renewed May 25, 1908. An apparatus for the wireless transmission of signals comprises a circuit including an arc, means for



929,487.—WIRELESS SIGNALING SYSTEM.

supplying an atmosphere containing hydrogen to the arc, and means for varying such supply according to the signals to be transmitted.

929,492. COLLECTOR BRUSH. Henry G. Reist and Jakob E. Noeggerath, Schenectady, N. Y., assignors to General Electric Company. Filed July 28, 1904. Comprises a box having an arc-shaped slot of greater radius than that of the collector surface, and a number of flexible conducting leaves contained in the slot, the ends of the leaves entering the slot being bent to form a compact mass.

929,506. FUSE BOX. Earl Sherwood, Honesdale, Pa. Filed May 18, 1908. A fuse holder comprises means for engaging the conductor, a pin is provided to hold one end of the fuse, and a flange for engaging a portion of the fuse adjacent to that portion engaged by the pin or stud.

929,517. METHOD OF TREATING ALUMINUM ORES. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Company. Filed March 3, 1909. The process consists of making a mixture of aluminum silicate, emery and carbon, the amount of carbon being sufficient to reduce the silica and all compounds in the mixture except alumina, but insufficient to reduce the alumina, interposing this mixture as a resistance conductor between electrodes, passing current through the same sufficient to fuse the alumina and reduce the other constituents to metallic form and keeping the temperature of the charge below the reduction temperature of alumina.

929,518. PROCESS OF TREATING ALUMINUM-SILICATE ORES. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Company. Filed May 4, 1909. The method consists in subjecting a charge of aluminum silicate, base metalliferous material, and carbon, to electrically developed heat, partially reducing the silica, adding further metalliferous material, and completing the reduction of silica.

929,525. RELAY. Jean F. Webb, Jr., Denver, Colo., assignor to the Electric Signagraph and Semaphore Company. Filed May 12, 1908. Comprises an armature and an operating magnet therefor, a stepped block secured to the armature and a keeper co-operating with the block to lock the armature in its various positions, and a pair of fixed contacts co-operating with the armature whereby when the armature is in one position the fixed contacts will be electrically connected.

929,528. CABLE-THREADING HEAD. Frederick S. Woodward, Brooklyn, N. Y., assignor to General Electric Company. Filed May 24, 1905. A cable-threading head for a multi-conductor

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cable has a number of tapered openings, and means for securing each individual conductor in an opening at an angle with the cable.

929,531. DEVICE FOR CONVERTING ORDINARY CLOCKS INTO CLOCKS WITH ELECTRIC DRIVING MEANS. August Anders, Charlottenburg, Germany. Filed June 19, 1908. Pawl holders and pawls are connected with the gear trains of the clock and adjustable rods connect independent driving levers (controlled by an electromagnetic device) with the pawl-holders and pawls, whereby the gear trains of the clock are operated.

929,543. INSULATING APPLIANCE. William A. Bonnell, Brooklyn, N. Y. Filed May 3, 1906. A combination coupling and bushing comprises a two-part sleeve and a nipple, one part of the sleeve being connected to the nipple, one part of the sleeve being provided internally with longitudinal ridges, and the other part of the sleeve being provided internally with transverse ridges.

929,578. TREATING METAL FILAMENTS. Karl T. Fuller, Schenectady, N. Y., assignor to General Electric Company. Filed August 24, 1907. The method of finishing tungsten filaments consisting essentially of material obtained by reduction of tungsten trioxide with hydrogen, consists in firing a number of the filaments in a furnace under protection of hydrogen and a carbon-absorbing means.

929,582. ELECTRIC-CURRENT RECTIFIER. Eugene Garretson, Buffalo, N. Y., assignor of three thirty-seconds to William P. Mashinter, three thirty-seconds to Clarence S. Sidway, three thirty-seconds to James D. Robertson and three thirty-seconds to William E. Robertson, Buffalo, N. Y. Filed September 10, 1908. Comprises a body of silver sulphide and a body of metallic oxide in electrical contact therewith.

929,587. ELECTRIC LOCOMOTIVE. Max R. Hanna, Schenectady, N. Y., assignor to General Electric Company. Filed September 11, 1906. A motor truck is swiveled beneath the vehicle body, a conduit extends from the truck motor through the pivot of the truck, and means are provided for creating a circulation of cooling fluid through the conduit.

929,591. BLOCK-SIGNAL SYSTEM. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. Filed September 21, 1906. Renewed October 17, 1908. Each of a number of parallel tracks has one rail conductively continuous for all currents and the other sectioned to form signal blocks, and connections conductive for all currents between rail sections of different tracks are arranged to form with the sections a continuous conductor for power-current independent of the continuous rails.

929,602. TRANSMITTER FOR ELECTRIC TELEGRAPHS AND THE LIKE. Charles L. Krum, Chicago, Ill., assignor to Morkrum Company, Chicago, Ill. Filed April 11, 1904. Comprises a set of relays, means for operating the relays in order, means controlled by the relays for imparting a succession of impulses to the line at each operation of the set, and a series of controlling keys for modifying the imparted impulses.

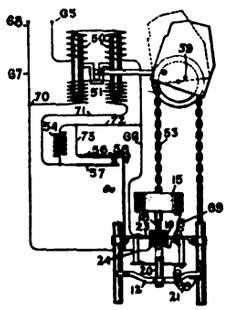
929,603. TRANSMITTER FOR AUTOMATIC TELEGRAPHS. Charles L. Krum, Chicago, Ill., assignor to Morkrum Company. Filed August 31, 1906. Has a keyboard, the keys of which operate type, each type being arranged to operate simultaneously a particular combination of switches.

929,607. INDUCTION COIL. Burton L. Lawton, Meriden, Conn., assignor to the Connecticut Telephone and Electric Company, Meriden, Conn. Filed January 12, 1909. A number of separate coil sections have sheets of insulating material interposed between the separate layers, forming partition walls, the inner terminal of one of the sections being led out through the corresponding partition wall and united to the outer terminal of the adjacent section.

929,609. ELECTRIC-CIRCUIT CONTROLLER. Harry W. Leonard, Bronxville, N. Y. Original application filed June 1, 1903. Divided and this application filed November 7, 1907. In combination with a switch is a mechanical device for holding it in a definite position, also an electromagnetic device having a movable part held by the electromagnetic device against the action of a force tending to move it whereby, when the magnetism of the electromagnetic device falls below a certain strength, the movable part will move under the action of the force and deliver a blow and cause the release of the mechanical holding device.

929,629. COIN BOX FOR TELEPHONES. Frank D. Powell, Chicago, Ill., assignor to American Coin Register Company. Filed November 18, 1908. Comprises a closed receptacle with a coin chute, a coin-registering mechanism having an actuating element interposed in the path of the coin to temporarily arrest its passage, and means in position to be moved by the coin when the latter is introduced to the coin-chute for engaging and actuating a previously inserted coin to move it past the arresting means and actuate the latter.

929,635. ELECTRIC SWITCH. Nathan H. Suren, Needham, Mass., assignor to the Gamewell Fire Alarm Telegraph Company, New York, N. Y. Filed May 23, 1908. A switch-arm consists of a hand-lever having overturned edges, and a contact plate has an integrally formed ear which enters the space between the overturned edges of the lever.



929,643.—ARC LAMP.

929,643. ARC LAMP. Johannes Härdén, Schenectady, N. Y., assignor to General Electric Company. Filed December 26, 1903. Comprises a main positive electrode formed of copper, a negative main electrode containing titanium, an auxiliary electrode formed of carbon, and means for starting the arc between the carbon electrode and the electrode containing titanium and for thereafter maintaining the arc between the two main electrodes.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired August 9, 1909:

480,266. SECONDARY-BATTERY PLATE. Edward R. Knowles, Brooklyn, N. Y.

480,284. INCANDESCENT ELECTRIC LAMP. Paul Scharf, Vienna, Austria-Hungary.

480,369. TIME CUT-OUT FOR ELECTRIC SERVICE SYSTEMS. Samuel R. Linville, Philadelphia, Pa.

480,372. SYSTEM OF ELECTRIC LIGHTING. George F. Myers, Pittsburg, Pa.

480,375. ELECTRIC-LIGHTING SYSTEM. Charles Selden, Baltimore, Md.

480,384. GALVANIC BATTERY. Herbert H. Dow, Midland, Mich.

480,392. METHOD OF ELECTRIC SOLDERING. Elihu Thomson, Lynn, Mass.

480,393. METHOD OF ELECTRICAL REGULATION. Henry E. Vineing, Roseville, N. J.

480,409. CLOSE CONDUIT FOR ELECTRIC RAILWAYS. Alexander L. Lineff, London, England.

480,475. TELEGRAPH-KEY. Alfred E. McClaren, Joplin, Mo.

480,491. ELECTROLYTIC CELL. Elisha B. Cutten, New York, N. Y.

480,492 and 480,493. METHOD OF ELECTROLYTICALLY PRODUCING POTASSIUM CHLORATE. Elisha B. Cutten, New York, N. Y.

480,539. SUPPORT FOR ELECTRIC ARC LAMPS. Augustus Wright, Providence, R. I.

480,567. DUPLEX TELEGRAPH. Thomas A. Edison, Newark, N. J.

480,575. ELECTRIC ACCUMULATOR. Giovanni Gandini, Lodi, Italy.

480,576. METHOD OF AND APPARATUS FOR TESTING CIRCUITS FOR ELECTRIC TIME SYSTEMS. William F. Gardner, Washington, D. C.

480,577. CLOCK-SYNCHRONIZING DEVICE AND SYSTEM. William F. Gardner, Washington, D. C.

480,656. TELEPHONE. James A. Christy, San Francisco, Cal.

480,683. ELECTRIC PUSH. John F. Wollensak, Chicago, Ill.

480,689. AUTOMATIC CIRCUIT-CLOSER FOR TELEGRAPH-KEYS. Charles W. Bradford, Clinton, Me.

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CONTENTS.

EDITORIAL:
Electricity in Coal Mines 323
Transferring Machinery to Improve Plant Economy 324
Extending Telephone Lines Into Sparsely Settled Territory 324
Electric Drive for Textile Mills 325
Reducing the Electric-Railway Transfer Abuse 325
Details of Watt-Hour Meter Manufacture.—II 326-330
Losses, Induced Volts, and Amperes in Armor and Lead Cover of Cables 331
Massachusetts Electric Light Association 332
Acoustic Method of Tuning for Wireless Telegraphy 333
Safe Use of Electricity in Coal Mining 334
Convention of the Society of Automobiles; Electrical Papers 335
Association of Edison Illuminating Companies—Dinner to Edison 336
Refinancing of the New Orleans Railway and Light Company 336
London's Subway System 336
The New Telefunken System 337
St. Paul Company Backs Minneapolis Enterprise 337
Discuss Telephone Problems 337
Electrical Workers Petition for Safeguards 338
7,500 Lights on One Sign 338
The Röntgen-Ray Tube 338
Increase in Accidents on Indiana Electric Line 338
Illuminating Engineering Society's Convention 339
The Copper Situation 339
The Electrical Operation of Textile Factories 340
Trackless Trolleys in Europe 341
An Important Meeting in the Northwest 341
Examination for Signal Service Electrical Assistant 342
Electrolytic Disinfecting; Results of the Poplar (London, Eng.) Plant. 342
New York Central Extends Its Electrification Book Review 342
BOOK REVIEW 343
QUESTIONS AND ANSWERS 344
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 345
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE 346
INDUSTRIAL SECTION:
The Robbins & Myers Company—A Successful Enterprise 348
Meter-Testing Rheostat 351
Some New Westinghouse Installations 351
New Features of Holophane Arcs 351
Line of Central-Office Telephone Switchboards 352
The First Modern Telephone Plant for China 353
Porcelain Electrical Specialties 354
Excello Series Flaming Arcs in Michigan Avenue, Chicago 354
The Kimble Variable-Speed Alternating-Current Motor 354
Westinghouse Storage Battery Company 354
CURRENT ELECTRICAL NEWS 355
RECORD OF ELECTRICAL PATENTS 362

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ELECTRICITY IN COAL MINES.

All electric installations have inherent danger characteristics which may, however, be reduced to a minimum by proper care in design, installation, maintenance and operation. In coal mines the conditions are much severer than usually obtain in other work and there is the added danger of explosion of fire-damp or coal dust, as well as an increased hazard from electric shock to the workers on account of the confined quarters in which they have to move about. The dampness of many coal mines and the corrosive effect of the acids often found in mine waters render the question of insulation a very difficult one. This emphasizes the necessity for rigid and continuous inspection, for an insulation which is perfect at the time of installation might become entirely useless in the course of a few months, or even weeks, with the methods at present adopted.

With all these and other drawbacks to the use of electricity in coal mines, it is not astonishing that many mining men still look askance on the new power, especially when failures and breakdowns have been frequent, and accidents out of all proportion to what they should have been. The reason for the latter is not far to seek. Incompetent soi-disant electricians, who perhaps were hardly skilled enough to wire a building, have "rushed in" where prominent electrical engineers would have "feared to tread." No wonder then that failure and disaster have so often resulted. But this is being rapidly changed. Mining and electrical men have realized that the problem is one for the skilled engineer, and that when an electrical equipment is properly designed and installed there can be none safer for use in mines. The problem is a difficult one, but when tackled in the right spirit by the competent man is one capable of very definite solution.

In another part of this issue will be found an abstract of a paper by George R. Ward on "Safe Use of Electricity in Coal Mines," in which some valuable information on the subject is given. Another noteworthy contribution on the same topic was a recent paper by Robert Nelson on "Electricity in Coal Mines," presented before the (British) Institution of Mining Engineers. Mr. Ward's recommendations will be found interesting in comparison with Mr. Nelson's, as showing the parallel progress being made in the two great coal-producing countries.

Mr. Nelson emphasizes the sparking danger, which he considers is largely independent of voltage, and recommends, in order to avoid sparking, that circuits should be made and

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broken under oil, or, if this be impracticable (as when using direct current), in properly designed explosion-proof chambers. He strongly prefers three-phase alternating current to direct current for many reasons and considers that the only advantage of the latter is that with its use coal cutters may be employed on the concentric system of working, a method which is at best one of very limited application.

When the mine water will not attack lead, Mr. Nelson recommends lead-sheathed armored cable. The alternative is fiber insulation with a sheathing of vulcanized bitumen. Electrical circuits in mines should be protected by maximum cut-outs in preference to fuses to avoid sparking as much as possible. Even these are not considered safe in all cases, and the use of some protective system is recommended.

The use of unarmored cable, according to Mr. Nelson, is preferably to be limited to cable for portable apparatus and to end connections where there exists no danger from falls or of firing timber work. Porcelain insulators should be used, with sufficient separation of the cable from the surface wired over.

Mr. Nelson deprecates the difficulty, which obtains at present, of obtaining oil-break switches with overload trip coils which will operate on circuits carrying less than 100 amperes. He thought that a reliable oil-break switch with an overload attachment for use on motor circuits of ten horsepower or over would practically do away with fuse boxes on motive-power circuits, besides the consequent greater rapidity and certainty of action in opening circuit. Squirrel-cage motors should be used wherever possible, and transformers for use underground should be oil-cooled. Mr. Nelson recommends earthing the neutral point of each transformer secondary. Motor frames and transformer cases should also be permanently and effectively earthed by stout wires.

TRANSFERRING MACHINERY TO IMPROVE PLANT ECONOMY.

The pursuance of any operating policy to extreme limits often results in losses of efficiency in the generating plant or upon the distribution system. Thus, in some cities all similar apparatus has been concentrated in a single station under the theory that the service will be more reliable when uniform equipment is installed in one place. To some extent this is true, and in addition there is no doubt that the number of spare parts are fewer and the possibility of rapid repairs is greater in case of trouble than where equipment is less homogeneous and more widely scattered. A recent instance from central-station practice, however, shows the importance of considering the efficiency as well as the reliability of the service, in a system where the load is divided between more than one generating station.

In the case in mind, the company supplied its local city lighting service from a waterpower plant located about six miles away from the business center, a steam plant with modern turbo-alternators being operated in the urban district in parallel with the hydraulic station so far as it was necessary to make up the load. The arc machines were located at the waterpower plant, but they were controlled from a switchboard in the city station, which was in some degree a substation of the waterpower installation, with a steam auxiliary. This plan worked very well as long as the supply of water was adequate, but it was found that when the river was low, sufficient power could not be secured from the waterwheels to operate the lighting generators, and as a result it became necessary to transmit current from the in-town station to the hydroelectric plant where a motor-generator was installed to drive the arc machines, the energy being returned to the city circuits over the arc lines. The losses by this method were considerable, without any compensating gain in flexibility. The company therefore decided to remove part of the arc equipment to the in-town station, operating it there by a motor-generator installation available at the time, and cutting out a double line loss with increased service reliability.

EXTENDING TELEPHONE LINES INTO SPARSELY SETTLED TERRITORY.

In the administration of public-service corporations' distributing utilities over wide areas, one of the most difficult problems encountered is the question of extensions into sparsely settled territory. This is clearly a matter where the most expert opinion is needed, to avoid excessive investments in unprofitable service and equipment on the one hand and a stagnation of enterprise on the other. Popular judgment can be of little value in the study of extensions, and wherever it is attempted to regulate developments of this character by untrained agitation, public petitions, and hasty action of municipal authorities, only harm may be expected.

The recent failure of the so-called telephone extension bill in the Connecticut Legislature is a case in point. The measure provided that the Southern New England Telephone Company should be required, on the petition of a certain number of persons, to extend a line into a specified district, no matter how sparsely settled. The judiciary committee wisely brought in an adverse report on the bill, but the House attempted to pass it, failing through the Senate's rejection and remanding of the measure to conference. If this measure had become law, an unfortunate precedent would have been established, since a thorough technical analysis of the cost of an extension, the annual operating and fixed charges upon it, and the immediate and probable revenue is the only sound basis for action. Where service is demanded by widely scattered customers in a territory where a company cannot afford to erect and maintain lines the plan of sharing the construction or maintenance expense with the prospective customer has often worked out favorably. Labor furnished by farmers under proper restriction for line construction and repairs can often be applied at far less cost than when the operating company must assemble and maintain the necessary force. To require a company to make extensions merely upon the presentation of a petition would be unreasonable in the extreme, if not confiscatory.

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ELECTRIC DRIVE FOR TEXTILE MILLS.

The electrification of existing textile mills and the installation of electric drive in mills projected or under construction are topics of timely and vital interest in view of the enormous strides this country is taking in the cotton industry. With abundant supplies of raw cotton and comparatively cheap (because efficient) labor close at hand, not to mention the advantages of our enormous potential hydroelectric resources as yet undeveloped, there is no doubt that this country is bound to take in a very short time a leading place among nations of the world in the manufacture of cotton goods.

It is a fitting sign of the times that many of the large cotton mills of Lancashire, the hitherto undisputed leader in cotton manufacture, have already installed electric drive, even when this meant the scrapping of valuable steam machinery; and cotton manufacturers of other countries have not been slow in following their lead.

Two essentials in textile manufacture may be pointed out: (1) The fluctuation of speed of the prime mover must be reduced to an absolute minimum, as very slight variations in speed will result in differences of tension of the yarn or thread sufficient to break it in its passage through the machines. (2) The temperature of the "sheds" or various rooms must be kept at a definite constant level, as must also the humidity, in most cases. This is especially the case in silk manufacture.

Both of these requirements are better met by the electric motor than by the steam engine. Steam engines for textile manufacture are preferably of comparatively slow speed, and consequently are of massive build and expensive to operate, and must be equipped with enormous flywheels and installed with the best of care to reduce speed fluctuation and vibration. With individual drive, motor-driven machines may be kept at almost exactly constant speed, and by suitable provision for ventilation of the parts the temperature rise may be kept within well-defined limits.

In another part of this issue will be found an abstract of an excellent paper on the subject which will well repay a careful perusal to those at all interested in the subject. In one of the greatest power schemes in the South, by means of long-distance, high-voltage transmission lines, and self-contained substations, a very good start has already been made in the electrical driving of textile mills.

REDUCING THE ELECTRIC-RAILWAY TRANSFER ABUSE.

There is little doubt that the street-railway free transfer is one of the most abused privileges in public-utility operation. Traction managers have long appreciated the losses in revenue chargeable to the improper use of the transfer, but the remedy has been hard to find. The prosperity of operating companies granting liberal transfers—in some cases two or three transfers on a single fare—is frequently seriously threatened by the abuses which have grown out of the disrespect which the public feels for that which costs it nothing. The situation is of more than local consequence to the electrical industry, because any illegitimate shortage of revenue means less money available for the purchase of new equipment and the adequate maintenance of existing installations. Fortunately in some instances matters have been improved by the raising of the street-railway fare unit from five to six cents, and where the extra cent has been applied to the transfer alone the results have appeared to be very interesting and suggestive.

Perhaps the best example that has yet come to hand of the effect of a transfer charge is afforded by the thirty-two miles of Newton lines of the Middlesex & Boston Street Railway Company. The management of this organization presented before the Massachusetts Railroad Commission quite recently figures showing the effect of a charge of one cent per transfer issued for a period of ten months compared with the same months of the year before, when all transfers were free. The Commission authorized the company in 1908 to charge the extra cent for each transfer for an experimental period of one year, being satisfied that the earnings and expenses of the road justified such a course. The company has just been authorized to continue the charge for a second year, after due public hearing in which, strange to say, no one appeared to raise an objection to the charge. The regular fare unit on this system remains at five cents.

The company's figures show a remarkable reduction in the transfer abuse as a result of the extra charge. The company's gross receipts on its Newton lines were $287,799 for the 1909 period and $285,688 for the corresponding 1908 period. There was no charge for transfers in the 1908 period. The passengers carried were 6,284,241 in 1909 and 6,434,602 in 1908, but the number of transfers issued were, respectively, 549,159 and 733,733, showing a reduction of 184,574 transfers, or twenty-five per cent, after the establishment of the charge. The significant figures, however, are those of the transfers turned in by the conductors, being 531,125 in 1909 and 623,556 in 1908, showing that before the transfer charge was instituted over 110,000 transfers were not redeemed in transportation by passengers asking for them and that after the extra cent was imposed only 18,000 transfers, or one-sixth as many, were thrown away or lost. In other words, eighty-five per cent of the transfers issued were used when they were free and ninety-seven per cent were used after the extra charge was made. The number of passengers carried per transfer issued was 8.8 in the free-transfer period and 11.5 in the year when a cent more was the price for each check given out. These figures show that a real abuse has been considerably checked, and while the patronage of the lines shows little improvement, matters are on a much sounder basis than before. Whatever growth comes now will be on a solid footing. Doubtless the charge of an extra cent on a street railway, whatever the cause, is a deterrent of traffic to some extent, but in the long run the value of a good service will outweigh such a temporary disadvantage.

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DETAILS OF WATT-HOUR METER MANUFACTURE.—II.

BY JOSEPH B. BAKER.

TOP BEARINGS.

The top bearing in many types of meter consists of a simple hole drilled in a brass plug, which is secured by a screw-thread or by a set-screw, forming a guide for a journal, consisting of the top of the shaft turned down to very small diameter.

The top bearing of Westinghouse meters (see Figs. 7 and 8 in the last issue) is different, in that the journal is a fixed pin, running in a lubricated bearing hole in the top of the shaft. The journal consists of a brass screw, tapped into the shield with careful alinement, as described elsewhere, with a piece of 0.023-inch diameter steel piano wire forced into its lower end. The free end of this journal is rounded and polished, and the journal is trued up with the screw by the same method that is employed for the staff of the register gears, as described elsewhere.

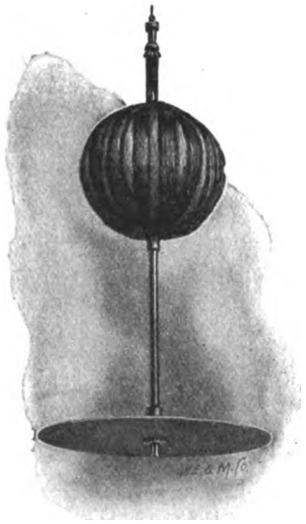

FIG. 10.—ROTATING ELEMENT WITH SPHERICAL ARMATURE.

The top of the meter shaft is fitted with a bearing in the form of an accurately drilled hole, below which is a larger hole containing disks of billiard-cloth soaked in oil. The tip of the bearing just touches these disks, so that effective lubrication is maintained and rust prevented, by capillary attraction.

THE ROTATING ELEMENT.

General Features in the Two Principal Types of Meter.—The various parts that go to make up the rotating element of modern direct-current and alternating-current meters are all designed for minimum weight consistent with the necessary strength and their proper functioning.

One of the greatest advantages of the induction meter over the commutator meter of the same watt-hour capacity is the lightness of the rotating element of the former, obtained by the elimination of the wound armature and the commutator, and the shortening of the shaft thus made possible.

The commutator meter obviously cannot be designed to have as light a rotating element (see Fig. 10) as the induction meter, in which the damping disk is itself the driving armature. Great improvements have been made, however; for example, the weight of rotating element in one of the older T R W commutator meters was 255 grammes, whereas the weight of the present type C-6 T R W rotating element is stated to be only ninety grammes. This reduction in weight has been secured mainly by substituting aluminum for copper in the disk, by using a tubular shaft instead of a solid one, and by changes in the material and construction of the armature core.

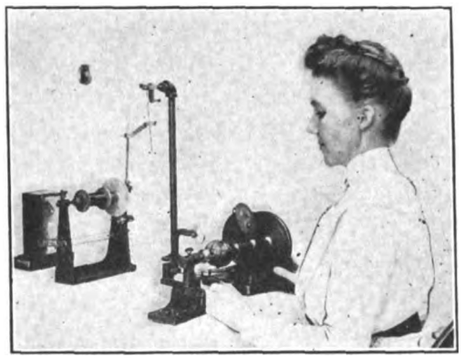

FIG. 11.—METHOD OF WINDING SPHERICAL ARMATURES.

The parts of the rotating element that are common to direct-current and alternating-current meters are the shaft, with or without removable pivot, the disk fixed thereon, and the driving member (worm or pinion) at the top. The removable pivot used in most makes of modern commercial meters, both direct-current and alternating-current, have already been described, under Step Bearings.

The Shaft and Driving Member.—The shaft, in the best forms of commutator meters, consists of a hollow steel tube with very thin walls, fitted at its upper and lower ends with solid plugs, which the shaft may be swaged down to receive. The lower plug may itself be pointed, hardened and polished to constitute the shaft end, or pivot, of the step bearing, or may be threaded to receive a removable pivot. The upper end of the shaft is shouldered down for the commutator and worm, and may be finished at the top as a spindle of small diameter, constituting the journal member of the top bearing. The placing of the worm at the top of the meter shaft meshing with the worm wheel (the "first drive"), for transmitting the motion of the shaft to the register, is characteristic of most modern meters.

The shaft of the Fort Wayne Electric Works meter is a composite one, consisting of three sections securely forced together. The short top section and the bottom section are of leaded brass, and the middle section of steel rod. The top and bottom sections are turned down for part of their length and the steel rod is drilled out at either end, and the three sections are then forced together and the whole machined to size. The worm is cut in the leaded-brass section at the top and a hardened steel pin forming the top bearing is driven into the same. The bottom section is drilled and tapped for the insertion of a separate brass stud containing the hardened steel pivot. This form of construction is stated to give a strong shaft, with top and bottom sections of metal, which is easily worked.

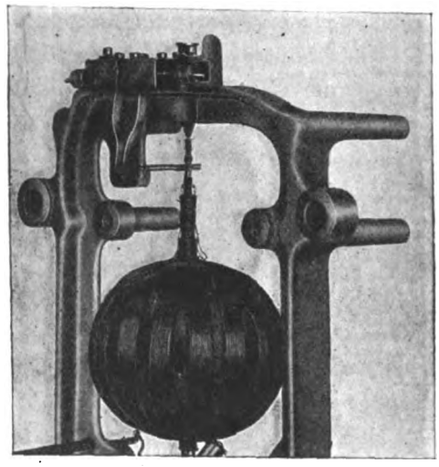

FIG. 12.—MOUNTING OF SPHERICAL ARMATURE.

A typical form of shaft worm and worm-wheel pair is that for the T R W meter, consisting of a worm of hard-drawn brass rod meshing with a worm wheel of hard rolled clock brass, the gear ratio being 100 to one for all meters. The parts are stated to be "properly made and highly polished to insure absence of friction."

A notable departure from the above construction is made in the Westinghouse meters, with their ball-jewel step bearing,

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fixed-journal top bearing, and pinion at top of shaft, described at greater length elsewhere.

The Disk.—Disks of commercial meters are now of aluminum, except in special cases where it is necessary to obtain the highest possible conductivity. Copper was exclusively used in the early types of meters, on account of its high conductivity, giving the necessary "drag," and owing to the fact that the production of aluminum was not then upon a commercial basis.

The use of copper for disks of the old T R W meters gave low speeds and correspondingly high disk constants (not lower than one-half). Later it was decided to increase the speed by an amount corresponding to the lowering of the constant limit to 0.2, which permitted the use of a disk of somewhat lower conductivity. It was possible to lower this damping effect in two ways—either by decreasing the thickness of the standard copper disk, or by using aluminum, which at that time had come into commercial use and was known to possess a conductivity about one-third that of copper. Aluminum disks were tried, and to compensate for the loss of conductivity were made somewhat thicker, the total loss, however, not being more than permitted by the lowered meter constant. It was found that aluminum was very satisfactory in every respect, and possessed the great advantage of being nearly four times lighter in weight than copper.

To add to the stiffness of the aluminum disk, and thereby prevent buckling by accidental blows, etc., in transportation or service, it is often stamped in shallow ribbed or corrugated form. Disks so made are claimed to be stiffer and stronger than an uncorrugated disk of twice the thickness.

General Electric meter disks, in meters of both the commutator and induction types, are made with two good-sized holes, diametrically opposite each other, between the center and edge of the disk. These holes are primarily intended to stop creeping of the disk, in the induction meter; but serve also, in the manufacture of disks for both alternating-current and direct-current meters, to drive the disk while the edge is being "trued up" in the shop.

The Shaft and Disk of the Westinghouse Induction Meter.—The rotating element of the Westinghouse induction meter, complete, weighs approximately fifteen grammes. This extreme lightness is due to the use of a short and light shaft and a thin disk of small diameter. The shaft is of phosphor-bronze, gold-plated like the register gears.

The disks for these meters are blanked out on a punch press from over-size circles of aluminum approximately 0.023 inch thick. The same operation makes the corrugations on the disk which give it the necessary stiffness. The disk and its hub (see Fig. 7) are then assembled and machined on a turret machine, as follows:

1. The hub blank, held in a revolving chuck, is turned down to diameter—a driving fit on the center hole of the disk.
2. With chuck standing still, the disk is forced on the hub; and with chuck revolving, the edge of the hub is spun over on the bottom surface of the disk.
3. Shaft hole in hub countersunk.
4. Shaft hole drilled.
5. Shaft hole reamed.
6. Edge of disk turned down to final diameter (four inches), and edge rounded and polished.

After the disk has been assembled on its hub, it goes to a bench to be "trued up." This operation is performed by a skilled workman, who mounts the disk on its own shaft, places it in a standard jewel bearing, and twirls it about under an even illumination, bending it gently and carefully this way and that between his fingers until it runs sensibly true on its shaft. The complete rotating element—disk and shaft—is then balanced, by rolling it on knife edges. When the heaviest part is thus determined, the lightest part (diametrically opposite) is weighted by putting on the under side of the disk, with a brush, a spot of dead black lacquer. This "spot" is not to be confused with the "counting spot," which is on the top of the disk near the edge.

Armatures.—The armatures of direct-current meters have undergone great improvements in the direction of reduced weight and bulk, by new methods of manufacture—a spherical armature (see Figs. 10 and 12) wound with film-insulated or "cellulose acetate" wire on a papier-maché or leatheroid shell or core having replaced the old T R W style armature of rectangular shape, wound with silk-insulated wire on a "spider." There are, of course, a large number of the latter style of armatures still in use.

The armatures may be wound by girls, on a winding machine, like the one shown in Fig. 11. Each machine is equipped with a clutch for holding the armature core and a counter for counting the number of turns wound on. The same machine is used for winding shunt-field coils.

The armature of the type C-6 meter has eight coils, of film-insulated wire, wound by an automatic winding machine on a molded leatheroid core. The film-insulated wire, by its superior space factor, allows the armature winding to be gotten into a relatively small space; and the spherical form of the complete armature permits it to be embraced closely by the field coils, so that high torque is secured with relatively low losses.

Commutators.—The commutator of the direct-current meter, along with other of its details, has been much improved in recent years in the direction of reduced diameter and weight, and general design. Thus, in the type C-6 T R W house-service meter of all capacities, it is 0.1 inch in diameter, and has pure silver segments secured to a supporting rod by lashings of silk. In the Westinghouse direct-current meter it is 0.154 inch in diameter, and has pure gold segments.

The type C-6 commutator is assembled upon a rod of high-grade steel, which is subsequently forced into the upper end of the tubular shaft, the latter having been reduced, or "swaged down," to receive it. In building up the commutator upon the rod, the latter is first insulated by a coat of enamel. Over this is placed a winding of silk, and the rod is then japanned and baked. The eight commutator segments, cut from wire of pure silver, of uniform cross-section, are placed in position on the rod by the aid of a small assembling jig. The ends are then tied down by silk tie bands, and the commutator is again japanned and baked. Next the commutator is turned down, using a sapphire turning tool, which gives the best results in this delicate operation. Finally, the japan is carefully cleaned from between the segments, giving in effect an air-insulated commutator at the part where the brushes bear upon it. Notwithstanding the small size of the structure, it gives superior insulation to that of the former T R W meter commutators, which were mounted upon fiber cores. The great advantage gained by the new small-diameter commutator is, of course, the reduction of commutator friction that is attained. This is said to be proportional to the reduction in the diameter of the commutator, thus resulting in great improvement in light-load accuracy.

RESISTANCE CARDS.

The non-inductive resistance that is placed in series with the armature in

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commutator meters is made up in various forms, such as a flat "card" in a protecting envelope, and a tube, enameled and baked.

The necessity of having the temperature coefficient of the armature circuit in a direct-current meter equal to that of the disk is due to the fact that, in order to maintain the calibration unchanged under temperature changes at the location of the meter, the energy expended in the armature and field must be balanced (neglecting C^2R and friction losses) by the energy absorbed in the braking of the disk by the damping magnets. General rise of temperature in the room in which the meter is located will produce a certain percentage of increase of resistance in the armature circuit, tending to slow down the meter; but if the disk is of a metal having the same temperature coefficient as the armature circuit, the rise of temperature will increase its resistance to the eddy currents (generated by the motion of the disk through the field of the damping magnets) in the same proportion, which will tend to allow the disk to be driven faster. These two tendencies will just balance each other, and the speed of the disk for a given load will be constant under local temperature changes.

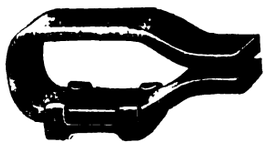

FIG. 13.—DAMPING MAGNET FOR T R W METER.

Modern commutator meters have an armature wound with copper wire. The resistance in series with the armature is, in some meters, composed of a certain number of ohms of tinned iron wire and about one-fourth this amount of German silver, in order to make the temperature coefficient of the armature circuit as a whole equal to that of the aluminum disk. Since copper has about the same temperature coefficient, iron a much higher, and German silver a much lower temperature coefficient than that of aluminum, the equalizing of the temperature coefficients of the armature circuit and of the disk is only a question of proportioning the amounts of iron and German silver wire in the circuit. If copper were used throughout for the armature circuit, it would introduce no serious error, but it would be too bulky and expensive.

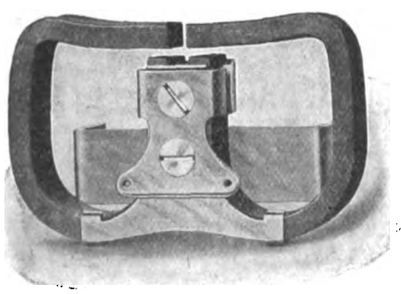

FIG. 14.—MAGNETS FOR TYPE C INDUCTION METER.

In some modern meters—the type C-6 T R W meter, for example—the shunt-field coils and resistance are in one, as described under Fields of Commutator Meters.

BRUSHES.

The new "gravity-control" brushes are superseding the spring-control brushes that were formerly employed in commutator meters. Each brush is mounted on a pivoted holder, so arranged that the pressure of the brush on the commutator is given by the weight of a small adjustable counterweight, consisting of a pair of knurled thumb-nuts, on a threaded rod, supported at right angles to the brush-holder. This counterweight can be adjusted quickly and accurately, and locked in the position to give the tension on the brushes that is best adapted to the local conditions of vibration, etc. The device gives equal tension on the two brushes, and on each individual leaf of each brush, since in adjusting the device the brushes are left in the original straight shape in which they come from the factory inspection of the meter. The making of a spring adjustment of the brushes, required with the old arrangement, and always a delicate and "fussy" operation to the most experienced meter inspector, is thus eliminated. Fig. 12 shows the gravity-control brush arrangement for the type C-6 T R W meter.

The "gravity-brush" arrangement is really an effective combination of gravity and spring contact, on account of the elasticity of the brushes. The latter are often of silver, either in the form of two-fingered flat strips or in the form of plain round wires. Or they may be phosphor-bronze wires carrying silver contact pieces.

DAMPING MAGNETS.

The need of having the non-friction load in the meter, given by the damping magnets, large relatively to the friction load, and equally constant, is an accompaniment of the use of high torque in meter design. To fulfill these requirements means, concretely, that the damping magnets must be both strong and permanent—a combination of properties the realization of which has required the exercise for many years of the utmost patience and skill in devising processes and in selecting and specifying material.

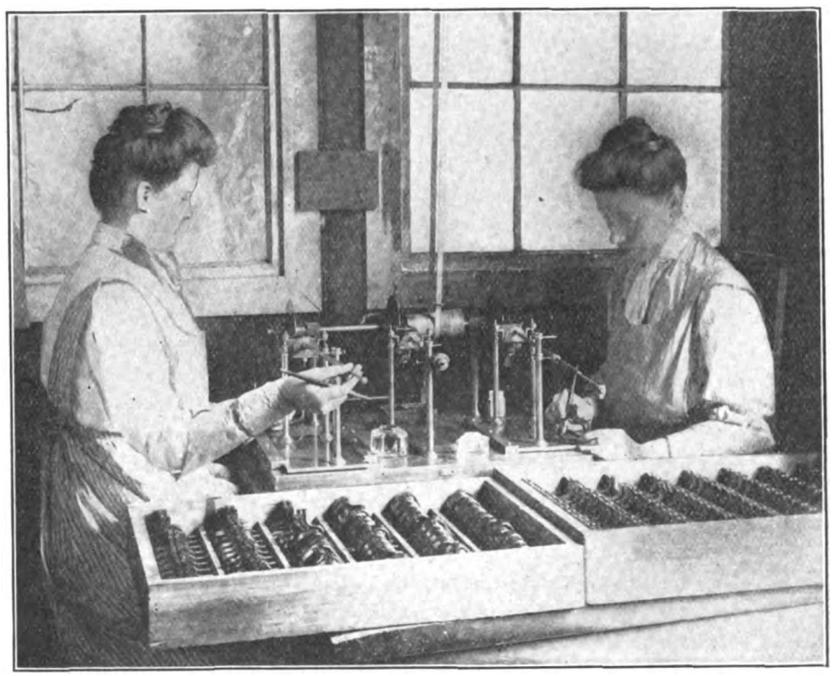

FIG. 15.—TESTING MAGNETS WITH MAGNET-MEASURING MACHINES.

Fig. 13 is a view of an old-style T R W meter magnet in its shoe, ready for mounting on the base of the meter. Fig. 14 is a view of the magnets and heavy brass magnet shoe of a Westinghouse type C induction meter, in position looking from

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the front of the meter. In alining the magnet system in the shoe so as to make the system interchangeable in different meters, the shoe is put on the magnets with the two heavy flat-head screws, that hold the parts of the shoe together, not set up tight, and the clamping lugs open. Then the magnet and shoe are put on a meter shield and the magnets are adjusted in the shoe in the right position, with their air gaps alined with the air gap between the shunt and series field cores, the screws are set up tight, and the clamping lugs are bent over under pressure to grip the magnets firmly.

The shoe carries at the back a U-shaped brass yoke, slotted at the ends for the light-load adjustment of the meter. The shifting of the damping magnets to effect this adjustment for the Westinghouse induction meter is described elsewhere as a detail of the factory calibration.

The two small holes at the bottom of the front plate are tapped for the meter name plate.

Fig. 14 shows also very clearly the shape of this magnet, used on all meters of Westinghouse make. The air gap is approximately three-thirty-seconds inch—one-thirty-second inch shorter than the gap between the shunt and series field cores.

The best meter magnets are made from a medium tungsten steel of low carbon, which comes to the factory in long, rounded-edge strips of proper width and thickness for magnets. Even under rigid specifications the shipments of steel are liable to vary somewhat in magnetic quality, and in order to insure the production of uniform magnets samples are selected from each shipment to the amount of about one per cent—not at random, but in a way to represent the lot fairly—and put through the same stages of manufacture as the regular product of magnets; with the additional feature that magnetic measurements are applied at each successive step in the process to determine the quality of the lot of steel and the best hardening temperature, or to locate the reason for its failure to meet the requirements.

In the handling of these samples—and of the entire production of magnets made from the shipment, guided by the results on these samples—pieces of the steel are cut of suitable length and bent up into magnet shape at bright-red heat on a "bulldozer" swaging machine. While hot the magnets are stamped with an identifying symbol, to facilitate looking up their individual history at any future time by reference to the complete records that are kept of all treatments and tests. After cooling naturally, the magnets are ground at the ends to proper length, sharp edges and slivers being removed, but no grinding being permitted upon the air-gap surfaces.

After "pickling" for about an hour in a fifty per cent solution of muriatic acid, to remove scale, the forms are ready for the hardening process. The sample magnets are divided into five batches, each of which is brought to a different heat in a gas furnace; the individual forms of each batch being brought to the same temperature, as judged by the eye of the skilled workman. The five heats range from a cherry red to a "white," and the heat that gives the best result under subsequent treatment is selected for hardening the entire shipment of steel. It is considered preferable to use the lowest temperature that will give "glass hardness" to the steel with high tenacity.

It is in the hardening process that the width of air gap is fixed, by using a special pair of tongs, provided with a pin, which is inserted between the jaws of the magnet and against which they are forced in taking the magnet out of the furnace ready for quenching. The magnet, held firmly in the tongs, is plunged into the quenching bath—a strong solution of rock-salt brine, kept at constant temperature—flatwise, to avoid distortion due to unequal cooling.

After a rest of twelve hours the magnets are tested for flaws, and for water or acid checks, by "ringing up," each magnet being struck a light blow or two, the workman rejecting all that do not give out a pure musical note. At this time also the air gap is gauged; all magnets of good general appearance, that allow a steel wire 0.125 inch in diameter to pass freely through their air gaps, but that do not allow a wire 0.150 inch to enter, being accepted.

The magnetizing device consists of an electromagnet, fed from a 110-volt direct-current circuit through a treadle-operated switch, with pole-pieces suitably shaped and spaced to fit closely the ends of the hardened steel form. Upon applying the latter to the poles and exciting the electromagnet, a powerful magnetomotive-force is applied to the steel. An important feature of the device is the use of a rotating copper disk driven at the rate of 3,000 revolutions per minute, the edge lying midway between the poles of the electromagnet. The complete arrangement constitutes a dynamo-electric generator of the disk type. In operation, powerful eddy currents are generated in the disk and give rise to an armature field the reaction of which against the main (exciting) field tends to force magnetic lines radially outward away from the center of the disk. This distortion of the resultant field drives a powerful flux through the steel form, whereas without the use of the rotating disk much of the main flux from the exciting electromagnet would pass directly from pole to pole of the latter without useful effect upon the steel form.

The magnets as they leave the magnetizing machine are supersaturated, *i. e.*, they are in an unstable magnetic condition, ready to lose a good percentage of their strength by ordinary vibration or handling, etc., or by mere lapse of time undisturbed, within a few weeks or months of the date of their magnetization. The next step, therefore, is to apply various artificial "aging" processes whereby the attainment of magnetic stability, or "permanence"—which would ordinarily take years of natural aging, with no assurance of permanence at the end of the period—may be hastened. These processes bring the magnets to a fixed magnetic condition in a few days.

The first treatment is an improvement upon the old academic procedure of aging by boiling. The magnets are hung upon racks in a "boiling machine," arranged to dip the magnets alternately in boiling water and cold water; the latter being constantly circulated and renewed to keep its temperature normal. In this machine the magnets have alternate exposures of about seven minutes each in boiling water and in water of ordinary temperature, there being at least eight complete cycles of this treatment. This process—which, it should be noted, carries the magnets through changes of temperature far in excess of any encountered in actual service in meters—removes about fifteen per cent of the magnetization.

The next aging process—to which the magnets are subjected after twelve hours of rest, followed by a second "ringing up"—is a treatment with steel-wire scratch brushes. This treatment serves the double purpose of subjecting the magnets to strong mechanical vibration, each wire of the brush giving a light hammer blow to the magnet as the brush revolves at high speed, and of cleaning up the surfaces ready for painting. It removes another

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fifteen per cent of the total initial magnetization.

The final aging process is the most severe, however, removing twenty per cent of the magnetization. It consists in applying each magnet for a few seconds to a rotating copper disk, eleven inches in diameter, driven at a minimum speed of 2,850 revolutions per minute. The poles of the magnet enclose the edge of the disk so that the latter is traversed by the magnet's field, just as it does under the same construction in the meter. But whereas the disk speed is very low in the meter, at the high speed of this device a strong armature field is set up, the reaction of which demagnetizes the magnet to the extent above stated.

After being painted a durable, glossy black, and air-dried, the magnets are placed in wood-compartment trays and sent to be tested on the magnet-measuring machine.

The form of magnet-measuring machine which the author inspected at the Lynn meter factory of the General Electric Company in 1904, is shown in operation in Fig. 15. This machine, at which two magnet testers may work at the same time, operates by weighing, in arbitrary units, the "drag" due to the reaction between the field of the magnet under test and the eddy currents that are generated in a rotating metal disk enclosed between the magnet poles. The machine consists of a horizontal shaft on which are fixed three similar copper disks. The middle disk has its edge enclosed between the jaws of a magnet of standard strength, carried on a balance frame supported on knife edges, the magnet being permanently mounted at one end of the frame and a fixed weight at the other end. With the disk rotating at a certain speed, the downward drag exerted on the magnet plus the weight of the magnet just balances the counterweight, and holds the frame horizontal. Each of the two other disks, which are, of course, rotating at the same speed as the middle disk, is fitted with a balance frame similar to the one for the standard magnet except that it is provided with a temporary seat for the magnet to be tested, and that the distance of the counterweight from the knife-edge supports is adjustable over a scale. In operation, the tester places the magnet to be tested on her frame, and then adjusts the counterweight till it just balances the weight and drag of the magnet, as above. The testers may note the state of calibration of the machine at all times by the balancing of the standard magnet under the drag of the middle disk—any lack of balance either way indicating that the speed has changed. After obtaining a balance as described, the magnet is removed and the scale reading is recorded —generally in white paint on the inside of the back, near the N-seeking pole.

An improved magnet-measuring machine manufactured by the General Electric Company, operates by comparing directly the speeds of two similar direct-current meters, one meter having a single damping magnet of standard strength and permanently mounted, and the other meter having no permanently mounted magnet, but being arranged so that the magnet to be tested may be slipped in place, enclosing the edge of the disk in standard position. The two meters are mounted in a case, one above the other, with their shafts (which rotate in opposite directions) in vertical alinement and connected together by a small differential gear. The latter consists of a pair of similar bevel pinions placed between, and meshing with, two bevel-gear wheels, fixed, respectively, on the bottom of the shaft of the upper meter (which is equipped with the standard magnet, and which rotates in the counter-clockwise direction) and on the top of the shaft of the lower meter (which is arranged to receive the magnet to be tested, and which rotates in the clockwise direction). With the same load thrown on the two meters, and a magnet to be tested placed in position in the lower meter, if this magnet is of the same strength as the standard, the speeds of the two meters will be the same, so that the pair of pinions in the differential gear, which is driven by the two bevel-gear wheels, will remain in the same position. If, however, the lower meter's disk is enclosed by a magnet weaker than standard, the damping effect on this disk will be correspondingly less, and the disk will run at higher speed than the upper meter's disk, causing the differential gear to revolve in the clockwise direction; and if the magnet under test is stronger than the standard, it will damp its disk down to a lower speed than that of the upper disk, causing the differential gear to revolve in counter-clockwise direction.

In the actual construction of the apparatus, the standard meter runs on constant load, but the load on the lower meter is arranged to be varied by an adjustable calibrated rheostat, by means of which its speed can be made equal, for any strength of magnet enclosing its disk, to the speed of the standard meter; resistance being cut in to compensate for a magnet weaker than standard, and cut out to compensate for a magnet stronger than the standard. The observer always notes through a window in the case the direction of revolution of the differential gear, by observing a circular scale, mounted on it, with reference to a fixed index. He then cuts resistance in or out, as may be required, by turning a hand wheel, graduated in percentages of the strength of the standard magnet, till the scale on the differential gear comes to rest. The scale reading of the hand wheel is then recorded as the strength of the magnet under test.

The magnet-measuring machine gives a record, in arbitrary units, of the strength of each magnet; the records serving not only as a guide to the acceptance or rejection of the individual magnets that have reached this stage of the process, but also to give a reading of the strength of each magnet for comparison with a second reading taken after a lapse of three months or less, and as a precaution against error due to personal equation on the part of the operator. In order to determine whether any natural aging or change takes place, following the violent artificial aging processes that have been applied up to this point, the individual records obtained for a batch of magnets are filed away with the batch for the above period.

Such magnets as are found too strong for use in meters are subjected to a fourth aging process by the use of an alternating field. Only about twenty per cent of the magnets require this treatment, which consists in passing the magnet through the core of a coil traversed by an alternating current of controlled strength. Whenever this last demagnetizing treatment is required, its use is always followed by a treatment with the demagnetizing disk; the latter weakening the "drag" of the magnet still further, probably by a rearrangement of the magnetic lines in the steel.

The magnets that pass successfully to this point in the process are sorted according to strength, ready for mounting in the various types of meters.

As showing the high quality of steel required for the making of these meter magnets, it is stated that only about two per cent of the shipments received have to be rejected, and that at the conclusion of the processes of hardening, magnetizing, and aging, above described, the magnets are strictly "glass hard," and yet are so tough that they cannot be deformed, broken or perceptibly reduced in magnetization by extremely rough usage. For example, in mounting each magnet in its brass holder, or clamp, for use in the meter, the fingers of the holder are hammered into place on the magnet (always on the side of the N-seeking pole) without altering the strength of the magnet in the slightest degree. The magnets can be subjected to heavy blows, and their jaws can be forced apart by a cold chisel through a distance eight or ten times as great as their original separation without snapping the steel, the jaws coming together again, when released, with a very small permanent set.

[To be continued.]

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LOSSES, INDUCED VOLTS, AND AMPERES IN ARMOR AND LEAD COVER OF CABLES.[1]

BY H. W. FISHER.

PART III.

CALCULATION OF IMPEDANCE, ETC.

A graphical method may be used for determining the conditions existing when the armor or lead circuit is completed. The conditions required to be known are the reactance and resistance of the conductor and of the secondary circuit. These may have been measured or calculated.

Refer to Fig. 8. The following construction has been made: OA is parallel to the X-axis and is equal to the conductor resistance; AC is parallel to the Y-axis and is equal to the conductor reactance (this may be calculated by formulas 11 and 14); BC is equal to the reactance of the secondary circuit and can be determined by formulas 12 and 14. The circle CPB has been drawn on CB as a diameter; BG has been drawn equal to BC, the reactance of the secondary circuit, and GF equal to r, the resistance of same. BF cuts the circle CPB at the point P.

Then OP is the impedance of the conductor when the secondary circuit is closed, OC being the impedance when this circuit is open. As r is varied, the locus of the point P is on the semicircle CPB, and it may readily be seen that the impedance may be greater with the sheath connected than when it is open. The effective resistance is $OA + BH$, the effective reactance $AB + HP$. BF is the impedance of the secondary circuit; the current induced in it, per ampere in conductor (see formula 7), is equal to $CB + BF$. If there be another secondary circuit beneath, whose reactance is CI, the voltage induced on it is equal to IP. If the current coil of a wattmeter be in series with the main conductor and the volt coil be connected to the terminals of this circuit, the reading will be the watts lost in the closed secondary circuit.

In the case of an iron-armored cable, where there is considerable loss, it is impossible to calculate accurately the conditions, but the following method has given results in fairly close agreement with actual tests. The open-circuit conditions must have been measured, or calculated from observations on another cable.

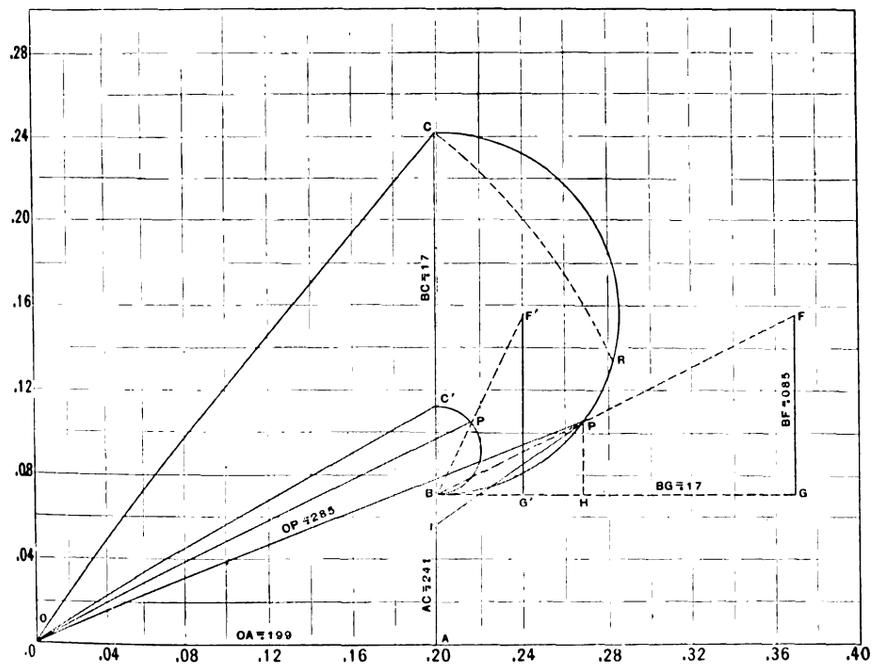

FIG. 8.—GRAPHICAL DETERMINATION OF IMPEDANCE.

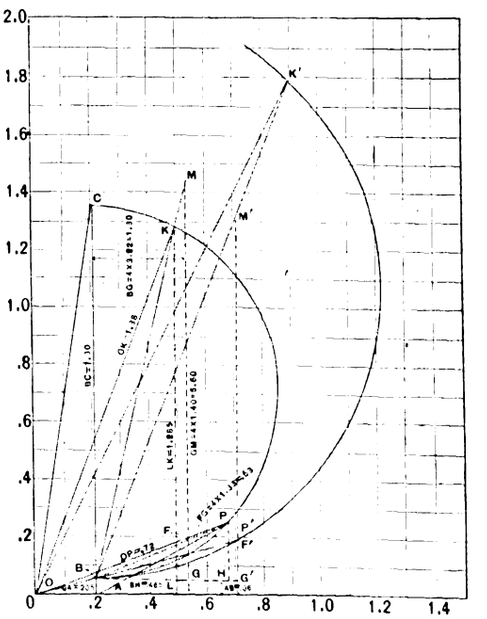

FIG. 9.—DIAGRAM FOR IRON-ARMORED CABLE.

The construction is as follows: Refer to Fig. 9. OA = conductor resistance; AB = reactance between sheath and conductor, and may be calculated by formulas 13 and 14; OL = loss when secondary circuit is open; OK = impedance. Circle BKC is constructed, its center being on BC. $BG = BC$. In the diagram as constructed it was necessary to draw BG, GM and BM, one-fourth size, on account of the great length of GM. This affects no other lines or points. GM is perpendicular to OL. Draw BKM, cutting MG in M. Then OK is the impedance which would have resulted had there been an imaginary completed circuit of reactance BC and resistance GM surrounding the conductor so as to have a reactance between itself and the conductor = AB. This assumption is actually far from true. A large part of the loss, probably one-half or more in the tape-armored cable, is due to hysteresis. The excuse for the method is that errors in calculation based on it are less than the variations would be between two cables made to the same specifications. For the remainder of the calculation, consider this imaginary circuit in parallel with the sheath when the latter is connected. The point P may be located as before, OP being the impedance of the cable. The voltage induced in the lead on open circuit is BK. The current is determined as before, except that the whole current ($= CB/CM$) may be supposed to divide between the two in accordance with the resistances.

It may be noted that the accuracy of any method for calculation of the performance of an iron-armored cable is somewhat reduced, due to the fact that the reactance voltage caused by the iron is far from a sine wave.

In demonstrating the correctness of the construction for the cable without iron the following facts[1] are made use of: (1) The effect of current flowing in a tube, on the magnetic field, is the same at any point outside the tube as if the current in the tube were concentrated in a conductor at the axis of the tube

[1] Abstract of a paper presented before the annual convention of the American Institute of Electrical Engineers, Frontenac, N. Y., June 29, 1909.

[1] See "A Treatise on Electricity and Magnetism," by J. Clerk Maxwell. Third edition, Vol. II, page 316.

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(2) The effect on the field at any point inside the tube is zero.

From (1) it follows that the electromotive-force induced in the tube is the same, whether the current be flowing in the tube or in a conductor at the axis of the tube.

The effect of non-uniform distribution of current in the tube when the cables are near each other has been neglected. This effect should be of about the same magnitude as that of the eddy currents, produced by current in the conductor when the necessary circuit is open. This latter is, in general, not of great importance.

Let Current in conductor $= I$.
$a + b$ = reactance of conductor.
a = reactance of tube (lead or armor).
aI = volts induced in tube when tube circuit is open.
r = resistance of tube.
r_1 = resistance of conductor.
C = current induced in tube.
C_1 = component of C in phase with I.
C_2 = component of C at right angles to I.
V = voltage.
V_1 = voltage in phase with I.
V_2 = voltage at right angles to I.
(V, V_1 and V_2 induced by the flux which cuts both the tube and the conductor, when the tube circuit is completed.)

Now, since the induced voltage is at right angles to the current producing it and is equal to the product of that current by the reactance of the circuit,

$$V_1 = C_2 \times a \quad \ldots\ldots (1)$$
$$V_2 = (I - C_1)\, A \quad \ldots\ldots (2)$$

Then since V_1 and V_2 are the voltages induced in the tube by the combined action of the current in the conductor and in the tube itself, the current induced is equal to the voltage divided by the resistance, and is in phase with the voltage producing it, or

$$C_1 = V_1/r \quad \ldots\ldots (3)$$
$$C_2 = V_2/r \quad \ldots\ldots (4)$$

From equations (1), (2), (3), and (4), we obtain—

$$C_1 = \frac{a^2}{r^2 + a^2} I \quad \ldots\ldots (5)$$

$$C_2 = \frac{a\,r}{r^2 + a^2} I \quad \ldots\ldots (6)$$

$$C = \frac{a}{r^2 + a^2} I \quad \ldots\ldots (7)$$

$$V_1 = \frac{a^2\,r}{r^2 + a^2} I \quad \ldots\ldots (8)$$

$$V_2 = \frac{a\,r^2}{r^2 + a^2} I \quad \ldots\ldots (9)$$

$$\frac{V_1}{V_2} = \frac{a}{r} \quad \ldots\ldots (10)$$

If I is put equal to 1, these values are in ohms, volts and amperes. The impedance of the conductor equals the vector sum of V_1, V_2, b and r.

If r be eliminated between equations (8) and (9), we get an equation between V_1 and V_2, which is that of a circle constructed on the line "a" as a diameter. This, with equation (10), confirms the correctness of the graphical construction. It is possible to calculate the conditions existing when two secondary circuits of different reactances and resistance are connected in parallel, but the formula is very complicated, and is of the fourth degree. It is much simpler, and generally would be very closely approximate to assume a single circuit having a reactance of about the average of the two. This will always give values of total loss somewhat lower than the true loss.

Having given the performance of one armored cable with the secondary circuits open, that of another of different dimensions may be easily determined nearly as closely as one of the same dimensions, provided only that the size of the armor and the method of construction be the same.

Let a_1 = diameter through center of armor of the measured cable, a_2 = same diameter on cable whose performance it is desired to calculate, at a current = C. Then the loss of apparent power in the second cable at C amperes caused by the armor is equal to a_2/a_1 times that of the first at $C\ a_1/a_2$ amperes. The loss to be used in the calculation is the total loss in the cable less the conductor C^2r. To get the impedance due to the armor, subtract from the total impedance (vectorially) the conductor resistance and the reactance calculated for cables of the same size at the same separation without armor. More accurately, that part of the reactance which is produced by the space that would be occupied by the armor should not be subtracted. Neglecting this will make an error of about five per cent in the reactance.

The formulas used to obtain calculated results given in this paper are as follows:

Inductance of a cable:

$$L = l\,\frac{15.24 + 140.5 \log_{10} d/r}{10^9} \quad (11)$$

where l = length of cable in feet; d = distance between centers; r = radius of conductor.

For tubes:

$$\text{Inductance} = l\,\frac{140.5 \log_{10} d/r}{10^9} = L \quad (12)$$

This is strictly true only for an infinitely thin tube.

Inductance of a circuit consisting of a tube and solid conductor =

$$L = l\,\frac{15.24 + 140.5 \log r_1/r}{10^9} \quad \ldots (13)$$

r_1 being the radius of the tube.

$$\text{Reactance} = 2\,\pi\,f\,L \quad \ldots\ldots (14)$$

where f = the frequency.

In Fig. 8 the construction resulting in the determination of the impedance OP was for the 1/0 copper-armored cable, distance between centers being eighteen inches. The impedance OP' is that of the same cable, the distance between centers being one-and-five-tenths inches. Both of these impedances were determined with the armor short-circuited at each end of the cable.

The construction of Fig. 9 is based on a conductor current of 300 amperes and twenty-four inches between centers of the steel-tape-armored cable. The incompleted semicircle $BF'K'$ is the construction for 156 amperes. It is interesting to note the relative increase of reactance compared with ohmic resistance, which is much greater in Fig. 9 than in Fig. 8.

Massachusetts Electric Light Association.

At the twentieth annual meeting of the Massachusetts Electric Light Association, held at the Tedesco, Swampscott, Mass., on Thursday, July 29, the officers of the association were re-elected, as follows:

President, C. L. Edgar, Boston.

Vice-presidents, A. B. R. Sprague, Worcester; C. F. Pritchard, Lynn.

Secretary, Everett W. Burdette, Boston.

The twentieth anniversary of the association was made the occasion of a special paper by Secretary Burdette, who reviewed the history of the association and the influence which it had exerted in behalf of the central-station companies of Massachusetts. Forty-seven members, representing forty-two companies, were present at the first meeting, which was held in Boston in 1889.

The report of the executive committee indicated that municipal ownership was becoming more and more a dead issue, and legislation hostile to Massachusetts central stations had been entirely absent during the past year.

Prof. Elihu Thomson was the guest of honor at the annual dinner, and in response to President Edgar, delivered a brief address devoted to the great advance which was possible through the reduction of cost to small consumers.

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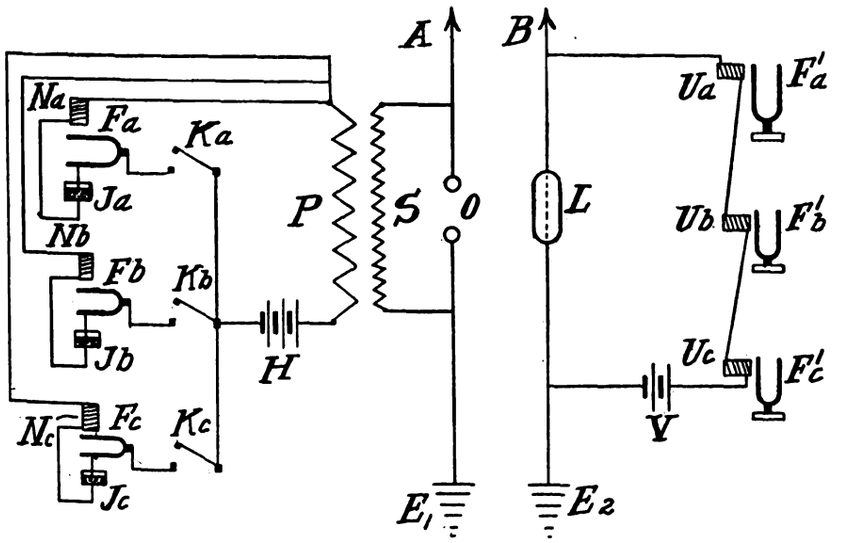
Acoustic Method of Tuning for Wireless Telegraphy.

In a system for selective wireless communication, invented by John H. Cuntz, of Hoboken, N. J., and recently patented, instead of the usual electrical tuning, the syntonization is accomplished by mechanical and acoustic methods.

When the customary transmitting apparatus of a wireless-telegraph system is set in operation, electromagnetic waves, with frequencies of the order of, say, 1,000,000 per second, are propagated. These waves, being started by the oscillatory discharge at a spark gap, decay rapidly, so that the number of waves due to a single original impulse is comparatively small, and the period of activity of these waves is only a small fraction of a second. If these impulses, instead of being given in a haphazard way, are regularly timed at definite intervals, groups of high-frequency electromagntic waves will be propagated, and by means of suitable transmitting apparatus, these wave groups may be made to have any convenient periodicity, or frequency, of a lower order than the electromagnetic-wave frequency. For instance, these groups may be given the frequency of audible tones, of the order, say, of 100 or 1,000 per second, each group being composed of a comparatively few electromagnetic waves of the order of 1,000,000 per second.

Now, if at the receiving station there be placed a suitable acoustic and mechanical receiving apparatus which will respond only to wave groups with frequencies of a definite pitch, such apparatus will select and receive messages from only those transmitting stations which send out wave groups of this same frequency, and will not be affected by any others.

One of the methods that Mr. Cuntz has devised for carrying this out is illustrated in the accompanying diagram, the left-hand side of which shows a transmitting equipment and the right-hand side a receiving equipment, each containing a number of corresponding selective devices. A and B are antennæ grounded, respectively, at E_1 and E_2. P and S are the primary and secondary of an induction coil, the secondary of which is connected across the spark gap 0. The primary is connected through a source of current H with a number of electromagnetically actuated tuning forks, F_a, F_b, F_c, each having in series with it a key, electromagnet and mercury cup designated



ACOUSTIC METHOD OF TUNING FOR WIRELESS TELEGRAPHY.

for the upper fork by K_a, N_a, and J_a, respectively, and by corresponding letters for the other forks.

Connected across the sensitive receiving device L at the right side of the diagram is a set of electromagnets, V_a, V_b, and V_c, in series with a source of current V and actuating a set of tuning forks F_a', F_b', F_c', corresponding to those of the transmitting apparatus.

In operation each tuning fork, when it is actuated by its electromagnet, makes and breaks its circuit by mechanical contact with solid contacts or, preferably, by means of a small rod or needle point dipping into a mercury cup. Since the forks in the transmitting apparatus are in separate parallel circuits, each one is in vibration only while signals are actually being sent. The different circuits can be operated either separately or simultaneously, without interfering with each other. When they operate simultaneously, they can send out signals to different receiving stations, or they can send a combined signal, composed of a number of tones, or a chord, or even a combination of sounds which will form articulate speech, to one or more receiving stations.

In the receiving apparatus the current in the local circuit changes every time a wave group strikes the responding device. A tuning fork is placed in proximity to the solenoid or electromagnet, so that when the magnetic field of the latter is changed at regular intervals corresponding to the natural rate of vibration of the tuning fork, the latter will begin to vibrate and sound its characteristic note. There may be as many tuning forks, of various pitches, at a receiving station as is desired, each being of the same pitch as a corresponding tuning fork at a transmitting station. Each tuning fork is controlled by an electromagnet or solenoid, and these electromagnets may be in series with each other, or they may be in parallel. These tuning forks can operate singly or simultaneously. When they operate simultaneously, they can receive signals from different transmitting stations at the same time, or they can receive a combined signal, composed of a number of tones, or a chord, or even a combination of sounds which will form articulate speech, from one or more transmitting stations.

The apparatus and method described are merely typical of the general principles of Mr. Cuntz's invention. Among some of the modifications are the substitution of other means for either mechanically or electrically interrupting the transmitting circuit and of various devices for receiving the Hertzian wave impulses. In all cases, however, there is included in both the transmitting and receiving circuits a set of corresponding tuning forks or equivalent devices for separating out particular wave groups of the wireless impulses. There can also be combined with it means for graphically recording the impulses sent out and received.

Interurbans Carrying Mail.

Most of the interurban electric-railway systems are making arrangements to carry the United States mails. The compensation is low, but the distribution of mail in this way with its prompt and more frequent delivery is popular in the rural communities.

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Safe Use of Electricity in Coal Mining.[1]

Owing to recent disastrous explosions in coal mines, many of which were attributed to dust produced by motor-driven machines, some interesting statistics were compiled of the amount of dust produced by various mining methods. One set of figures, from results obtained at the mines of the Washington Coal and Coke Company, Connellsville, Pa., gave 1.80 pounds of dust (screened through a forty-mesh screen) per square foot undercut, for hand mining; 4.58 pounds for puncher machines; 1.48 pounds for chain machines with pick-pointed bits. Results from two other mines gave 6.18 pounds for the puncher machine, and 2.43 pounds (2.51 pounds at one trial) for the chain machine with standard chisel bits. With regard to the danger of igniting fine dust by electricity, it was pointed out that electricity in itself will, of course, not explode, and will not arc except when a circuit is broken. In a mine generating explosive gas in large quantities it is advisable to keep all electrical wires, and, so far as possible, electrical apparatus, on the intake air, for obvious reasons.

Discussing the danger of high-potential electric currents, the author considered that the higher voltages, as of 500 volts, to which a large number of plants have in recent years been changed, usually from 250 volts, were far more dangerous than the lower voltage. Proper methods of resuscitation of persons who were shocked by the electric current would prevent many fatalities, and instances were given in support of this contention. Particulars were given of the efforts being made in Pennsylvania to draft a new mine law to diminish the possibility of electric shock. A committee of operators and electrical manufacturers was appointed to confer with the commission which was appointed by the governor to draft such a law.

Returning again to the question of safety of the men, it has been considered useless for some years past to insulate electric wires underground, since there seemed to be no commercial insulation which was of value after a few years' use, or in some cases, a few months' use. It has, therefore, been preferred to use bare wires, even for machine lines in room headings, and depend on the miners' intelligence to recognize the danger of a bare wire. In this connection it is interesting to note that at the testing station of the Geological Survey in Pittsburg the electrical department is making some experiments on various insulations subjected to extreme mining conditions. Cables with rubber and other insulations are submerged in acid mine water, readings taken of their initial insulation resistance, and these readings repeated at frequent intervals. The weakness of the insulation will be shown by the gradual or sometimes sudden drop in these values.

An insulation called varnished cloth or varnished cambric, tested at this station, has been used by the author under mine conditions, and has been subjected to severe service for over two years, without any sign of trouble. This does not seem to be affected by acid and is perfectly moistureproof. The cost of this insulation will, it is believed, be considerably less than the best rubber, and if the results obtained at the testing laboratory measure up to those found in practice, the author believes it will be only a short time until it can be confidently recommended that all machine wires carrying 500 volts or over be insulated, where carried on room headings.

Bare wires can, of course, be used where the wires are carried through air courses or off the traveled roads. So far as the trolley is concerned, it is out of the question to consider protecting this for its entire length. At all places, such as partings, turnouts, and where the traveling roads cross the haulage road, the trolley wire can be protected by means of a trough or a single board projecting below the level of the trolley and firmly supported from the roof. In a large number of mines, all branches from the main trolley, on which but one locomotive works at a time, are sectionalized by the use of automatic trolley switches, which cut the current off the branch except when the locomotive is working thereon.

It has been found by experiment that in many mines where the rails are in contact with the earth and the headings are wet with acid moisture, part of the return current, amounting in some cases to sixty per cent, is carried by the earth. Electrolysis in the pipes parallel and near to the track is caused by the current where it enters and leaves these pipes. In flowing through moist earth from the pipe to the rail it will carry part of the iron of which the pipe is composed into the earth toward the rail. This is prevented by using copper connections for the current from rail to pipe and back.

The use of electric lights in mines is strongly recommended, particularly at partings, turnouts, and all points where men must travel along or across the rails. It is advisable to have more than one circuit where lights are used as danger signals, to provide for burnouts. In some mines red lamps are installed at the danger points and show only when the current is on the wires at the parting.

In all cases where large tracts of coal are to be developed, the author recommends the use of 275 volts potential, using high-tension alternating-current transmission from the central plant, and locating substations as close to the work as possible. Where the cover is excessive, these substations can be located underground at the center of distribution. Wherever the cover is light, it would usually be preferable to have the substations overhead and the direct-current cables taken into the mine through boreholes.

Many mining men are possibly familiar with plants on the three-wire system. In these plants the current is generated by standard railway machines at 550 to 600 volts. The neutral tap is taken off these generators by means of proper connections to the windings from collector rings, and these taps, by means of balancing coils, furnish a neutral lead, between which and either main lead, the potential is one-half that of the generator. Apparatus in the mine is operated between either main lead and the rail, which is the neutral, and the maximum potential which can be received will be 300 volts. Stationary apparatus, such as fan motors, car hauls, large pumps, etc., can, if desired, be operated on full potential, or, if a wide speed range is desired, motors may be operated first on 300 and later on 600 volts.

The wiring in the mine is so sectionalized that an approximate balance of load is maintained between the two sides of the system, and in the case of a perfect balance, the system is equivalent to a metallic-circuit 600-volt transmission, using twice the copper as a grounded return system, or one-half the copper as compared with a 300-volt grounded system.

Where there are a large number of small units operated, such as locomotives, machines and pumps, a close balance may be maintained, and the efficiency of the transmission depends on the balancing, since with total unbalance it will be a straight 300-volt transmission. In actual operation at Ellsworth, Pa., and Minden, W. Va., the average balance is held within fifteen per cent, with an occasional unbalance of twenty-five to thirty per cent.

[1] Abstract of a paper by George R. Wood, presented at the summer meeting of the Coal Mining Institute of America, at Punxsutawney, Pa., June 29.

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Convention of the Society of Automobile Engineers; Electrical Papers.

The Society of Automobile Engineers held its summer convention in Chicago on August 5, 6 and 7 last. The first day was devoted to hill-climbing contests at Algonquin, Ill., and a gratifying feature to electrical men was the record of the Babcock and the Columbus electric vehicles. The former car won the electric event, but both cars surpassed the performances of some of the gasoline cars.

Among the papers presented there were several of interest to electrical men.

INCREASING WEIGHT EFFICIENCY OF STORAGE BATTERIES.

Dr. Edward Sokal, consulting chemical engineer, Chicago, read a paper entitled "Possible Increases of the Weight Efficiency of Storage Batteries." The author discussed the attempts to increase the output per unit of weight, and said that in his opinion improvement in this direction would probably not be attained by substituting different chemical materials than those of the lead battery. He criticized Edison's battery and pointed out that the result of eleven watt-hours per pound of element attained in this battery can be exceeded by the lead storage battery. Improvement in storage batteries since the days of Planté and Faure had been mainly along the lines of manufacturing and operating, and most electrochemists were somewhat skeptical in their attitude toward storage batteries of different type to the lead cell.

The output per unit weight of the lead storage battery varies with the design. Standard American cells usually give from nine to twelve watt-hours per pound of total element, while German cells for electric-vehicle use have an output of up to seventeen watt-hours per pound, though this latter figure is obtained by the use of exceedingly thin plates which are not considered advisable under the conditions which obtain in this country. The porosity and thickness of the plates both have an appreciable effect on the specific output. It is impossible to combine all advantages in one type of cell, and each manufacturer's practice must necessarily be in the nature of a compromise.

Doctor Sokal proceeded to tell of a method he is trying out of increasing the output for a given weight. Instead of using one more negative plate than positive, as is done at present, he recommended the use of one more positive plate than negative, as although the specific output of the negative electrode is greater than that of the positive, it is almost always the positive plate that fails first. He has constructed elements in this manner showing ten to fifteen per cent increase in specific output, but the practicability of his suggestion might be affected by further experiments.

The author then showed by detailed explanations that lack of electrolyte of proper concentration in the pores of the active material is the principal cause of the low output per unit weight of the lead cell. He told of his own experiments which he is conducting at present toward remedying this defect, by promoting the flow of the electrolyte through the pores by pressure or similar means. By forcing circulation through the walls of specially constructed shallow or bottle-shaped electrodes he had succeeded in increasing the specific output by from fifty to 100 per cent.

OPERATION AND CARE OF STORAGE BATTERIES.

Another paper on storage batteries was one entitled "Some Points in the Operation and Care of Vehicle Batteries," by H. M. Beck, of the Chicago office of the Electric Storage Battery Company, of Philadelphia. The author gave the following practical suggestions on the care of storage batteries: (1) The battery must be charged to a proper degree, not overcharged. (2) Short-circuits must be avoided. (3) The plates must be kept covered with electrolyte. (4) Only pure water must be used for replacing evaporation. With regard to charging: (1) On regular charges the rates must be kept as low as practicable and the supply promptly cut off. When in doubt cut off too soon rather than run too long. (2) Overcharges must be given at stated intervals and continued to a complete maximum. When in doubt run too long rather than cut off too soon.

Lack of "capacity" from batteries after washing is usually due to undercharging following the cleaning. It is a common mistake, and one to be deplored, that cells are frequently supplied with electrolyte instead of water to replace evaporation losses.

The author concluded by some excellent instructions on the methods to be employed in restoring a "low" battery to its proper condition. He said also that good results had been obtained with the mercury ampere-hour meter to show the amount that has been actually charged and also discharged in a vehicle's storage battery.

DISCUSSION ON STORAGE BATTERIES.

The two papers on storage batteries were discussed together. Ernest Lunn, of the Commonwealth Edison Company, Chicago, said, in commending Doctor Sokal's paper, that some of that gentleman's recommendations and predictions may be adopted in the near future. The mercury ampere-hour meter mentioned by Mr. Beck, he said, permitted the driver of an electric vehicle to ascertain the remaining battery charge, and that it enabled the private owner to keep a check on the amount of charge he is paying for at public garages.

A. Churchward, of the General Electric Company, New York, deprecated Doctor Sokal's criticism of the Edison battery, and said that his seven years' experience with one of these cells showed a discharge of considerably more than the eleven watt-hours per pound of element, given by Doctor Sokal. The new Edison battery, he said, gave over sixteen watt-hours per pound of element.

F. J. Newman, of the Woods Motor Vehicle Company, Chicago, remarked that want of proper axle alinement was a frequent cause of electric-vehicle troubles. The mercury ampere-hour meter, he said, was an old device and occurred in two types, one recording on discharge, and the other having the discharge travel at a faster rate than the charge and being compensated for. These meters are liable to be tampered with and are really unnecessary in commercial service, a hydrometer being quite sufficient for the purpose. The readings of the meter will be misleading any way, if the batteries are not in proper condition.

Wilton Bentley, of the Universal Electric Storage Battery Company, Chicago, suggested that ampere-hour meters might be locked to prevent tampering. He believed in their usefulness.

Scott Van Etten, Elkhart, Ind., gave as his opinion that the usefulness of the hydrometer test was interfered with by the formation of white sulphate of lead—among other sulphates—and that this gave a false specific gravity.

H. M. Beck pointed out that the specific-gravity test must show if the battery falls behind, and for this purpose the specific-gravity test was superior to the ampere-hour test.

J. F. Firestone, of the Columbus Buggy Company, Columbus, Ohio, said that shortage of water in the batteries was nine times out of ten the cause of the troubles encountered with electric vehicles.

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Another trouble was lack of air in the tires.

F. J. Newman differed with Mr. Van Etten's remarks and explained the chemical action of the storage battery to substantiate his contention that there can be no false specific gravity. He said that the difference in sulphates was probably caused by difference in crystallization. He advised the use of a pilot cell.

Ernest Lunn said that in his six months' experience on fifteen vehicles with the ampere-hour meter he had had no troubles with it and no misleading results. The device was useful in that by its use it prevented vehicles from being stalled for lack of energy. The specific-gravity test, however, must not be overlooked.

Several other speakers gave their views on the subject.

Mr. Beck closed the discussion. He said that the ampere-hour meter must be considered as a supplementary device. The specific-gravity test gives practically the same information, but the meter is very convenient.

THE ELECTRIC CRADLE DYNAMOMETER.

A paper on "The Electric Cradle Dynamometer," by H. S. Baldwin, was read by Alexander Churchward in the unavoidable absence of the author. The electric cradle dynamometer was described more especially from the viewpoint of its adaptability in testing gasoline engines. The dynamometer is of the absorption type and an electric generator is used for loading the gasoline engine which is being tested. The energy is dissipated in a rheostat of suitable design placed at a convenient distance from the dynamometer so that the temperature rise of the latter is only moderate.

Will Pick Up Old Cable.

The cable-laying steamship Colonia, of the Telegraph Construction Maintenance Company, of London, which has completed laying 1,307 miles of cable for the Commercial Cable Company from St. Johns, N. F., to New York, is to try to pick up 900 miles of cable that is no longer in use.

According to Frank Petley, the engineer, the shore end of the cable weighs about sixteen tons to the mile, while the deep-sea cable, but an inch in diameter, weighs one-eighth as much. In the sweep of the circle made from St. Johns to New York to avoid shoals the cable lies for more than 150 miles in 3,000 fathoms, or 18,000 feet, of water.

Association of Edison Illuminating Companies—Dinner to Edison.

The annual convention of the Association of Edison Illuminating Companies will be held at Briarcliff, N. Y., August 31 to September 3, inclusive, under the presidency of W. W. Freeman, of Brooklyn, N. Y.

One of the distinguishing features of this, the thirtieth, convention will be a notable dinner given in honor of Mr. and Mrs. Thomas A. Edison on Thursday evening, September 2. On this occasion the association will entertain the guests of honor, who will meet the members of the association and guests composed mainly of those who were pioneers in the Edison electric-lighting industry in the early eighties.

The committee in charge of the arrangements for the Edison dinner consists of Samuel Insull, of Chicago, chairman; Charles L. Edgar, of Boston, and John W. Lieb, Jr., of New York.

The convention already promises to be one of the largest ever held by the association, and it is an interesting coincidence that it is both the thirtieth convention and the thirtieth anniversary of the commercial use of the Edison incandescent lamp of 1879.

Electricity for Mexican Mines.

The most important mining district in Mexico is soon to be electrified by a Canadian company, which will operate almost at the very border line of the United States. The organization is called the Mexican Northern Power Company, and has secured the rights to a perpetual concession granted by the government of Mexico for the development of the water-power on the Conchos River, in the state of Chihuahua, Northern Mexico, and its utilization, to generate electrical energy for the supply of cities and towns of that state and its mining districts. The district this company will serve is one of the largest and oldest of the mining districts of Mexico, and lies within fifty miles of the plant.

It is proposed to build all of the necessary dams and transmission lines for 25,000 horsepower, but to install initially machinery, hydraulic and electrical, for 15,000 horsepower only. The cost of construction for this is estimated at about $1,500,000 gold, and to increase to 25,000 horsepower will involve an additional outlay of $500,000. The selling price for the electrical energy is figured at $75 per annual horsepower on the peak load.

London's Subway System.

London is underrun by a network of subways or tubes. There is the Metropolitan line (the old Underground), seventy-one miles in length; the Metropolitan District line, twenty-eight miles in length; the Great Northern and Piccadilly line, nine-and-one-fourth miles in length, which is a double tunnel worked by electric motor power; the Baker Street and Waterloo line, nine-and-one-half miles in length, which was originally one of Whitaker Wright's enterprises; the Charing Cross, Euston and Hampstead line, about eight miles in length; the Central London line, six-and-one-half miles in length, which consists of two separate parallel tunnels worked by electric motor power on the multiple-unit system; the Waterloo and City line, about two miles in length; the Great Northern and City line, from Finsbury Park to Moorgate Street, about three-and-one-half miles in length; and the City and South London line, from Clapham Common to the north end of City Road, Islington, with an authorized mileage of twelve-and-one-half miles, something over half of which is in operation.

These lines cross and intersect at various points, making it possible by transfers to go almost anywhere underground. The total mileage—constructed, authorized and projected—is 145½ miles, and the total authorized capital of the nine existing companies is £61,553,996.

Refinancing of the New Orleans Railway and Light Company.

Directors of the New Orleans Railway and Light Company have settled the financing of their corporation on the following terms: They have sold to Bertron, Griscom & Jenks, of New York, and their Parisian associates, the first $5,000,000 of the new $50,000,000 bonds recently authorized by the stockholders. Under the terms of the agreement, Bertron, Griscom & Jenks are to take $5,000,000 of the new $50,000,000 bonds, $30,000,000 of which are to be placed in escrow to protect the company's underlying securities. They are to take these at the rate of $1,000,000 per year for three years, after buying in the first year $2,000,000, the proceeds of which will be used to retire the outstanding collateral trust notes of the company.

As a bonus for financing the proposition the New York and Parisian bankers are given about 26,000 of the company's preferred and common stock at forty and fifteen, respectively.

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The New Telefunken System.

From reports just received, remarkable results are being obtained abroad with the Telefunken Company's new "singing" or "quenched-spark" system, recently described by Count Arco[1] in his paper before the Verband Deutscher Elektrotechniker (German Electrotechnical Society) at Cologne, Germany.

For instance, during some of the preliminary tests following upon the completion of the twenty-kilowatt station at Pola, on the Adriatic—which is one of three similar stations now building for the Austrian Government—it was found that the signals were so strong at both the Norddeich (on the North Sea coast) and Copenhagen stations that perfect coherer reception—*i. e.*, signals printed on tape—was possible at both stations. It was also possible to copy everything in Berlin with an ordinary portable set with a twenty-five-metre mast.

Even better results were obtained with an eight-kilowatt set installed on the Austrian battleship *Erzherzog Karl*. The tests with this set were made with the vessel at anchor at Pola, and in this case everything sent was copied at Kiel. Very interesting results showing the immunity from atmospheric interference with this system were also obtained with three vessels of the Black Sea fleet. These vessels were equipped with two-kilowatt sets, and while one vessel remained at anchor at Sebastopol the other two steamed out to sea. The transmitters of all three sets were adjusted for the same wave length, but for different tones, and although atmospheric interference, which is always troublesome on the Black Sea, was particularly strong, perfect communication, both ways, was maintained up to a distance of 600 kilometres.

It was also possible to receive two messages simultaneously from the moving vessels on the stationary one at Sebastopol and over the entire range and on one and the same receiver and detector, but with two differently adjusted telephone receivers. In this connection it is also interesting to note the remarkable fact that the signals from an old type fifteen-kilowatt station near Sebastopol, which was also used in this test, became absolutely unintelligible on board the moving vessels on account of atmospheric interference long before the extreme effective range of the new type two-kilowatt sets had been reached.

[1] See the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, May 29, 1909, p. 986.

St. Paul Company Backs Minneapolis Enterprise.

The Westinghouse interests of Pittsburg are, it is said, about to enter into the electric lighting field in Minneapolis. This is said to be in connection with the application of the Northern Heating and Electric Company, of St. Paul, for a Minneapolis franchise.

The Northern Heating and Electric Company, whose application for a Minneapolis franchise has been before the City Council, is backed financially, it is said, by the Lockharts, capitalists, of Pittsburg, who have many large investments, and who are its principal owners. This is confirmed by the St. Paul officers of the company.

Figures today show that the company has a stock issue of something more than $885,000, representing actual cash invested in the business in St. Paul. In the statement of December 31, 1908, the item of $483,626.88 appeared under the heading "obligations and unpaid bills." The company actually owes today, it is said, only $5,700, representing unpaid current monthly bills.

The Northern Heating and Electric Company has a twenty-five-year franchise. Its officers argue that this is a moderate term, considering that it would take a number of years to become fully equipped. They speak of plans that would mean the spending of much money and would give the company an investment in Minneapolis that within two or three years would equal or exceed that in St. Paul.

Telephones for Dispatching.

There are 250 miles of the Michigan Central equipped with telephones for train dispatching, and 200 miles more will be so equipped, making 1,000 miles of the New York Central system operated by telephone.

The Northern Pacific has installed telephone service on 470 miles and will install 250 more immediately.

The Norfolk & Western has arranged to equip its entire main line, 710 miles, with telephones.

These are some of the latest cases of this tendency in train dispatching.

New Penny for Telephone Slot.

It has been discovered in Washington, D. C., that the new Lincoln penny is five times as valuable, in one respect at least, as the old Indian-head cent. It will sometimes answer the place of a five-cent piece when making a telephone call.

Discuss Telephone Problems.

Eighty-five district managers and managers of the commercial department of the New England Telephone and Telegraph Company held their first annual convention at the Hotel Somerset, Boston, last week. L. P. Lanthier, of Boston, called the meeting to order.

The convention was held with the idea of giving the managers, scattered as they are through the four northern New England States, a chance to become better acquainted and of promoting a hearty esprit de corps. In this territory there are more than 320,000 subscribers, and the eighty-five managers at the meeting represented direct relations with the public in 261 exchanges.

Among the subjects given special attention were "Public Relations," "Municipal Relations," and "The Press." New ideas of operating and service were advanced and the company hopes that these ideas will prove of great benefit to the service and to aid toward furnishing the people of New England with the best telephone service in the world.

The commercial department is that branch of the company's organization which deals directly with the public.

A dinner at the Somerset concluded a busy two days' programme.

Giving the Poor Boy a Chance.

Hitherto, in England at any rate, the "plums" in the engineering profession have been open, with few exceptions, only to those privileged few who were able to afford the luxury of a premium apprenticeship or pupilage to some prominent engineer or in a large engineering establishment. Premiums have invariably ruled high, from hundreds to thousands of dollars, and the poor boy consequently had no chance to compete on anything like equal terms with the rich man's son.

It is gratifying then to be able to record the commendatory attitude of the authorities of the towns of Heston and Isleworth, suburbs of London, England, which places the matter of appointing apprentices on a strictly competitive basis. In future, in place of the departmental heads being allowed to take premium pupils, the vacancies as they occur will be put up for competition among those boys who at the elementary schools secured a scholarship, and have completed their course at the secondary school. This applies to the electricity undertaking and other departments of the Council.

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Electrical Workers Petition for Safeguards.

The electric workers of South Bend, Ind., have filed a petition with the City Council asking for the betterment of electric construction and for the safer protection for the line men. The petitioners ask that all high-tension wires be placed on cross-arms for high and low voltage; that high-tension wires be placed on yellow cross-arms; primary and arc light wires on black cross-arms, and low-voltage wires, such as telephone, telegraph, police and fire alarm on red cross-arms.

When high and low voltage wires are on the same poles the petitioners ask that a clearance of six feet be made, and that all cross leads have a clearance of four feet with proper guards. High-voltage wires should be placed on the tops of the poles and no street-car line should carry more than a 1,000 voltage on their wires. In support of their petition the workers cite a number of fatal accidents where local electric workers had been electrocuted and nothing done to make conditions less hazardous. S.

7,500 Lights on One Sign.

Seven thousand five hundred electric lights on one sign is the record-breaking contribution which the firm of Colgate & Company, of New York, will make as its share of the Hudson-Fulton celebration. The Metropolitan Engineering Company has submitted a proposition for increasing the size of the big sign which the company now carries in Jersey City by the addition of a "life-size" electric-light reproduction of the "Half Moon."

At present the Colgate sign at the Pennsylvania ferry house, with its giant clock, is the largest device of the sort in the world, being 200 feet long by fifty feet high. The apparently moving pendulum effect is produced by a "flasher."

The electric "Half Moon" will be seventy-four feet long, with masts sixty feet high. The flags will be controlled by a flasher which will give them the effect of waving in the breezes; the same means will be employed to give the idea of dancing waves on which the old Dutch vessel rides. The present sign and the clock call for the constant use of 5,000 lights, and the addition of the "Half Moon" will bring into play 2,500 more. There will be two dates in large letters on the completed product—"1609" and "1806," the latter the year of the founding of the Colgate company.

The Röntgen-Ray Tube.

The Journal of the Röntgen Society contains an illustrated paper by J. H. Gardiner on the origin, history and development of the Röntgen-ray tube. The council of the society has recently got together a collection of tubes showing the development of the modern apparatus from the original Crookes tube used by Röntgen in 1896, and has presented it to the authorities of the South Kensington Museum. Several of the improvements illustrated by the collection are discussed by Mr. Gardiner, but the most important step taken recently appears to be the substitution of tantalum for platinum in the anti-cathode by Messrs. Siemens. The higher melting point of tantalum makes it possible to employ currents of thirty milliamperes through the tube. With a well-focused tube a current of this magnitude will melt the front surface of a tantalum anti-cathode one millimetre thick, and Mr. Gardiner advocates the use of a magnet to direct the cathode rays to a new portion of the surface.

Magnetic Detector for Slot Machines.

At the July 19 meeting of the Academy of Sciences at Paris, Messieurs Fodor and de Büty read a paper on "The Application of the Magnetic Properties of Metals to Automatic Coin Machines."

A permanent magnet is applied in a slot machine in such a manner as to permit the machine to operate only when a nickel coin is inserted. A disk of iron completely blocks the machine and prevents further use of the machine until the disk is removed. Disks or coins of other metals drop through without affecting the operating mechanism.

Twenty-third Street-Metropolitan Street Railway.

Judge Lacombe, in the United States Circuit Court, at New York, has denied the application for the Twenty-third Street Railway Company for permission to sue the Metropolitan Street Railway Company and its receivers, and the Metropolitan Trust Company, in the New York State Supreme Court, to recover $200,000 of the extended bonds, and $150,000 of its debenture bonds. In the memorandum Judge Lacombe says:

"I am satisfied that no sound objection can be maintained by any of the proposed defendants to this court's exercising plenary jurisdiction. Leave is granted to sue the receivers in this court."

Increase in Accidents on Indiana Electric Lines.

The Railroad Commission of Indiana has issued Bulletin No. 8, covering collisions and derailment of trains and casualties to persons during April, May and June, 1909. The total casualties on all electric interurban roads for years ending June 30, 1908, and June 30, 1909, are as follows:

	Deaths.		Injuries.	
	1908.	1909.	1908.	1909.
Passengers	5	13	168	213
Travelers on highways	23	14	30	54
Employes	5	6	28	43
Trespassers	12	19	3	15
Total	45	52	229	325

For the quarter ended June 30, 1909, compared with 1908, the total casualties on all interurbans were as follows:

	Fourth Quarter,	
	1908.	1909.
Deaths	11	20
Injured	64	98

The comment made is that the increase is not general over all the electric lines in the state, but is confined to a few lines.

Rock Island Orders Gasoline Cars.

The Rock Island Railway has tested the new gasoline car built by the General Electric Company, between Chicago and Bureau Junction, Ill., this week, and the officials were well pleased with the operation of the car, so much so that an order was wired to the Western Coach Manufacturing Company, of Schenectady, N. Y., for twenty-five of the cars. Some of the cars will be placed on the run between Peoria and Chillicothe, which for some time has been demanding a better service than is afforded by the regular passenger trains. The cars are fifty-five feet long and will seat forty-eight passengers. The car made a run between Joliet and Bureau Junction in two hours and ten minutes; while on the way out from Chicago the car made an average of forty-five miles an hour. V.

Live-Wire Thief Trap.

A new and successful use is being made of electricity in the discovery of wrongdoers in Indiana. Brice H. Reed, of Elkhart, connected a live wire in his boat house, and detected, without serious injury, the party who had been breaking into his boat house and carrying away fixtures and other property. And similarly the employes of a Goshen factory whose clothes had been repeatedly robbed of pocketbooks placed a live wire in a coat pocket containing a pocketbook and the suspected party was found writhing on the floor. S.

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Illuminating Engineering Society's Convention.

The third annual convention of the Illuminating Engineering Society is announced to be held at the United Engineering Societies Building, 35 West Thirty-ninth Street, New York city, on September 27, 28 and 29 next.

The following tentative programme has been prepared:

Monday Afternoon, September 27, 2 p. m.—Address of welcome, T. Commerford Martin. Response, Walton Clark. President's address, W. H. Gartley. Reports: Committee on Nomenclature and Standards, Dr. A. C. Humphreys, chairman; Committee on Division of Membership, E. L. Elliott, chairman.

Monday Evening, 8 p. m.—Reception in the Assembly Rooms, followed by a musical programme in the auditorium.

Tuesday Morning, September 28.—Review of the historical parade in connection with the Hudson-Fulton celebration.

Tuesday Evening, 8 p. m.—Session for the presentation and discussion of papers.

Wednesday Morning, September 29, 10 a. m.—Session for the presentation and discussion of papers.

Wednesday Afternoon and Evening.—Arrangements for the entertainment of the lady guests, and for a general inspection of the illumination in the evening, will be announced later by the Entertainment Committee.

PAPERS.

The list of papers to be presented, which may be altered somewhat and which will probably be added to subsequently, is as follows: "Ethics of Illuminating Engineering," by E. L. Elliott; "Some Notes on Illuminating Engineering Practice in Europe," by H. Thurston Owens; "The Importance of Illuminometry in Practical Illuminating Engineering," by Norman Macbeth; "Efficiency of Lighting Installations," by A. L. Eustice; "Shades and Reflectors," by Dr. Louis Bell; "The Design of Reflectors," by A. J. Sweet; "Diffusing Mediums," by A. J. Marshall; "Absorption and Diffusion of Various Forms of Glass Surfaces," by Basset Jones, Jr.; "Factory and Mill Lighting," by L. B. Marks; "The Photometric Laboratory of the United Gas Improvement Company," by C. O. Bond; "The New Physical Laboratory of the National Electric Lamp Association," by Dr. E. P. Hyde; "The Problem of Heterochrome Photometry," by P. S. Millar; "Description of a Demonstration Lighting Installation," by W. C. Morris; "Discussion of the Efficiency of the Moore Light," by Messrs. Hyde, Woodwell, Sharp and Millar.

EXHIBITION.

The exhibition feature of the convention, which was so successfully introduced last year, will be extended in scope during the coming convention. The committee has secured the use of the building at 5 West Thirty-ninth Street, about midway between Fifth Avenue and the Illuminating Engineering Societies Building. This building was especially fitted up and occupied for a number of years by a prominent manufacturer of lighting fixtures, and is admirably adapted to the purpose.

A historical and educational exhibit will be arranged under the direct auspices of the Exhibition Committee. In addition to this there will be exhibits by the manufacturers of the various commercial types of electric and gas lamps, accessories and fixtures. The exhibition will be especially valuable as containing a number of the latest developments in the production and utilization of light, which have not been heretofore publicly exhibited in this country.

The building will be open to the public during the entire week, from 8:30 a. m. until 11 p. m.

London County Council Trolleys.

Of all electric-railway authorities in the United Kingdom, the best purchaser just now is the London County Council, which in respect of the current year's requirements has placed orders for 200 electric tramcars, the bodies to be of the Council's standard vestibule roof-covered pattern, with British Westinghouse electrical equipments, including trolley equipments and plows for running over conduit sections, and Westinghouse brakes. The total cost of the 200 cars will be $884,750; $1,590 per set is the cost of the equipments, plus $275 per car for the complete braking appliances. Fifty additional cars are also required by the Council, but it has been thought better, in regard to these, to make them to a particular design for safe working on steep gradients. First, one car is to be built at the Council's own car works at Leytonstone, and when it has been declared by the Board of Trade to be particularly suited for the class of service named, the other forty-nine will be made to the same design, etc. A. H. B.

The Copper Situation.

The report of the Copper Producers' Association for July, made public last week, shows a reduction of 32,261,454 pounds in the stocks of copper during July, in spite of a continuance of the heavy rate of production. Sales during the month, as indicated in the figures of deliveries to domestic buyers and for export, amounted to 150,539,057 pounds, a gain of 18,981,484 pounds over June. This is comparable with a decrease in that month from May's deliveries amounting to 148,505 pounds.

The stocks of copper now in the hands of the producers at all points in the United States total 122,596,607, only 239,341 more than were reported as on hand on January 1, when the Producers' Association's statistics were first compiled.

Production, too, which was increasing steadily during the first half of the year, remained about stationary during July. In that month there were produced 118,277,603 pounds, which compares with 118,356,146 turned out during May, the last preceding month of thirty-one days. The following table shows in detail the production, deliveries, and stock in each month this year, the figures being in pounds:

	Production.	Deliveries.	Stocks.
July	118,277,603	150,539,057	122,596,607
June	116,567,493	131,557,573	154,858,061
May	118,356,146	131,706,078	169,848,141
April	113,574,292	112,656,121	183,198,073
March	117,058,661	106,063,007	182,279,902
February	103,709,817	74,546,614	173,284,248
January	112,135,200	90,362,421	144,130,045

Liquid Fuel and Marine Practice.

In the course of an interesting paper by Arthur J. Maginnis on "Marine Engineering Progress," presented at the summer meeting of the (British) Institution of Mechanical Engineers last month, the author gave some interesting figures referring to the use of liquid fuel in marine boilers.

In the case of a vessel of the size of the Lusitania the number of firemen, he said, would be reduced from 312 to twenty-seven, a saving of no less than $35,000 would be effected in the cost of fuel, wages, etc., on each round voyage between Liverpool and New York, and increased accommodation both for passengers and freight would be afforded, all by the substitution of oil for coal in firing the boilers.

If the above estimates are approximately correct and there are no accompanying disadvantages it would appear that a great revolution in the design of large ocean-going steamers will be effected.

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The Electrical Operation of Textile Factories.[1]

This paper is professedly in the main a review of the arguments, for and against the use of electrical power transmission in textile factories, which have appeared from time to time in various trade publications, engineering societies' proceedings, etc.

The claims in favor of electric driving are as follows: (1) Independence of relative locations of mill and engine houses. (2) Simplification of transmission apparatus, and consequent cost reduction and increased flexibility. (3) Less arbitrary grouping of machines. (4) Minimized chances of breakdowns causing stoppage of whole mill. (5) Sections of machinery may be stopped or run overtime without waste of power. (6) Reduction in maintenance and depreciation charges. (7) Reduction in capital cost per loom or per spindle of the whole factory when a given size is exceeded, partly consequent on the reduction in weight and cost of the buildings. (8) Records may be kept of work done in the various departments. (9) Greater steadiness of drive, thus permitting higher average speed and increased output.

This last is the most important claim of them all, and has been absolutely proved in many cases. Except where in a few special instances a variable speed is desired, an absolutely constant speed is most essential in textile machinery, where otherwise a difference in tension caused by a slight variation in speed will break the threads.

The speed of the driven machine should correspond with the speed of the prime mover. This is where the direct electric drive has the advantage over even the best rope transmission. With the latter it has been found that the speed of the machines closest to the driving point is steadier and higher than that of machines farther away. This entails a reduction in the quantity and also in the quality of the output. The author cited a case of two mills in Lancashire, under the same management, where the yarn from the electrically-driven mill of the two brought a price of about 2.5 per cent higher than that of the yarn from the mechanically-driven mill.

The increase in output of electrically-driven mills over mechanically-driven mills was estimated at about five per cent which the author showed gave an increased profit of about 0.35 per cent on the whole turnover, allowing for an increased cost in power (which personally he did not admit) and not taking into account the increase in quality of the finished product.

Admitting for the sake of argument the approximate correctness of these figures, the opponent of the electric drive would immediately advance the objection of increased capital cost caused by the installation of an electrical transmission system. From available records it may be said that taking a new spinning factory as a basis, and assuming that if electrically operated the structure would be brightened and modified to suit the altered conditions, then below 80,000 mill spindles the mechanical transmission system is the cheaper, between 80,000 and 100,000 the costs are about equal, and above 100,000 the electrical system is the cheaper. This implies the taking of the total cost of the finished factory, and would involve the use of a steam turbine or high-speed engine as the prime mover for the electrical transmission system. The steam consumption per indicated horsepower-hour would probably be slightly higher than if a slow-speed mill engine were used. The efficiency of the electrical transmission system would be about eighty-two to eighty-three per cent, or about the same as that of a well-designed modern mechanical transmission system.

In re-equipping an old factory it frequently happens that electric drive involves less capital expenditure than mechanical drive besides giving an increased efficiency. This is usually due to inconvenient arrangement of the existing buildings. Cases in the author's experience showed a reduction of twenty per cent in power consumption.

The author proceeded to show the advantages of the exhaust-steam turbine in the case of a fairly modern factory mechanically driven but electrically lighted. An additional load of about 200 horsepower to a load of 1,000 horsepower was required. The existing 1,000-horsepower, vertical, compound, condensing engine consumed about thirteen pounds of steam per indicated horsepower per hour. By combining this with an exhaust-steam turbine the main engine would generate (non-condensing, of course) about 850 indicated horsepower, and the turbine 500 horsepower, for a combined steam consumption of 10.5 pounds per indicated horsepower per hour. The increased available power over that required, involved either wholly or partially the electric driving of the factory. There were some special considerations involved, but these difficulties could be overcome without much trouble.

Regarding the advisability of taking power from an outside source, rather than generating it at the mill, it was pointed out that in Lancashire a factory of 1,500 indicated horsepower capacity can produce electrical energy at a cost of about 0.6 of a cent per kilowatt-hour, allowing for interest and depreciation. This is on the basis of a cost of $2.00 a ton for good slack coal (delivered) with a calorific value of 11,000 British thermal units per pound. It has been found generally practicable to induce fairly large companies to purchase power at about 0.8 of a cent per kilowatt-hour, the power being metered on the low-tension side of the mill switchboard before reaching the motors.

The main differences of opinion among engineers designing the lay-out of electrically-equipped mills arise over the questions of group or individual driving. The larger and the fewer the motors in a mill the smaller is the capital outlay, but at the same time the less the special advantages of electrical driving are felt. The more nearly the ideal of a motor to every machine can be approached the better the actual results, but the higher the capital outlay and generally the running cost. The author's personal feeling is in favor of the individual driving of ring spinning frames and the group driving of all other machines, but keeping the groups fairly small.

A point needing attention is the heating effect of the motors. In a ring-spinning room, for example, with a large number of small motors directly coupled to single machines, the total amount of heat given off from the motors may be sufficient to raise the room temperature considerably. It is now the best practice to build these motors with hollow frames and to bring cooling air from some external source round the frames, thus preventing the discharge of heat to the room. It should be added that in view of the great increase in electrical installations in the textile mills of this country the paper is particularly timely.

In conclusion, the author gave tables taken from practice showing the horsepower required by the different machines, and particulars as to speeds, loads, motor sizes required, etc.

[1] Abstract of a paper by Herbert W. Wilson, presented at the summer meeting of the Institution of Mechanical Engineers at Liverpool, England, July 27-30.

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Trackless Trolleys in Europe.

Consul Walter C. Hamm, at Hull, England, sends a summary (*Daily Consular Report*, August 14, 1909) of a report on trackless-trolley cars employed on the Continent. The report was made by a committee consisting of two members of the City Council of Leeds, England, and the general manager of the tramway system of that city. They visited the Continent and inspected various systems of railless-trolley traction in order to advise as to the adaptability of such means of transit to the needs of English communities. The result of their observations is summarized as follows:

The three systems considered were the Mercedes-Stoll, which is in operation in various parts of Austria, and was seen in Vienna; the Filovia, used on six or seven routes in north Italy, and seen in Milan; and the Max Schiemann, which is employed in Germany, especially in the Rhine Valley.

The vehicles operated under each of these systems in general appearance do not differ greatly from the familiar single-deck motor omnibus, except that they have some means of collecting current, such as a "fishing rod" from the roof to the electric current supply, as in the case of ordinary electric cars worked from overhead cables. But while the ordinary electric car is able to let its used-up current return to earth through the metal wheels, the rubber-tired trackless tram has to let that current return by means of a second overhead cable running parallel with the supply cable. It appears that the principal difference among the various systems occurs in regard to the arrangement for keeping the two shoes on the two cables.

Mercedes-Stoll System.—The length of the route inspected in Vienna is about one-and-one-half miles, where the road—of a switchback character, having at one stretch of about 100 yards a gradient of one in ten—is macadamized. On this route there are two pairs of cables, one for going and one for returning cars, though elsewhere one pair is made to suffice, so that when two cars meet one has to stop and remove its connection with the wires until the other has passed. The vehicles carry twelve passengers seated. The entrance is at the driver's end, and he attends to all the duties of a conductor as well as driver.

The committee was particularly struck with the smoothness and comfort of riding, the spring base of the truck being very well arranged. The brakes are ample, and sprags are fitted to prevent running backward if the car is stopped on a hill. Satisfactory assurances were received as to the operation of the cars under the severest winter conditions, though it is noticed that on this particular route the cars have been running only since last October. The motors, which are each twenty horsepower, form the hubs of the back wheels, and the current is collected from the supply cable by means of a pair of wheels running on the top of the wire—a similar pair of wheels transferring the used current to the return. A weighted pendulum slung from a frame carrying these two pairs of wheels keeps them well pressed upon the wires, and the current is conveyed to the motors, not by a "fishing rod," but by a pair of cables which allow the car to pass to any part of the road in the avoidance of other traffic. The empty car weighs two-and-one-half tons.

The cost of the chassis of the Mercedes-Stoll is about $2,750, without body. The cost of the overhead construction is about $8,500 per mile.

Filovia System.—On the Filovia system in north Italy, the cars will take thirty passengers. A framework, carrying two pairs of wheels, one pair in contact with each overhead cable, is employed to maintain the circuit. It is very similar to that used in the Mercedes-Stoll system, except that it is pressed by a "fishing rod" or "boom" against the under sides of the cables. There are two direct-current motors of ten to twelve horsepower each.

The route inspected, owned by a private company, is four-and-one-half miles long, and the fare charged is eight cents. The committee found the vehicles well able to reverse, turn around, and maneuver without the trolley being removed, and to take heavy gradients over bad and muddy roads without difficulty, vibration, or noise. The practicability of this type of railless traction considerably impressed the committee. The cost of overhead construction is estimated at only $3,756 per mile, but only wooden poles were used. They were, however, found to be quite serviceable.

Max-Schiemann System.—The Max-Schiemann system was seen working at Mulhausen. Here the contact with the pair of cables is maintained by means of a "fishing rod," carrying at its extremity a pair of sliding shoes. The overhead construction is similar to that of the systems previously described. The vehicle carries about fifteen passengers seated, and only the front wheels have rubber tires, so that there is considerable vibration and noise. The single motor drives onto the front axle, so that the steering is comparatively heavy. The design of this type, however, is stated to be undergoing radical modification. The weight of the present empty car is 6,330 pounds.

It is stated concerning all of the three systems that very few hitches have been reported, and owing to the comparative lightness of the vehicle the surface of the road suffers less than in the case of a service of cars carrying their own patrol or other engines.

The committee was much impressed with the practicability of each of the various schemes, and considers that by avoiding the heavy expenditure required in the installation of ordinary tramway traction this method of conveyance offers considerable possibilities as general feeders in suburban and interurban districts to tramway systems, and is quite capable of supplying a sufficient service for thinly populated districts on a reasonably economic basis.

An Important Meeting in the Northwest.

The Seattle section of the American Institute of Electrical Engineers and the Northwest Electric Light and Power Association will hold a joint meeting at Seattle, Wash., at the Alaska-Yukon-Pacific Exposition on September 7, 8 and 9. On the first day four papers will be read on the subjects of electric power transmission, telephone practice in the Northwest, electrical illumination and relative merits of the different types of incandescent lamps. On the second day there will be executive meetings of the Light and Power Association. The programme for the third day has not been decided upon, but it is expected that it will be made up largely of entertainment features.

The Seattle section of the Institute is one of the most progressive branches of the national organization. Regular meetings are held and the members are all alive to the possibility of assisting themselves to the parent organization by active, earnest work. The section is making a very creditable exhibition at the Exposition, and its booth is headquarters for visiting engineers engaged in all branches of electricity and allied engineering departments.

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Examination for Signal Service Electrical Assistant.

The United States Civil Service Commission announces an examination on September 29, 1909, to secure eligibles from which to make certification to fill two or more vacancies in the position of electrical assistant in the Signal Service at Large, War Department, at $1,080 per annum. The examination will consist of the subjects mentioned below, weighted as indicated:

Subjects.	Weights.
1. Practical questions in electrical science	20
2. Practical questions in construction and installation of electrical instruments.	30
3. Training and experience.....	50
Total	100

Applicants should be thoroughly familiar with the practical side of electricity as applied to telegraph, telephone and cable engineering, and also with the methods of testing and installing electrical instruments used in fire control, such as storage batteries, motor generators, power and telephone switchboards, wireless telegraph apparatus, telegraphs, electric clocks, telephones, etc.

In accordance with a recent act of Congress an applicant for this examination will be required to be examined in the state or territory in which he resides and to show in his application that he has been actually domiciled in such state or territory for at least one year previous to the examination.

This examination is open to all citizens of the United States who comply with the requirements.

Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at the principal cities for application Form 1312. No application will be accepted unless properly executed, including medical certificate, and filed with the commission at Washington prior to the hour of closing business on September 18, 1909.

Asks $20,000,000 Increase.

At a public hearing in the Engineering Society Building, 29 West Thirty-ninth Street, New York city, before the up-State Public Service Commission, the New York, Westchester, Manhattan & Boston Railway Company asked permission to make an increase of $20,000,000 in its capital stock. The company's present capital is $4,000,000.

The corporation, which is controlled by the New York, New Haven & Hartford Railroad Company interests, recently acquired all the rights, title, and interest to the New York and Port Chester Railroad, and it asked for permission to consolidate the two properties, the same to be operated under the name of the New York, Westchester & Boston Company.

Electrolytic Disinfecting; Results of the Poplar (London, Eng.) Plant.

The electrolytic disinfectant plant which was put down by the Medical Officer of Health for Poplar (London, Eng.), Dr. F. W. Alexander, has continued to give satisfaction during the third year of its working. During these three years the Public Health Department has used no other disinfectant, and Doctor Alexander says that during the past year the saving to the borough has been $4,000. Since its introduction the plant has paid for itself and for the construction of the depot, has saved more than $6,000 to the borough, and the health of the inhabitants has improved. The plant, which is producing 185 gallons of fluid in eight hours, at an average strength of 4.5 to 5.0 grammes of chlorine per litre, has been greatly improved since it was first put down. During the past year it produced and distributed to the various depots 28,280 gallons of the electrolytic fluid, the cost of the materials being $280. This figure includes: chloride of magnesium, $52; six tons of salt, $49; caustic soda, $29; 4,543 units of electricity, at three cents per unit, $142, and water, $8. Tests as to the stability of the fluid showed very satisfactory results for eighteen months or two years after it was made. As passengers are landed at Poplar by vessel from cholera-infected ports, samples of the fluid have been examined and reported upon by Doctor Klein, the eminent bacteriologist to the Local Government Board, and he states that one ounce of the electrolytic fluid to 150 ounces of water will kill the cholera germ in two-and-one-half minutes, and in the same proportion will kill the typhoid fever germ.

Excavate By Electricity.

The Utica Gas and Electric Company, of Utica, N. Y., has closed a contract with the Stanley-Morrissey Company, which has the contract for building the barge canal from the Oneida-Herkimer County line to the Oriskany road, a distance of about eight miles, to furnish electricity for the operation of two large excavators which, it is expected, will be in operation in about six weeks. The construction company has also contracted for electricity for lighting purposes, and it is intended to run the excavators night and day, three separate shifts of men being required, each working eight hours. The transmission lines run close to the right-of-way, making the power very convenient.

Vacuum Cleaners on Trains.

The Great Northern Railway has introduced another innovation on its transcontinental train between St. Paul and the Pacific Coast. Vacuum cleaning machines are now used to keep the cars spick and span. The time-honored broom has been relegated to a dark corner of the porter's locker, and its functions hereafter will be performed by portable vacuum cleaners, in charge of a skilled operator. The machine is mounted on wheels and is taken from car to car. There are special attachments for taking the dust out of upholstery, curtains and draperies, as well as from the carpets. The vacuum cleaner is now a part of the train equipment, and a uniformed operator has been added to the train crew; his only duties being to keep the cars neat and clean.

Side-Door Subway Trains.

In accordance with the orders of the New York Public Service Commission, the Interborough Rapid Transit Company, New York city, now has in operation six trains consisting of forty-eight side-door cars. The train of end side-door cars, as recommended by B. J. Arnold, is now in the shop and will be converted into the center-door type. Transformation of that portion of the rolling stock recommended in the Commission's order will be pushed as fast as possible, and it is expected that it will all be in operation within the time allowed in the order.

New York Central Extends Its Electrification.

Steadily and surely the electrical zone of the New York Central & Hudson River Railroad is reaching out toward Fishkill Landing, to which it must inevitably be extended soon.

So steadily is the extension of the zone going on that to reach these villages is now but a step. Croton, about twenty-five miles south, already is in the zone, and Peekskill, Cold Spring, and Fishkill Landing will be included when the next step northward is taken.

Last week the big power plant at Glenwood, near Peekskill, was put in operation. This plant gives the New York Central a power house which will supply power sufficient to run the cars from New York to Croton-on-Hudson. A like plant is to be erected either at Fishkill Landing or Poughkeepsie. Grade crossings are to be abolished within the zone.

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BOOK REVIEW.

"Elementary Manual of Radio Telegraphy and Radio Telephony," by Prof. J. A. Fleming. London, Eng.: Longmans, Green & Company. Cloth, 340 pages, illustrated. Supplied by the Electrical Review and Western Electrician for $2.

This manual is intended for those with an elementary knowledge of electricity and magnetism, who are not prepared to follow the more pretentious treatises on the subject, for instance, "The Principles of Electric-Wave Telegraphy," by the same author. The treatment is mildly technical and free from advanced mathematics, many analogies being given to aid the explanation of oscillatory electric current phenomena.

The first three chapters discuss "skin effect" and other changes in wire constants due to high-frequency currents. The properties and choice of dielectrics are carefully considered for these frequencies.

After discussing the physics of the differential "frequency equation" of an oscillatory circuit, practical rules for choosing wireless apparatus are given. Too much space is devoted to interrupters, as modern practice tends to small transformers. Coupling between two circuits is treated mathematically, and the method is given of producing phase differences in two transmitted waves for securing partial secrecy.

Modern apparatus, such as the high-frequency arc and generator, is treated rather loosely, the arc especially receiving by no means as good a presentation as could be expected. No discussion is given of the criteria of frequency, stability, type of arc, whether "pure" or "impure" Duddell phenomena are involved, etc., all of which are elementary factors, and can be found in Barkhausen's memoir. A good comparison of criteria for achieving sharp resonance with persistent oscillation is given, however.

In Chapter IV the author persistently asserts that the electric and magnetic forces in a plane wave are in quadrature, whereas they are in phase. Too great authority has been attributed to his powers of mathematical treatment to allow such a palpable error to pass unnoticed. By a double error he derives the correct circuital equations, and then gives their particular instead of their general solution.

His solution is of the form $E = A \sin \phi$

$H = B \cos \phi$

Whereas the correct general solution is

$E = A \sin \phi + B \cos \phi$.

$H = C (A \sin \phi + B \cos \phi)$, which are in the same phase, and only differ by a constant.

His model on page 126, of an electric wave, is, of course, incorrect.

In treating the radiating and receiving circuits the author uses the questionable assumption, discarded for five years in the best American practice, that a linear oscillator with variable current along its axis is equivalent to a Hertz oscillator with uniform axial current. This error renders the "resistance equivalent of radiation" as given by the author incorrect—a single wire antenna vibrating at its fundamental has a resistance of forty ohms instead of sixty-four ohms. The treatment of the magnetic or small loop oscillator is not reduced to a practical basis, *i. e.*, while the closed-circuit oscillator radiates, other things being equal, as the square of the frequency and the open-circuit or electric oscillator as the square of the frequency, in the latter case, other things are not equal, as the current is a function of the frequency, and with a given voltage it radiates as the fourth power of the frequency, and not as the square.

Proper forms of verticals and "earthing" are taken up and a discussion of the directive antenna is given based on the analysis of a loop into a composite system of the Hertz oscillators—a view challenged as erroneous by both German and American physicists. A theory of long-distance transmission is given, which tends to support Nikola Tesla's early ideas of "world telegraphy." The author on page 166 is in error when he states that a Stone direction finder cannot use waves of more than 1,000 feet successfully. As a matter of fact, 600-metre waves permit a warship's bearing, seventy-five miles away, to be known quickly to within five degrees. The Bellini and Tosi direction finder is carefully described, however, and discussed in an interesting manner.

In treating the subject of oscillation detectors. Fleming discusses their underlying principles shortly but systematically. The chapter is marred, however, by the author's habitual and unnecessary dragging in of the Fleming-De Forest controversy over the invention of the "audion" detector. Waiving the merits of the case, expert handling has shown that it is by no means a pure rectifier and therefore not a valve. The author seems studiously to have ignored its distinctive features—as it is certainly more sensitive than any oscillation gas valve. Another detector recently patented by L. H. Walter, which embodies a tantalum-mercury contact, has been used at various times in two laboratories in this country, in fact, as early as 1904.

The remainder of the book concerns itself with the design and operation of large stations and the elimination of natural and artificial interference. German methods with arc stations, and Marconi's long-distance work with the spark, are described. Radiotelegraphic measurements are concisely classified, and although many difficulties are pointed out, the treatment could well be more exhaustive—"damping" especially needs more discussion.

The final chapter, on radiotelephony, should have been called an appendix; as, although the treatment is clear, it is not extensive enough to justify the latter half of the book's title. Professor Fleming might well refer to the work of De Forest along arc telegraphy and telephony, in view of the latter's reputation and achievements during the past year in Europe and America.

On the whole, the manual is well worthy of a place in any electrical engineer's library who can overlook faults due to the personal equation in the application of theory to fact. Its defects are, with two exceptions noted above, those inevitable in a work collated from many sources, and are compensated by general excellence of arrangement and clearness of presentation. The author's progress toward a broader view of both American theory and practice will doubtless prove instrumental in removing the slight defects of the present volume in future editions. Freedom from typographical errors and an excellent binding render the price ($2.00) a remarkably reasonable one in contrast to that of more pretentious works on the subject.

O. C. Roos.

Trackless Trolleys in New York?

The Trackless Trolley Company, of New York city, with a capital of $150,000, has been incorporated at Albany, N. Y. The directors are Charles E. Barrett, of New York city, and A. Livingston Norman and Sadie E. Wiener, of Brooklyn.

Trackless trolleys are being established in one or two English cities and have been in operation for some time in certain European cities. In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of April 10, 1909, appeared an article giving the results of trackless trolley omnibus service in Vienna and other cities.

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QUESTIONS AND ANSWERS.

MEASUREMENT OF THREE-PHASE POWER.—Kindly inform me what is the best and simplest method of determining the horsepower-load on three-phase motors? Can the voltmeter and ammeter be used for this purpose?—W. A. T., St. Charles, Mo.

If by horsepower-load is meant the mechanical output of the motor, the proper method for determining this is by means of a Prony brake or other similar device for measuring mechanical power. If the electrical input to the motor is meant, this is best determined by means of either the single, or better yet, the two-wattmeter method. A voltmeter and ammeter cannot be used to determine alternating-current power as they can for direct-current power. In the latter case the product of the volts and amperes gives the power in watts, but in alternating currents another factor enters into the calculation. This is the cosine of the angle or lead or lag; it is usually termed the power-factor. If a voltmeter and ammeter were used it would also be necessary to use a power-factor indicator to determine this other element. Moreover, the readings would have to be taken on each phase, since it is never certain whether the circuit is perfectly balanced. By using a wattmeter the power is determined from one instrument. When the single wattmeter method is used, the current coil of the instrument is placed in one phase of the circuit and the pressure circuit is connected first between this phase and one of the other two, and then between the same phase and the one remaining. The sum of the two readings obtained in this manner is the true power of the circuit.

ELECTRIC LAMPS FOR PRINTING PICTURES.—What is the best electric light to print pictures by? We have used carbon 110-volt arc lamps, but they seem to flicker too much. Recently you described the Küch quartz lamp. Who manufactures this lamp, and is it for sale in this country?—H. S. D., Plattsmouth, Neb.

For printing photographs, blue-prints, etc., both arc lamps and mercury-vapor lamps have been extensively used. There is some difference of opinion on the part of those who have had experience with each type of lamp as to which gives best results. The mercury-vapor lamp is a more efficient lamp and is very rich in actinic or chemical rays, which seem to adapt it excellently for this purpose. However, it is claimed by some that, because the light does not come from so concentrated a source, it does not give such sharp contrasts nor so well-defined a print. The Küch quartz lamp is manufactured by the Quartzlampen-Gesellschaft, Pankow, Germany. We have not been able to determine whether this company has any agency in this country.

ADVANTAGES OF ENCLOSED FUSES.—Why are enclosed fuses generally required in place of the less expensive and simpler open fuses? Are not open fuses equally reliable?—J. S., Eau Claire, Wis.

The enclosed fuse is a much more reliable and safe device than the open fuse. It is more expensive, but its action is more dependable and avoids fire hazard due to the use of open fuses. When an open fuse "blows" the molten metal usually flies in all directions and is apt to cause damage. Moreover, where open fuses are used it has been found to be the common practice to replace them when blown by anything in the shape of a wire conductor that is available regardless of proper carrying capacity and melting point. The enclosed fuse prevents the splashing of the molten metal since it retains all these particles within the cartridge. Usually the terminals are so spaced that none other than the right type of fuse can be used.

SKIN EFFECT.—What is meant by skin effect in electric circuits?—V. P. B., Memphis, Tenn.

It has been found that the effective resistance of a conductor when carrying alternating current is somewhat higher than when it is carrying direct current. When the frequency is very high or the conductor of large diameter this difference becomes quite marked. It is in general due to the fact that with high-frequency alternating current the central portion of the conductor does not carry its proportionate share of the current, and that the outer layers form the effective conductor. This is therefore called the "skin" effect. The exact reason for this phenomenon seems to be because each element of the conductor is surrounded by its own magnetic field, and the exterior portions of the conductor are cut by the circular magnetic lines due to the interior elements. This produces a local electromotive-force which tends to send a current in the exterior of the wire along with the main current and a return current through the interior opposing the main current. Therefore the central portion of the conductor is apt to carry very little current at very high frequencies. It has been proposed for this reason to use tubular conductors for high-frequency purposes.

FREQUENCY CHANGERS.—We have a twenty-five cycle supply and wish to use upon it arc lamps which we understand require sixty-cycle current. Is there some simple way for changing the twenty-five-cycle to the sixty-cycle current?—F. T., Lockport, N. Y.

For changing the frequency of an alternating current it is necessary to use a set of rotating machines. The most common type of freqency changer is a motor-generator set, the motor of which is a synchronous motor which has mounted upon its shaft a generator developing alternating current of the proper frequency. The only connection between the machines is the mechanical connection of the shaft. The ratio of the number of poles of the generator and motor must be the same as the ratio of the two frequencies. Another type of frequency changer is used somewhat in England. It is known as the induction frequency changer. It has an induction motor with a coil-wound rotor. Mounted on the same shaft is a machine which resembles a rotary converter except that it receives its electrical supply from the rotor of the induction motor.

THE USE OF SQUIRREL-CAGE MOTORS IN MINING.—What type of electric motor is best suited for mining purposes? Has the induction motor any advantages over the direct-current series motor?—Y. A., Kobe, Japan.

For electric mining purposes it is necessary to use a type of electric motor as free from hazard and as rugged in construction as possible. The direct-current motor has excellent operating characteristics, but when used for such hard service as it is subject to in mining, the commutator and brushes are not apt to receive the proper attention, therefore sparking of the brushes is liable to be frequent. In coal mines particularly sparking must be absolutely avoided on account of the danger of igniting inflammable gases. The induction motor, particularly of the squirrel-cage type, requires no sliding electrical contacts of any kind. The connections to it are made permanent and the rotor is self-contained and is not connected with the circuit in any manner. Therefore this machine meets the requirement of freedom from sparking. Incidentally it is a very rugged machine and is capable of standing the most severe service. Induction motors with auxiliary resistance for the rotor circuit require a commutator.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

MANUFACTURERS' LIGHT AND HEAT COMPANY.

The semi-annual report of the Manufacturers' Light and Heat Company and affiliated companies, of Pittsburgh, Pa., for the six months ended June 30 shows the gross earnings were $2,802,699.33, and the operating expenses were $671,882.83. During the period the company purchased $215,363.18 of gas from other producers. Changing construction cost the company $11,260.43. Taxes totaled $44,361.18. This makes the total operating expenses and taxes $942,867.62, leaving net earnings from operations $1,859,831.71. Deductions from net earnings include interest and discount and accrued interest and tax on bonds, $343,021.91; drilling wells, $149,519.44, leaving a surplus of $1,367,290.36. The net decrease in liabilities is $1,220,798.26.

The following balance sheet of June 30, 1909, compared with the balance sheet of December 31, 1908, shows the following changes in the assets and liabilities of the company:

LIABILITIES.		
Bonds paid and canceled	$789,500.00	
Decrease in bills payable	502,557.10	
Decrease in accrued interest	21,987.34	
Total decrease in liabilities		$1,314,044.44
Increase in accts. payable	$ 78,165.29	
Increase in security deposits	2,599.90	
Increase in accrued tax on bonds	12,480.99	
Total increase in liabilities		93,246.18
Net increase in liabilities		$1,220,798.26
ASSETS.		
Improvements, betterments, extensions, etc	$208,344.47	
Wells, new material	78,654.24	
Increase in investment accounts		$ 286,998.71
Increase in bills receivable		9,217.56
Total increase in assets		$ 296,216.27
Decrease in cash	$ 87,657.97	
Decrease in accounts receivable	62,066.20	
Total decrease in assets	$149,724.17	
Net increase in assets		$ 146,492.10
Surplus		$1,367,290.36

The consolidated balance sheet shows as follows:

ASSETS.	
Property account	$37,193,511.26
Treasury stock	628,600.00
Cash	246,022.05
Accounts receivable	465,670.62
Bills receivable	33,625.85
Total	$38,567,429.78
LIABILITIES.	
Capital stock	$21,500,000.00
Bonds less cash in sinking funds	5,855,500.00
Bills payable	2,921,288.57
Accounts payable	207,059.11
Security deposits	87,722.01
Accrued interest on bonds	72,585.00
Accrued tax on bonds	101,835.32
Surplus December 31, 1908	6,454,149.41
Surplus 1909, to date	1,367,290.36
Total	$38,567,429.78

AMERICAN LIGHT AND TRACTION.

The American Light and Traction Company has issued its report for the six months ended June 30, 1909, showing a balance after all charges and dividends of $317,860, against $203,430 the previous year and $167,259 for the corresponding period in 1907.

LONDON UNDERGROUND.

The Underground Electric Railways, of London, report earnings for the week ended July 31, and for thirty weeks ended July 31, 1909, compared as follows:

	1909.	1908.
Bakerloo	£ 3,125	£ 2,720
Piccadilly	5,180	4,815
Hampstead	3,670	3,200
District	9,753	8,841
Tramways	6,393	8,382
Total	£ 28,121	£ 27,958
Thirty weeks:		
Bakerloo	£ 99,520	£ 90,980
Piccadilly	172,380	161,730
Hampstead	116,610	97,690
District	299,661	270,398
Tramways	178,540	196,799
Total (30 weeks)	£866,711	£817,597

NORTHERN TEXAS ELECTRIC.

The Northern Texas Electric Company, which owns the capital stock of the Northern Texas Traction Company, of Fort Worth, Tex., has issued a report for the year ended April 30, 1909, which compares as follows:

	1909.	1908.
Gross earnings	$1,142,510	$1,080,577
Operating expenses	668,124	630,052
Net earnings	$474,386	$450,525
Deductions:		
Interest and taxes	$200,449	$189,541
Preferred dividends	150,000	149,700
Total deductions	$350,449	$339,241
Surplus	123,937	111,284

BELL TELEPHONE OF CANADA.

The Bell Telephone Company, of Canada, has issued its annual report for the year ended December 31, 1908, which compares as follows:

	1908.	1907.
Gross earnings	$4,580,606	$4,829,657
Operating expenses, legal insurance, bond interest and miscellaneous	3,156,332	3,785,859
Net earnings	$1,424,274	$1,043,798
Dividends	1,000,000	871,018
Surplus for year	$ 424,274	$ 172,779
Previous surplus	66,225	61,037
Total sprplus	$ 490,499	$ 233,816
Deductions:		
Charged off building	$ 90,654	.....
Insurance reserve	115,517	1,631
Accident reserve	53,670	3,509
Contingent account	150,000	162,451
Total deductions	$409,842	$167,592
Surplus, December 31	80,657	66,225

Western Electric Reports Better Business Than Ever.

Preliminary returns of the Western Electric for July show that the company's business for that month ran approximately forty-six per cent ahead of July, 1908. The eight months' returns indicate a gross business for the year of about $47,000,000, but it is expected that the improvement in industrial conditions, which is now setting in, will enable the company to show nearer $50,000,000 in round figures. For the year ending November 30 last, gross sales of the Western Electric totaled $33,000,000. In 1907 the total was $52,000,000 and $69,000,000 in 1906, the last-named figure being the high record for the company. So it is clear that 1908-09 will show close to the Western Electric's second best record.

July is ordinarily a slightly better month, it being the time of the year when the purchasing for fall requirements begin. In respect to electric-lighting supplies and electrical machinery, last month was the largest in the Western Electric's history.

Of late there has been considerable activity in the foreign departments. The recent order by the Chinese government for an experimental telephone system for the city of Pekin is important rather as an indication of the rapidly changing attitude of China, than for the size of the contract, which amounted to about $150,000. This news is particularly interesting to Wall Street in view of the efforts of American capital in late years to open up China to modern ideas and methods. The room which exists for expansion may be gathered from the fact that the population of China is five times greater than the population of the United States.

B. F. Sturtevant Company Reorganized.

The B. F. Sturtevant Company, having formerly a capital of $500,000, has been reorganized and recapitalized. The new corporation is organized under Massachusetts laws with $1,250,000 six per cent cumulative preferred stock and $1,250,000 of common stock, and the stock has all been taken by a few of the large owners. John Carr is president, Eugene N. Foss is treasurer, and E. B. Freeman has been elected general manager.

The increased capitalization represents capital expenditures during the past year, largely in the erection of a new plant in Hyde Park, which cost over $1,500,000. The B. F. Sturtevant Company has been doing a business of about $3,000,000 a year.

Firmer Crude Rubber Market.

During the latter part of the week the crude rubber market has ruled firm, due to speculation in London. Manufacturers are still buying only moderately to meet their urgent requirements. Quotations are: Up-river Para, $1.91; coarse, $1.15; islands, fine, $1.79@$1.80; coarse, $0.78.

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REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

AN ALTERNATING-CURRENT PRIMARY CELL.

A curious galvanic cell giving alternating currents for several hours is described by W. Kistiakowsky in the *Zeitschrift für Elektro-Chemie,* of May 1, 1909. The communication comes from the electrochemical laboratory of the St. Petersburg Polytechnic. The cell consists merely of two iron electrodes, preferably of different surface areas, made of pure iron, such as can be obtained from Kahlbaum, in Berlin, and of a mixture of sulphuric acid and potassium bichromate, which is used in primary cells. The proportions of these latter chemicals should be a solution of potassium bichromate, saturated at eighteen degrees centigrade, and a double normal sulphuric acid, mixed in equal volumes. The iron is applied in sheets of 0.2 millimetre thickness up to seven centimetres in width; they are dipped into the electrolyte to a depth of three or four centimetres. When the circuit is closed by an aperiodic voltmeter, and the scale is so arranged that zero is in the middle, the needle will be seen to oscillate between + 0.4 volt and — 0.4 volt in a peculiar fashion. The needle creeps up on the positive side, slowly at first, then more rapidly; it stops for a moment at + 0.4 volt, and suddenly swings back to zero. After an interval of five or ten seconds the needle moves over to the negative side in the same manner, stopping at — 0.4 volt and returning. Another interval of five or ten seconds follows, and the play is repeated. These oscillations of the electromotive-force may continue for hours. Sometimes the one plate becomes passive, and the phenomena then become pulsating; the current oscillations are confined to the one side, positive or negative, as if only one of the electrodes were active. When no current fluctuations are observed at all, they can be started by cleaning the electrodes (with the aid of emery paper) or by touching them in the electrolyte with metallic magnesium. The phenomenon recalls the oscillatory character of the solution of chromium in certain solvents which W. Ostwald observed some years ago. The electrodes of the cell may also be made of chromium, but the oscillations are less marked than with iron electrodes, with which currents of 0.15 ampere can be obtained. The communication of Kistiakowsky is preliminary. It would be interesting to hear more about the pulsating currents resulting when one of the electrodes is in the passive state; the phenomena of passivity are still obscure, and might further be studied in this way.—*Abstracted from Engineering (London), July 30.*

STANDARDIZATION OF CONDENSERS.

The precise determination of capacities is frequently of considerable importance in the investigation and arrangement of telephone and telegraph lines, and especially in telegraphy without wires. Devaux-Charbonnel has obtained very exact results by means of a method, the principle of which is well known, but which does not seem to have received the appreciation it deserves. The method is described by him in a note to the French Academy of Science. If a capacity C charged by a battery E is discharged n times per second through a galvanometer, one may ascertain the passage of a current $I = nCE$. The same current may be reproduced by means of the same battery and a resistance R: $I = E/R$. From this the value of the capacity may be immediately deduced: $C = 1/nRE$. An electric tuning fork was employed for producing the successive discharges. A sheet of platinum attached to one of the branches of the fork oscillates between two contacts, and at each oscillation charges the condenser and discharges it through the galvanometer. At the same time a stylo inscribes on a cylinder covered with lampblack the vibrations of the tuning fork and also those of an electric seconds pendulum. A remarkable precision may be attained with this arrangement without difficulty. A fraction of one-thousandth of a second may be observed on the cylinder; the resistance can also be measured with great exactness and the capacity is, therefore, easily determined within one-thousandth of its value, which is more than sufficient for practical purposes. In working with a standard mica condenser it was observed that, contrary to accepted opinions, its capacity varies slightly with the frequency. An air condenser maintained the same capacity, no matter what the frequency. The exact knowledge of capacities also makes it possible to verify the graduations of variable self-inductions by balancing the self-induction by a condenser shunted through a resistance in a bridge arrangement with telephone.—*Translated and abstracted from L'Industrie Electrique (Paris), July 25.*

IMPROVEMENTS IN ELECTROPLATING.

Wire, band or tape is usually provided with galvanic coatings by passing it successively through the cleaning arrangement, the galvanic bath and the after-treatment apparatuses. The wire is unrolled from one drum, galvanized and wound on another. In consequence of the great length of the wire in the bath, comparatively heavy currents have to be employed, and the sagging or breaking of the wire means danger of short-circuit by contact with the anodes. The high current intensity itself has an injurious effect on the structure of the wire, and it also suffers if it is made to change its direction several times in the bath by bending it over rollers. F. A. Hermann, of Leipsic, has overcome these evils by passing the wire through a rake-like arrangement or a crating of insulating material which is not attacked by the electrolyte employed. Furthermore, the guide-rollers for the wire are movably arranged so that they are pressed down by the wire, when it is tight, but which raise when it becomes slack or breaks and lift it from the current-conducting rollers. Another method of electroplating wire, chains and the like devised by Dr. A. Barth, of Frankfort-on-the-Main, aims at preventing the repeated bending of the wire during the treatment. In this process the wire is unwound from a drum, passed in a perfectly straight line through the cleaning and galvanizing baths as well as through the washing, drying and polishing arrangements and then wound on a second drum. This is accomplished by moving the wire at a slight angle to a horizontal line so that it enters the bath from the top and leaves it

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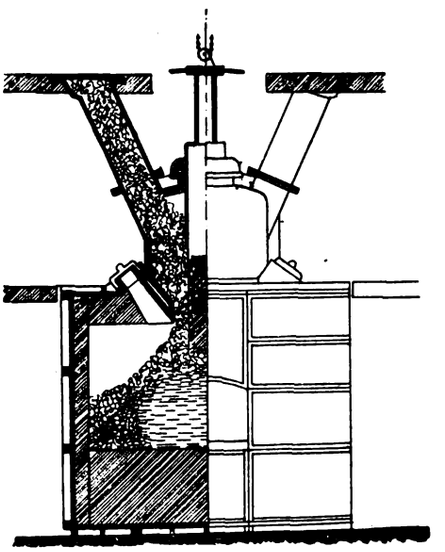
through an opening in the wall of the galvanizing vat. The opening may be provided with a stuffing-box so that no fluid can escape from the vat.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), July 25.*

ELECTRICITY IN THE BIBLE.

It is very probable that electricity was employed by civilized peoples of ancient times, especially by priests, for producing certain physical phenomena which would make supernatural impressions on the ignorant masses, says E. Stadelmann. The knowledge of such phenomena and their skillful use for religious purposes was confined to the priests, who carefully guarded their secret. A number of bible incidents are referred to in support of these statements. Thus it appears that the lightning conductor was known to the old Israelites, for the spears on the temple were connected by chains with two iron columns which ended in a water reservoir, essentially the arrangement of lightning conductors of the present day. In examining the construction of the ark of the covenant, it will be seen at once that it consisted of an insulating vessel covered by metal inside and outside and constituted a large Leyden jar or condenser. This condenser was charged by atmospheric electricity by means of the metal-covered columns of the temple hall. The discharge from this condenser was probably powerful enough to kill any one coming in contact with the two metal coatings, and only the initiated could approach the ark. The officiating priests were protected against harm from these discharges by their dress, which consisted partly of gold tissue. Although the altar is not exactly described, the indications are sufficient to permit the assumption that this, also, was a large Leyden jar, and the sacrificial offering was probably ignited by the artificially produced discharge of this condenser. Moses very likely gained his knowledge of electricity from the Egyptians.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), July 25.*

LARGE ELECTRIC FURNACES.

The electrothermal industry, as represented by processes utilizing extremely high temperatures in the electric furnace, has recently increased in importance and extent to an enormous degree. The manufacture of carbide, which is the pioneer of these industries, is technically farthest developed. Great progress has been attained during the past few years by the introduction of very high furnace loads, especially by Dr. A. Helfenstein, of Vienna. This is of the greatest importance not only for the carbide process, but also in the rational manufacture of ferro-silicon and similar products. The greatest load on a single electrode in a furnace, which has so far proved practicable in permanent operation, is said by Helfenstein to be 2,500 to 3,000 kilowatts, namely, 30,000 to 40,000 amperes at seventy-five to ninety volts furnace tension, which means, in three-phase furnaces (in which alone they are at present employed), a total load of 7,500 to 9,000 kilowatts, or 10,000 to 12,000 horsepower. In the manufacture of carbide, however, a further step in advance has been made by the construction of double



ELECTRIC FURNACE FOR A 10,000-HORSE-POWER LOAD.

three-phase furnaces with a load capacity of 18,000 kilowatts, corresponding to a carbide production of eighty to 110 tons in twenty-four hours. But as regards the single-reaction furnace a point has been reached with loads of about 3,000 kilowatts, at which a further increase necessitates a complete change in the method of operation, as well as apparatus built on new principles. This practical limit in the load on single electrodes in open furnaces is due, in the first place, to the great heat of the reaction gases burning in the furnace, so that even with less than 3,000 kilowatts, special protective arrangements are necessary for the workmen and the current-conducting devices. A further current increase would make these devices so complicated that their adoption would not be profitable. Another impediment in the development of the open furnace is the smoke evil, which naturally grows with increasing load. In the manufacture of carbide, and especially of ferro-silicon, it assumes such proportions at loads of 3,000 kilowatts on single electrodes, that it is not admissible for sanitary and other reasons. But the most serious obstacle to a further increase in the load on single electrodes is the question of charging the furnace. The usual method of charging by hand with shovels becomes inadequate, and there is danger that the furnace will not be properly covered and material will be lost. Furthermore, the question of a rational and economical utilization of the energy in the furnace gases becomes more important. The furnace constructors are thus actually compelled to build closed furnaces in order to utilize the reaction gases. By closing the furnace and making use of the gases, the heat and smoke evils, which prevent a further increase in the load, are removed, and the question of continuous and mechanical charging finds its natural and practical solution. It is in this direction that Dr. Helfenstein has recently made important improvements. The accompanying illustration shows a single electric furnace, partly in section, designed upon these lines, for a load of 8,000 to 10,000 horsepower. About eight to ten metres above the base of the furnace there is a gallery for transporting the mixture to the charging apparatus in dump cars at equal time intervals. The charging apparatus consists of a spacious reservoir over the furnace pit, which can be closed air-tight. Through its center passes the easily adjustable electrode (3,000 to 4,000 kilogrammes in weight for 10,000 horsepower), which is surrounded by the mixture on all sides during operation. Large supply tubes extend from the reservoir, which holds 5,000 to 7,000 kilogrammes of material, up to the charging gallery, and by means of this arrangement the mixture is made to flow continually along the electrode in the measure the process requires into the smelting furnace. Broad slots in the roof of the furnace, which can be hermetically closed, permit the detection of any disturbance in the process. In the large three-phase furnaces for 25,000 horsepower three separate electrodes are employed and a charging arrangement is provided for each of them. Helfenstein's method of removing and utilizing the gases cannot yet be described on account of patent questions.—*Translated and abstracted from Zeitschrift für Elektrochemie (Halle), August 1.*

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Robbins & Myers Company—"A Successful Enterprise."

When the results of twenty-odd years of persistent endeavor to build up and establish a reputation for high quality of apparatus and undisputed recognition of business integrity can be summed up as "A Successful Enterprise," it is fitting that some analysis be made of the efforts which have contributed toward this consummation. At a time when the wheels of progress are turning busily, and when there is every prospect of an era of unparalleled prosperity for the industry of the nation, it is interesting to chronicle the growth and development of an organization which has made steady progress through all the vicissitudes of business depression, change in the art, and continually increasing demand for material to meet severe conditions of service.

The Robbins & Myers Company, of Springfield, Ohio, was organized about twenty years ago for the making of gray-iron castings. After a number of years of gratifying success in this business the company found itself in possession of a plant and facilities that would warrant the undertaking of a regular manufacturing enterprise. In 1897 the company commenced the manufacture of direct-current, motor-driven ceiling fans, becoming one of the pioneers in a practically undeveloped industry. Few people realize the severity of the service demanded of an electric fan. It is almost invariably placed in the hands of people unfamiliar with electrical apparatus, and must be so designed that it will run for long periods of time without attention, and it must also be suited for use in any climate and any temperature in which people can live. A proper recognition of this condition set the company about producing a practically indestructible motor. The results of its efforts are demonstrated by the thousands of ceiling fans produced during the first years of its connection with the industry which are still in successful operation.

The sales of this apparatus increased so rapidly that in three seasons larger facilities were necessary, and at this juncture the company purchased a large three-story factory building, which the business depression of the early nineties had rendered vacant, and which was located adjacent to their original property. By this time the company had added a line of desk fans and had also commenced the manufacture of power motors.

At this time the designing of small motors along first-class engineering lines had not been developed to any considerable extent, and as rapidly as possible after getting into its new quarters the company developed a line of direct-current motors ranging up to fifteen horsepower. New frames were added from

C. F. McGILVRAY,
President Robbins & Myers Company.

time to time, and in a short time the company had established a universal reputation for the quality of its product. Once again, at a period of financial depression, the company found itself ready to take on more business and enlarge its facilities, and early in the winter of 1908 a new factory was made ready for occupancy. The views accompanying this article illustrate to a partial extent the facilities which the company now possesses for the manufacture of its various lines of apparatus.

The present manufacturing facilities consist of a series of buildings grouped around a cement-paved area. There is a new machine shop and motor department housed in a two-story structure, with a saw-tooth roof, having a northern light exposure. The second floor of this building is in the form of a gallery, with a clear story down the center aisle, leaving all portions of the building exceptionally well lighted. Every attention has been given to securing comfortable working conditions for the employes, all modern sanitary appliances being provided.

The company operates its own water-works system, taking its water from one of the underground springs which gives the city its name, is amply equipped with fire protection, and uses natural gas for its power plant. The power plant consists of two large double-cylinder horizontal gas engines, direct-belted to generators from which power is delivered to large switchboards located on the main testing floor. The various machine motors, about 150 in all, are connected to a three-wire system of distribution, the machines being divided into convenient groups, each group being driven by its separate motor. The larger tools are individually equipped, and the various elevators throughout the plant and a large number of individual special machines which the company has found necessary to build, are driven by individual motors.

The equipment of the winding room is worthy of special mention, the company having designed and built for its own use a complete equipment of winding machines, able to handle a wide range of armatures and field coils, improving on hand operation, and greatly increasing the possible output.

In line with the improvement of special machinery for the production of motor and fan parts, the company has spared neither money nor effort in the equipment of its testing department. One of the prime requisites in a successful electric fan is cleanliness and noiselessness of operation. A room is set apart, as far as possible from any moving machinery, and specially equipped as a fan-testing room. Every fan is given a run under full load of sufficient duration to develop its maximum running temperature, and the fan is under constant inspection during this time.

In the motor department the same thoroughness is in evidence, each motor being tested both under full load and under its guaranteed overload. The other departments of the works have been given the same careful attention as regards detail of manufacture and rigidity of in-

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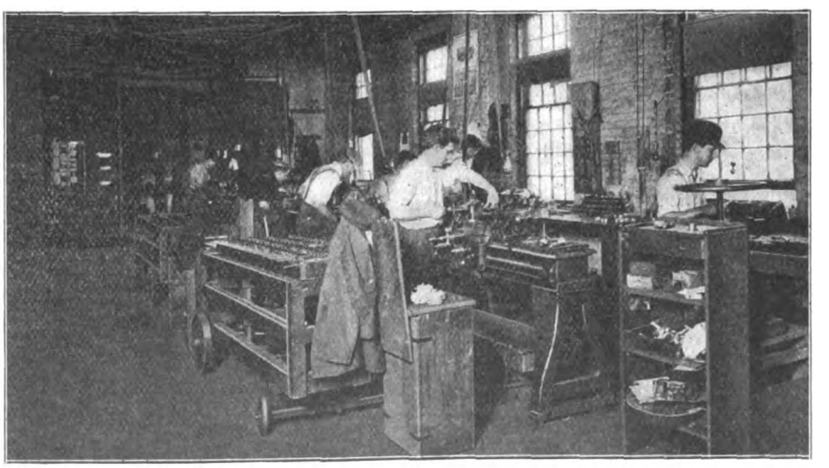
spection and test. The shipping department is located with reference to one of the company's private switches, which greatly facilitates the loading of cars for carload shipments. Large stocks of apparatus are kept in hand for immediate delivery, and the storage capacity has been so increased that the company can now carry from five to six thousand assorted fans in stock without crowding.

A considerable portion of the company's motor business consists of motors for special applications to direct-driven apparatus, and a large number of special types of motors have been facilitated by a well-organized engineering and experimental department. As the mechanical work of this department is carried on entirely independent of the general manufacturing, new special work is produced with great facility and without interfering with the regular output of standard apparatus.

PRIVATE OFFICE OF PRESIDENT AND GENERAL MANAGER.

OFFICE OF SALES MANAGER OF MOTOR DEPARTMENT.

OFFICE OF SALES MANAGER OF FAN DEPARTMENT.



GROUP OF ARMATURE FINISHING LATHES.

The development of the plant has been harmonious in all its details. The old practice of carrying iron in ladles and pouring off has been replaced by a modern trolley leading to all parts of the foundry. Molding machines have been installed in large numbers, and the company has adopted the electric drive in its foundry wherever the application has been found possible. Of late years, the company has enjoyed a very successful business in the manufacture of resistance grids, the ability to control at all times the chemical qualities of its iron being of inestimable advantage to the electrical manufacturing department.

The fan business was commenced by the development of a single type of large-blade ceiling fan, which is still known as the "Standard" fan, Style A. This is a high-priced fan, and its design and construction was based, and has been kept upon a high ideal of performance and artistic appearance. Several additions have been made to this line in the form of double and three-blade fans, to meet the demand for a high-powered fan at a lower cost. The company early developed a line of swivel and trunnion fans in connection with its desk and bracket line, and as early as 1904 secured patents and began making an oscillating fan. Recently there has been developed a smaller model of fan for use in residences and small offices. The company also manufactures exhaust and ventilating fans of various types and capacity.

In the manufacture of its "Standard" motors and generators the company enjoys a most enviable reputation. Durability has been secured by careful design, liberal proportions, and the use of the best obtainable material and the highest grade of workmanship. These motors have been adapted to many special classes of service, and the line is so extensive that about fifty per cent of all conceivable motor needs can be met from catalogue selections of "Standard" frames and ratings.

The plant of the company is very pleasantly located just on the outskirts of the city of Springfield. There is at all times surrounding the works an atmosphere of country freshness, and the enterprise manifested by the whole organization is in keeping with the choice surroundings of its plant. The main offices of the company are conveniently located at the

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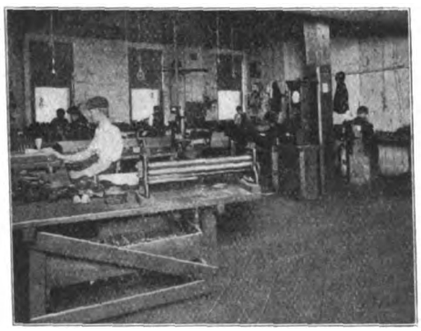
northern end of the manufacturing plant on two sides of the building, with the private offices of the secretary and the general manager at the apex. The main entrance is into a general office, where

PORTION OF WINDING ROOM.

MAIN AISLE OF THE MACHINE SHOP.

the reception room and telephone facilities are located. The other offices are divided into departments for the motor-sales department, fan-sales department, and accounting department, equipped

VIEW ON MAIN TESTING FLOOR.



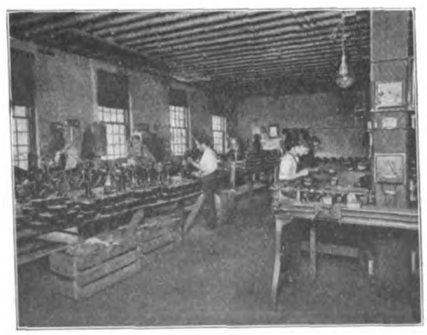
FAN BLADE ASSEMBLY ROOM.

with every modern facility in the way of card-index and filing systems, rapid circular addressing and printing apparatus, follow-up systems, adding machines, etc.

The various heads of departments are kept in touch with each other and with the entire manufacturing establishment by intercommunicating-telephone systems, each department also having connection through an internal exchange with local and long-distance lines.

The company has established offices in practically all of the larger cities, where complete stocks are maintained in addition to well-equipped and stocked first-floor stores in New York, Philadelphia, and Chicago. Its entire South American business is conducted from its offices in Buenos Aires, and its English and East Indian trade through prominent London engineering firms. The company is also represented and enjoys a large trade in Australia, so that its products are sold and well known in practically every quarter of the globe.

A manufacturing plant, no matter how well equipped, would be of little avail unless it were managed by a strong, intelligent personnel. The growth and development of this company is typical of American industry and enterprise, and is a fine example of business acumen plus modern manufacturing facilities. The officers and sales managers of the company are: C. F. McGilvray, president; H. E. Myers, vice-president; W. J. Myers, treasurer; W. A. Myers, secretary; H. B. Ramey, sales manager motor department, and W. W. Mumma, sales manager fan department.



GENERAL FAN ASSEMBLY ROOM.

New Motor-Starting Switch for Printing Machines.

A new type of motor-starting switch for use with printing machines is described in a recent issue of *The Times (London) Engineering Supplement*, from which the following is taken. Some of the features are quite novel.

Every printer and every printer's engineer is aware that the starting of printing presses is very hard on the switchgear, on account of the constant starting and stopping of the motor (or "inching"), which is necessary when preparing the press. This constant "inching" causes most injurious arcing on the contacts of the starting switch, with the result that ordinary starting switches are soon destroyed, and even though renewable contacts may be used, the renewals are required so frequently as to become a nuisance as well as a serious expense.

With the object of rendering ordinary hand-operated starters suitable, such devices have been employed as carbon auxiliary contacts, magnetic blow-outs, and interlocked solenoid switches. These devices have failed because they have protected only the first step, whereas the attendant, whose eyes must be on the machine and not on the starter, pulls the handle, when "inching," over to the third or fourth contact, or perhaps further, and in moving it back draws a destructive are across the starter steps.

In the new switch there is an interlocked magnetic circuit maker and breaker, but the essential merit of the arrangement consists in the fact that no matter how far the operator pulls the handle over in a forward direction, the slightest backward movement instantly opens the circuit-breaker. Consequently no arcing can occur on the starter steps because they are "dead." With this starter, therefore, "inching" may be practiced to an unlimited extent.

The new switch is manufactured by the Adams Manufacturing Company, Limited, of Bedford, Eng.

Signs of Prosperity.

The rapidly increasing demand for rolling stock to take care of growing traffic on steam railroads, particularly in the West, is indicated in no small measure in the list of orders for car equipments made public recently by the United States Light and Heating Company, of Maine, with executive offices at 30 Church Street, New York city. During the last month the company received orders to equip no less than 240 cars, of which eighty-eight are for the Western Pacific. The other orders came from the Santa Fe, Denver & Rio Grande, Ann Arbor, Minneapolis & St. Louis, Pennsylvania and Erie.

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Meter-Testing Rheostat.

In calibrating service wattmeters it is the general practice to use an artificial load. The device commonly employed for this purpose—a bank of incandescent lamps—is far from satisfactory, on account of its size and weight, and is uneconomical because of the expense of lamp renewals. The meter-testing rheostat, illustrated herewith, a recent product of the General Electric Company, is especially adapted for testing service, as it has small dimensions and weighs only seven pounds. Fig. 1 shows the rheostat complete.

FIG. 1.—METER-TESTING RHEOSTAT COMPLETE.

As may be seen from Fig. 2, several resistance units are supported by a sheet-metal frame, and connections are made to knife switches, mounted on a small terminal board. Each switch is marked with the value of the load which it controls, the steps being arranged to give loads from one-half to fifteen amperes in one-half-ampere increments. On the inner side of the terminal board are two binding posts, into which the line wires are inserted and fastened by set screws. The sides of the box are hinged and serve as supports when the rheostat is in use. The resistance metal is non-corrosive and has a low temperature coefficient. It is wound on a fireproof body and the complete unit is covered with a protecting compound. The rheostat is neatly finished in black japan.

Some New Westinghouse Installations.

The Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., reports the following important new business:

The new power plant of the Southwestern Portland Cement Company, El Paso, Tex., will contain two 600-kilowatt Westinghouse steam turbines driving 750-kilovolt-ampere, Westinghouse revolving-field alternators, delivering sixty-cycle, three-phase current at 440 volts. Excitation current is furnished by a fifty-five-kilowatt, 125-volt Westinghouse engine-driven generator, and by a motor-generator set, comprising fifty-five-kilowatt and twenty-kilowatt direct-current generators, driven by 115-horsepower type CC1 induction motor. The turbines exhaust into Westinghouse LeBlanc condensers, which maintain a vacuum of twenty-eight inches. The motor equipment of the mill, also Westinghouse apparatus, comprises a number of type CC1, three-phase, 440-volt, induction motors of both vertical and horizontal types and ranging over 100, seventy-five, fifty, thirty, twenty, fifteen, ten and five-horsepower capacities, besides a thirty-five-horsepower HF motor, and one to five-horsepower SA variable-speed motor. All motors are furnished complete with starting apparatus, by the Westinghouse company. The power plant of the Southwestern Portland Cement Company supplies lighting service in addition to operating the cement mill.

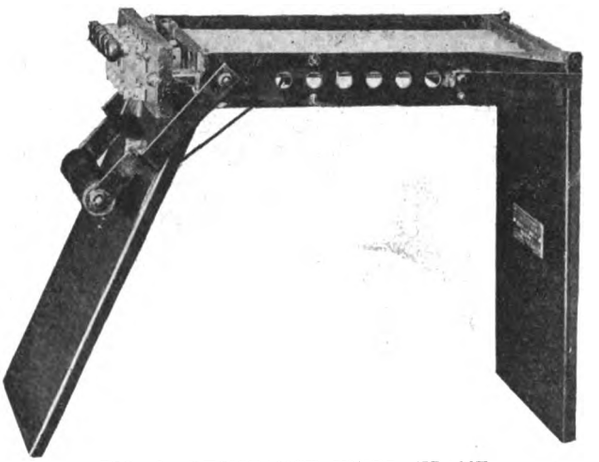


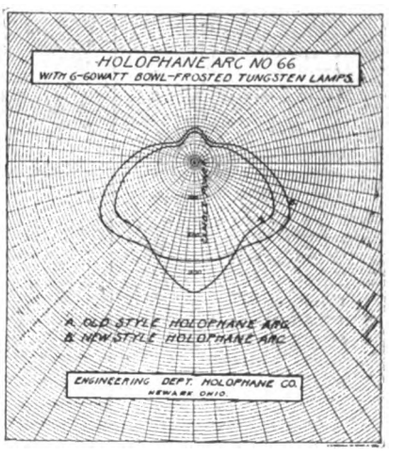
FIG. 2.—RESISTANCE UNITS, FRAME, KNIFE SWITCHES, ETC.

A 2,500-kilovolt-ampere Westinghouse alternator, driven by a 2,000-kilowatt Westinghouse steam turbine, has been ordered for furnishing light and power service to the Erwin Cotton Mills at West Durham, N. C. The steam element operates at 175 pounds pressure and exhausts into a vacuum of twenty-seven inches. The power distribution will be made with three-phase, sixty-cycle current at 600 volts. This property is the largest among the great cotton-mill interests of the Dukes, of the American Tobacco Company.

New Features of Holophane Arcs.

Holophane arcs, made by the Holophane Company, Newark, Ohio, have won renewed popularity since the improvements in tungsten lamps made it possible to burn them at any angle without appreciable effect on their life. They are being offered for the coming year with many new features.

Most important of the features of 1911 Holophane arcs is the new Holophane glass equipment, by the use of which a much better distribution of light is secured. The comparative curve herewith illustrated shows how great is the improvement in this regard of the new units over the old.



COMPARATIVE DISTRIBUTION CURVES OF NEW AND OLD HOLOPHANE GLASS.

A separable cluster body also is now supplied, so that the new Holophane arcs can be taken apart and the glassware cleaned without breaking the connection.

The standard finish of Holophane arcs in future will be brush brass. Square-linked chain is used for the suspension and a separable canopy is supplied which does away with the necessity of a long nipple at the ceiling.

Harriman Has Crossed the Rubicon.

The work of constructing power houses along the Rubicon River, in California, for electrifying the mountain division of the Southern Pacific Railway has been started. Thus has E. H. Harriman indeed crossed the Rubicon—from steam to electricity.

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New Line of Central-Office Telephone Switchboards.

The Western Electric Company is offering to the trade a complete line of non-multiple central-office switchboards, known as the No. 1200 series. These switchboards are made up in one and two-position sections, each type of section having three different capacities, as for example: Sixty, 105 and 165 lines to a position. Each of these different sections is furnished with eight different types of equipment, as follows:

1. Magneto equipment with self-restored line signals. (Code No. 2.)
2. Magneto equipment with manually-restored line signal. (Code No. 4 for selective lines; Code No. 56 for bridging lines.)
3. Magneto equipment with electrically-restored line signal. (Code No. 34.)
4. Magneto equipment with electrically-restored line signal (Code No. 34), arranged for conversion to central-battery service.
5. Central-battery equipment with magnetic line signal. (Code No. 34.)
6. Central-battery equipment with lamp-line signal.
7. The magneto switchboards are arranged to be additionally equipped with ringers for operation on exceedingly long lines or on lines where audible code signaling is desired.
8. The central-battery switchboards are arranged to be additionally equipped with a No. 2 combined jack and signal for operation on rural lines.

All of these switchboards are furnished for operating with standard ringing systems, such as one-way, two-way, two-party, four-party pulsating, four-party harmonic, eight-party harmonic, etc. They are also furnished for single or double supervision. The double supervision cord-circuits used in these switchboards are guaranteed to prevent "ring-through" or "hang-up" difficulties.

When desired, these switchboards can be equipped with through toll-line circuits (sometimes known as "cut-in-stations"), audible code ringing on each of the line circuits, etc.

The Western Electric Company is offering in connection with these switchboards a standard line of accessories, such as lightning arresters, cabinets, calculagraph sections, calculagraph shelf extensions, cash-drawer shelf extensions, etc. It will be noted that this line of switchboards and accessories will fulfill every known telephone condition.

The general outline of these switchboard sections is such as to present a neat, practical and pleasing appearance. Fig. 1 illustrates a two-position section equipped with No. 2 combined jacks and signals.

Fig. 2 illustrates a one-position section arranged for magneto use, the line circuits in which are equipped with No. 34 signals for the city lines and a No. 2 combined jack and signal for the rural lines.

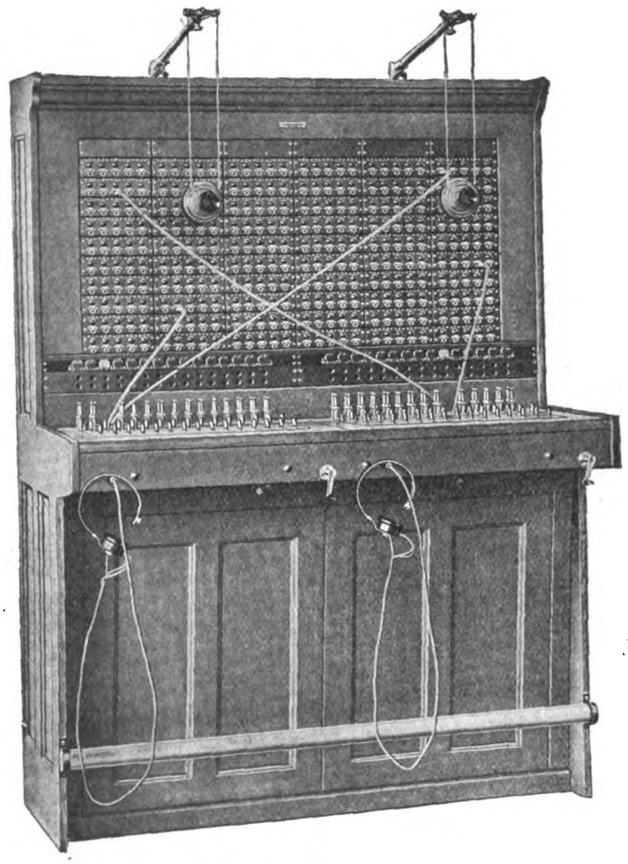

FIG. 1.—FRONT VIEW OF NO. 1250 SWITCHBOARD.

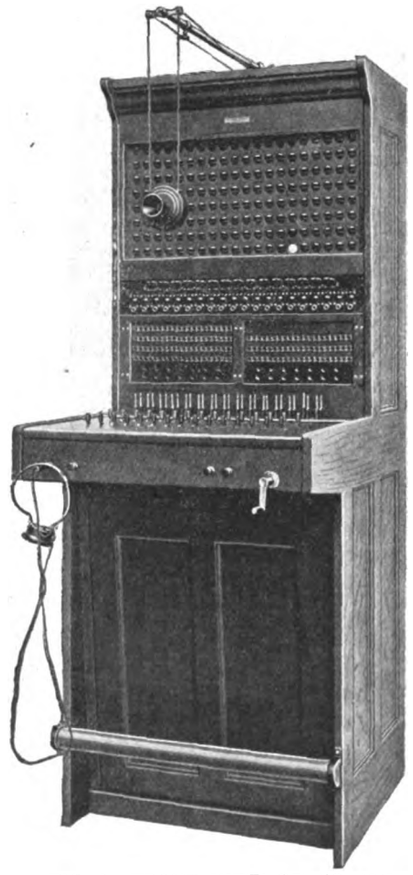

FIG. 2.—FRONT VIEW OF NO. 1215 SWITCHBOARD.

Some novel features of construction will be found in this section. All joints in the woodwork are tongued and grooved and securely fastened with a fine quality of glue and further reinforced with steel angles. The key shelves of these sections are strengthened by steel bars to which the operator's keys are fastened by means of machine screws. This not only insures a perfect alinement for the keys, but permits of their easy removal should occasion require. The key shelves are hinged by means of a piano hinge extending the full length of the shelf. This arrangement very materially strengthens the key shelf and plug shelf and also adds to the appearance of the switchboard. The exterior surface of the sections is finished with a rich, golden-oak finish. The outer coat of varnish is hand-rubbed and of such a character as not to scratch easily or to show ordinary wear.

These switchboards are equipped with Western Electric Company's Bell type of apparatus throughout. Many interesting features will be noted in connection with this apparatus. The No. 2 combined jack and signal used on the line circuits of the self-restored signal type of switchboard represents a radical departure from any previous design of magneto signal. The signal is given by means of an indestructible revolving steel ball, the visible portion of which changes color when operated. A portion of the surface of this ball projects out from the faceplate in such a manner that the signal can be seen from the side as well as from the front. One of the great advantages of this type of signal is that there are no projecting surfaces on the face of the board that are liable to injure the hands or tear the clothes of the operator. Another novel

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feature of this signal is the circular armature that is made use of in order to permit of readily removing the coil from the signal. By means of the circular armature, none of the line connections are disturbed in any way, and no parts of the signal that enter into the adjustment of the same are disturbed. The coil is removed by the simple operation of removing a single screw. Especial attention has been given to the night-alarm attachment. The circuit is completed through two platinum-pointed springs that are attached to each of the signals, which springs make contact when the signal is operated. These springs are located in an accessible position behind the face-plate so that the operator can in no way injure the same.

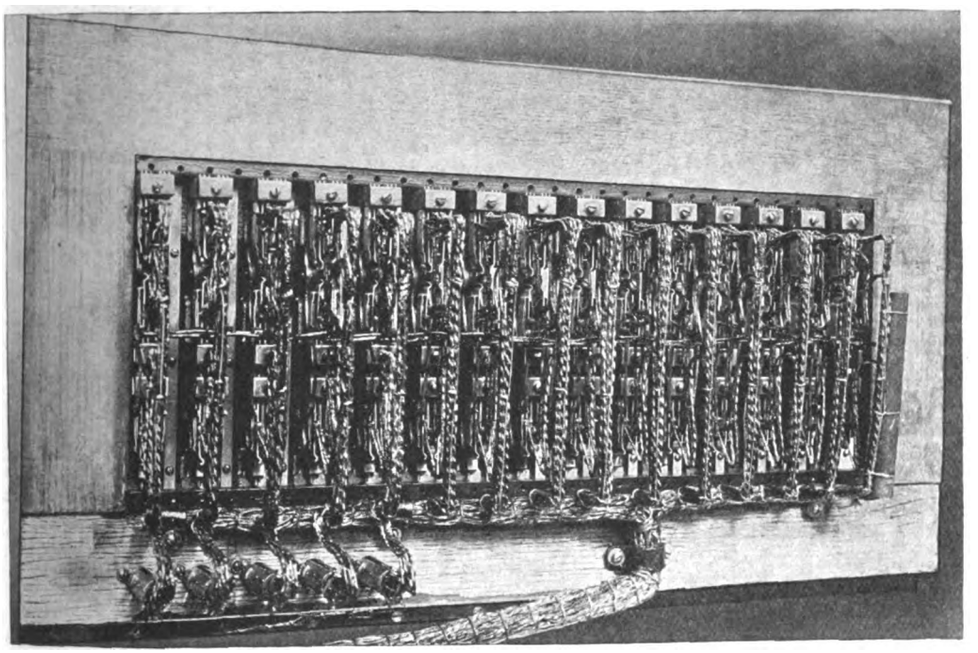

FIG. 3.—SHOWING KEY SHELF THROWN OPEN.

The No. 4 and the No. 56 type drops which are used in the manually-restored type of switchboards are of the standard Bell type, which has been manufactured for the last fifteen years.

The No. 34 signals, used in the electrically-restored time-signal type of switchboards, both for magneto and central-battery operation, have been thoroughly tried out in service. There is a total of about 1,900 switchboard sections in operation today that are equipped with these signals. The keys that are used in these switchboards are of the well-known No. 102 type. They are equipped with horizontal springs that are mounted on edge in blocks of hard rubber. By means of this construction it is possible for the trouble-man, upon opening the key shelf, to clearly see at a glance whether or not any trouble or obstruction is in the key springs. This feature is shown in Fig. 3. This renders it seldom necessary to remove the key from the key shelf.

The cords used on all of these switchboards are of the flat steel wire type, which are renowned for their long service.

In the design of all of the apparatus used in these switchboards, especial attention has been given to the high efficiency of operation and also to a low maintenance expense. Especial attention has also been given to the location of the apparatus in the switchboard sections. The result is that all of the apparatus is easily accessible, and the services of an expert are not required in order to maintain these switchboards.

The First Modern Telephone Plant for China.

On Wednesday, August 4, the export department of the Western Electric Company received from Pekin, China, a cablegram stating that a contract with the Chinese government to supply a complete common-battery telephone plant for the city of Pekin had been signed. The Chinese government, through the president of the Board of Communications, had ratified the sale, which came as a result of negotiations of a year's standing.

This order was secured by the American company only after the most strenuous competition, in which the largest telephone manufacturers of the world figured. To gain a foothold in China—absolutely a new field for telephones, and one giving great promise for future development—seemed more than desirable to the large manufacturers. It is considered quite a victory for American methods.

Heretofore, almost nothing in the way of telephone development has been accomplished in China. There have been telephones in only a few of the cities, and these largely in the foreign quarters, which were served by small out-of-date systems. The two switchboards sold by the Western Electric Company to the government are the first common-battery boards in the entire empire, yet China has an estimated population of over 400,000,000. Our own country, with a population but one-fifth as large, has more than 1,000 telephone exchanges larger than the two intended for Pekin, besides fully 15,000 smaller ones in smaller cities and towns. This gives some idea of the magnitude of the field still to be opened in the far East.

Though only two exchanges so far have been ordered, this is considered as but the beginning of a system that will eventually be fully developed throughout China. The Board of Communications not long ago formed what was known as the International Chinese Telephone Administration. Last fall F. M. Dresing, foreign adviser of this body, while on an American tour visited the Western Electric Company, and made known the desire of the Chinese government to buy some telephone equipment. Chinese commissioners visited this country, inspected the telephone plants of the large cities and were shown through the shops of the large telephone manufacturers. The Western Electric Company sent a special emissary to Pekin, and the result of his efforts has just been announced.

The order amounts to about $150,000, and covers a complete telephone plant of the most modern type, including several hundred thousand feet of lead-covered aerial and underground cable. The contract calls for complete delivery at Tientsin by February 3, 1910, allowing but six months for manufacturing and delivering to the Chinese government. The work of installation will be done under the supervision of one of the Western Electric engineers, who will be sent to Pekin for that purpose. It may be noted that this new order of things is attracting the attention of the entire press.

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Porcelain Electrical Specialties.

The Mechanical and Electrical Manufacturing Company, 54 North Desplaines Street, Chicago, Ill., is the maker of a comprehensive line of porcelain electrical specialties. These include porcelain pendant waterproof sockets and wall sockets, outlet boxes and festoon sockets, sign sockets and open-type sockets, combination outlet-box cover and open-type socket. Also a combination with a waterproof socket, combination metal outlet-box cover and open-type socket with steel covers and with steel fiber-lined covers; with brass covers and brass fiber-lined covers; lined and unlined metal outlet-box covers, and porcelain bushings for metal and wood.

COMBINATION OUTLET-BOX COVER AND WEATHERPROOF SOCKET.

These porcelain specialties are made to withstand every degree of weather. The shells are made of copper, and brass screws and nuts are used in attaching the copper terminals to the shells and porcelain buttons. The shells are removable when replacing is necessary. A copper washer is used for the center terminal inside the shell. The copper terminal connections are perfectly made, and there is no waterproofing material between the outer side of the shell and the inner side of the porcelain.

The accompanying illustration gives a good idea of the appearance of one of these specialties.

Excello Series Flaming Arcs in Michigan Avenue, Chicago.

The article in the issue of August 14 describing the series flaming-arc lamps installed by the Excello Arc Lamp Company for the South Park Commissioners on Michigan Avenue, near Twelfth Street, Chicago, has attracted considerable attention. In this connection an error should be pointed out. The main office of the Excello Arc Lamp Company is in New York, H. M. Hirschberg, president; R. F. Pierce, sales engineer. The Chicago office is in charge of G. W. Armstrong, western manager.

New Substitute for India Rubber.

A. G. Inrig has patented in Great Britain and Germany a new process for making a substitute for india rubber. The materials used are animal refuse capable of yielding gelatin, oils, sulphur, chromates and sodium stannate, the addition of the last-named salt being the distinguishing feature of the process. The proportions recommended are animal refuse 100 parts, water fifty parts, oil twenty to sixty parts. These ingredients are stirred together for about an hour and then one per cent of potassium bichromate and one per cent of sodium stannate are added. The mixture is then heated to about 212 degrees Fahrenheit, and kept at this temperature about five minutes, or until the previously liquid mass becomes pasty, in which condition it is poured into molds. A harder and tougher mass is made by adding twenty per cent of oil, one per cent of sodium stannate, one per cent of potassium bichromate, and five to ten per cent of sulphur, and heating the mixture to 257 degrees Fahrenheit.

The Kimble Variable-Speed Alternating-Current Motor.

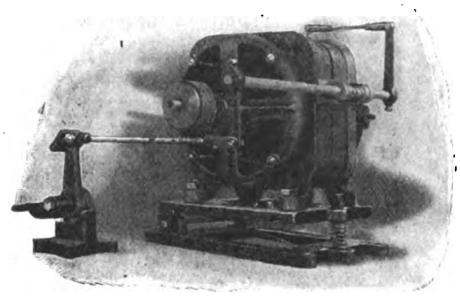
One of the most striking successes of recent inventions of interest to the industrial power user, particularly to the printer, is the Kimble variable-speed alternating-current motor. During the four years that it has actually been upon the market, this motor has been installed in hundreds of plants of various kinds, and the manufacturers have been obliged to enlarge their factory and equipment three times.

The installation of the alternating-current single-phase motor has not been particularly satisfactory to the printer, as in many cases there has been a large consumption of current due to the excessive demand of the motor in starting up, and there has been an uneconomical consumption of current due to the increased energy requirement because of the low power factor.

Printing press requirements necessitate a variable-speed motor which has been obtainable only by the installation of costly and intricate auxiliary devices. These were expensive, were not easy of control, and many times did not possess ruggedness of construction to make a good showing in service.

The increasing demand for alternating-current networks for other services made imperative the development of a thoroughly reliable alternating-current single-phase motor; and in meeting this demand, the Kimble Electric Company has been particularly fortunate. The motor starts with a full-load current and is started, stopped and reversed, and its speed controlled all from a single lever contained within the motor itself.

The accompanying illustration gives a good idea of the appearance of this motor and its lever connections. The lever is operated by a foot treadle, and outside of the wiring connections there are no exterior apparatus or devices. The speed range is from 300 to 3,000 revolutions per minute and the motor runs very quietly.



KIMBLE VARIABLE-SPEED ALTERNATING-CURRENT MOTOR.

The Kimble Electric Company, 1121-1123 West Washington Boulevard, Chicago, Ill., is the manufacturer of this motor. The company also makes variable-speed reversible ventilating fans and other industrial power apparatus.

Westinghouse Storage-Battery Company.

The Westinghouse Storage Battery Company, which was incorporated July 12 last, has acquired all of the plant, patents, and equipment of the storage-battery department of the Westinghouse Machine Company and of the General Storage Battery Company, and will manufacture, at Boonton, N. J., both the Westinghouse and Bijur types of storage battery for those classes of service in which each has proven superior. The Westinghouse Storage Battery Company enters the field with greatly increased manufacturing facilities and the best engineering talent obtainable, and will maintain thoroughly equipped testing and commercial laboratories, insuring uniformity of both materials and product. The general offices of the company will be located at Boonton, N. J., with sales offices in the principal cities of the country. Both the Westinghouse and Bijur storage batteries have been on the market for many years.

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Current Electrical News

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, AUGUST 8.—The following new companies have been formed on the Continent: Robinovitch and Marcat, electrical supplies, Paris. L. Cazelle and Company, electric installations, Toulouse. Penin and Leclercq, electric apparatus and automobiles, Lille. Narici and Castiglia, consulting engineers, Turin. Brivio and Company, gas, water and electricity, Milan. Leoni and Company, electrical machinery, Milan.

The new underground subway at Vienna for carrying mail matter is likely to be realized in the near future. According to the present plans, the subway will consist of a tunnel lying twenty-five feet below the surface and having a five by four-and-one-half-foot section. On the tracks will run light trains carrying letters, printed matter and packages, and the subway line is to connect the main post office building with sixty-four branch offices in the city, and also the leading railroad depots. The train will be run without a motorman and will be controlled from a central post.

Connection between the Varese-Masnago electric line and the Lago Maggiore, Italy, is to be made by a new electric road which connects with the former at Masnago, and it will proceed from this point to the locality of Angera, on the shore of the lake. From here the steamboat service on the lake will allow passengers to reach Arona, on the opposite shore, within ten minutes. The new section of electric line will therefore be of good service for the traffic in this region.

The Spanish government has lately voted a credit of $20,000 for the purchase of scientific apparatus, including high-grade measuring instruments, for the different public laboratories and the technical institutions in the principal cities.

It appears that the project which has been agitated in Berlin for some years past regarding the construction of the metropolitan subway is now in its final stages. Owing to various difficulties, the subway project, which was voted in principle by the Municipal Council some four years ago, could not be carried out. At present the greater part of the difficulties have been met with, and recently the emperor gave his approbation to the scheme. The line will connect the northern and southern districts of town and is to have fourteen stations. There is also some talk of extending the line to the suburbs on an overhead structure, as well as erecting other lines within the city. The cost of the project is estimated at $20,000,000.

The work on the new Mont Blanc Railroad has been making considerable progress of late. It will be remembered that the line is operated on the rack-rail system, and that it is to eventually reach the high peak known as Aiguille du Gouter, which is one of the highest points to be reached by ascensionists, but at present it is a very difficult matter to make the climb to this point. The new railroad is to have an 875-millimetre gauge, using rails weighing twenty kilogrammes per metre, laid on metallic ties. Between the rails is laid the rack rail, which is designed on the Strub system, having a rail head for the use of a grip brake, so as to keep the car on the track. The line starts at the terminus of the Paris-Lyons-Mediterranean branch railroad, which runs from Geneva to Fayet, this latter point being also the starting point of the Fayet-Chamonix electric line. It will take about four hours to reach the Aiguille du Gouter by the new railroad, and from here the summit of Mont Blanc can be reached on foot in five hours, including the return, so that the whole trip will take about thirteen hours.

A new company has been formed in Italy for the supply of current for industrial purposes, which is to have a considerable scope. It is known as the Rosario Valley Company, and its headquarters are located at Spezia. One of the enterprises which it will undertake in the first place is the equipment of a traction line running from Spezia to the Hunigiana region, and having its terminus at Fivizzano. The line runs through a district which has abundant natural resources, and is besides well populated, so that it is sure to be well patronized and will aid in developing the region.

The appointment of M. Millerand as one of the ministers of the new cabinet and the chief of the postal, telegraph and telephone service is likely to bring about a reorganization of the telephone service especially. M. Millerand states that he recognizes the defects in the Paris telephone service, and will take measures to remedy these so as to place Paris on the same footing as the other capitals in this respect. The troubles with the employes will now likely come to an end, and this will be a great relief to the public.

A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, AUGUST 14.—The city of Toronto, Ont., now receives over $2,070 per day, in percentages alone, from the Toronto Street Railway Company.

There are now no obstacles, it is said, in the way of the company which proposes to construct an electrical line in the Cobalt district. The chief engineer of the Nipissing Central Railway has been in Ottawa to place the location and structural plans for the railway before the Railway Commission and the Department of Railways. The plans were approved by both departments.

The old Beauharnois Canal, although of necessity kept in working order, is no longer needed for transportation purposes, having been superseded by the new canal on the north shore of the river. The old canal has, through its important system of retaining dams, afforded a site and valuable waterpower to the manufacturing town of Valleyfield, Que. Its exceedingly valuable water privileges have been acquired by the Canadian Light and Power Company, which intends to transmit electric power to Montreal. The company intends to develop 21,000 horsepower there.

The contracts for the remaining eight stations of the Hydro-Electric Power Commission's power line have been let to the lowest tenders. Edge & Gutteridge, of Seaforth, Ont., were the successful tenderers for the stations at St. Marys, Stratford, Berlin and Guelph. These will cost $18,700 each. The contract for the Preston, Paris, Woodstock and St. Thomas stations goes to John Hayman & Son, of London, for $19,850 each. A contract has also been awarded to Pratt & Letchworth, of Brantford, Ont., the lowest bidders, for the supply of 12,000 galvanized clamps for the carrying of the cable. These contracts complete the large items in connection with the line. All that now remains to be let is mechanical equipment, such as cranes, boiler packing, water piping, etc.

The city of Brockville, Ont., in common with the whole of Eastern Ontario, is just now deeply interested in a scheme to develop electric energy at the Long Sault Rapids, on the St. Lawrence, which, when carried to completion, will stimulate industrial enterprise in this portion of the province. The site of the proposed new power plant is near Cornwall, at the foot of the rapids. The plant is to be constructed, and managed jointly, by two companies, the Long Sault Development Company, on the American side, and the St. Lawrence River Company, on the Canadian side. The latter company already has the power house at Mille Roches, which furnishes light and power for the locks and power and light for Cornwall, but in order to develop more power the two companies have designed a scheme which will be able with ease to furnish unlimited power to the whole of Eastern Ontario at reasonable cost. It is calculated to use the rapids as a headrace for three mammoth power houses, capable of turning out over 100,000 horsepower. It is proposed to divert the waters of the Sault in the proper direction by the construction of a dam over 4,000 feet in length. The constructive work alone is expected to occupy over five years' time, involving an expenditure of some $20,000,000. It is expected that the power can be retailed for $15 per horsepower. The companies are seeking a charter from the Canadian Parliament and the United States Congress, and have made a vast quantity of plans and computations for details.

W.

LIGHTING AND POWER.

(Special Correspondence.)

CLARKSVILLE, MO.—E. N. Moody and others have formed a company to put in an electric-light plant.

TULARE, CAL.—The Mt. Whitney Power Company of Visalia, Cal., has bought a site for a substation here.

BISHOP, CAL.—Ben H. Yandell has applied for an electric-lighting and power franchise in Inyo County.

BEMIDJI, MINN.—The Warfield Electric Company has applied to the City Council for a renewal of its franchise.

C.

ANTIGO, WIS.—The Antigo Electric Company has been incorporated with a capital of $125,000, by John Manser and others.

DOUGLASVILLE, GA.—The sum of $10,000 electric-light bonds issued by this town have been purchased by the Central Bank and Trust Corporation of Atlanta, Ga., Carter & Gillespie, of Atlanta, having the contract to complete the work on the

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lighting system. The bonds were sold, it is reported, for considerably more than par value. L.

WONDER, NEV.—The Round Mountain Mining Company, of which James R. Davis is manager, is to install an electrical equipment.

ALBEMARLE, N. C.—An issue of $27,000 municipal bonds for lights, water, etc., has been carried by a large majority in a recent election in the town. L.

FRESNO, CAL.—Manager A. G. Wishon, of the San Joaquin Light and Power Company, has sent out 400 men to work on the company's dam at Crane Valley.

DOVER, DEL.—The Water-Power Securities Company has been incorporated, with a capital of $765,000, by L. H. Woodruff, J. Welch and B. H. Welch, Philadelphia.

GLENDALE, CAL.—Arrangements are now under way for the purchase from L. C. Brand of so much of his lighting system as is inside of the city limits for $25,000.

EVELETH, MINN.—The lighting plant owned by the Northern Electric Company has been sold to Con Lee, H. E. Griswold and H. W. Irwin, local capitalists, for $50,000. C.

WALLACE, IDAHO—The Interstate Mining Company, Oscar B. Wallace, Wallace, Idaho, manager, will put in the equipment for an electric power plant in the near future.

HAGERMAN, IDAHO—H. A. Stroud and associates, of Hagerman, Idaho, are formulating plans for the installation of a 75,000-horsepower electric plant and the construction of electric car lines.

WINNEMUCCA, NEV.—S. R. Young, one of the valley's most enterprising business men and ranchers, is to install a big electric plant on the Humboldt River, about nine miles from the town of Lovelock.

REDDING, CAL.—Following the injunction issued last week by the Superior Court, the Sacramento Valley Power Company has removed its dam from Old Cow Creek, thus losing 400 inches of its water supply.

PENDLETON, ORE.—The owners of the Lohman Springs property near here are planning to put in a hydroelectric power plant to develop current to supply light and power to the hotel, camp grounds, etc.

GREAT FALLS, MONT.—The village trustees have granted a franchise for lighting the town to G. H. Jay, of Great Falls, Mont. Mr. Jay proposes to install a waterpower plant at an estimated cost of $35,000.

MANCHESTER, N. H.—The Manchester and Derry Electric Company has increased its capital stock from $200,000 to $240,000, and papers have been filed recording the increase at the secretary of state's office.

HAMILTON CITY, CAL.—The Northern California Power Company has completed its power house at this place and a large force is now installing the transformers and placing the cables for its 60,000-volt line.

SALTILLO, MEX.—An electric-light and power plant is shortly to be established at General Cepeda, Coah. The congress of the state has approved the contract of Abel G. Trevino, who will install the machinery.

CORDOVA, ALASKA—The Cordova Power Company announces that it will expend $50,000 in extending its pipe lines to Crator, or Summit Lake. This will require about three miles of pipe and will give a fall of 1,800 feet.

CHAMPLAIN, N. Y.—The North Creek Electric Company, to operate in Johnsburg, Warren County, has been incorporated. The capital is $25,000 and the directors are: Charles S. Wood, John H. Wade, Charles S. Wade, North Creek.

GILBOA, N. Y.—The Gilboa Electric Light, Heat and Power Company has been incorporated, to sell electric light, heat and power; capital, $25,000. Incorporators: Ernest E. Billings, Eli S. Persons, Sidney Rivenberg, all of Gilboa, N. Y.

LUCILLE, IDAHO—Walter Hovey Hill, engineer, and a party of Portland mining men contemplate putting in an electric plant to pump water on the high bar at Lucille, Idaho, for placer purposes. M. S. Heart is manager of the property.

COLUMBIA, S. C.—Reserve power will be furnished the Dudley Shoals Cotton Mill Company, of Granite Falls, by the installation of an auxiliary steam plant of 125 horsepower. It will be used when the company's hydroelectric plant is affected by low water.

WALLA WALLA, WASH.—The John Day Power Company has filed articles of incorporation here. The capital stock of the company is $500,000, the incorporators being N. G. Blalock, Y. C. Blalock, W. J. Mariner and A. D. Lyman. The company plans to develop electric power from the waters of the John Day and Deschuttes rivers.

MODENA, UTAH—The Gold Springs Mining and Power Company is making preparations for the construction of a large power plant at Modena, construction to start as soon as the material is delivered. C. A. Short is president of the company.

FRESNO, CAL.—The Fresno Power Company, of San Francisco, has filed articles of incorporation here. The capital stock of the company is $1,000,000. The incorporators are G. A. Knight, J. M. Ough, H. M. Woolley, C. J. Haggerty and W. M. Madden, of San Francisco.

PATCHOGUE, N. Y.—A mortgage for $200,000 made by the Suffolk Gas and Electric Light Company to the Kings County Trust Company, as trustee, has been filed in the county clerk's office. A recording tax of $750 was paid before the mortgage could be recorded.

CHISHOLM, MINN.—W. M. Pratt, president; L. C. Newcombe, vice-president, and A. C. Schirmer, treasurer, have retired from the Mesaba Electrical Company, and the business will be continued by S. R. Greenthal, who has assumed the interest of the retiring partners. C.

MAMMOTH SPRINGS, ARK.—Napoleon Hill, of Memphis, has installed an electric-light and power plant, furnishing Mammoth Springs and Thayer, Mo., with day and night service. It is said the line will be extended to Koshkonong and West Plains, Mo., and Hardy and Salem, Ark.

ALTOONA, PA.—Hollidaysburg is to have a new electric-light company, an application for a charter having been made to the governor of the commonwealth by a number of prominent local capitalists. It will be known officially as the Juniata Electric Light, Heat and Power Company.

ZACATECAS, MEX.—Robt. H. Towne, president of the Soubrette Mining Company, of this place, gives out that the company has completed extensive surveys and investigations along the Durango River and will put in a power plant to furnish power for the mines and reduction works in this locality.

CHEWELAH, WASH.—The Ione Water and Power Company has been incorporated here with a capital stock of $50,000. Charles P. Moeser, of New York, is president; E. B. H. Hemley, of Newport, vice-president, and W. G. Murray, of Ione, treasurer. The company's immediate expenditure will be about $12,000.

TOLEDO, OHIO—The Coshocton Light and Heating Company, of Coshocton, Ohio, has issued $100,000 of six per cent preferred stock, which will be sold at par and with it will be given twenty-five per cent of common stock as a bonus. The money will be used in completing its new hydroelectric plant, the power to be derived from the state dam in the Walhonding River.

TOLEDO, OHIO—F. C. Kingsbury, who recently secured a franchise for furnishing an electric-lighting system for the city of Bucyrus, Ohio, has entered into a contract with the board of public service, whereby he is permitted to purchase the present plant of the Bucyrus Electric Light Company, with the proviso that he shall install all new machinery and equipment throughout. H.

ALBEMARLE, N. C.—An election on a bond issue for electric lights and other municipal improvements was ordered in the town of Albemarle recently, the population being about 5,000. The proposed issue is for $67,000. The bond issue was voted favorably by a vote of overwhelming ratio against the opponents of the bonds, and the town is thus assured of a modern electric-lighting plant. L.

MONTEZUMA, COLO.—The Silver Princess Mining Company (formerly known as the Silver King) has just completed the installation of its electrical dynamo, air compressor, two air drills and two stoping machines, and electrical power was turned on by the Summit Power Company last week. The company expects to very materially increase the output since the electrical power has been supplied.

MARQUETTE, MICH.—Marquette's municipal-owned lighting and power plant, which has been earning large profits for the city for a decade or more from the sale of light and power to private consumers, is producing power so cheaply that the Marquette Street Railway Company has asked the City Commission if it would entertain a proposition to furnish power for the operation of the street-car system.

ANTIGO, WIS.—The Antigo Electric Company let the contract for the installation of the electrical apparatus in its new plant to the Westinghouse Company, and for the new engine to the Norberg Manufacturing Company. The plant will include two generators, 250 and 150 kilowatts, respectively, a switchboard costing $3,600, and a 250-horsepower Norberg tandem, compound condensing, high and low pressure, engine. C.

PETERSBURG, VA.—It was announced that in pursuance to a resolution of the directors a meeting of the stockholders of the Virginia Electric Tool and Manufacturing Company is to be held in Petersburg, for the purpose of considering a plan to dissolve the old company and organize a new one with capital of $1,000,000 to carry on a greatly enlarged business, under the

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name of the American Electric Tool Company. The stockholders of the old company were, it is understood, to receive a good share of the stock of the new company in exchange for stock held in the former concern, provided the dissolution programme be carried out. L.

NORWICH, N. Y.—F. W. Somers of Ithaca, general manager of the Norwich Gas and Electric Company, has approved the plans for extensive repairs and improvements at the gas and electric plants of the company. In all about $43,000 will be spent. Practically four miles of new gas mains will be laid. In the electric department a 150-kilowatt generator will be installed and also a 200-horsepower engine.

NEW RICHMOND, WIS.—At the annual meeting of the Apple River Power Company Homer W. McCoy, of Chicago, was elected president; M. P. McNally, of New Richmond, vice-president, and E. P. Manwarring, of Stillwater, Minn., secretary-treasurer. This company, which has taken over the Washington County Light and Power Company, of Stillwater, Minn., will expend $210,000 in extensions and betterments. C.

CHESTER, S. C.—The Southern Power Company is making ready to develop the waterpower at Gettys Shoals, on the Catawba River, twelve miles above Camden and twenty-five miles south of Great Falls, where another large development is being finished up. The Gettys plant will give 100,000 horsepower, it is estimated, while the dam will be over 100 feet high, it is stated, with backwater running twenty miles up the river. L.

SAVANNAH, GA.—The Twin City Power Company, holding a franchise to build a dam and construct an electric plant on the Savannah River at Augusta, has applied to the city of Savannah and Mayor Tiedeman for a franchise to sell power in Savannah. The power company was represented by Judge Joseph R. Lamar and two officers of the Twin City Company. It is expected that similar franchises will be asked of numerous other cities and towns in the state of Georgia. L.

COLUMBIA, N. J.—The contract for the construction of a hydroelectric development across Paulin's Kill, Columbia, N. J., for the Warren County Power Company, Meikleham & Dinsmore, engineers, has been awarded to Frank B. Gilbreth, 60 Broadway, New York city. This contract includes the construction of a Ransom hollow dam thirty feet high and 350 feet long, as designed by Ransom & Hoadley, of Providence, R. I., a reinforced concrete power house and a tailrace, etc.

WADESBORO, N. C.—Simultaneously, almost, with the announcement of the sale of the Rockingham Power Company's plant, following long litigation for control, and winding up in a receivership and sale to parties who will spend large sums in completing the same, comes the announcement that a million-dollar cotton mill will be organized and built at once at Rockingham, some sixty-five miles southeast of Charlotte, by W. B. Cole, William Entwhistle and associates, the concern to be operated by electricity. L.

ESMERALDA COUNTY, NEVADA—The Walker River Electric Power Company, headed by George P. Costigan and Dr. A. L. Pollard, of Denver, which recently purchased water rights in Esmeralda County, Nevada, is making preliminary arrangements for the installation of a waterpower plant for the generation of electric power, the intention being to supply mine operators at Sweetwater and Lucky Boy, and other mining camps, with power for mine and mill purposes. The plant will be established on East Walker River.

PROVIDENCE, R. I.—After fifteen years of continued defeat at the hands of the farmers, the villagers of North Smithfield have voted to instruct the Town Council to enter into a one-year contract with the Woonsocket Electric Machine and Power Company for the installing of street electric lights in the town. They appropriated $12,000 for the purpose. The vote calls for lights all night, every night, for one year in Union village, Branch village, Forestdale, Slatersville, Waterford and Daly Hole, at locations to be designated by the Town Council.

BOSTON, MASS.—The Board of Gas and Electric Light Commissioners has given its approval to a consolidation of the Cohasset Electric Company with the Electric Light and Power Company, of Abington and Rockland. Under the terms of the consolidation, the latter company is to pay $18,000 for the property of the former, and to assume all of its debts. The board finds that facilities for furnishing light, heat and power will not be diminished by the consolidation, and decides that the consolidation under the terms agreed upon is consistent with the public interest.

SAN FRANCISCO, CAL.—It is given out here that a formal contract has been signed by representatives of the Truckee River General Electric Company and the reclamation service of the government fixing the respective rights of the two parties in the waters of Lake Tahoe and the Truckee River. Under this agreement the Truckee River General Electric Company relinquishes control of the Truckee River outlet to the lake to the government, and the federal government on its part grants to the company a right for a power site in the Truckee-Tahoe watershed. The government is to pay one-half of the cost of building a new dam across the Truckee River and to pay the entire cost of maintaining and operating this for irrigation purposes. It is supposed that the settling of the differences between the Reclamation Service and the power company will be followed by active work on the part of the latter.

HICKORY, N. C.—After some delay in perfecting details, it is now announced that all of the capital stock has been taken in the hydroelectric waterpower development on the Catawba River, near Hickory, in which Colonel Thornton, of Hickory, is a principal promoter. A six-million-dollar cotton-mill plant will be erected and will use power from the proposed plant, besides other industries. Although this plant has been discussed for some time, it seems very likely now that the financing of the project is fully assured and that the details will be worked out in a short while and work begun. L.

DANVILLE, ILL.—Active work looking to the harnessing of the Vermilion River for use in developing electrical power has been started. The principal dam and plant will be located midway between the C. & E. I., Grape Creek division bridge over the river and the Grape Creek interurban bridge, 800 feet north of the former. Chicago electrical men are behind the project. No bonus will be asked from the city or business men, no lots will be sold or any other catch propositions handled. The plant will be built, the power developed and sold, the price asked to be as low as can be and make a fair return to the investors.

SUPERIOR, WIS.—At the annual meeting of the Superior Water, Light and Power Company, held Thursday, August 5, the following officers and directors were elected: William R. Merriam, president; Robert R. Dunn, St. Paul, vice-president; V. M. Watkins, St. Paul, treasurer; W. H. Winslow, Superior, secretary and general manager. The following board of directors was chosen: Charles A. Chase, Superior; Kenneth Clark, St. Paul, Minn.; Robert R. Dunn, St. Paul, Minn.; William R. Merriam, Washington, D. C.; Frank A. Ross, Superior; V. M. Watkins, St. Paul, Minn.; P. G. Stratton, Superior; Thomas B. Scott, Burkeville, Va.; W. H. Winslow, Superior.

PITTSFIELD, MASS.—At a meeting of the stockholders of the Pittsfield Electric Company the following officers were re-elected: President and treasurer, Alexander Kennedy; clerk, William L. Adam; directors, W. L. Adam, S. G. Colt, Alexander Kennedy, James W. Hull, Charles E. Merrill, Henry R. Peirson and A. H. Rice. The treasurer's report showed an increase in business of 18.6 per cent over the previous year, the gross revenue of all classes of service being $142,175.30. A dividend of eight per cent was declared for the year. Reports showed that the company maintains 222 miles of overhead wires in the city and is installing three miles of underground mains in the business section this year.

PITTSBURG, PA.—Stockholders of the Philadelphia Company have voted to increase the indebtedness of the company $5,000,000 and to increase the capital stock from $42,000,000 to $47,000,000. Of this amount about $2,500,000 will be used for extensions and improvements by the Pittsburg Railways Company, the Allegheny County Light Company and other subsidiary concerns of the holding company. After the proposed improvements had been outlined by the directors 578,839 shares of stock were voted for the increase and 1,114 against. Of the issue of 5,000 debentures each has a par value of $1,000, bearing five per cent interest and maturing in ten years. They are convertible at the option of the holders into common stock on the basis of twenty shares for each debenture.

SPARTANBURG, S. C.—Following the announcement that the Electric Development and Power Company was interested in an extensive interurban trolley proposition, it is further reported that the company is now negotiating for the purchase and development of another hydroelectric site which will be bought in and developed. The company has withheld the details of the reported plan since some of the details of the scheme are not yet worked out fully. This company is carrying out extensive plans in the Spartanburg section, in which several hundred cotton mills are located, and this field is an important one, the Southern Power Company being the only competitor in one part of the field that is covered by the Electric Development and Power Company. The number of mills is rapidly increasing. L.

CHARLOTTE, N. C.—C. A. Hunt, C. A. Hunt, Jr., and W. E. Holt, Jr., of Lexington, N. C., have been in conference with the officials of the Southern Power Company in regard to buying electric power for the Winnonah, Nakomis and Dacotah cotton mills at that place. Contracts have been signed for something like 2,000 horsepower to be furnished to these mills at Lexington. The steam power will be discarded entirely, and as soon as the electric equipment can be properly installed the mills will run in the future by the hydroelectric power furnished by the Southern Power Company. Orders have already been placed by the mills for the electric motors and their necessary machinery, and as soon as the equipment is ready the Southern Power Company will be ready to furnish the power required.

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ELECTRIC RAILWAYS.

(Special Correspondence.)

MAYFIELD, CAL.—The Peninsular Railway Company has applied for a franchise for an electric road in this place.

SAN FRANCISCO, CAL.—The United Railroads of San Francisco will relay its Fillmore Street line, in this city, with 141-pound steel rails.

CEDAR RAPIDS, IOWA—The Cedar Rapids and Iowa City Interurban Company has let contracts for enlargements and additions to its plant aggregating $125,000. C.

SCOTTSBURG, IND.—Scott County has voted a subsidy of $43,000 in aid of the construction of a traction road from Scottsburg to Cincinnati, by way of Madison. S.

STERLING, ILL.—It is stated that the Aurora, Joliet & Eastern Electric Railway Company will extend its line to the Mississippi River by the way of Sterling. C.

CORPUS CHRISTI, TEX.—Daniel Hewitt, of Saline, Kan., has been granted a franchise by the City Council of Corpus Christi for the construction of an electric street-railway system.

TACOMA, WASH.—The Stone & Webster interests here have secured a franchise for the extension of the Stillacoom electric line through Salter's Point. The survey for the extension has already been made.

WATERLOO, IOWA—The Waterloo, Cedar Falls & Northern will spend $500,000 on its lines in the near future. The interurban will be extended from Denver Junction to Waverly, a distance of six miles. C.

ALBANY, N. Y.—The Trackless Trolley Company, of New York city, with a capital of $150,000, has been incorporated. The directors are: Charles E. Barrett, of New York city; A. Livingston Norman and Sadie E. Wiener, of Brooklyn.

FRESNO, CAL.—The Board of Supervisors of this county has granted F. S. Granger a franchise for the connecting links across the county roads for his proposed electric railway between this place and Hanford. It is stipulated that work must begin within ninety days.

PARIS, TEX.—It is stated that the control of the Paris Transit Company, the local street-car system, had passed into the hands of a St. Louis trust company and that considerable improvements and extension to suburban property owned by the trust company would be made.

CARMI, ILL.—An electric railway is to be built from Carmi to Fairfield. The survey will be taken in a few days, and the line will be built for both passengers and freight traffic. Kansas City (Mo.) capitalists are financing the road, which will ultimately connect with the Evansville (Ind.) line.

MONMOUTH, ILL.—The Rock Island Southern interurban line has been completed to the Edwards River and the entire road will be in operation to Rock Island by January 1, 1910. Orders for eleven passenger electric cars, two Baldwin locomotives and other equipment have been placed in the East. C.

ROCK ISLAND, ILL.—A deal has been closed whereby the Rock Island Southern will get into Aledo, as the latter city has long wished. The road will build a spur from near Gilchrist to Aledo. The officials formerly asked a subscription of $100,000 from Aledo citizens, but it is understood this sum was reduced.

TRENTON, N. J.—Articles of incorporation have been filed for the Montana, Wyoming & Southern Railroad Company, Jersey City, with a capital of $5,500,000. The incorporators are Frank S. Gannon, William C. Langley and William H. Seibert. The company is to operate railroads, tramways and terminals.

BLUFFTON, IND.—The directors of the Bluffton, Geneva & Celina Traction Company have contracted with the General Electric Company for four gasoline motor cars, to be used on the road now building between the cities named. The company has decided to use motors cars until such time as the power house and overhead work is completed. S.

INDIANAPOLIS, IND.—The Vincennes Citizens' Street Railway Company, now known as the Vincennes Traction and Light Company, has filed with the secretary of state notice of the increase of the capital stock of the company to $350,000. The increase in the capital stock of the company was made necessary by the numerous improvements to track and buildings now being made or contemplated by the company.

MILLINOCKET, ME.—According to Boston advices received here the first 1,200-volt direct-current electric railroad system in New England will be between Presque Isle and Washburn, Me., with an ultimate additional extension of 110 miles north to St. John River. The Aroostook Valley Railroad, affiliated with the Canadian Pacific Railroad, are the promoters. By virtue of a law conferring monopoly within its territory, the Bangor & Aroostook Railroad is protected from invasion by a steam railroad, therefore the new road will be built for electric operation, both passenger and freight. Its voltage will be the same as the New York Central road's voltage through the Park Avenue tunnel. Power will be purchased, according to the plans, from the Maine and New Brunswick Power Company, at Aroostook Falls. On the south the new road will connect with the Canadian Pacific.

ZANESVILLE, O.—B. E. Ottman, treasurer of the Cleveland, Barberton, Coshocton and Zanesville Interurban, has announced that construction on the new road would commence some time in August. One force of workmen will work from this city north and one from Coshocton south. The road at this end of the line will be finished first.

GRAND RAPIDS, MICH.—The Michigan & Chicago Westbound Railway Company, capitalized at $3,000,000, has filed incorporation papers at Lansing. This is believed to be the interurban from Grand Rapids to Kalamazoo, through Allegan and Barry counties, in the promotion of which W. P. Jacobs, of Kalamazoo, has been working for several years.

EVANSVILLE, IND.—The strike on the Evansville & Southern Indiana Traction Company's local division by carmen has been declared off, the forty men which the company agreed to re-employ have been assigned to work at the old rate of wages and the company maintains an open shop. The men were out ten weeks and failed to gain a single point. S.

SAN JOSE, CAL.—The Peninsular Railway Company, under which name are consolidated the old Peninsular Railroad Company, the San Jose-Los Gatos Interurban Railway Company and the Santa Clara Interurban Railway Company, has filed its articles of incorporation here. The company will operate, when the projected extensions are completed, 222.2 miles of electric road.

BELLEVILLE, ILL.—Work on the East St. Louis, Columbia and Waterloo Electric Railway is being pushed so as to have the road in operation by November 1. Condemnation suits have been filed in the County Court. President E. F. Schoenning and Secretary-Tresurer H. Reichenbach, of Waterloo, declare that the road will be completed and ready for passengers by November 1.

PEORIA, ILL.—The Peoria Railway Company will lay new rails on the upper part of Adams Street, a distance of about two miles, as soon as the summer rush is over. The company will use the heavy girder rail, as with the new double-truck cars the rails now in are too light. This company has just placed an order for a number of pay-as-you-enter cars for the Adams Street line. V.

BISBEE, ARIZ.—Recently in Washington, D. C., the secretary of the interior decided in favor of the Cochise County Electric Company and against the Arizona Southern Company, in the case long drawn out for the right-of-way over the abandoned E. P. & S. W. grade from French through the pass by Cochise. The former company will now build its electric line from Bisbee to Douglass.

DES MOINES, IA.—It is stated that Congressman McKinley, head of the Illinois Traction system, will spend $500,000 on new tracks, new cars and better service when he takes over the Des Moines City Railway Company. Mr. McKinley has been making a thorough inspection of the lines, though the actual fact of purchase or details connected with it have not as yet been announced.

BRISTOL, CONN.—The Meriden, Middletown and Guilford Electric Railway has been organized in Meriden with $50,000 capital. Ex-Senator Francis Atwater is president. The stock has all been taken up by the incorporators. Work will begin at once. When completed the road will give direct connection to the shore and run through a prosperous and picturesque section of the state.

ROCKLAND, ME.—Another link in Maine trolley line construction destined to traverse the entire length of the Penobscot Valley will be built between Camden and Belfast. The charter is held by the Waldo Street Railway, some of the directors of which are also identified with the Rockland, Thomaston & Camden Street Railway. The latter corporation is not concerned in the project, however.

IOLA, KAN.—It is stated at Coffeyville that the Kansas Union Traction Company, of which W. J. Jones, of Altamont, is president, is going to make that city the starting point for a line to Columbus, Kan. It will run through Mound Valley, Oswego, Hollowell and Sherwin. At the same time it is announced that the company will build from Coffeyville to Parsons by way of Altamont.

PENDLETON, ORE.—Articles of incorporation have been filed for the Farmers' Railway and Navigation Company, which proposes to build and operate an electric railroad system in Umatilla County. The first unit will be a road between the towns of Umatilla, on the Columbia and Milton, in the heart of the fruit and grain belt of the east end of the county. The company behind the scheme is incorporated for $250,000, and it is announced that surveyors are already in the field prepared to locate the right-of-way. The capital stock of the Farmers' Railroad and Navigation Company is divided into 2,500 shares, of

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$100 each. In addition to the main line of electric road from the Columbia to the center of the wheat belt, articles of incorporation also permit branch lines, the maintenance of a fleet of steamers on the Columbia, and construction of telegraph and telephone lines.

AUBURN, ME.—Directors of the Portland, Gray and Lewiston Electric Railroad have raised the necessary capital to build the road. A large number of changes have been made in its location since the original survey. It will be practically a straight line from Main and Lisbon streets in Lewiston to Monument Square in Portland. W. S. Libbey, of Lewiston, has been elected treasurer.

WHEELING, W. VA.—It is stated that the proposed electric line between Marietta and Wheeling is not to be a trolley line, but an electric railroad, equipped with electric locomotives for the hauling of freight and passenger trains. The right-of-way men have been working between Marietta and Newport and have secured some of the desired privileges and are now waiting until the engineer arrives in order to make some suggested changes in the survey.

ERIE, PA.—Notice was given in court last week that Attorneys Gunnison, Rilling and Fish, acting as attorney for the Erie, Cambridge, Union & Corry Railway Company, have given their consent to the decree of the court directing the sheriff to sell the Erie, Cambridge, Union & Corry Railway Company to satisfy the creditors. The sale was brought about at the suit of the Erie Trust Company, successors to the New York Security and Trust Company.

SAN FRANCISCO, CAL.—The Board of Supervisors has adopted the recommendation of the Public Utilities Committee favoring the re-submission of the proposition of issuing bonds for the construction of a municipal electric railway on Geary Street in this city. The proposition will be submitted in December. The proposition was lost by a few hundred votes a few weeks ago, notwithstanding the fact that a considerable majority of the votes cast were in favor of it.

PETERSBURG, VA.—As required by law, the charter of the newly organized or reorganized properties, under the title of the Virginia Railway and Power Company, having been granted, and a mortgage deed given in favor of the Equitable Trust Company of New York to secure a fifteen-million-dollar first and refunding mortgage bond issue of five per cent gold bonds, this mortgage has been filed with the court here to be copied. It is a lengthy manuscript of some 125 pages of printed matter. L.

SOUTH BEND, IND.—The South Shore traction railroad has acceded to the demands of its trainmen and increased their pay from 23 to 27½ cents an hour. This agreement is significant, because it is the first instance known where an agreement was entered into between an electric company and the steam-railway unions. General Manager Wallace says the arrangement will assure the company experienced trainmen in its service, because the Steam Trainmen's Union requires a two years' apprenticeship. S.

QUINCY, ILL.—The city of Quincy, Ill., is asking the Illinois Traction Company, which owns the local street railway, to build an interurban from Quincy as the price of the extension of the local franchise. A committee will wait upon General Manager Chubbuck to ask the company to accede to their demands. They are not particular as to what direction the road goes, but they will ask for a line to Peoria, Springfield, to East St. Louis via Roodhouse, to Galesburg, and from Quincy to Carthage, Nauvoo and Fort Madison. V.

AUGUSTA, ME.—The Board of Railroad Commissioners have rendered a decision approving the amended petition of the Portland, Gray & Lewiston Railroad Company to operate an electric line between Auburn and Portland through the towns of New Gloucester, Gray, Cumberland and Falmouth. The amended petition provided for a different route for the road so as to get rid of telephone poles along the line. This railroad has been in the public eye of late because of litigation among its promoters over the stock of the company.

ASHEVILLE, N. C.—Provision has been made by the Asheville Electric Company, by a bond issue, for the raising of three-and-one-half million dollars for improvements whenever such shall be decided upon by this thriving company. The electric company has made a mortgage deed to the Old Colony Trust Company, trustee, for the three-and-one-half million dollars, in denominations of $1,000, payable July 1, 1939, at five per cent interest. The mortgage given the Old Colony Company is located in Buncombe County, of which Asheville is the county seat. The city system of trolleys is known for its high degree of efficiency and successful management, and extensive improvements locally are not unlikely in the near future. L.

DALLAS, TEX.—Texas Traction is doing well. The increase in earnings is averaging thirty-six per cent over last year. June 30 ended the road's first year of operation of the Dallas-Sherman line. In that twelve months passenger receipts at various stations were shown as follows: Dallas, $52,162.75; Richardson, $5,125.75; Plano, $20,025.15; Allen, $7,248.95; McKinney, $39,690.90; Melissa, $5,698.69; Anna, $5,675.20; Van Alstyne, $14,644.80; Howe, $7,036.75; conductors, $50,305.10; gross total, $244,780.08; redemptions, $368.72; net passenger, $244,411.28; express, etc., $13,904.61; total, all, $263,315.89. As the express business started in September only, the total is regarded as excellent, in view of the fact that the first month showed about $600 and June made it $2,949.81 and July promises much better.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

BUCHANAN, N. D.—A telephone company is being organized by Edward Isaacs and others.

NASHWAUK, MINN.—The Mesaba Telephone Company is preparing to put in a central here.

GILMER, TEX.—The Gilmer Telephone Company has been incorporated in this place with a capital of $10,000.

FORDYCE, ARK.—The Southern Telephone Company has been incorporated with a capital stock of $1,000,000.

CEDAR RAPIDS, IOWA—The Cedar Rapids & Iowa City Interurban Company has let the contract for additions to its plant, to cost $150,000.

MARSHALLTOWN, IOWA—The Farmers' and Merchants' Telephone Company is about to begin construction of a plant here, to cost about $150,000.

WENATCHEE, WASH.—C. B. Cooper, construction engineer of the United Wireless Telegraph Company, is here to superintend the construction of a wireless station.

ST. PAUL, MINN.—The Bell Telephone companies in Minnesota, the Dakotas, Iowa and Nebraska have been merged for operating purposes, but will retain separate corporate existence with local officers.

SUMTER, S. C.—The Sumter Telephone Company is making ready to improve its Sumter system of telephones by the installation of the common battery, and by other improvements, costing about $12,000, to be put in within a few months. L.

GOUVERNEUR, N. Y.—A new telephone line is to be constructed from this village to the plant of the Uniform Telephone Company, which is now being built at Talcville. It will be a part of the Bell system. The work will be commenced immediately.

YORKVILLE, S. C.—N. C. McCorkle, with the aid of experts, is laying off the streets of Yorkville preparatory to rebuilding the local telephone system of the Piedmont Telephone Company, and laying the lines in underground cables, affording the town an up-to-date system for local use. L.

SALISBURY, N. C.—A recent report here is to the effect that application has been made of the town for a franchise by outside parties to locate a number of telephone booths in the town, though it is not known who is behind the movement at this time. At present the Bell Telephone controls the field. L.

ENOREE, S. C.—The Enoree Telephone Company has made application for the right to increase its rates for telephones, and the railroad commission has sent the company a copy of its thirtieth report, prescribing the necessary methods of procedure where such a step is contemplated in South Carolina. L.

LITTLE ROCK, ARK.—Articles of incorporation have been filed with the secretary of state by the Southern Telephone Company, capital stock $1,000,000, of which $233,000 has been subscribed, incorporated to do a general telephone business. The company will have its offices at Fordyce. The incorporators are A. B. Banks, J. W. Lee, H. C. Couch, H. A. Longino, C. B. Lyle and T. A. Monroe.

SAN FRANCISCO, CAL.—The United States Circuit Court of Appeals, in the case of the Sunset Telephone and Telegraph Company vs. the City of Pomona, Cal., has decided that any telegraph or telephone company doing an interstate business may establish its lines in any city or state without a franchise, being subject only to a police power concerning where such poles and wires may be placed.

FLINT, MICH.—Flint is to have a $100,000 telephone exchange. B. W. Trafford, vice-president and general manager of the Michigan State Telephone Company, was in this city Thursday afternoon and announced that bigger quarters are necessary for the business. Ground has been purchased in the heart of the business district and a two-story brick building, to be sixty feet square, will be completed by the first of the year.

TOLEDO, OHIO—The Central Union Telephone Company has begun mammoth improvements at Dayton, where they will expend about $200,000. The work will consist of a new branch exchange building, two stories high, with commodious lunch and rest rooms, lavatories, club room, kitchen, supply rooms, and elaborate equipment. The Rouzer Company has been awarded the general

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contract and the work will be completed by October 1. Numerous underground connections are necessitated, adding materially to the expense. The company announces that two additional exchanges will probably be installed next year. The system when completed will be one of the most complete in the entire country. H.

HOUSTON, TEX.—Prominent among the proposed new buildings here will be that of the Southwestern Telegraph and Telephone Company. This will be the new station in South End. According to District Manager Pike, it will not be less than four stories, built of concrete. Work will commence on it within the next month or six weeks, as the company must occupy a portion of it by November 1. It will not cost less than $60,000.

TOLEDO, OHIO—During the rush hours Monday of last week the entire force of girl operators at the office of the Home Telephone Company, of Napoleon, Ohio, went out on strike, leaving the manager in sole charge of 700 telephones. Without previous warning the girls demanded weekly pay and an advance of salary. The time of payment was conceded, but the advance denied. The vacant places have been filled by help from Toledo and Detroit. H.

RICHMOND, VA.—An important farmers' telephone line will soon be connected with the telephone exchange of the Southern Bell Telephone Company in Richmond. The line will extend about five-and-one-half miles from Richmond, in Chesterfield County, and will connect with the Southern Bell Telephone Company. There are a number of farmers' telephone lines in Chesterfield County already, and the progressive farmers are in close touch with their friends and neighbors.

SPRINGFIELD, MASS.—Branch offices have been established by the New England Telephone and Telegraph Company at a half-dozen different places in Springfield and vicinity for the convenience of subscribers who desire to pay their bills in person, and who do not wish to go to the central office. The company officials say they believe this plan of establishing branch agencies will not only be of convenience to subscribers, but will be advantageous to the company by securing prompter payments.

DES MOINES, IOWA—It is stated that a radical change in the managerial policy of the Iowa (Bell) Telephone Company will shortly be inaugurated. In general the new arrangement contemplates the doing away with a large number of managers of local exchanges. In lieu of a manager in each town the state will be divided into districts, with a general manager in charge of each district. Just how many districts will be comprised within the border lines of Iowa is still to be decided. It furthermore is reported from Des Moines that among the men to be favored with the new managerial position local Manager F. D. Cleaver, of Dubuque, will be assigned to a post.

HARTFORD, CONN.—The action of the state Senate in passing the bill authorizing savings banks to hold first-mortgage bonds of the Southern New England Telephone Company is considered a common sense proceeding. The company has a long record of prosperity, is recognized as managed with keen business ability, and never misses a dividend. Its bonds should be as safe as those of any other latter-day public service corporation. It is unfortunate that the state has to pass special laws for the government of savings bank investments. Such legislation is taken as an order to buy. In fact, it is at most merely permissive. The officials of the institution may buy these, if they deem best; they are not compelled to do so. In the case of the Southern New England bonds there is so little element of risk that it is surprising that there was any objection.

NEW MANUFACTURING COMPANIES.

(Special Correspondence.)

INDIANAPOLIS, IND.—Wood Electric and Manufacturing Company, South Bend, has given notice of increase of capital from $10,000 to $30,000.

MUNCIE, IND.—The Warner Electric Company has incorporated, with a capital of $100,000, for the purpose of establishing and equipping a plant for the manufacture and sale of electrical machinery and supplies. W. E. Hitchcock, R. C. Stone, A. L. Johnson and C. E. Davis, directors. S.

COLUMBUS, OHIO—The Electric Supply Company, of Columbus, was incorporated last week with a capital stock of $50,000, for the manufacture of electrical, gas and steam supplies and other merchandise. The incorporators are E. W. Swisher, L. M. Ferguson, J. D. Price, C. E. Myers and Ferdinand Baumann.

NEW YORK, N. Y.—The Traction Materials Company, of New York, has been incorporated to manufacture and deal in electrical and mechanical apparatus, material, appliances, etc., machinery and supplies. Incorporators: Adolph Schneider, 1834 Catin Avenue, Brooklyn; George W. Meacham, 126 Riverside Drive; John G. Bishop, 87 Madison Avenue, both of New York. The capital stock is reported to be quite small, though it may be merely nominal.

ELECTRICAL SECURITIES.

The bulls are still in control of the market and electrical securities in common with industrials generally hold their strength. The placing of large orders by equipment companies has shown the absolute strength of the position of United States Steel. The market is intrinsically sound, but prices are now running to a level where some setback may be expected, as speculators have about discounted conditions, and it will be some while before transactions broaden sufficiently to carry prices much higher.

DIVIDENDS.

Mobile Electric Company have declared a quarterly dividend of one-and-one-half per cent on the preferred stock of the company, payable August 16, 1909, to stockholders of record August 14, 1909.

Directors of the Northern Texas Electric Company have declared the regular semi-annual dividend of three per cent on the non-cumulative preferred stock, and an initial dividend of two per cent on the common stock of the company. Both dividends are payable September 1 to stock of record August 30, 1909.

NEW YORK.

	Aug. 16.	Aug. 9.
Allis-Chalmers common	15⅛	15¾
Allis-Chalmers preferred	53⅞	56¼
Amalgamated Copper	86⅛	85⅝
American Tel. & Cable	80*	80*
American Tel. & Tel.	141⅝	142½
Brooklyn Rapid Transit	80¼	80½
General Electric	169⅝	171¾
Interborough-Metropolitan common	14½	15½
Interborough-Metropolitan preferred	47¾	48½
Kings County Electric	135	....
Mackay Companies (Postal Telegraph and Cables) common	81	82½
Mackay Companies (Postal Telegraph and Cables) preferred	74½	74⅝
Manhattan Elevated	143½	144⅝
Metropolitan Street Railway	20	....
New York & New Jersey Telephone	143	142
U. S. Steel common	78½	77⅜
U. S. Steel preferred	127	126¾
Western Union	74	75½
Westinghouse common	87⅛	88¾
Westinghouse preferred	120	....

*Last price quoted.

BOSTON.

	Aug. 16.	Aug. 9.
American Tel. & Tel.	141⅝	142¾
Edison Elec. Illuminating	254	....
General Electric	169⅝	....
Massachusetts Electric common	13	13
Massachusetts Electric preferred	73	74½
New England Telephone	137	....
Western Tel. & Tel. common	11⅛	....
Western Tel. & Tel. preferred	90	90

PHILADELPHIA.

	Aug. 16.	Aug. 9.
American Railways	45⅞	47
Electric Company of America	12¼	12½
Electric Storage Battery common	61	61¾
Electric Storage Battery preferred	61	61¾
Philadelphia Electric	12⅜	12½
Philadelphia Rapid Transit	30¼	31⅜
Philadelphia Traction	91	91¼
Union Traction	54⅝	55⅜

CHICAGO.

	Aug. 16.	Aug. 9.
Chicago Railways, Series 1	108	112
Chicago Railways, Series 2	38⅛	39
Chicago Subway	20½	23½
Chicago Telephone	135½	135
Commonwealth Edison	121	120⅛
Metropolitan Elevated common	17¾	....
Metropolitan Elevated preferred	49	50
National Carbon common	99	98
National Carbon preferred	119	120

PERSONAL MENTION.

E. E. KESTER, of Greenville, Ohio, has been appointed by H. E. Roseman, general traffic manager of the Illinois Traction system, to succeed S. K. Holland as division traffic manager at Peoria, with the title of general agent. V.

S. K. HOLLAND, division traffic manager for the Illinois Traction Company at Peoria ever since the company has been running into that city, has resigned. Mr. Holland will ally himself with the Peoria and Galesburg Interurban and will hold a position close to President Stephens, who was formerly with the Traction Company. V.

PUTNAM A. BATES, specialist in electrical and mechanical equipments and, among other works, designer of the heating, lighting and power plant of the Engineers' Club Building of New York, has removed from his offices in Broadway to occupy more commodious quarters in the top floor of the United States Express Building, 2 Rector Street, New York city.

J. J. BROWN, M. Am. Soc. M. E., was elected vice-president and general manager of the Wheeler Condenser and Engineering Company, at the recent annual stockholders' meeting, held at the company's works at Carteret, N. J. Mr. Brown entered the condenser field some fifteen years ago as southwestern manager for the Henry R. Worthington Company, and later became general

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sales manager. After the formation of the International Steam Pump Company he became their western general sales manager, with headquarters at Chicago, and resigned that position to take up his present work.

C. A. PINYERD, traveling electrician of the train-lighting department of the 'Frisco, has been spending several weeks in the analytical department of the chemical department of Armour Institute of Technology, Chicago. Mr. Pinyerd will return to Chicago some time this month to accept a position in the operating department of the Safety Car Heating and Lighting Company.

CHARLES W. McDANIEL has been appointed general commercial superintendent of the Missouri & Kansas Telephone Company. Mr. McDaniel is one of the old-timers. He built the first telephone exchange in Hannibal, Mo., in 1879, and also built the Moberly exchange a little later. He then moved to Joplin, where he operated exchanges covering twenty-seven counties, equipping exchanges in Joplin, Carthage and Webb City, Mo., and at Galena, Kan. In 1883 he sold out to the Missouri & Kansas Company, which company he has been with since that time, acting just before he received the above appointment as assistant general superintendent. Other changes which have occurred in the company are W. W. Johnson, general superintendent of plant, and F. C. Penfield, general superintendent of traffic. In connection with his early experience in the telephone industry, Mr. McDaniel is proud of an autograph letter from Theodore N. Vail, now president of the American Telephone and Telegraph Company. This letter was written on March 8, 1879, when Mr. Vail was general manager of the old Bell Telephone Company, whose offices were in room 52 of the New York Mutual Life Insurance Company, Boston, Mass. At that time Gardner G. Hubbard was president and Thomas Sanders treasurer of the company. Alexander Graham Bell was electrician, and Thomas A. Watson general superintendent.

OBITUARY.

CAPTAIN HERMAN P. SCHUYLER, assistant treasurer of the General Electric Company, and one of the best-known credit men in the country, died on August 14, at his home in Albany, aged sixty-seven years. He was a direct descendant of General Schuyler of Revolutionary fame, and himself won distinction in the Civil War. In 1864 he was appointed head of the Ordnance Department with headquarters at the Watervliet Arsenal. In 1887 he became private secretary to the late H. H. Rogers, of the Standard Oil Company. He had been with the General Electric Company since 1893.

NEW PROPOSALS.

POST OFFICE AND COURT HOUSE, SAN ANGELO, TEX.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., September 16, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring and standard clock system) of the U. S. Post Office and Court House at San Angelo, Tex., in accordance with the drawings and specification, copies of which may be obtained from the custodian of site at San Angelo, Tex., or at the Supervising Architect's office.

NEW PUBLICATIONS.

YEARBOOK OF THE MICHIGAN COLLEGE OF MINES—The Michigan College of Mines, Houghton, Mich., has published its yearbook for 1908-1909 announcing the courses for 1909-1910. Besides the usual calendars, lists of officers and instructors, regulations for admission, departmental information, etc., always included in such publications, the yearbook in question contains a map of the campus, a map of the Portage Lake mining district and a number of tables giving a schedule showing the number of hours given to each subject during each week in each term and time schedules for the different terms.

ENGINEERING ASSOCIATION OF THE SOUTH; PROCEEDINGS—Vol. XX, No. 2, for April, May, June, 1909, of the quarterly publication of this association, contains the minutes of the Nashville (Tenn.) Section meetings, held on May 24 and June 21 of this year, those of the Birmingham (Ala.) Section of April 1, May 6, May 20 and June 3, and of the Atlanta (Ga.) Section, April 22, May 13 and June 10. The following papers are included: "Pavements Demanded at the Present Time by Urban and Interurban Roads," by H. L. Collier—presented June 10. "Tar-Cap Macadam," by M. Nicholson—February 4. "Water-Power Economies," by John Wilkes—March 15. "Observations on Jetty Building," by R. H. Lowndes—February 25.

INDUSTRIAL ITEMS.

THE NATIONAL POLE COMPANY, Escanaba, Mich., has just loaded two trainloads of poles at its Northern Minnesota yards for shipment to Mississippi.

THE DICKINSON MANUFACTURING COMPANY, Springfield, Mass., announces that it has registered its "Gummon" trademark in the United States and many foreign countries.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has issued a catalogue describing with the aid of some very clear illustrations their new type of rosettes.

THE GREGORY ELECTRIC COMPANY, Chicago, Ill., has issued the August number of its monthly "Bargain Sheet" of second-hand but reliable electrical apparatus and machinery.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, Ill., has published a complimentary pamphlet, entitled "What They Think of the Telephone in Train Dispatching," giving the opinions on this subject of prominent railroad men.

THE J. P. DEVINE COMPANY, Buffalo, N. Y., is distributing a pamphlet containing a list of over 2,000 users of their Passburg vacuum drying and impregnating apparatus. The same company has also issued some attractive motto cards suitable for hanging.

ROTH BROTHERS AND COMPANY, Chicago, Ill., have issued Bulletin 207 on Roth motors, which are ordinarily furnished shunt-wound, but compound or series-wound if desired. The same firm has also issued a blotter illustrating a feed-grinding mill geared to a Roth motor.

THE CURTIS BATTERY COMPANY, Minneapolis, Minn., has issued a pamphlet on its primary and storage batteries. A table gives the number of cells, lamp voltages, amperes per lamp, discharge rates, costs, etc., for lighting plants of given numbers of sixteen-candlepower lamps from six to 100.

THE KIMBLE ELECTRIC COMPANY, Chicago, Ill., has issued a convincing folder extolling the merits of Kimble motors. These motors are made for use on single-phase alternating-current circuits and have variable speeds from 300 to 3,000 revolutions per minute. They need no extra current to start, and will start with the full load. The motors are sold on a "money-back" offer and are guaranteed for two years.

THE EXCELLO ARC LAMP COMPANY, Chicago and New York, has just issued its latest bulletins (Nos. 101 and 102), the former on the Excello Flaming Arc Lamp, and the latter on the Duplex Excello Flaming Arc Lamp. These give detailed descriptions and explain the working and new features of the lamps, with the aid of some excellent diagrams. Bulletin 102, on the Duplex lamp, describes the mechanism and its action in great detail.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing several folders descriptive of improved wireless telegraph apparatus suitable for experimental and private installation. A complete description is given of the various sizes of receivers, detectors and sending sets. Several new types of spark and tuning coils are described which, together with complete diagrams of connections, should prove of much interest and service to those engaged in wireless telegraph work.

THE UNITED ILLUMINATING COMPANY, Bridgeport, Conn., is installing a Westinghouse 500-kilowatt steam turbine for driving a 650-kilowatt-ampere, 2,400-volt, three-phase, sixty-cycle Westinghouse alternator, which is to feed into the distribution system serving the city of Bridgeport and surrounding territory with light and power. The present installation is an addition to the existing equipment of a 300-kilowatt Westinghouse turbine driving a Westinghouse alternator, besides several small belted units.

THE WESTERN ENGINEERING COMPANY, Los Angeles, Cal., announces a successful trial of the Seabrook-Box Differential Axle, which was made over the lines of the San Bernardino Valley Traction Company on a street car fitted with the new axles. Appended to the announcement is a list of signatures of the members of the party carried in the car, who thus certified to the excellence of the differential axle in promoting a smoothness of running not hitherto attained in cars fitted with the ordinary stiff one-piece axles. The above company is the exclusive agent for the American Differential Axle Company, which has recently issued its second annual report of the directors. This report shows evidences of ultimate success of the associated companies promoting the differential axle.

THE ELECTRICAL ALLOY COMPANY, Morristown, N. J., which was formed some months ago, has now got its plant in good running order and is doing good business in the manufacture of electrical resistance alloys. The company has recently issued a pamphlet setting forth the merits and variety of its goods, which shows that it is manufacturing resistance materials in every variety of wire, sheet and ribbon, including nickel-steel, nickel-copper, ferro-nickel, nickel-chromium and german-silver

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alloys, for use in all kinds of electrical apparatus. These alloys are turned out in some forty different diameters from as fine as 0.003 inch (containing 5,000 feet to the pound), and all run exactly even, to meet the most exacting requirements. H. P. Reigart is the president, and F. S. Reigart the secretary, of the company. Both are resident in Morristown.

THE UNITED ELECTRIC COMPANY, Chambersburg, Pa., has contracted with the Ball & Wood Company, Elizabethport, N. J., for two 750-kilowatt, Rateau-Smoot, high-pressure turbines and sixty-cycle, three-phase generators, to be installed in its plant at Lemoyne, Pa. The United Electric Company is owned by the Cumberland Valley Railroad Company, and the latter is, in turn, controlled by the Pennsylvania Railroad Company. The specifications for the units just contracted for were issued by the Motor Power Department of the Pennsylvania Railroad Company.

THE HOYT INSTRUMENT WORKS, Penacook, N. H., have issued an instructive catalogue on ammeters, voltmeters and volt-ammeters, for direct current. The Hoyt voltammeter for testing ignition circuits consists of a type C. 25 ammeter and voltmeter mounted on a single base and so wired into the ignition circuit that both instruments are in circuit during the whole period that the engine is running. Type 35 ammeters and voltmeters are made in two styles, C. 35 for switchboard or wall use, and P. 35 for portable use. They are furnished in various finishes. The ammeters of the first class are self-contained up to 5 amperes normally, and those of the second class up to 100 amperes. All the type 35 voltmeters are self-contained up to 150 volts. Type P. 5 instruments register up to 200 amperes, and 750 volts, respectively. Other types are described for dashboard and switchboard use, pocket use, etc.

THE GARWOOD ELECTRIC COMPANY, Garwood, N. J., announces that it has appointed the Tucker Electric Company, of 970 Old Colony Building, Chicago, as its selling agent for the city of Chicago and as far south in Illinois as a line drawn east and west through Springfield, and including Springfield, and as far in Wisconsin as a line drawn east and west through Madison, and including Madison, and that portion of Indiana north of a line drawn east and west through Indianapolis, and including Indianapolis. Mr. Tucker is very well known in the electrical field, was formerly connected with the Western Electric Company, and but recently with the International Cash Register Company. The Garwood Electric Company announces that it has appointed Fellows & Fellows, Lawler Building, Toronto, Canada, as its sales agents. Their territory includes the entire Dominion of Canada. Fellows & Fellows are very well known in railway and general engineering lines.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., reports the following among recent orders for electrical apparatus: Indiana Steel Company, Gary, Ind., seventy mill motors, totaling about 2,400 horsepower (this is an addition to the 11,000 horsepower of Crocker-Wheeler motors employed at the present time by this company); Gould Paper Company, Lyons Falls, N. Y., electric drive for paper-making machine about to be installed; J. M. Kohler Sons Company, Sheboygan, Wis., one 750-kilowatt, 250-volt, direct-current generator; King Bridge Company, Cleveland, Ohio, one 150-kilowatt, compound-wound, 250-volt generator, for supplying light and power; American Lace Manufacturing Company, Elyria, Ohio, one 100-kilowatt generator; Bethlehem Steel Company, a 225-horsepower, compound-wound motor, to be installed at the Saucon plant (this is an addition to the 8,800 horsepower of Crocker-Wheeler motors employed at the present time by this company); Beadleston & Woerz, New York city, 187 horsepower in compound-wound, 115-volt motors, and one 150-kilowatt, 125-volt, compound-wound generator; Roessler & Hasslacher Chemical Company, Perth Amboy, N. J., 295 horsepower in three-phase, sixty-cycle, 480-volt, induction motors of the squirrel-cage type.

DATES AHEAD.

Northwest Electric Light and Power Association. Annual convention and joint session with Seattle branch, A. I. E. E., Seattle, September 7-9.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8-10.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 14-16.

Kansas Gas, Water, Electric Light and Street Railway Association. Next meeting, Wichita, Kan., September 23-24.

Illuminating Engineering Society. Annual convention, New York, N. Y., September 27, 28 and 29.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Railway Signaling Association. Annual meeting, Louisville, Ky., October 12-14.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 18.

RECORD OF ELECTRICAL PATENTS.

[Issued (United States Patent Office) August 3 and 10, 1909.

929,708. SERVICE-METER SYSTEM. William Reid, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company. Filed December 5, 1907. A service meter for a telephone system has differentially wound coils.

929,744. MOTOR. Ernest E. Yaxley, Chicago, Ill. Filed December 28, 1908. Includes an electromagnet, an accumulatory power device for operating mechanism for transmitting energy to do work, a circuit-closing mechanism for the first, etc.

929,745. WIRELESS COMMUNICATION. Clifford D. Babcock, New York, N. Y., assignor to United Wireless Telegraph Company. Filed September 25, 1905. Describes a form of electrode for a radiotelegraphic liquid detector.

929,758. DYNAMO REGULATOR. Stephen D. Field, Stockbridge, Mass., assignor to Pittsfield Spark Coil Company. Filed February 14, 1908. In combination with the armature of a self-excited dynamo are an electromagnet having a number of windings, a resiliently mounted armature therefor, a storage battery, a circuit extending between the armature and the battery, and including a portion of the windings of the electromagnet and its armature, depolarizing coils on the field magnet, and means actuated by the electromagnet for cutting in and out these coils.

929,763. ELECTROMAGNETIC APPARATUS FOR ACTUATING MECHANISMS. Samuel H. Hoggson, New York, N. Y. Filed June 29, 1906. Comprises a frame, a weighted oscillating member pivotally mounted thereon, a lever pivotally mounted upon the frame, having one end pivotally secured to the oscillating member, and another end connected to an armature, a solenoid secured to the frame, a circuit-closing device, and means carried by the weighted arm for actuating the circuit-closing device near the end of the oscillations of the oscillating member.

929,773. CURRENT-LEAK INDICATOR FOR ELECTRICAL CONDUCTORS. Raymond S. Masson, Berkeley, Cal. Filed August 10, 1908. The indicator consists of an insulator whose surface is visibly changed by the action of an electrical current thereon.

929,778. COMPOUND METAL BODY AND PROCESS OF PRODUCING SAME. John F. Monnot, New York, N. Y., assignor to Duplex Metals Company, New York, N. Y. Filed April 24, 1907. Renewed June 16, 1909. The process of producing compound bodies comprising aluminum and a non-aluminous metal inseparably united, consists in contacting a body of one such metal with a supermolten mass of a third metal and then contacting the coating formed by such supermolten mass with a mass of molten aluminum and causing a layer thereof to solidify thereon.

929,844. RELAY. John Erickson, Chicago, Ill., assignor, by mesne assignments, to First Trust and Savings Bank, trustee, Chicago, Ill. Filed August 20, 1906. An armature is hung on a knife-edge bearing carried at one end of the tubular casing of an electromagnet; a sheet-metal holding device is secured to the magnet and engages the armature to removably hold the same in place on its fulcrum; and switch contacts are secured at the other end of the casing and operated by the armature.

929,854. ELECTRICAL MEASURING INSTRUMENT. Dugald C. Jackson, Madison, Wis., assignor to Dugald C. Jackson and William R. Jackson, Madison, Wis., a copartnership. Filed June 5, 1905. Renewed June 21, 1909. Associated with the circuit through a pressure field coil for a movable element connected in bridge of the line limbs of the instrument, is a transformer which co-operates with an inductance means to modify the current flow through the pressure coil to bring the current into phase with the main-line pressure.

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929,878. INSULATOR. Joseph W. Ranson, Batavia, Ohio. Filed July 22, 1908. Comprises a rotatable body provided with means for receiving the wire when in one position and means for bending and automatically interlocking with the wire when rotated to a different position.

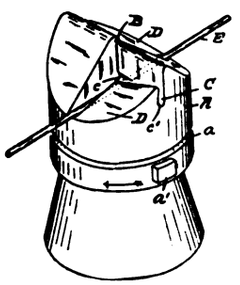
929,901. ELECTRIC HEATER. Charles E. Trewhella and Everett D. Holley, Forestville, Conn., assignors to the American Silver Company, Bristol, Conn. Filed July 17, 1907. The heat-unit-receiving member has a number of heat-distributing wings extending from it, and the heat unit is provided with an insulating block and a contact.

929,918. TROLLEY-WHEEL. Bert Crow, Findlay, Ohio. Filed August 8, 1908. The body has pivotally connected to it a harp which is mounted to swing into or out of engagement with the wheel.

929,947. ELECTRIC NEEDLE-SPRAY BATH-BRUSH. Harry Hertzberg, New York, N. Y. Filed July 5, 1902. Renewed September 10, 1903. Comprises a handle, groups of coarse and soft bristles, and means for directing the spray between either the coarse or soft bristles.

929,965. EXTENSION-CALL FOR TELEPHONES. Abner R. Marcotte, Concordia, Kan., assignor of one-half to George A. Layton, Concordia, Kan. Filed May 1, 1908. A mechanically operated closer controls the circuit, and can be locked in the open-circuit position by a latch member having at one end a rotatable forked tail-piece adapted to straddle the bell rod of the telephone call bell, this tail-piece having one fork plain, and the other formed with a cam shoulder.

929,984. MACHINE-TELEGRAPH. Guy C. Read, Davenport Station, Toronto, Ontario, Canada. Filed March 21, 1908. The printing keys are operated each by a corresponding one of a number of magnets which are energized in a predetermined



929,878.—INSULATOR.

order by contact bars controlled by a mechanism comprising a number of jointed rods having endwise movement and controllable by electric dots and dashes passing over a telegraph line.

929,995. SELECTIVE-RINGING MAGNETO-BELL. Burton W. Sweet, Cleveland, Ohio, assignor to Century Telephone Construction Company. Filed September 8, 1905. Comprises an exciting electromagnet, a sectional armature mounted to oscillate in a fixed position before its poles, a bell-tapper actuated thereby, and a screw-adjustment associated with the armature adapted to adjust the air gap between the sections of the armature and the magnet poles.

930,006. BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES. John E. Webster, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 25, 1905. Has a supporting arm having a brush-holding slot, a shaft mounted on this arm and a spiral spring comprising a number of turns of different diameters which surround the shaft, and a guide web integral with the arm and a portion of which is substantially concentric with the spring-shaft and contiguous to the outer turn of the spring.

930,007. BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES. John E. Webster, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 3, 1906. Renewed May 19, 1909. Insulating tubes severally closed at one end are fitted over a pair of parallel cylindrical supporting arms or projections, and thin metal caps are fitted over the insulating tubes to protect and seal the insulation.

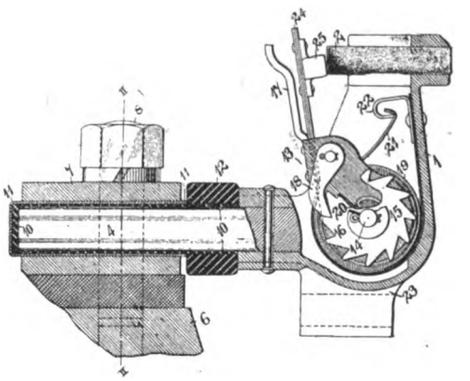
930,022. ELECTRIC POWER HAMMER. Thaddeus F. Baily, Alliance, Ohio, assignor of one-half to the Transue & Williams Company, Alliance, Ohio. Filed May 19, 1909. A number of vertically disposed series of coils are wound and connected in accordance with induction-motor construction, to act as a solenoid for the ram.

930,023. PROCESS OF STERILIZING FLUIDS. Charles B. Bartley, Pittsburg, Pa. Filed August 5, 1908. The process consists in establishing a direct current through the medium to be sterilized between immersed current terminals and simultaneously inducing a disruptive discharge through the medium and the atmosphere between an immersed terminal and an outer terminal.

930,065. ELECTRIC STORAGE BATTERY. Bruce Ford, Philadelphia, Pa. Filed September 7, 1906. An invertible battery jar is subdivided into intercommunicating superposed overflow and plate compartments and provided with oppositely arranged vent tubes communicating with the overflow compartment and respectively with the plate compartment and with the outside of the jar, and whereof the latter extends into the overflow compartment beyond the possible level of liquid therein when the jar is inverted.

930,067. COMMUTATOR BRUSH. Frank W. Garrett, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 3, 1906. The brush has an end cavity and a slot in one corner, and a cap plate has a portion that projects into the slot and a resilient stud that projects into the cavity.

930,068. BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES. Frank W. Garrett, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 21, 1906. In combination with a brush and a holder having a loop, is a shunt connector having one end attached to the brush and having a hook at its other end. A spring holds the hook in engagement with the loop.



930,007.—BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES.

930,100. TELEPHONE SLUG-HOLDER. Michael J. Stark, Jr., Chicago, Ill., assignor of one-half to Caspar B. Knudsen, Chicago, Ill. Filed June 27, 1908. A blank for the coin-tube consists of a substantially rectangular portion having at both ends U-shaped central extensions and centrally projecting lugs, the blank being adapted to be formed into a longitudinally open tube and the U-shaped extensions forming bottoms and covers for the tubes, there being a U-shaped excision in one of the extensions.

930,150. AUTOMATIC CUT-OFF FOR TROLLEY LINES. Robert Brown, Windber, Pa. Filed September 16, 1908. A circuit-breaker for electric conductors comprises conductor wires, a plate of non-conducting material, the ends of this plate being secured to the conductor wires, a lever pivotally secured intermediate of its ends to the plate of non-conducting material, one end of the lever always in contact with the conductor wire at the end of the plate and adapted to swing into and out of contact with the wire at the other end of the plate.

930,155. CIRCUIT-BREAKER. Herbert W. Cheney, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed October 22, 1906. A multipole switch or circuit-breaker comprises a frame or casting, an insulating support, sets of stationary contacts, in line, carried thereby, contact rods connected to the contacts, and passing through both insulating support and frame or casting at points which are staggered or out of alinement so that long leakage surfaces are provided.

930,156. OIL-SWITCH. Herbert W. Cheney, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed October 22, 1906. The oil tank is detachably secured to the frame.

930,177. ELECTROMAGNET. David J. Hauss, Aurora, Ind. Filed September 2, 1908. A core of magnetic material has a non-magnetic disk attached to one end, and a magnetic disk at-

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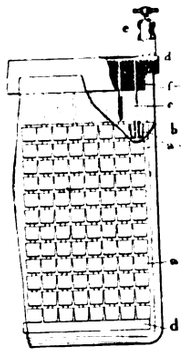
tached to the opposite end; a coil of insulated wire encircles the core, and a tubular housing of magnetic material recessed upon the interior receives the disks and forms a shoulder against which the disk of magnetic materials seats and is locked when the parts are assembled.

930,196. TIMER. Alvaro S. Krotz, Chicago, Ill. Filed February 28, 1907. The distributing member is a lateral stem carried by an arbor; a casing carries a series of contacts, each of which comprises a supporting stem carried by the casing; and a contact disk having a larger bore than its supporting stem provides a tilting as well as a lateral movement of the disk.

930,203. ELECTRICAL INSTRUMENT FOR PYROGRAVURE AND SURGICAL PURPOSES. Louis Mandarelli, Paris, France, assignor to Paul Berville, Paris, France. Filed November 28, 1908. The instrument comprises a hollow point having an opening at its rear end for the circulation of air, a body within the point, a metal tube connected to the point, a rod within the tube having one end engaging with the body, electric conductors connected with the tube and with the rod, and a handle of non-heat-conducting material surrounding the tube.

930,212. APPARATUS FOR TREATING GASES BY ELECTRICITY. Ignacy Moscicki, Fribourg-Gambach, Switzerland. Filed August 28, 1906. An electric furnace for the treatment of gases comprises a pair of separated circular concentric electrodes, arranged to form a circular arcing space, means for producing a magnetic field whose flux cuts this arcing space, means for causing a flow of the gases to be treated through this arcing space, and means for supplying an igniting gas to the space.

930,213. SECONDARY ELECTRIC BATTERY OR ACCUMULATOR. Walker Moseley, London, England. Filed March 29, 1909. An accumulator plate consists of a series of conical cups, adapted to receive and hold a semiliquid solution of



930,213.—SECONDARY ELECTRIC BATTERY OR ACCUMULATOR.

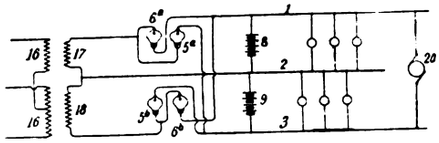
oxide of lead, each cup being provided with a perforated stem, made a little higher than the rim of the cup, vertical rods of lead upon which the cups are threaded, lower and upper bars of lead to which the rods are fixed, and crossbars of vulcanite for supporting the upper bars.

930,238. PRODUCTION OF LONG STABLE ELECTRIC ARCS. Otto Schönherr and Johannes Hessberger, Ludwigshafen-on-the-Rhine, Germany, assignors to Badishe Anilin & Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany. Filed March 16, 1906. The process of producing a long stable electric discharge consists in forcing one part of the discharge away from the other by a current of fluid directed alongside one of the terminals.

930,275. TROLLEY-WHEEL. Erastus E. Ecker, Kansas City, Mo., assignor of one-half to Robert McClintock, Kansas City, Mo. Filed August 18, 1908. Has a main central groove and right and left hand grooves communicating with opposite sides of the main groove.

930,324. ANNUNCIATOR-DROP. Burton W. Sweet, Cleveland, Ohio, assignor to Century Telephone Construction Company, Buffalo, N. Y. Original application filed May 19, 1906. Divided and this application filed February 28, 1907. Comprises a conductive mounting-plate, a pivoted drop thereon, an insulated contact-spring extending freely adjacent to the plate, in position to be actuated against the same by the drop, an electromagnet, and a hook and armature actuated by the magnet and thereby controlling the position of the drop.

930,325. SYSTEM OF DISTRIBUTING ELECTRICAL ENERGY. Percy H. Thomas, Pittsburg, Pa., assignor to Cooper Hewitt Electric Company. Original application filed January 20, 1903. Divided and this application filed May 6, 1903. In combination with three-phase mains and means for deriving therefrom independent two-phase sources, is a three-wire work circuit connected to two of the terminals of the independent sources, the neutral wire of the receiving circuit being connected to the two other terminals of these sources



930,325.—SYSTEM OF DISTRIBUTING ELECTRICAL ENERGY.

and vapor-electric devices connected between each of the outside direct-current mains and each of the first-named two-phase terminals so directed as to pass current through the work circuit in one direction only, together with storage batteries between the receiving circuit mains and the neutral wire whereby energy from either of the independent two-phase sources impresses a constant potential upon one only of the sides of the three-wire receiving circuit.

PATENTS ISSUED AUGUST 10.

930,336. TROLLEY-WHEEL HOLDER. James Barry, Ocean View, Cal. Filed October 18, 1907. Renewed February 20, 1909. A spring secured to the trolley pole holds a pivotally mounted yoke in an elevated position at all times for permitting the wheel to engage a trolley wire, and a spring mounted on each side of the trolley pole engages the side of the frame for checking any lateral movement of the same.

930,337. BRUSH-HOLDER. Norman C. Bassett, Lynn, Mass., assignor to General Electric Company. Filed March 24, 1902. The holder has narrow surfaces (one movable) for supporting a brush on opposite sides of the same, but displaced with respect to each other lengthwise of the brush.

930,351. SPARK-PLUG. Alexander Clarke, Folsom, W. Va., assignor to South Penn Oil Company, Pittsburg, Pa. Filed May 29, 1908. A ball armature loosely mounted in a socket in the plug is magnetically attracted away from a contact point to break the circuit.

930,388. ELECTRIC SIGNALING FIRE-ALARM APPARATUS. William H. Kirnan, Bayonne, N. J. Filed November 7, 1908. A sprinkler system is operated by a thermostat, which also controls an alarm box.

930,404. AUTOMATIC GAS-FEED FOR VACUUM-TUBES. Daniel M. Moore, Newark, N. J., assignor to Moore Electrical Company. Filed May 8, 1906. A thermostat controls means for supplying gas to the tube as the heat of the gas in the tube increases.

930,427. BRUSH-HOLDER. Lorenzo H. Sparks, Warren, Ohio. Filed January 16, 1908. The brush carrier is slidably fitted against a flat face on the holder and a finger on the carrier is acted on by a spring of adjustable tension.

930,449. SNAP-SWITCH. James H. Wyatt, Philadelphia, Pa., assignor to William M. Scott, Philadelphia, Pa. Filed February 6, 1908. Describes the details of a spring switch.

930,474. CURRENT-TESTING DEVICE FOR ELECTRIC BATTERIES. William C. Hood, Chicago, Ill., assignor of one-half to Charles W. Dietrich, Chicago, Ill. Filed March 20, 1908. A battery-current-testing device consists of an insulating support and metal foil mounted thereon of graduated widths at different points.

930,508. RECEIVER FOR HIGH-FREQUENCY ELECTRICAL OSCILLATIONS. Frederick K. Vreeland, Montclair, N. J., assignor to Wireless Telegraph Exploitation Company. Filed July 25, 1905. Two relatively movable coils are arranged in close inductive relation with their magnetic fields mutually opposed, such coils being connected in parallel.

930,512. TELEPHONE-EXCHANGE SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Filed August 4, 1904. Describes the details of a telephone-exchange system, including telephone lines extending to a central office. There may be also included under this classification the following, all by Harry G. Webster and assigned to Milo G. Kellogg: 930,513, filed August 4, 1904; 930,514, filed December 16, 1904; 930,515 and 930,516, filed December 4, 1905; 930,517, filed January 13, 1906; 930,518, filed February 10, 1906; 930,519, filed February 23, 1906; 930,520, filed May 4, 1906; 930,521, filed December 4, 1907.

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930,547. APPARATUS AND SYSTEM FOR MEASURING TELEPHONE SERVICE. David S. Hulfish, Chicago, Ill., assignor to American Telephone and Telegraph Company. Filed April 3, 1905. A selective switch is provided with means for automatically selecting an idle trunk line; and a meter connected with this switch, and actuated upon the energization of a relay, is provided with means whereby the meter when once actuated changes its circuit connections and thereby renders itself unresponsive to further action of the relay during the continuance of the connection to the selected trunk.

930,552. RELAY. Jacob M. Long. Los Angeles, Cal. Filed March 4, 1907. Has stationary contact pieces, with which a two-ended contact piece on a rotatable shaft alternately makes and breaks contact when the solenoid is energized and de-energized, upon the opening and closing of an electrical circuit.

930,586. ELECTRIC CURLING-IRON. Charles W. Wilmot, Redondo, Cal. Filed June 17, 1908. Comprises two connected outer heating irons, a relatively movable intermediate heating iron, and a shield or apron connected with the intermediate heating iron and looped over the outer heating irons.

930,588. RECEIVING ELECTRIC SYSTEM. Christoph Wirth and Christof Beck, Nuremberg, Germany. Filed March 18, 1909. Cut-outs for the motors are actuated only when the motors are permitted to run for a sufficiently long time.

930,603. CONTROLLING DEVICE FOR ELECTRIC MOTORS. Charles D. Knight, Schenectady, N. Y., assignor to General Electric Company. Filed February 21, 1907. An electromagnetically controlled switch closes the primary circuit, an impedance is provided in the secondary circuit, and a varying mechanism therefor controls the switch circuit.

930,606. ADAPTABLE TERMINAL CONTACT FOR SAFETY FUSES. Victor F. Morgan, Hartford, Conn., assignor to the Sachs Company, Hartford, Conn. Filed March 7, 1906. An adjustable terminal-inclosed fuse has in combination a tube of insulating material, ferrules on the ends of the tube, and terminal contacts provided with contact arms having a threaded engagement with the ferrules.

930,608. INSULATOR. Louis McCarthy, Boston, Mass., assignor to the Macallen Company, Boston, Mass. Filed October 8, 1908. Comprises metallic connections secured together and insulated from each other by interposed insulation and having a covering of molded composition provided with a projecting portion and a cap secured to one of the metallic connections and having a hub and flange between which the projecting portion of the insulating covering is fitted.

930,609. INSULATOR. Max Neubert and Raymond P. Jones, Glen Jean, W. Va. Filed February 24, 1908. Describes a form of sectionalizing insulator for electric trolley systems.

930,622. MOTOR-DRIVEN FAN. Harry M. Shedd, Roselle, N. J., assignor to Westinghouse Electric and Manufacturing Company. Filed July 27, 1908. Has means dependent upon the oscillation of the fan for imparting limited rotative movements to a shaft centrally disposed in front of the fan and substantially parallel to the pivotal axis of the fan.

930,638. ELECTRIC SMOOTHING-IRON. Alfred O. Whitmore. Salt Lake City, Utah. Filed August 7, 1908. Has a cover or top plate provided with an extension which has an upstanding guard and depending wings.

930,644. SURFACE-CONTACT ELECTRIC-RAILWAY SYSTEM. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company. Filed February 20, 1905. Two contact boxes are separated from each other by a distance greater than the length of the car current-collecting device, but sufficiently close together to be spanned by the car magnet. An auxiliary contact device is provided adjacent to one or both of the boxes and electrically connected therewith.

930,666. PROCESS OF TREATING ORES. Paul L. T. Heroult, La Praz, France, assignor to Societe Electro-Metallurgique Francaise, Froges, France. Filed April 19, 1906. The method of treating copper ore containing sulphur consists in feeding it into an electric furnace and fusing it therein and simultaneously injecting oxygen into the ore to oxidize part of the sulphur.

930,674. MANUFACTURE OF RAIL-BONDS. George A. Mead, Mansfield, Ohio. Filed November 2, 1906. Comprises a stranded body portion, stranded terminal members and terminal lugs, all of which parts are separate from each other, and united.

930,675. SAFETY-FUSE. Werner Menzel, Hanover, Germany. Filed August 3, 1906. An adjustable ring is located in a socket and has a notch co-operating with a peripheral ring. A set-screw is provided for locking the ring in the socket.

930,698. TROLLEY-RETRIEVER. Major D. Self, Bessemer, Ala., assignor of one-half to William E. Woodson, Jefferson County, Ala. Filed December 30, 1908. Consists of an air cylinder mounted on the roof of the car, a piston therefor connected to the trolley pole, and a trip rod for the valve also connected to the pole.

930,701. ROTARY FAN. Chester M. Spalding, Schenectady, N. Y., assignor to General Electric Company. Filed December 22, 1902. The armature of a direct-current motor has pivoted to it the blades of a ventilating fan which forces air through the armature regardless of its direction of rotation.

930,704. PUZZLE TOY OPERATED BY STATIC ELECTRICITY. Edward A. Sullivan, Toronto, Ontario, Canada. Filed August 18, 1908. An enclosed casing containing light objects has a glass top adapted for being rubbed so as to attract and move the objects.

930,723. PROCESS OF FORMING ELECTRIC-INCANDESCENT-LAMP FILAMENTS. Werner von Bolton, Charlottenburg, and Felix Hartmann, Berlin, Germany, assignors to Siemens & Halske, A. G., Berlin, Germany. Filed February 3, 1909. Consists in fitting together two tubes of different ductile metals, inserting tungsten powder into the inner one, then working the whole set into filament form and removing the outer metal tubes.

930,727. STORAGE BATTERY. Rufus N. Chamberlain, Depew, N. Y., assignor to Gould Storage Battery Company, New York, N. Y. Filed April 5, 1905. The connecting lug for each group of plates is set on edge close to the inner wall of the jar. This permits removal of any separator or either group of plates without disturbing the rest.

930,728. STORAGE BATTERY. Rufus N. Chamberlain and Herbert E. Pratt, Depew, N. Y., and Albert S. Hubbard, Belleville, N. J., assignors to Gould Storage Battery Company, New York, N. Y. Filed December 17, 1906. Combined with a battery cell is a crate having its walls provided with upright air channels adjacent to the cell and having bottom openings for the admission of air to the channels.

930,738 and 930,739. REGISTERING AND RECORDING MEANS FOR MUSICAL INSTRUMENTS. Benjamin S. Dean, San Francisco, Cal. Filed November 21, 1906. A number of circuits are closed in accordance with the extent of movement of an inertia bar. These circuits control the electrical recording mechanism.

930,746. AERIAL CONDUCTOR. Simon Eisenstein, Kiew, Russia. Filed March 27, 1908. In a system for wireless telegraphy and telephony there is, in combination, a supplementary capacity, an aerial conductor and a self-induction in the form of a lengthening coil in series between the capacity and aerial conductor, immediately below the former and at the top of the latter.

930,750. INSULATOR. Charles M. Graham, Malvern, Victoria, Australia. Filed August 4, 1908. Consists of a bolt secured to the cross-arm, a wooden pin surrounding the bolt, an insulating cup screwed on top of the pin and a porcelain casing screwed over the cup.

930,751. REINFORCED WOODEN SUPPORT FOR INSULATORS. Charles M. Graham, Malvern, Victoria, Australia. Filed August 4, 1908. Renewed April 22, 1909. The wooden pin referred to in the above has a circumferential upsplash preventer.

930,753. MONOTELEPHONE-RELAY TRANSFORMER. Paul E. Heina, Paris, France. Filed March 24, 1908. Consists of a circular plate of iron supported at three points and a lever adapted to oscillate at a slower rate than the vibrations of the plate.

930,754. ELECTRIC CLOCK. Robert D. Hickok, Atlanta, Ga. Filed November 5, 1908. A primary clock controls a number of secondary clocks, whose operating circuits are in shunt with that of the primary clock.

930,761. REGISTERING DEVICE FOR PASSENGER-CONVEYING VEHICLES. Edgar V. Jacka, New York, N. Y. Filed April 22, 1909. An electromagnetically controlled taximeter.

930,772. PROCESS OF CURING MEAT. John C. Lincoln, Cleveland, Ohio, assignor to the Electric Meat Curing Company, Cleveland, Ohio. Filed May 4, 1907. Consists in circulating brine about the meat, cooling the brine in a tank outside of the curing tank and passing an alternating current through the brine and meat.

930,780. MAGNETIC DETECTOR. Joseph Murgas, Wilkes-Barre, Pa. Filed March 17, 1909. A combined condenser and oscillation detector comprises a disk of iron, means for producing a magnetic field, means for rotating the disk therein, a stationary coil surrounding the disk, and a dielectric separating the coil and disk.

930,788. EXTENSION PLUG OR DEVICE FOR CONNECTING ELECTRIC CONDUCTORS. William E. O'Neil, Norwich, N.

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Y. Filed March 27, 1909. A spring attachment plug is arranged so it can expand when inserted into a socket.

930,815. ELECTROLYTE. Abraham Van Winkle, Newark, N. J., assignor to the Hanson & Van Winkle Company, Newark, N. J. Filed November 20, 1908. A zinc electrolyte contains fluosilicate of zinc, a salt of aluminum, and a small quantity of gelatine previously dissolved.

930,819. ELECTRIC GENERATOR. Edward F. White, Spokane, Wash. Filed September 12, 1908. A magneto-generator operated by hand through a crank and gearing is mounted with a number of switches and a governor in a closed box.

930,854. TELEPHONE REPEATER. Mark R. Gilson, Philadelphia, Pa. Filed August 8, 1907. Comprises a stationary field magnet, a hollow drum-wound armature, a stationary field magnet located within the armature, and means for destroying residual magnetism in the field magnets.

930,855. INDICATOR FOR SPARK PLUGS. Alfred C. Hall, Sebastopol, Cal. Filed September 25, 1908. Combined with an electric circuit are a spark gap and a reactance coil in series, a second spark gap in shunt with the reactance coil, and a secondary condenser.

930,864. BRUSH-HOLDING STUD. Thomas L. Kearney and Michael J. Kearney, Carbondale, Pa. Filed February 10, 1908. Is formed of insulation with a flat tongue at one end, an attaching device having a recess into which the tongue is fitted, and a fastening passing through the device and tongue for removably securing the parts together.

930,871. TIME-CONTROLLED ELECTRIC DEVICE. Waldron J. Lunger, Elm Creek, Neb. Filed July 24, 1908. An alarm clock has connected with it at the back a shaft and disk carrying adjustable circuit-terminal contacts.

930,873. ELECTRIC COUPLING. Thorvald Maijgren, Rochester, N. Y., assignor to Electro Surgical Instrument Company, Rochester, N. Y. Filed July 10, 1908. Comprises a terminal, an insulator mounted in the terminal, a movable plunger mounted therein and forming the other terminal, and a helical spring surrounding the plunger and holding it in one position.

930,896. ARMORED CONDUCTOR. Edward D. Speer, New York, N. Y. Filed June 27, 1908. A flexible protective covering for the insulation consists of two longitudinally corrugated metal strips arranged one on the other so as to constitute practically a double armor, the inner strip being provided with relatively wide corrugations and relatively narrow beads between the corrugations and the outer strip having a smooth true working fit on the corrugations of the inner strip.

930,902. ELECTROLYZING APPARATUS. Edgar L. Thorp, Nottingham, England, assignor to the British Hosiery and Electrolytic Bleaching Company, Ltd., London, England. Filed November 21, 1905. An electrode is formed of a plate having active sections on one side alternating with active sections on the other side, a covering of insulating material applied over each of the unexposed sides of the sections, the edges of the coverings on opposite sides of the plates overlapping and forming narrow neutral strips covered on both sides.

930,928. ELECTRIC SWITCH APPARATUS. Arthur F. Berry, Ealing, England. Filed April 6, 1906. A solenoid-controlled relay switch has two sets of contacts, movement of one causing a movement of the other.

930,958. ELECTRIC GLOW LAMP. Gustave K. Hartung, New York, N. Y. Filed May 27, 1904. Is provided with a tube in which a current of air through the lamp in contact with the glower is created, a valve or damper in the tube, and means for automatically shifting the valve under variations of the potential of the current supplied to the glower.

930,971. FIRE-ALARM SIGNAL APPARATUS. William H. Kirnan, Bayonne, N. J. Original application filed November 7, 1908. Divided and this application filed February 17, 1909. A number of circuit controllers are arranged to send each a different signal over the circuit when free to act.

930,972. THERMOSTATIC CIRCUIT CONTROLLER. William H. Kirnan, Bayonne, N. J. Original application filed November 7, 1908. Divided and this application filed February 17, 1909. Relates to details of the above.

930,989. CONVERTIBLE SYSTEM OF PRESSURE OR VACUUM CONTROL. Walter J. Richards, Milwaukee, Wis., assignor to National Brake and Electric Company, Milwaukee, Wis. Filed January 25, 1905. Comprises a motor-operated pump, a compressed air reservoir and a vacuum reservoir, a valve for operatively connecting one reservoir or the other with the pump, an automatic switch for closing and opening the circuit of the pump motor, and pressure gauges sensitive to variations in the air and the vacuum tension and thus governing the automatic switch.

930,997. ALTERNATING-CURRENT RECTIFYING APPARATUS. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company. Original application filed March 23, 1903. Divided and this application filed April 30, 1904. Combined with a number of transformer windings connected to a common neutral point and traversed by current impulses of one polarity is a vapor rectifier receiving the current, a consumption circuit connected therewith, and counter-magnetizing coils for the windings traversed by the unidirectional impulses.

931,008. SUBMERGIBLE MOTOR. Augustus C. Durdin, Jr., Chicago, Ill., assignor of thirty-five one-hundredths to Maurice I. Weil, Chicago, Ill. Filed May 18, 1908. A hood surrounds the motor and is adapted to form an air chamber about the same and there are spring clips for positioning and securing the hood upon the motor.

931,013. ELECTRIC HEATER. John E. Macomber, Albany, N. Y., assignor to Consolidated Car Heating Company, Albany, N. Y. Filed April 24, 1909. Is provided with a casing having a transverse end plate and an auxiliary plate superposed thereon and forming a junction box with the end plate and casing.

931,015. INSULATING COMPOSITION. MinDelin McGerry, Kalamazoo, Mich., assignor to Bert E. McDonald, Chicago, Ill. Filed October 5, 1908. A composition for coating wire for insulation consists of asbestos pulp and slippery elm digested to a jelly in a vegetable acid, and mixed with an aqueous solution of glutinous and starchy material.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired August 16, 1909:

480,727. ARMATURE CONDUCTOR AND MEANS FOR INSULATING THE SAME. Emil Kolben, Schenectady, N. Y.

480,728. RING ARMATURE. Emil Kolben, Schenectady, N. Y.

480,729. ELECTRICAL DROP-ANNUNCIATOR. Thomas W. Lane, Boston, Mass.

480,739. COMMUTATOR FOR ELECTROMAGNETIC MACHINES. Horace F. Parshall, Schenectady, N. Y.

480,740. ARMATURE FOR DYNAMO-ELECTRIC MACHINES. Horace F. Parshall, Schenectady, N. Y.

480,782. ELECTRIC LIGHTING SYSTEM. Michael J. Quirk and Christoph Bach, Jr., Milwaukee, Wis.

480,794. ARC WELDING AND HEATING APPARATUS. Philip I. Unwin and Henry Howard, Halesowen, near Birmingham, England.

480,802. ELECTRIC FUSE. Otto T. Blathy, Buda-Pesth, Austria-Hungary.

480,804. ELECTRIC DISPATCH SYSTEM. Andrew Bryson, Jr., New York, N. Y.

480,845 and 480,846. ELECTRIC ELEVATOR. Frank E. Herdman, Indianapolis, Ind.

480,850. ELECTRIC RAILWAY. Rudolph M. Hunter, Philadelphia, Pa.

480,884. BATTERY CELL. Edward P. Usher, Grafton, Mass.

480,885. STORAGE BATTERY. Edward P. Usher, Grafton, Mass.

480,886. BATTERY PLATE. Edward P. Usher, Grafton, and William F. Draper, Hopedale, Mass.

480,887. BATTERY PLATE. Edward P. Usher, Grafton, Mass.

480,888. ELECTRICAL MEASURING INSTRUMENT. Edward Weston, Newark, N. J.

480,889. APPARATUS FOR RETARDING OR DAMPENING THE MOTION OF MOVING BODIES IN ELECTRICAL INSTRUMENTS. Edward Weston, Newark, N. J.

480,890. ELECTRIC TIME-INDICATING APPARATUS. Edward Weston, Newark, N. J.

480,891. TEMPERATURE-REGULATING DEVICE FOR ELECTRICAL CIRCUITS. Edward Weston, Newark, N. J.

480,892 and 480,893. RHEOSTAT. Edward Weston, Newark, N. J.

480,894, 480,896, 480,895, 480,897, 480,898 and 480,899. ELECTRICAL MEASURING INSTRUMENT. Edward Weston, Newark, N. J.

481,030. METHOD OF ELECTRIC WELDING. Henry Howard, Halesowen, near Birmingham, England.

481,062. ELECTRIC CONTROL OF RAILWAY TRAINS. Robert C. Sayer, Bristol, England.

481,075. ELECTRIC BATTERY. Peter Stiens, Charlottenburg, Germany.

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CONTENTS.

EDITORIAL:
- Ice Making as a Means of Improving the Load Factor of Central Stations 367
- Cotton-Mill Loads 368
- A Field for Trackless Trolleys 368
- The Kilbourn Waterpower Development 369

Indiana Electric Light Association—First Annual Convention 370-373
The Right Kind of Bump 373
Navy Department Supplies 373
The Kilbourn Hydroelectric Plant at Kilbourn, Wis. 374-379
Telephone and Telegraph Business 380
Engineers Endorse Electric Headlight 380
Telephoning Across the Ocean 380
The Michigan Electric Association—Sixth Annual Convention 381-384
Baltimore Electric Light and Power Companies 384
Faster Telegraph Service 384
Paris-New York by Wireless 384
Another Atlantic Cable 385
United Railways Investment's Recently Organized Companies 385
A $10,000 Prize for Inventors 385
Details of Watt-Hour Meter Manufacture.—III 386-389
Long Island Railroad Company Wants $16,500,000 389
Electrical Days at the Alaska-Yukon-Pacific Exposition 390
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 391
Commonwealth Edison Company, of Chicago, to Increase Capital Stock. 391
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE 392
INDUSTRIAL SECTION:
- The New Watson-Stillman Automatic Tank Switch 394
- A Convenient and Practical Telephone Bracket 394
- A Motor-Driven Centrifuge 394-395
- "Electrocuted" Air for the Chicago Public Library 395
- An Electric-Driven Well Driller 396
- Lifting Magnets 397
- The Dallas (Tex.) House of the Western Electric Company 397
- Westinghouse Type "R" Trolley Ear 398
- The Bradshaw Car Skid 398
- Condit Disconnecting Switches 398
- Pressure-Controlled Motor-Speed Regulators 399
- Adjustable Speed Commutation Pole Motors 400
- The Hemere Combined Meter Panel and Cut-Out 400
- Westinghouse Electric Company 400

CURRENT ELECTRICAL NEWS 401
RECORD OF ELECTRICAL PATENTS 406

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ICE MAKING AS A MEANS OF IMPROVING THE LOAD FACTOR OF CENTRAL STATIONS.

Much attention has been given by electrical engineers and central-station managers to means of improving the load factor of electrical generating plants, seeking to shorten and fill in the ordinarily long "valley-load" period, during which a large part of the plant investment lies idle. It has been recognized that the lying idle, during so large a part of each twenty-four hours, of the large amount of machinery required to deliver the maximum demand, and representing invested capital, has a serious influence on rates.

Hitherto, however, on account of the time of day during which electricity is not required in any amount at all proportionate to the capacity of the station, the plant thus released has not been available for any other purpose. It has been proposed, and tried, to utilize the exhaust steam of power stations for heating; but heat is not required during the period of low-valley load, say, from as late as 10:30 in the evening to 6 o'clock in the following morning. The world is, for the most part, asleep during these hours, and does not have to be warmed, does not have motors running or electric heating devices turned on—does not engage in any activity, any more than it needs electric light to any great extent.

In the earlier days of electrical engineering, with direct current, it was proposed to level down the peak loads and level up the valley loads on the machinery installed by the employment of storage batteries; the object being to carry a given average and maximum demand with a plant of electrical machinery having a capacity for delivering the average demand only, instead of being obliged to provide a plant of running machinery capable of delivering the maximum demand. The introduction of alternating current, however, with its numerous advantages for efficient transmission and distribution of power, has retarded the installation to some extent of large storage batteries. Therefore, the need is still unmet for a practicable industrial utilization of the power plant—engines, turbines, or waterwheels—that can keep the plant profitably busy running night and day.

It is suggested that the manufacture of artificial ice might be in a measure a solution of this problem. Electricity supply and ice manufacture are both public-service operations, hence it seems logical to carry them on, where practicable, with the same central-station plant. To be able to transmute the interest now drawn by idle machinery, which is a serious and

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regrettable loss, into a profit from a marketable product like pure ice, is certainly a consummation to be desired.

The ideal system would be a flexible one in that the rate at which power would be absorbed by the use of the ice-making apparatus would not need to be uniform, but could conform to the available power supply. Ice of marketable thickness would have to be made in the time available—*i. e.*, in the eighteen to twenty hours out of the twenty-four during which the full capacity of the power plant is not required for the generation of electricity for the ordinary uses. Attainment of these features would mean that ice-making would supplement the present function of the power station and increase the dividend on invested capital by rendering the station machinery a continuously profitable installation, instead of an installation earnings profits during a fraction of each twenty-four hours only, and running at a loss for the remainder of the time.

COTTON-MILL LOADS.

Few industries furnish as uniform a load and as high a load factor as cotton mills, on electrical supply systems.

A case in point is that of a New England cotton mill that is driven by power from a central station, and has electric motors of 817 aggregate horsepower. During a recent year this cotton mill consumed 1,187,000 kilowatt-hours of metered energy, or 1,452 kilowatt-hours per motor horsepower. If this mill operated 2,500 hours during the year, the average load was 475 kilowatts, or 0.58 kilowatt per horsepower of motor rating.

A cotton mill in South Carolina with a motor equipment of 445 horsepower consumed 84,450 kilowatt-hours during the twenty-six week days of one month, with 271.5 hours of operation. This record shows an average load of 311 kilowatts during the working hours of the month, or 0.7 kilowatt per horsepower of the connected motors.

On each of the twenty-six working days of the month the average consumption of energy at the above mill was 3,248 kilowatt-hours, while the largest consumption on any one of these days was 4,500 kilowatt-hours, and the least was 1,650 kilowatt-hours, during the six hours' work of a Saturday. This largest consumption of 4,500 kilowatt-hours during a day of eleven-and-one-fourth hours amounts on an average to a load of 400 kilowatts, or to nearly 0.9 kilowatt of load per horsepower of the motor equipment.

On the basis of this largest average load of 400 kilowatts for one day, the average of 311 kilowatts for the month shows a load factor of 77.7 per cent.

At a smaller mill, in North Carolina, during the twenty-six working days of another month, the consumption of energy from the electric line was 57,920 kilowatt-hours, and the total hours of operation were 266, so that the average load was 217 kilowatts for the working hours.

Like the mill in South Carolina, the one under consideration operated only to noon on Saturdays, and the consumption on one Saturday was only 1,350 kilowatt-hours. The greatest consumption on one day was 2,530 kilowatt-hours, corresponding to an average load of 230 kilowatts during the eleven hours of operation.

On the basis of 230 kilowatts as the largest average load on one day, the average load of 217 kilowatts for the month gives a load factor of 94.3 per cent. This is certainly a high figure, but the maximum load of the month was no doubt greater than the average load during the day of greatest consumption, so that the ratio of average to maximum load was less than that just given.

In another cotton mill, located in New England, the total horsepower of the operating motors was 1,365, and the total consumption of energy during 221.5 hours was 202,600 kilowatt-hours, corresponding to an average load of 914 kilowatts.

Per motor-horsepower this average load amounts to 0.67 kilowatt. The 221.5 hours of operation occurred during four weeks, and during the week of largest energy consumption the average load for fifty-eight hours was 958 kilowatts, the largest average for either week. Of this largest average load the average for the four weeks was 95.4 per cent.

To secure these large cotton-mill loads it is necessary to make very low rates for electric energy. In the New England mill above mentioned, where the annual consumption was 1,187,000 kilowatt-hours, the rate was 1.8 cents per kilowatt-hour, and the income of the electric station from that mill was thus $21,366 during the year. Good steam coal costs about $4.25 per long ton in carload lots in the city where this last-named mill and the central station that generates the power are located, and the central station operates with steam power exclusively.

In another New England textile mill that operates with electric power from a central station the total motor equipment was 746 horsepower, and the rate paid about one cent per kilowatt-hour. The energy in this case, however, was developed mainly by waterpower. A very large cotton-mill plant in Canada got its power from a hydroelectric supply system at 0.572 cent per kilowatt-hour. The cotton mills of North and South Carolina above mentioned are in a region where hydroelectric power is frequently sold to small mills as low as 0.8 cent per kilowatt-hour, and the cotton mills form much the largest single load of the electric system.

A FIELD FOR TRACKLESS TROLLEYS.

Trackless-trolley vehicles could find profitable employment on many routes where the stage drawn by horses continues to be the only mode of public conveyance.

Strange as the fact may appear at this late day, there are no less than thirty-six stage routes in regular operation along about two hundred miles of a single steam railroad in New England. These stage routes connect the railroad stations with villages that have neither steam nor electric transportation and are probably too small in many cases to warrant the construction of standard electric railways.

In length these stage routes are mostly one to eight miles each, though about one-fifth of the total number range from

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ten to eighteen miles, and one is twenty-six miles long. Electric railways parallel the stage routes for several miles in some instances, but as the electric cars do not carry baggage, and cover only a part of the distance to the desired destination, the stage gets the traffic.

As a rule, the stages run daily, or daily except Sunday, and make one or two trips per day between the railroad station and the villages to which they go. In a few cases the stage runs only one, two or three days per week, while in one instance, where the route is a mile long and the fare is twenty cents, the stage makes ten trips each way per day. With trackless-trolley transportation at shorter intervals and somewhat lower rates there can be no doubt that the volume of traffic over many of these stage routes would greatly increase.

On most of these stage routes the fare amounts to between five and twelve cents per mile, and the highest rate noted was twenty cents per mile. For a complete single trip of a stage the lowest fare is ten cents, this for a distance of one mile, and in a number of instances the fare is one dollar, while it reaches $1.50 for the twenty-six-mile ride. Per mile of travel, the stage fares amount to between five and twenty times the electric-car fares in the same sections of the state. Moreover, the least unit of fare for any part of the stage journey is often as high as twenty-five cents, and sometimes even more than this.

The trackless trolley is suggested for application on these stage routes because it appears to offer the cheapest and most desirable form of public transportation there, and because in many instances it can be constructed as an extension of an existing electric railway that runs parallel to some part of the stage route, or at least reaches the steam-railroad depot whence the stage starts.

In such a case, the double trolley wires for the trackless electric cars may be merely an extension of conductors from the existing trolley wires and track, and would, of course, take energy from the same generating stations. Such extensions of trackless trolleys from existing electric railways would act as feeders and increase the traffic on the main parts of the system, besides carrying a paying traffic of their own. With power to operate the trackless trolley from a standard electric-railway system, it is hard to see how any form of independent motor car, much less the stagecoach, could successfully compete with it.

Additional advantage on the side of the trackless trolley in comparison with other than electric vehicles may be gained in some cases by operating the direct-current motors at 1,200 volts, which has been found to give quite satisfactory results with standard railway equipments. Trackless-trolley cars in the place of stagecoaches must, of course, earn interest and dividends from a very light traffic, and while the daily expense for labor and power will be small, the investment must be kept as low as practicable. With 1,200 volts between the trolley wires, the entire weight and cost of the overhead structure will, of course, be much less than that necessary for 600-volt work.

It is just this matter of low relative investment that makes the trackless trolley practicable in many situations where a standard electric-railway line cannot hope to earn a fair return. Of course, the most important advantage of the trackless-trolley line as to investment is in the item of roadbed and track, but here it is sufficiently large to greatly extend the area of electric transportation. An example of costs on a recently constructed interurban road shows how large a part of an electric-railway investment often goes into the item of roadbed and track. Figures for an interurban road are taken so as to avoid the large additional expense incident to the construction of electric roadbed and tracks with girder rails in paved city streets.

The electric railway in question is 47.3 miles long, and the second main track and sidings bring the total length of single track up to 78.5 miles. Of the total length of railway, 12.8 miles are located on private right-of-way. For the roadbed, tracks and electric-line construction the cost on this railway was $2,527,887, or $32,202 per mile of single track, not including interest during construction, engineering or incidental expenses.

For the roadbed and tracks alone the cost amounted to $2,211,067, leaving $316,820 as the cost of the poles, trolley wires and feeders, so that the complete overhead construction cost only 14.3 per cent of the amount invested in roadbed and track. Per mile of single track, the complete overhead structure cost $4,036, and per mile of railway line, sixty per cent double track and trolley, the cost was $6,700, compared with $46,745 per mile of line for roadbed and tracks.

Besides the great reduction of necessary investment by the use of the trackless trolley, there is a large saving by avoiding the annual expense of repairs to roadbed and tracks, which amounted to $10,793 and to $8,864, respectively, in the two latest years for which records of these railways are at hand.

It is not meant to suggest that the time has come when the trackless trolley can supplant the electric railway with special roadbed and tracks for heavy and frequent traffic, but simply that the omission of such roadway and tracks makes it practicable to extend the radius of electric traction for light or infrequent traffic.

This view has found favor in Europe, for trackless-trolley lines are in operation at Vienna and a number of other points on the Continent, and are being considered for extensions of the regular tramway systems at various places in the British Isles, notably Birmingham, Leeds and Edinburgh.

THE KILBOURN WATERPOWER DEVELOPMENT.

On other pages of this issue is an illustrated article describing the hydroelectric plant of the Southern Wisconsin Power Company at Kilbourn, Wis. Of particular electrical interest in this installation is the relatively low voltage used on the transmission line in comparison with its length. Although the use of 44,000 volts for the 125-mile line is only temporary, even the ultimate voltage planned, 72,000 volts, seems moderate in view of the success of 110,000-volt systems and the tendency to employ 1,000 volts per mile.

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Indiana Electric Light Association.

First Annual Meeting, French Lick Springs, August 18 and 19.

The first annual meeting of the Indiana Electric Light Association was held at the French Lick Springs Hotel, French Lick Springs, Ind., on August 18 and 19. The weather was delightful, and this and the beautiful scenery surrounding the noted resort, not to mention the indefatigable efforts of Fred Leslie, of Muncie, Ind., the genial and popular secretary-treasurer of the association, combined to make the meeting a memorable success in every way, in spite of the comparatively poor attendance of the central-station men.

It may be interesting here to note that the Indiana Electric Light Association was formed last November, and that a meeting was held at Indianapolis, Ind., in January of this year, as already reported in these columns.

The convention was opened on Wednesday afternoon, August 18, at 2:30 p. m., by the president of the association, T. C. McReynolds, of the Kokomo, Marion & Western Traction Company, Kokomo, Ind.

After the secretary had read the minutes of the Indianapolis meeting, the president proceeded to deliver his annual address, an abstract of which follows:

PRESIDENT'S ADDRESS.

The president, in welcoming the delegates to the first annual convention of the association, explained that the world-famous resort of French Lick Springs had been chosen for this meeting to afford those attending a chance to combine a pleasurable vacation with the more serious business of the actual proceedings. Referring to the recent bills affecting electric-light men, which were dropped in the committee stage at the last state legislature, he recommended that the association consider future bills before they were to be taken up again by the legislature. Through the medium of discussion at association meetings members could exchange ideas regarding the investing of their capital to the mutual benefit of all. Meetings of this sort, press reports, etc., were helpful, but not necessary to success. He compared business in the past with that of the present, and pointed out that the per capita consumption of electric current had doubled in recent years and tended still further to increase, while the operating costs had largely decreased. He predicted a phenomenal electrical growth for the future, and said that those in charge of public-utility properties will be expected to develop materially along economical lines with corresponding increases in earnings. To this end the companies must take full advantage of passing opportunities, and employes must be selected with regard to their skill and intellect. A man must not necessarily have had a college training to succeed, although such was an advantage. Energy and push are the chief desiderata. Electrical magazines helped one to keep in touch with current developments, and the interest of members in attending association conventions of this sort afforded the greatest help to the man who would keep abreast of the times.

TOM TAGGART'S ADDRESS.

Following the presidential speech an address of welcome was given by Tom Taggart, the president of the hotel company.

Mr. Taggart said it was a pleasure to meet the association at French Lick. He had heard the preceding address, and heartily concurred in everything that the president had said. He himself had an electric power plant adjacent to the hotel, and could therefore speak with some authority. He insisted that every young man should be qualified to fill the position of trust given him. He believed that every electric-light plant in Indiana should join the association and suggested the inclusion of water and other public-utility companies. In conclusion, he told of some experiments he was conducting with electric batteries, both direct and alternating current, of much potency, some with ice and some without, and invited those present to investigate later for themselves, as his guests.

Mr. Taggart was enthusiastically applauded. He was subsequently made a member of the advisory committee of the association.

SECRETARY-TREASURER'S REPORT.

Fred Leslie, of Muncie, Ind., then presented his report as secretary-treasurer.

Mr. Leslie regretted that more of the company members were not represented at the convention, and that some of them had not attended any of the meetings. He had not had time to go out and make a personal canvass. According to the record there were twenty active members and fifty-two associate members. Collections from dues were the only source of revenue and these amounted to $520. There was a balance of $206.30 up to the time of this convention. In answer to a question he said that about 130 private companies in the state were eligible to active membership.

CENTRAL POWER STATION PRACTICE.

Phil. H. Palmer, of the Kokomo, Marion & Western Traction Company, Kokomo, Ind., then read a highly suggestive paper on "Central Power Station Practice."

The author began by stating that as from sixty to eighty per cent of the total cost of central-station lighting is within the power station, a change in economy in that department figures largely in the lighting company's cost account. Most of the losses occur in the boiler room. These are uncertain, variable, and difficult to locate and remedy, yet time spent in this direction is amply repaid by the better results to be obtained. Recording wattmeters and the weighing of coal, to begin with, will demonstrate in most cases poor records of coal per kilowatt-hour. The author gave an account of the plant of his company which includes two 1,000-kilowatt steam turbines (one being used as a reserve), operating with a twenty-seven-inch vacuum (referred to thirty inches barometer), and having a fifty per cent average daily load factor. Various curves were shown. Illinois slack coal averaging 11,000 British thermal units per pound gave an evaporation not greatly exceeding 5.5 pounds, which showed an efficiency of boilers and furnaces of 57.5 per cent, a fair average for an everyday result. Attempts to burn better coals showed an increased evaporation but a faster rise in price per ton, which proved less economical than the low-priced coal in this particular case. The author pointed out that careless firing was the frequent cause of poor efficiency. The use of a CO_2 recording instrument was then touched upon. If the CO_2 in the breeching is found to contain only five or six per cent of CO_2 an increase in boiler efficiency could usually be effected by trying different manipulations of draft, thicknesses of fire, stopping leaks, etc. With bituminous slack coal an increase of CO_2 from six to eight per cent will ordinarily increase the evaporation about eight per cent; a further increase of CO_2 from eight to twelve per cent will increase the evaporation 4.5 per cent. The best coal for use in a given plant can be determined only by experimentation. Boilers must be kept clean. With hard waters depositing one-sixteenth of an inch of scale in four weeks or less a water-softening apparatus should be installed. In plants where exhaust steam is not in demand it will pay to use electrically-driven pumps for every purpose except boiler feeding. In the engine room the attendants should be accustomed to a variety of shifts so as to be ready to fill different positions in emergencies. The author reviewed the practice in his plant where with thirteen men employed the labor cost was 0.2 of a cent per kilowatt-hour. The cost per ton of coal for handling coal and ashes, and for firing, was twenty-six cents. Pride in employes should be encouraged, and the fact kept in mind that power-plant daily records are as important as office bookkeeping. Too much reliance should not be placed on automatic devices to the exclusion of regular inspection. Uniformly correct voltage at the distribution center must also be insisted upon. Selection of lubricating oil, and its conservation (as by recovering oil from used waste) were important points. Mechanical oil-feeders for feed pumps and other auxiliaries using cylinder oil, were recommended. In keeping the daily log sheet the total load at least in kilowatts should be plotted. Principal records of the station operation should also be included in the log sheet, but not too many detailed records. Boiler and engine-room records should be kept separately, and all records kept for future reference. Some interesting figures were given of the detailed operating costs of various lighting plants. Small plants furnishing from 400 to 800 kilowatt-hours each night gave an operating cost of 2.31 cents per kilowatt-hour at the switchboard. On the other hand, a plant furnishing 40,000 kilowatt-hours per twenty-four hours, with a seventy per cent load factor, gave an operating cost of 0.54 of a cent per kilowatt-hour. The author gave in detail the cost of his company's plant at Kokomo, which gave a cost of 0.72 of a cent per kilowatt-hour for an average of 12,083 kilowatt-hours per day in

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the year 1908. In conclusion, the author called attention to the fact that interest and depreciation on a plant investment are no small portion of the expense of producing electricity and in making each addition and improvement these details should be kept thoroughly in mind. He pointed out, finally, that old equipment, if in good condition, was useful for short peak hours and for reserve, and gave figures showing the plant saving per kilowatt-hour which would have to result in order to cancel the interest and depreciation charge on a given investment per kilowatt-hour installed for improvement—a fact often lost sight of in rebuilding and improving plants.

At the conclusion of his paper the author was greeted with a spontaneous and prolonged outburst of applause. A hearty vote of thanks was accorded to him.

In the discussion that followed, Mr. Palmer, in answering several questions, said that Indiana mine-run coal saves about five per cent over Indiana slack, but that the difference in price is more than correspondingly greater. Regarding the thirty-two per cent motor-generator and battery losses of his installation, he had no figures of the details, but said that the combined battery and booster efficiency was eighty per cent.

C. C. Perry, of Indianapolis, remarking on the operating costs cited by Mr. Palmer, said that the station cost is only a small portion of the expense. Interest on investments and office cost, etc., combine to give a much larger cost figure to the company.

C. A. Bookwatter, mayor of Indianapolis, said it does a public official good to go out to meetings of this kind, to meet men trying to please and satisfy the public. In his twenty years of experience he had found that when the public gets tired of kicking an official it gave the public-utility company a turn. A certain newspaper which had raised its advertising rates twice within a year editorially advised the public-utility companies to lower their charges to the public. Indiana was going to have a public-utility bill. Public-utility men have the right to make a fair and legitimate profit, and to this end should see that the drafters of the bill should have the best expert advice possible beforehand. Such a bill could not be other than beneficial to all concerned. Confiscation was unfair to honest business men who had sunk their own capital in their enterprises, and after all the general public is more concerned in obtaining first-class service from first-class plants than in seeing those plants go into the hands of a receiver.

Mr. Palmer said that the members of the association should obtain data like the public-service commissions.

Mr. Bookwatter told of a firm of Chicago engineers that advised one of its clients to buy power from the central-station company because the price would be cheaper than if an isolated plant were installed.

The president said that a public-utility bill will undoubtedly deal with the question of prices.

THE TUNGSTEN LAMP AND ITS LATER DEVELOPMENT.

George S. Merrill, of the engineering department of the National Electric Lamp Association, Cleveland, Ohio, read a paper on "The Commercial Effects of the Tungsten Lamp and Its Later Development."

The reception of the tungsten lamp by those stations whose rates were largely on a kilowatt-hour basis was rather unenthusiastic until the possibility of developing new business by its use became known. The author showed the analogy between the tungsten lamp and the introduction of the Welsbach mantle for gas lighting. He pointed out that the high efficiency of the tungsten makes it possible to secure all kinds of service, whether residential or commercial, which was inaccessible before on account of the prohibitive cost to the consumer. The introduction of the tungsten where electric light was not used before opened new fields for the introduction of other electric devices, all of which tended to improve the load factor. Even by consuming only the same amount of power as before, by distributing part of his former peak-load consumption over the off-peak period, the customer was made more profitable to the central station. Merchants were willing also to use more light and consume as much current as before, or more, on account of the advertising value of the extra light. Mr. Merrill emphasized the importance of using proper fixtures and methods of installation to obtain the greatest effect from the tungsten lamp. By properly attending to this phase of the situation central-station men could transform a dissatisfied customer into an enthusiastic booster. He proceeded to show the development of the incandescent lamp in its relation as a competitor of gas, and demonstrated in detail the adaptability of the various forms of tungsten lamps to all classes of service, showing especially the advantages of the tungsten street series lamp over its competitors. These advantages are its capability for artistic arrangement, its small depreciation in efficiency, the constancy and quality of the light, and the ease with which it may be controlled from some central point. He further went on to expound the possibilities of the low-voltage, four-candlepower lamp in outdoor decorative lighting, recommending the use of special transformers for this class of work. Some practical pointers on the installation of these lamps were given in detail. In conclusion, the author referred to the advantages of the tungsten lamp in sign lighting (this preferably on a flat-rate basis), train lighting, and automobiles, in fact in every case where an economical and convenient unit of moderate size is required, particularly where a light of a good color is desired.

A spirited discussion followed.

George C. Osborne, of the General Electric Company, Harrison, N. J., gave some figures relating to the consumption of gas for lighting in Massachusetts. Nine billions of cubic feet of gas are used annually, two-thirds of this for lighting. The total gas used is equivalent to 97,000,000 kilowatt-hours. A good deal of this business should be captured for electrical men by means of the tungsten lamp, especially by the series-incandescent system of lighting, which is popular in New England. The tungsten lamp, he said, deteriorated only from five to ten per cent, while the gas mantle deteriorated thirty to forty per cent for the first hundred hours, and up to seventy per cent for longer periods.

C. A. Howe, manager of the Chicago office of the Holophane Company, said that the tungsten lamp at first occasioned fear among central-station men, but it was now recognized that the new lamp has done more than anything else to raise the standard of illumination.

Mr. Merrill, answering a question by R. C. Waite, saw no objection in the use of the lamp for residences, although some thought that the yellowish light of the carbon lamp was more homelike.

Mr. Perry advocated the tungsten for house lighting, except in some minor features, as small candelabra, etc.

J. H. Harding, of Laporte, Ind., said that the principal trouble was the bad practice of trying to utilize unsuitable existing fixtures for tungsten lamps.

Mr. Howe said the tungsten gave a more pleasing light than the gas mantle, and, if properly installed, should be the chief weapon to enter the home with electric service.

G. E. Varney, of Danville, Ind., said that the ordinary tungsten units are too large for the average residence. He suggested a twenty-seven-volt size and the use of transformers, so as to use small and numerous units to give enough light, but without the glare of the larger lamps.

Mr. Howe said that proper installation covers proper sizes of lamps. Many indirect methods of lighting, as the I-Comfort system, had successfully tackled this problem with regard to the proper installation of fixtures, the placing of lamps, etc. A study of these will enable the tungsten lamp successfully to enter the home-lighting field.

Mr. Harding remarked that the trouble was with old, not new, installations.

Mr. Howe said that sometimes old fixtures can be changed, but that chiefly it is a question of new fixtures.

Mr. Osborne recommended the use of

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frosted tips, suitable shades, etc., to soften the glaring effect.

At the commencement of the Thursday morning session, at 10 a. m., the president announced that this session would be prolonged to complete the whole of the proceedings in order to permit of the members catching an early train.

CENTRAL-STATION HEATING.

A paper entitled "Central-Station Heating," by W. H. Schott, of Chicago, was read in the author's absence by Mr. Hornung.

Success in central-station heating was due to the general conditions surrounding the plant being favorable and to the existence of a heating situation, as well as, of course, suitable design and the cognizance taken of the commercial requirements. The type of plant depends on the conditions of the territory to be covered. As a rule, with numerous large buildings close together, a steam plant is required; for other situations water is the more economical. The different points to be regarded in making installations were given at length. Plants using coal and those employing exhaust steam both paid, if properly founded. Curves were exhibited showing what some of the heating plants are doing when operated with electric-lighting plants in the state of Indiana. The author showed that a heating plant properly operated in conjunction with a lighting plant will earn sufficient money to absorb the fuel charges of the combination plant and leave a profit, besides the aid they gave in taking care of competition.

A vote of thanks was accorded the author and reader of this paper. There was no discussion.

NEW BUSINESS AND ADVERTISING.

A paper on "New Business and Advertising" was read by A. P. Tills, of the Evansville Gas and Electric Light Company, Evansville, Ind.

One sure way to increase business is to put out men to take care of old customers and to solicit new business. The average business man likes to be interviewed by central-station representatives rather than to have to seek the company. It is good policy to keep men in the field, and when funds are low these men can be paid on a commission basis, to which any good solicitor will not object. Peak business is similar to order business and can be transacted by mail if necessary, but for off-peak business the solicitor is an indispensability. The best method to get new business is to go out and get it. Electric companies may co-operate with gas companies where heating is required to get business, but not otherwise. Local newspaper advertising gives slight returns compared with solicitors, and such expenditure is usually a matter of policy in keeping in with the papers. The advertising quality of light should be insisted upon to local merchants, in prospecting for new business. Another point of value in this respect is to advertise the good results due to the advertising qualities of light installations already furnished in the town, which stirs up a spirit of competition among those merchants who do not want to be thought backward in adopting modern methods. Circulars are no good unless followed up by solicitors.

The discussion resolved itself mainly into a spirited debate between C. C. Perry and G. E. Varney.

Mr. Perry related how his advertising campaign in Indianapolis had increased business and told of the good effects of the "electric house" he had had fitted up in the fourth story of his company's building, which had a good educative effect on the public in showing them the possibilities and utilities of electric light and appliances.

Mr. Varney discussed the feasibility of co-operation between central stations and the dealers. The latter, he said, were incensed at the action of some of the central-station companies because of their cutting prices on electric appliances to secure their adoption in order to sell more current. The dealers can't do this, for their profit comes from the sales of the appliances, and not of the current. The central stations, by antagonizing the dealers, were losing a valuable adjunct for securing new business.

Mr. Perry agreed with this point of view, but remarked that the central stations spent a deal of money in seeking new customers; his own company had spent between $2,000 and $3,000 in two or three months recently in this way. The dealers don't or won't do this as a rule. He sells lamps at cost, but would rather the dealers would handle this business, if they would push it sufficiently; but would they, he asked?

Mr. Varney commended this argument, but asked if it were not possible to obtain active co-operation with the dealer, who has not the facilities the central stations have of reaching prospective customers. The very fact of spending $2,000 or so demands a profit for selling utensils to cover this outlay. By making a price comparable with the lowest profitable price of the dealer, the central station could at least obtain his good will.

Mr. Perry told of the situation at Indianapolis, where three different central-station companies were competing, and such things happened as giving utensils away gratis, which was deplorable from a business standpoint.

Mr. Howe remarked that it all settled down to a matter of education—some of the central-station companies had educated the public to expect something for nothing. He told of a St. Louis man who acted differently. This man always obtained list prices, and the dealers were thereby encouraged to co-operate with him.

This ended the discussion, following which Mr. Howe gave, by the aid of figures on a blackboard, a demonstration of the practical application in illumination problems of the flux-of-light method of Cravath and Lansing.

IMPROVING THE LOAD FACTOR.

H. W. Eells, of the J. G. White Company, New York, then read a paper entitled "How Can We Best Improve Our Load Factor?"

In considering the influences affecting the load factor the author divided these into two parts: (1) Fixed charges. (2) The quantity of output, which is dependent on fuel, oil, water and other charges, and wages. Wages do not increase materially, if at all, with the output, neither do the fuel and water charges. Depreciation of boilers is about the same, whether they are idle or running at maximum capacity. Maintenance of the distribution system is likewise unaffected by changes of load. The obvious inference, then, is to operate a system already designed and installed, to its fullest extent. The author recommended every solicitor to possess a copy of the Electrical Solicitor's Handbook, recently published by the National Electric Light Association. Solicitors should show customers how to reduce their bills and obtain the most satisfactory service. The question of rates was discussed briefly and the utility of storage batteries in certain cases. A continuous campaign the author considered was a straight business proposition and one satisfied customer was better than ten prospectives. The company's offices should be central and attractive, and the officials should be readily accessible for personal interviews. A display room is advisable. Second orders are easier to obtain than first orders, and each kilowatt used is equivalent to a new sale. Publicity and generous advertising are profitable. Lists of customers should be classified, also the types of plant that can be used by them. Old customers are prospects for all they do not already use. Small cities should give a larger per capita return than large cities. It was policy to persuade customers to discard steam or other non-electric power and put in motors, and arrange to pay for these by installments. The author suggested the formation of an association to obtain the highest possible price for the old plant. This, he intimated, might be done under the auspices of the state electrical association. Customers should be advised freely in regard to new installations, and in selling light other devices should be pushed to better the load factor. Secondary distribution systems should be extended from transformers and adapted for the use of electric appliances as well as light installations. In conclusion the author referred briefly to the use of the tungsten lamp and pointed out that if by its use light bills were reduced its influence was greatly beneficial on the load factor by enabling customers, who were usually prepared to spend the same amount as formerly on electric current, to install electrical devices which were mainly used in off-peak hours.

L. E. Holderman, assistant general manager of the Terre Haute, Indianapolis and Eastern Traction Company, Terre Haute, Ind., told of the policy of his company in allowing dealers bonuses for new business, as follows: Fifty cents per customer plus five cents for each sixteen-candlepower unit sold; fifty cents for twelve-inch fans, seventy-five cents for sixteen-inch fans; flatirons, forty

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cents and fifty cents, according to capacity. Lamps were sold to dealers at two cents less than general prices, and motors at from seven-and-one-half to ten per cent off the retail selling price. By these means co-operation was effected with the dealers and confliction avoided.

R. W. Waite upheld Mr. Varney's arguments put forth in a previous discussion and said that a reasonable profit of from twenty to twenty-five per cent should be made on electric appliances. He was doing this, successfully.

In reply to a query by Mr. Leslie, Mr. Eells said that a load factor of forty per cent (up to fifty per cent in rare cases) was usually obtainable in average plants, defining the load factor as the ratio average load to peak load.

A unanimous vote of thanks was accorded to Mr. Eells for his paper.

A congratulatory telegram was dispatched at this time to the Michigan Electric Light Association, which was holding its annual convention at Detroit.

LIGHTNING ARRESTERS.

E. E. F. Creighton, of the General Electric Company, Schenectady, N. Y., gave a practical demonstration on lightning arresters.

He showed that lightning arresters have to take care of frequencies of from 2,000,000 cycles per second of actual flashes, down to the sixty cycles or so of the generators. The multigap arrester is no good for a continued succession of discharges. The new aluminum electrolytic arrester remedies this defect and is easily good for ten years on a ten per cent depreciation allowance. The chief disadvantage of the aluminum arrester is the necessity for continuous inspection, and this will limit its use on distribution circuits on account of the cost both of installation and inspection.

Mr. Creighton continued his interesting lecture at 2:30 p. m. to those members who were not leaving on the early train.

At this point the president gave a brief address, in which he deprecated the absence of many of the active members and cordially thanked the supply men for their earnest co-operation in making the meeting a success.

ELECTION OF OFFICERS.

The secretary then proceeded to read the report of the nominating committee, which was adopted unanimously. The following officers for 1909-1910 were elected:

President, C. C. Perry, Indianapolis Light and Heat Company, Indianapolis, Ind.

Vice-president, G. E. Varney, Danville Light, Heat and Power Company, Danville, Ind.

Secretary-treasurer, Fred Leslie (re-elected), Muncie Electric Light Company, Muncie, Ind.

Executive Committee, J. H. Harding (chairman), Laporte Electric Company, Laporte, Ind.; L. E. Holderman, Terre Haute, Ind.; W. B. McDonald, Evansville, Ind.; J. P. Ohmer, Elkhart, Ind.; R. W. Waite, New Albany, Ind.

The new president was then introduced and gave a brief address in which he forecasted a brilliant future for the Indiana Electric Light Association. At his suggestion a vote of thanks was accorded with acclamation to the retiring president and to the secretary-treasurer for their earnest work during the past year.

Among the supply men and manufacturers' representatives present were the following: H. H. Cudmore, Brilliant Electric Company, Cleveland, Ohio; Harry C. Rice, General Incandescent Lamp Company,

FRED. LESLIE,
Secretary Indiana Electric Light Association.

Cleveland, Ohio; J. E. Hall, Fort Wayne Electric Works, Fort Wayne, Ind.; G. S. Merrill, National Electric Lamp Association, Cleveland, Ohio; E. E. F. Creighton, General Electric Company, Schenectady, N. Y.; A. L. Waddle, Varney Electric Supply Company, Indianapolis; Mr. Townsend, F. Bissell Company, Toledo, Ohio; H. C. Houck, General Electric Company, Cincinnati, Ohio; R. C. Sueve, Allis-Chalmers Company, Cincinnati, Ohio; George C. Osborne, General Electric Company, Harrison, N. J.; J. W. Kampman, Illinois Electric Company, Chicago, Ill.; J. C. Henderson, Westinghouse Electric and Manufacturing Company, Indianapolis, Ind.; W. H. Pearl, Central Electric Company, Chicago, Ill.; F. O. Kirkpatrick, Westinghouse Electric and Manufacturing Company, Cincinnati, Ohio; A. S. Phill, Poyse Electric Company, Indianapolis, Ind.; A. D. Gillespie, Monarch Electric and Wire Company, Chicago, Ill.; P. R. Boole, Electric Appliance Company, Chicago, Ill.; H. W. Strock, Shelby Electric Company, Shelby, Ohio; J. H. Dunbar, O. Canman, P. Worth and J. R. Farrell, General Electric Company, Cincinnati, Ohio; C. A. Howe, Holophane Company, Chicago; A. B. Hoffman, Wagner Electric Manufacturing Company, Cincinnati, Ohio; Thos. H. Gage, Monarch Electric Company, Chicago; A. M. King, Brilliant Electric Company, Cleveland, Ohio; J. H. Bell, Electric Appliance Company, Cleveland, Ohio; J. F. Kerlin, National Carbon Company, Cleveland, Ohio.

The above list is only partially complete, owing to the lateness of some of the registrations and the unexpectedly quick close of the proceedings.

There was no exhibition in connection with the convention, but the Shelby Electric Company, of Shelby, Ohio, and the Holophane Company had a joint showroom in the hotel. The former company was represented by Henry W. Strock and showed carbon, tungsten and other lamps. W. H. Myers, sales manager of the Shelby company, arrived on Thursday from Detroit, where he had been attending the Michigan Electric Association's convention, in time to interview many of the delegates. The Holophane Company was represented by Charles A. Howe, manager of the Chicago office of the company, who was present with a very handsome display of Holophane globes and reflectors. Both exhibits attracted much attention and Mr. Howe was constantly surrounded by an attentive audience, to whom he gave many practical pointers on the subject of artistic and economical illumination.

The Right Kind of Bump.

Milan R. Bump, native of Spokane, Wash., has been placed in entire charge of the construction of the $2,000,000 electric generating plant to be constructed on Spring River, near Joplin, Mo.

The plant is being constructed by Henry L. Doherty & Company, of New York, which company recently purchased the Spokane gas plant.

The young engineer, who has been entrusted with the entire charge of the construction work on the mammoth plant, is well known in Spokane, having graduated from the local high school with the class of 1898. Mr. Bump was then but seventeen years old. Four years later he graduated with the class of electrical and mechanical engineers from the University of Wisconsin at Madison. For about fifteen months he was in the employ of the Washington Water Company, and since leaving Spokane six years ago has been with the New York company.

It is stated that $6,000,000 will be ultimately expended on the plant.

Navy Department Supplies.

Bids will be opened on September 7 for one surface condenser, for delivery at Charleston, S. C.; one indicator, for delivery at Brooklyn, N. Y.; and one punching and shearing machine, for delivery at Washington, D. C.

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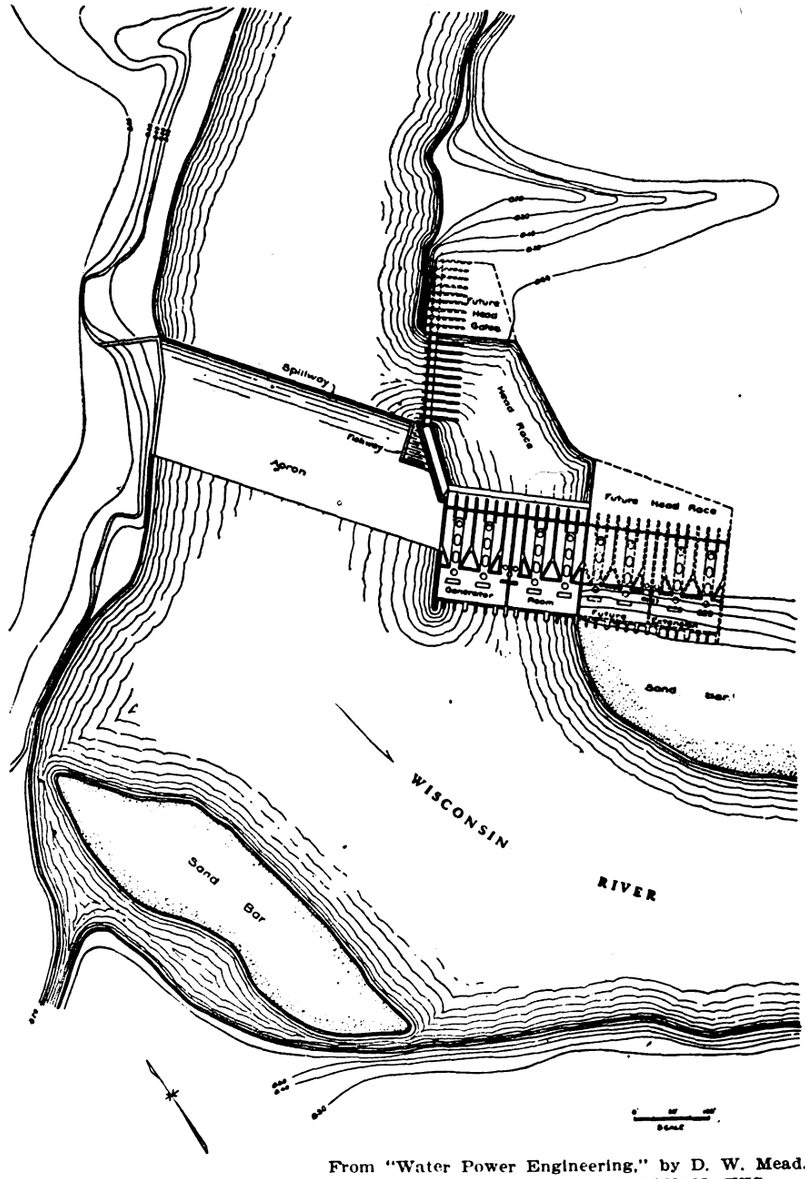
The Kilbourn Hydroelectric Plant.

The village of Kilbourn, Wis., has long been noted as being the center of the famous Dells of the Wisconsin River. For many miles along the river at this point the water has steadily eroded its way through a sandstone bed, leaving its valley marked by the most varied and picturesque stratified rock formations, in cliffs, ravines, canyons, gulches and caves, to be found in this portion of the country. These interesting sights, combined with excellent boating and fishing, have made the Dells quite a summer resort. To these attractions around Kilbourn there has just been added one of the largest dams and hydroelectric power developments in the state of Wisconsin. This is the plant and transmission system of the Southern Wisconsin Power Company, which it will be the aim of this article to describe.

An exhaustive study of the characteristics of the Wisconsin River and of the waterpower project in general was made by the company's consulting engineer, Prof. D. W. Mead, of Madison, Wis. Some of the main hydraulic data collected in this investigation have been published in his latest book.[1] About one-fourth of a mile below the double-deck railway and highway bridge at Kilbourn was found an excellent site for the construction of a dam across the river, which would give a normal head of seventeen feet. By means of this dam the river could be controlled so as to give a minimum flow of about 5,000 cubic feet per second.

The construction of the dam involved the formation of a reservoir some ten miles long by the raising of the river level above the dam about fifteen feet, which, it was feared by the residents, would destroy the beauty of the upper Dells. To avoid litigation, the backers of the project formed a subsidiary corporation, the Wisconsin Dells Company, which purchased the land that was partly flooded, including the principal scenic spots. On completion of the dam this summer it was found that the beauty of the Dells was not materially marred; on the contrary, by increasing the depth of the stream, larger boats and launches could be used than heretofore, and a much greater portion of the river could be easily reached, thus disclosing a number of points of geological and scenic interest that had formerly been practically inaccessible.

In the accompanying plat the general layout of the Kilbourn plant is clearly shown. The power house is located on the eastern shore of the river at a bend in the stream. Its site had to be cleared largely by blasting out the solid rock. At present four main generating units have been installed that have a normal capacity of 8,000 horsepower. A future extension of the plant to double its present capacity is contemplated. This is shown by the dotted lines.



From "Water Power Engineering," by D. W. Mead.
GENERAL PLAT OF THE HYDROELECTRIC PLANT, KILBOURN, WIS.

THE DAM.

The dam has a total length of 310 feet across the river, and an extreme width, including the apron, of 154 feet. Its crest has a width of about fifteen feet and is normally seventeen feet above low water. On account of the severe floods to which this river is occasionally subject it was necessary to arrange a movable crest to permit a possible flood flow sixteen feet deep to pass over the dam. For this purpose twelve gates, each twenty-five feet wide, are provided between concrete piers, thus giving a total spillway of 300 feet. The gates are of steel and weigh about seven tons each. They are capable of being lowered six feet into the dam. For moving them, a continuous line shaft has been erected along the footway on top of the dam; any gate may be raised or lowered by connecting it to this shaft through a clutch and gear.

[1] "Water Power Engineering." By Daniel W. Mead. McGraw Publishing Company, New York, 1908.

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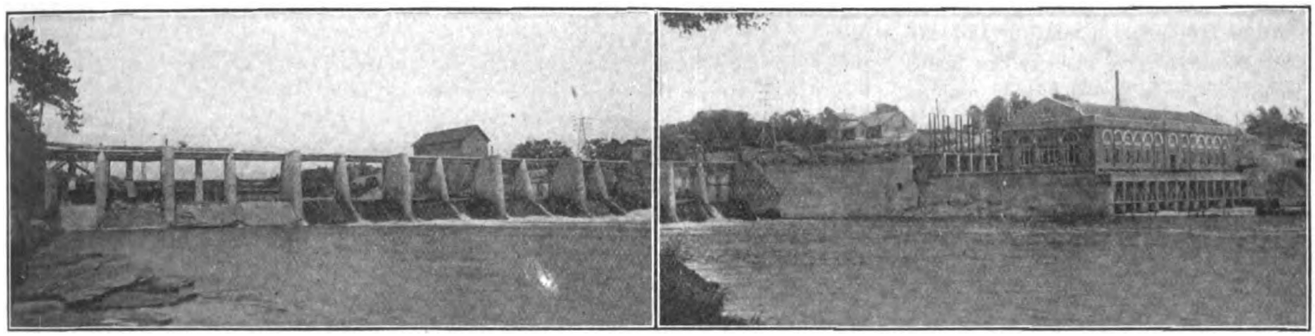
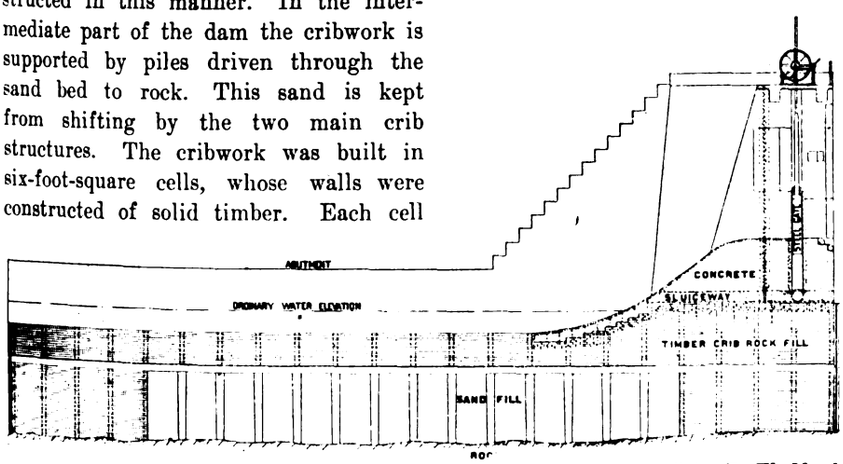
For driving the shaft a fifteen-horsepower, 220-volt induction motor and its controller are installed in the little brick control house at the southeastern end of the dam. The gates may also be operated by hand. To prevent the pockets for the gates from getting clogged up, sluiceways have been provided through the bottoms of the pockets. By raising the wooden gate in each a strong flow of water is established therethrough, thus washing out any accumulation of sand or other sediment. At the southeastern end of the dam a fishway has been constructed.



The H. H. Bennett Studio, Kilbourn, Wis.

DOWN-STREAM VIEWS OF THE DAM AND POWER HOUSE AT KILBOURN.

The construction of the dam is shown by the accompanying cross-section and general views. The apron of the dam extends about 100 feet beyond its main body. The ends and face of the dam itself have a foundation of rock-filled timber cribwork resting upon the solid rock. The edge of the apron is also constructed in this manner. In the intermediate part of the dam the cribwork is supported by piles driven through the sand bed to rock. This sand is kept from shifting by the two main crib structures. The cribwork was built in six-foot-square cells, whose walls were constructed of solid timber. Each cell was then carefully filled with rock and sand. The top of the dam and its piers are of reinforced concrete, which is tied to the cribwork foundation. All the timber work is constantly submerged in water, and only the concrete portion is exposed.



From "Water Power Engineering," by D. W. Mead.

CROSS-SECTION OF THE DAM AT KILBOURN.

To render the dam impervious, triple sheet piling has been placed along the face of the dam and the toe of the apron. This has been securely bolted to the cribwork and prevents leakage of water through or below the dam. As a further protection for the stability of the structure, riprap has been placed both above and below the dam itself. The utmost care was exercised throughout the design and construction of the dam, and over two years were required for its erection.

POWER HOUSE.

The power house proper is about 200 by sixty feet in dimensions. A good idea of its arrangement can be obtained from the illustrations herewith. The generator room (190 by thirty-four feet) constitutes the main portion of the building itself. It is unobstructed from the generator floor to the roof. Surrounding it entirely is a gallery at the switchboard and transformer level, twenty feet above the floor. The penstocks, in which the hydraulic turbines are entirely submerged, extend under the switchboard floor and under the platform between the power-house building and the gates in the head race.

There are at present eleven entrance channels between concrete piers between the river and the head race. For the future extension nine others will be provided. The head race is excavated from solid rock and is unlined. The water passes through racks to intercept floating objects before passing through the head gates and wheel pits. There are fourteen head gates, three for each main unit and one for each of the two exciter units. These gates are operated by a three-phase induction-motor-driven crab hoist that can be moved opposite any gate along the track on the top of the wall. A wire conduit, with specially protected outlet boxes, is embedded in the concrete along the top of the wall. The terminal of a flexible cable from the motor can be plugged in at any of these outlets. The head gates may also be operated by hand.

Each turbine unit consists of three pairs of turbine wheels, fifty-seven inches in diameter, built by the Wellman-Seaver-Morgan Company, of Cleveland. Each wheel is rated at 500 horsepower maximum. All the six wheels are direct-connected in tandem to the generator shaft. The four middle wheels discharge in pairs through common draft tubes; the two end wheels have independent draft tubes. The bearings within the wheel pits are reached by separate manholes with wrought-iron casings, as shown in the cross-sectional view. The total length of each main turbine is seventy-four feet. For each of the exciter units only two wheels constitute the turbine equipment. The turbines are all controlled by Lombard governors, built by the Lombard Governor Company, of Ashland, Mass.

Between the wheel pits are triangular rooms entered from the generating room. In these are stored oil, waste, and other supplies, and in two of them are installed motor-driven pumps for supplying cooling water for the transformers and for the power-house service in general. In another of these rooms is installed a set of three fifty-kilowatt step-down transformers for the power-house motor and lighting service.

The main generators are of the re-

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volving-field type, and are rated at 1,500 kilowatts at ninety per cent power-factor. They generate twenty-five-cycle current at 2,300 volts, and have a normal speed of 100 revolutions per minute. The exciter units are rated at 150 kilowatts each and develop 125 volts when running at 200 revolutions per minute. They are compounded for constant voltage. The connections from the generators and exciters to the respective busbars are made by varnished cambric insulated cables passing through the concrete floor and wall to the switchboard level. From this point on the three leads for each generator are carried together in five-inch iron pipe conduit to the busbar and oil-switch floor directly over the switchboard.

SWITCHBOARD.

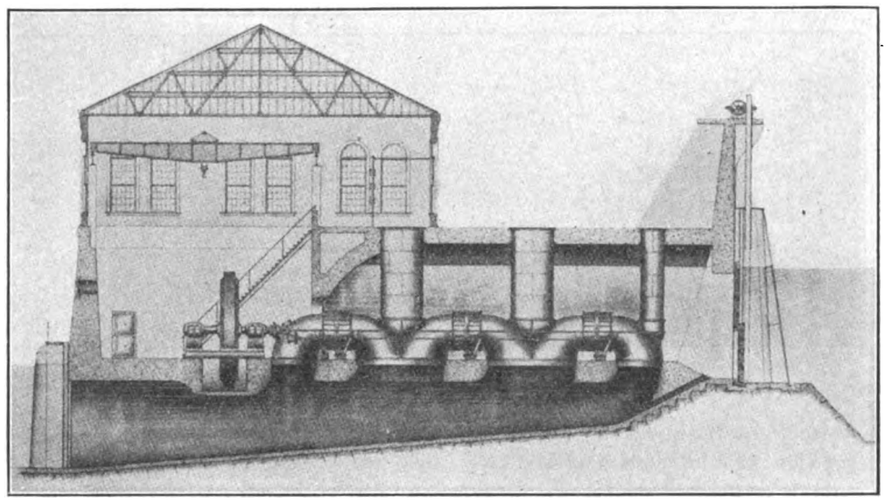
The main switchboard is of blue Vermont marble and is located along the northeastern portion of the gallery. Its equipment is very complete and provides indicating and recording instruments for each of the generator and outgoing line circuits, as well as a comprehensive outfit of regulating and switching devices. All switching operations on the 2,300-volt and high-tension circuits are remote-controlled, solenoid-operated oil swittches being used. All alternating-current circuits are twenty-five-cycle, three-phase. A separate switchboard is provided for the low-tension power and lighting circuits for station service.

joint or independent control of the exciters in connection with a Tirrill regulator. This is arranged so as to compensate for either or both sets of the 2,300-volt generator buses. The 125-volt, direct-current control circuits for operating the oil switches, and the station-lighting circuits, may be connected at this panel to either exciter bus.

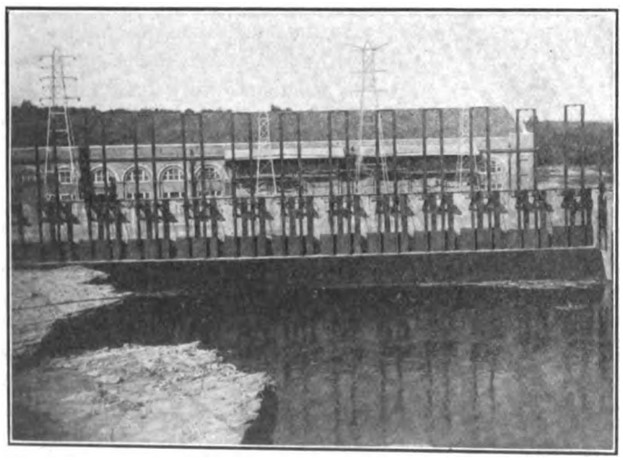
Next are the four main generator panels, which are each provided with a field ammeter and field switches connected to either exciter bus. The other instruments on each of these panels are: An indicating wattmeter, an integrating watt-hour meter, a voltmeter for connecting across each machine phase, and an ammeter with switch for connecting into each phase. There are also plug controls for the oil switches connecting the generator to either the A or B set of 2,300-volt buses. Each of these controls is provided with red and green pilot lamps, as has become standard. On each of these panels there is also a plug control for the motor on the turbine governor that can change the speed of the unit. In adjusting the speed during synchronizing, this plug when pulled starts this motor one way, and when pushed starts it the other way.

Four panels are reserved for the generators to be added in the extension of the plant. At the left end of the board are hinged a synchroscope, a bus voltmeter, and a frequency indicator. These instruments can be plugged in on either set of buses from any generator panel.

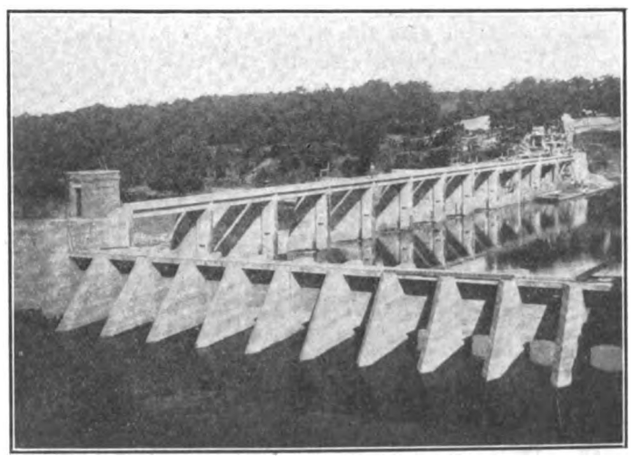
There are at present two main transmission lines operating temporarily at 44,000 volts. There are separate panels for the bank of three step-up transformers associated with each line. Each of these panels has an integrating watt-hour meter, an ammeter for each phase, and a power-factor indicator; plug controls with pilot lamps for the oil switches connecting each bank of transformers to either set of 2,300-volt buses; and inverse-time-limit relays for each of these



From "Water Power Engineering," by D. W. Mead.
CROSS-SECTION THROUGH POWER HOUSE.



Head Gates and Terminal Towers.



The Dam. Entrances to Head Race in Foreground.
UP-STREAM VIEWS OF POWER HOUSE AND DAM.

At the left end, when standing in front of the main board, are two exciter panels, each having a voltmeter, ammeter and circuit-breaker of suitable range. Two sets of exciter buses are provided, to either of which each exciter may be connected. This enables them to be operated independently or in parallel. Adjoining these panels are two other panels for the

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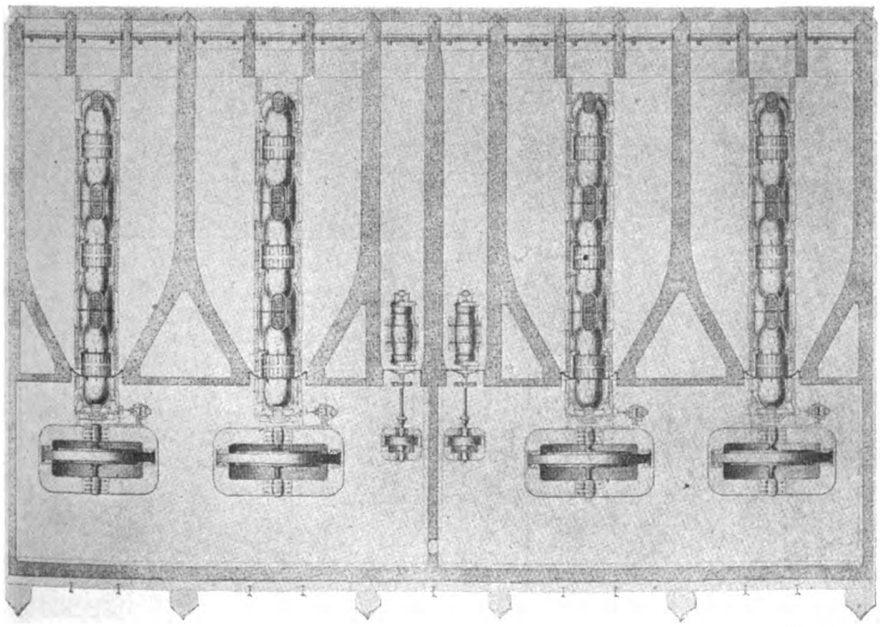
switches. Next to these panels is one with a curve-drawing voltmeter that can be connected to either the A or B bus. Adjoining it are two panels for each of the outgoing, high-tension lines. There is on each of them a curve-drawing wattmeter and the control for the line switch. On one panel there is a similar control for the tie switch, by means of which the two lines may be operated in parallel. Provision is being made for two 2,300-volt feeders to supply the Kilbourn city lighting plant and power users. The panels for these lines are provided with ammeters, indicating wattmeters, integrating watt-hour meters, and the requisite plug controls and pilot lamps for switching each line on to either the A or B sets of busbars.



From "Water Power Engineering," by D. W. Mead.

PLAN SHOWING WHEEL PITS, TURBINES, GENERATORS AND EXCITERS.

The last panel on the board contains similar instruments and switch equipments for the bank of three fifty-kilowatt 2,300/220-volt station transformers. The low-tension side of these transformers connects to the separate station switchboard, which will be described below.

In the control equipment for the oil switches provision is made so that no machine or transformer can be put on the bus except through the six-point plug. The control wiring for all the switches is run in conduit and is sectionalized by fuses so as to permit ready location of trouble. Near the middle of the switchboard is a telephone panel, by means of which the operator can communicate with anyone about the plant.

The arrangement of the 2,300-volt buses which, with oil switches associated therewith, are located on the floor above the switchboard, is shown by the accompanying view. These buses are sectionalized so that at one side are the transformer and generator switches, and at the other the switches for the local and station circuits. The buses can be tied together through any generator or other oil switches connected with them. The switches for the 2,300-volt circuits from the generator and the local and station transformer lines, are of the K-2, solenoid-controlled, oil-switch type. They are rated at 500 amperes and 7,500 volts. The main transformer switches are of the same type, but are capable of carrying 1,500 amperes each. All of these oil switches are of the triple-pole pattern.

Before describing the station equipment for the high-tension transmission lines, it will be well to consider the separate switchboard for the station circuits. This is located in a room to be partitioned off at the east end of the gallery floor back of the main switchboard. This room is fitted up as a machine shop for general repairs and new construction work. In this shop there is an equipment of several machine tools that are driven by individual direct-current motors, either from the exciter bus or from a Northern Electric Company motor-generator set of fifteen kilowatts, changing the 220-volt alternating current to 125-volt direct current. The generator of this set was run by a Westinghouse steam engine during the construction period, thus providing a supply of current for the operation of these tools.

The station switchboard controls the circuits for lighting and motor service throughout the plant. These circuits are intended to be run normally from the step-down station transformers referred to above. The lighting circuits can be connected on the three-wire system to the 220-volt secondaries of these transformers, or on the two-wire system to the exciter circuits. Among the motors controlled from this board are the motor of the motor-generator set referred to, the motor-driven sump pumps in pits No. 1 and No. 2, the motors for the dam gates, head gates and tail gates, and other motor-driven pumps for house service. Provision will also be made for a motor to drive the twenty-ton Northern Engineering Works traveling crane which spans the generator room; at present this crane is operated by hand.

The station board and these various motors were furnished by the Fort Wayne Electric Works. Practically all the other electrical apparatus, including the generators, exciters, oil switches, transformers and lightning arresters, the main switchboard with nearly all its switches and instruments, except some Weston direct-current instruments, were supplied by the General Electric Company.

The step-up transformers for the high-tension lines are installed in separate compartments on the switchboard floor to the north of the main board. There are six 1,100-kilowatt oil-filled, water-cooled transformers, each line having a bank of three. Each transformer may be isolated by disconnecting switches in both the high-tension and low-tension lines, and is mounted on wheels so as to be capable of being rolled out of its chamber to the edge of the gallery, where it may be picked up by the traveling crane. The risers for the pipes supplying the circulating water are erected along the wall of the north gallery. The discharge pipes have gaps above funnels, so that the amount of flow can readily be seen from the switchboard and its temperature easily determined.

The transformer connections are now delta, thus stepping up from 2,300 to 44,000 volts. By connecting the secondaries in Y they will step up to about 72,000 volts. This will be done when the receiving circuits at the end of the transmission line are prepared to receive 66,000 volts. Each of the high-tension leads leaving the transformers, after passing through a disconnecting switch, divides into two branches, one running to the outgoing line and the other

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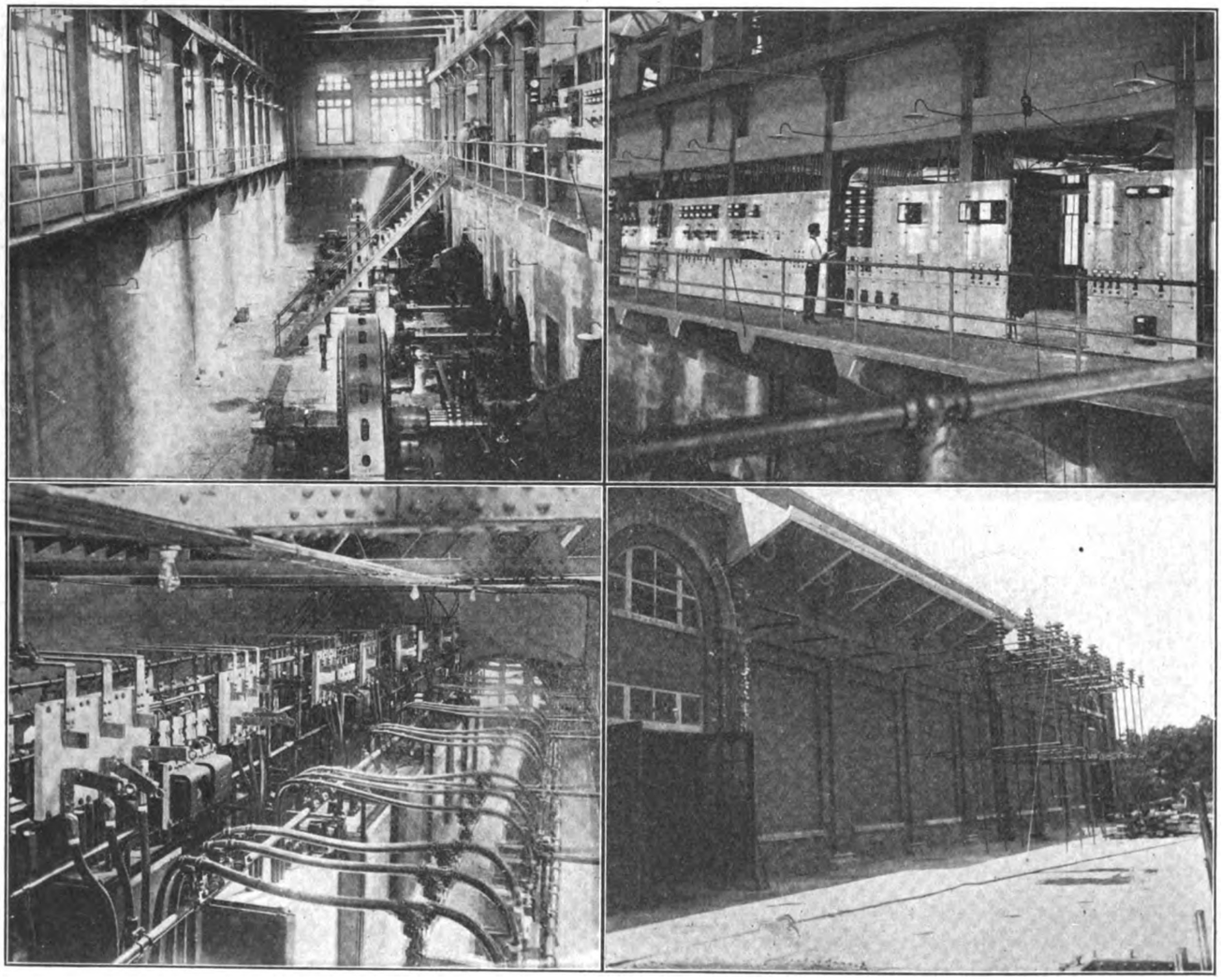
through a disconnecting switch to a tie oil switch. This is installed between the transformer banks. The other branch to the line passes through a disconnecting switch, a similar line oil switch, and through the series relays, ammeters, and choke coils to the wall insulators and out to the tower line. These tie and line switches are of the K-10, triple-unit, joint solenoid-control pattern. They are designed for 100,000 volts and 100 amperes.

A tap is taken off from the line at the last tower and passes through a horn-gap set that is mounted on a pipe framework on the platform over the wheel pits just outside the building. The ground side of the horn gaps is connected through wall insulators to a set of aluminum-cell lightning arresters mounted near the wall inside of the building. There are four of these cells for each line, one in each of the three line connections, and one between ground and the ground side of each of the three other cells. This ground cell is mounted so it can be interchanged with one of the three line cells. To charge these electrolytic cell arresters once a day, one side of each horn gap is pivoted on a vertical axis so it can be brought into contact with the opposite horn, which is normally locked in a slightly offset position. Concrete hoods have been built over the wall insulators where the lines and lightning-arrester circuits pass through the station wall.

Two No. 0 copper ground wires are run in concrete the entire length of the building, and are submerged in the running water at several places. To these are securely grounded the legs of the terminal towers, all inspection tubes, the grounds from the lightning arresters, and all other connections that require grounding.

All the bus compartments for the 2,300-volt and high-tension circuits are built of concrete. The barriers between the different phases are either of concrete or slate. The high-tension bus chambers on the upper floor have asbestos-board doors. Rooms containing high-tension apparatus are kept locked. All the high-tension wiring within the building is of three-fourths-inch copper tubing, angles and tees being slipped into the ends of the straight lengths and soldered thereto; this makes a very stiff construction. All the copper used for the 2,300-volt and low-tension busbars was cut and bent on the ground.

On the bottom chord of the roof trusses a plank runway has been placed. It runs the entire length of the building and is accessible from either end. This runway commands an entire view of the station. On one side can be seen the generating room and on the other the busbars, oil switches and other auxiliary high-tension apparatus. Thus in case of serious trouble the extent of the disturbance can



Generator Room.
2,300-Volt Oil Switches and Busbars.

Main Switchboard.
Lines Leaving Building and Horn Gaps.

THE KILBOURN HYDROELECTRIC POWER HOUSE.

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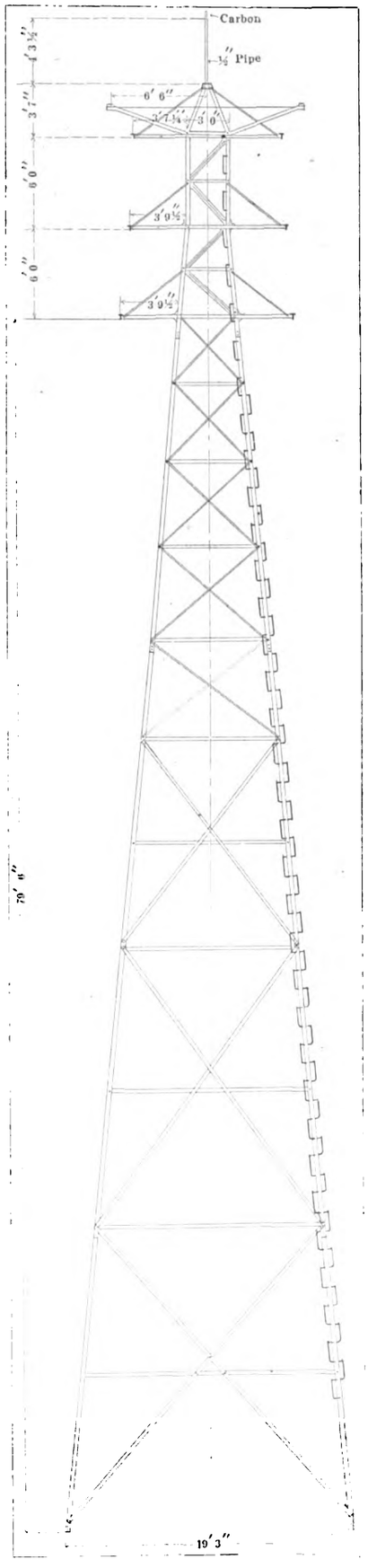
be readily observed without great personal hazard.

TRANSMISSION LINES.

The Southern Wisconsin Power Company is singularly fortunate in that it has a consumer for its power that takes about half of its output, and is ready to take all of the energy that is generated at the plant. This consumer is the Milwaukee Electric Railway and Light Company. A steel tower line has been erected by the power-producing company from Kilbourn to Watertown, Wis., a distance of nearly seventy miles. At the latter point the current is delivered to the Milwaukee company, which has an interurban railway line terminating at Watertown. The tower line has been continued east of Watertown for fifty miles by the Milwaukee company, and terminates at the West Allis substation, where the current is stepped down to 13,200 volts and transmitted underground five miles to Milwaukee. The total length of the transmission line thus is 120 miles from Kilbourn to Milwaukee. At the present time power is being transmitted over this entire distance at a potential of 44,000 volts at the power plant. A substation is to be erected at Watertown which will be equipped to receive 66,000 volts in the near future. That portion of the line from Milwaukee to near Watertown was built several years ago to carry a maximum of only 44,000 volts, and the substations between these points are also equipped for this potential. As soon as this substation equipment has been changed for the higher voltage, the potential will be raised to 66,000 volts at the Watertown receiving end.

The line that was erected by the power company was built almost entirely on private right-of-way. From Kilbourn to Watertown it follows very closely the main line of the Chicago, Milwaukee & St. Paul Railway. The construction of the steel towers is clearly shown in the accompanying views and in the elevation of the structural part of the highest tower. The entire tower is built of galvanized steel and is of the four-post pattern. For carrying the line wires, which are suspended from triple-unit suspension-type Thomas insulators, furnished by the H. W. Johns-Manville Company, three brackets are provided on each side of the tower. These are well braced and are mounted one over the other. On top of the tower a pair of upwardly extending brackets is provided for carrying ground wires almost directly over the transmission lines. These ground wires are placed thirteen feet apart. At the apex of the tower a lightning rod extends upward about four feet and is capped by a carbon point.



ELEVATION OF STEEL TOWER.

The two transmission lines are arranged to be operated independently or in parallel. Either one alone will suffice to carry the total energy when repairs are being made on the other line. The transmission cables are No. 0 six-strand copper wire with a hemp center. For the ground wire a seven-strand galvanized-iron wire has been used for ten miles from the power house and for four miles at the receiving end. It was thought desirable to study its efficacy in protecting the line before extending its use over the entire distance. Brackets for carrying the ground wire are provided on each tower, however, so that it can be placed along the entire length of the line, if desired.

The average height of the towers is forty feet. The highest one is eighty feet. The average space between towers is 525 feet. At railroad crossings and at curves the spacing is considerably less. At all deviations in the direction of the line from ten degrees to twenty degrees strain insulators are used for supporting the outer transmission cables. At angles in excess of this point the strain insulators are used on both the inner and outer lines. The total number of towers erected by the power company for its portion of the transmission line was 720.

The contract between the Southern Wisconsin Power Company and Milwaukee Electric Railway and Light Company runs for a period of twenty-five years, during which the latter company agrees to take an average of 84,000 kilowatt-hours per day. A number of requests have been received for the sale of power to communities near Kilbourn, particularly along the present tower line. Arrangements are being made to supply the city of Portage. The circuits for the local Kilbourn installation have already been provided, but the pole line has not yet been completed. These circuits were used after the plant began running on June 8 of this year for testing out the generators and the rest of the equipment. The first commercial load transmitted over the tower line to Milwaukee was supplied on the second of this month.

For the data that were used in preparing this article the author is indebted to H. P. Broughton and H. P. Ridgely, general manager and superintendent, respectively, of the Southern Wisconsin Power Company, and to Daniel W. Mead, its chief engineer.

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Telephone and Telegraph Business.

The capital invested in the telegraph and telephone business in this country is in excess of a billion, $814,616,004 credited to the telephone systems and $220,293,575 to the telegraphs. According to the third census of the electrical industries, made by the government, there is a grand total of 15,072,220 miles of single wire in the telegraph and telephone service. Of this, the telephone systems controlled 12,999,369 miles, of which there were on pole or roof lines 5,002,223, in overhead cables 2,917,114, in subways or conduits 9,469,302, and in submarine cables 20,730 miles. Of the grand total stated, the telegraph systems, exclusive of government telegraph systems, used 2,072,851 miles, of which there were on pole or roof lines 1,958,336 miles, in overhead cables 41,886, in subways or conduits 65,347, and in submarine cables 7,382 miles. These figures emphasize the economic importance of the telegraph and the telephone.

A comparative summary deals with the telephone and commercial telegraph systems, not including railroad lines and the wireless, giving the grand total as 22,996 companies, of which there are 22,971 telephone systems, which include 17,702 independent farmer or rural lines and twenty-five commercial telegraph systems, not including the wireless. The grand total of single-wire mileage was 14,570,142, of which the telephone systems controlled 12,999,369 miles, which include 486,294 miles of wire on independent farmer or rural lines, while the telegraph systems used 1,570,773 miles, exclusive of 7,188 miles of leased wire.

The grand total of ocean cable was 46,301 nautical miles, all controlled by the commercial telegraph systems.

The grand total of salaried officials. clerks, etc., was 29,470, of whom 25,298 were employed by the telephone systems and 4,172 by the commercial telegraph. The telephone officials, etc., received in salaries $19,298,423, and the telegraph clerks $2,794,937. The total of 142,733 wage-earners is divided, 118,871 belonging to the telephone systems and receiving in wages $48,980,704, while the 23,862 telegraph wage-earners were paid $15,013,312.

The grand total income was $236,015,615, of which the telephone concerns earned $184,461,747, expending $140,802,305, and the telegraph system earned $51,583,868, expending $41,879,613. Of the whole number of systems in operation, the telephone formed 99.9 per cent.

The surprising thing about this report is the rapid growth of the telephone business, which is still far from the height of its possibilities.

Engineers Endorse Electric Headlight.

According to the testimony given before the Washington State Railroad Commission at Olympia last week by E. H. Stewart and George Barnhart, engineers on the Oregon Railway and Navigation Company's lines, and G. E. Foster, an engineer on the Northern Pacific, there is no comparison between the electric and acetylene headlights. The electric headlight, in the opinion of the engineers, is the only light to be considered.

E. H. Stewart stated that he had run behind both electric and acetylene headlights, and he was outspoken in favor of the electric light. He said it showed the track much farther ahead and that there was no additional trouble in distinguishing the various colored lights along the track.

George Barnhart said he had been riding in an engine cab for twenty-five years and had had both electric and acetylene headlights on his locomotives. He is an enthusiast over the electric light and declares that the stronger light does not bother his eyes in the least.

G. E. Foster, of the Northern Pacific, also testified as to the superior merits of the electric light. He said he had had only electric lights on his engines, but stated that he has never had the least bit of trouble with them.

X-Ray as Leprosy Cure.

The X-ray as a cure for some cases of leprosy has been demonstrated by the American health authorities in the Philippines, according to Dr. Victor G. Heiser, chief quarantine officer at Washington, D. C.

Dr. Heiser, in a report to Surgeon-General Wyman, says the X-ray is suitable only for specially selected cases, and is valuable apparently only in the early stages. San Lazaro Hospital, Manila, was the first institution in the world to use the X-ray for leprosy treatment.

Official figures show that on March 31, 1909, there were 2,446 lepers in the Philippines, segregation having reduced by more than 1,000 the number of cases during the last two years. At the beginning of the American occupation, eleven years ago, there were nearly 4,000 lepers.

Telephoning Across the Ocean.

A fresh experiment is to be made with a method of promoting submarine telephony devised several years ago by Prof. M. I. Pupin, of Columbia University. It consists of the introduction, at carefully computed intervals, in the cable, of choking coils. These increase the distance at which speech can be made audible, not by magnifying the sound, but by lessening the rapidity with which electric vibrations die out. According to the London *Times*, the British government—doubtless in co-operation with that of France—has decided to lay a cable prepared in this manner across the English Channel. As it will connect with land lines at Dover and Calais, it is expected to facilitate telephonic communication between London and Paris. Though some use of Professor Pupin's invention has been made in the United States to enhance the efficiency of the American Bell Telephone Company's overland wires, it has thus far had only one trial under water—on a telephone cable which crosses Lake Constance from Switzerland to Germany. As for some reason the pioneer experiment has not proved entirely satisfactory, the outcome of the second trial under water will be awaited with exceptional interest.

If in this instance the system should work perfectly, it is not unlikely that there would be a fresh discussion of the feasibility of transatlantic telephony. It has repeatedly been pointed out that even if all the technical difficulties in the way of such an enterprise should be overcome it might not prove commercially successful. The hours during which a telephone line between New York and London would be patronized would be limited, and the cable devoted to such service would cost much more than one for telegraphy alone. It is to be remembered, however, that a cable equipped with choking coils could be employed for telegraphy as well as telephony. It would not necessarily lie idle, therefore, when it was not used for conversation.

Cipher Telegraph Rates Advanced.

An increase of rates on code messages has been announced by the Western Union and Postal Telegraph companies. Cipher messages will be charged at the rate of five letters to the word, instead of ten letters, unless the telegram is made up of only such words as can be found in the dictionary. Domestic messages only are affected.

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The Michigan Electric Association.

Sixth Annual Convention, Detroit, Mich., August 17, 18, 19.

With an attendance that surpassed that of any previous meetings, the sixth annual convention of the Michigan Electric Association was held in Detroit, Mich., August 17, 18, and 19.

This convention, viewed from every standpoint, will be considered most successful. Central-station men from the far corners of the state were in attendance, as was also a representative gathering of manufacturers who conducted a number of interesting exhibits.

The meetings were held in the convention hall of the Hotel Tuller. A gratifying spirit of activity and interest was shown by the members and, although the discussions which followed the reading of the various papers were brief, unvarying attention was maintained throughout the presentation of all of the papers.

TUESDAY EVENING SESSION.

The convention was formally opened at 8 o'clock, Tuesday evening, by President H. W. Hillman. In his presidential address Mr. Hillman said in part:

It is my pleasure to address you once more in connection with the opening of this, your sixth annual convention. The object of this association shall be to foster and promote the common interests of its members and to advance scientific and practical knowledge in all matters relating to electric-light and power companies.

Notwithstanding the intensely interesting character of our industry, there has probably never been a time when your Association has given more attention to the subject of incandescent lamps. It seems apropos to call this a tungsten session, and to spend several hours rehearsing the evidences of advancement in connection with the subject of tungsten electric lights.

The heating branch of the industry has likewise advanced since your last meeting. The heating committee of this association has an interesting report to make at our third session, and in addition to the many papers that have been planned it would seem that this organization is not lagging on this most important subject.

Electrochemical and electrometallurgical matters are constantly coming before the central stations for discussion and handling. For fear your Association will make the mistake to fail to advance scientific and practical knowledge in all electrical matters, I would recommend that the incoming president appoint a committee of three members to be known as the committee on electrochemical and electrometallurgical matters.

The situation regarding electric motors is one which could be studied more than ever with the prospect of excellent results. At this meeting unusual importance will be attached to the forcible presentation of the merits of the curve-drawing wattmeters, and their value with relation to electric motor drive. Experience and careful study would seem to indicate that the curve-drawing wattmeter is as important to the electric motor branch of our industry as illuminating engineering has proved to be in relation to the lighting field. Therefore, it is hoped that every member will not only absorb but digest all that the papers have to offer on this subject so that central stations in Michigan will be the first to benefit from the extensive use of the curve-drawing wattmeters.

At the close of his address Mr. Hillman introduced E. G. Bieg, of the General Electric Company, who read a paper entitled "The Supremacy of the Tungsten Lamp." Mr. Bieg's paper describes the process of manufacturing the tungsten lamp. It deals quite fully with the supremacy of this lamp for both interior and exterior lighting. Mr. Bieg also advocates tungsten sign lighting, and gives some figures showing the comparative costs and comparative illumination between the tungsten and carbon lamps, which indicates the domination of the lighting field with the tungsten lamps.

The next paper was read by B. F. Fisher, Jr., on "Tungsten Lamps." Mr. Fisher said in part:

The introduction of a small step-down transformer opens another important field of usefulness for the tungsten lamp. The twenty-five-watt or twenty-candlepower lamp appears to be the smallest practical capacity for a unit at regular voltages, but by the introduction of a small auto-transformer it is practical to step down the standard voltages to twenty-seven or twenty-eight volts.

Another line of these new lamps which is of very great importance is the series lamp for street lighting, which should enable the central stations to compete favorably with the gas lamp for this class of lighting.

The tungsten lamps have the highest efficiency of any lighting units, excepting the larger arc lamps, said the author, and they burn with a clear, soft white light at approximately 1.25 watts per candle. This high efficiency is important to central-station management in its effect in flattening out the load peak without seriously reducing station output, and in the increased capacity of station apparatus and lines and the direct saving in cost of station and line apparatus due to the reduction of the load peak by the higher efficiency.

Next to the efficiency of the tungsten lamp its most important characteristic is the quality of light. To the storekeeper this quality of light produced is of far greater importance than the efficiency. In the home the quality of light permits combinations which are a constant pleasure.

The simplicity of the tungsten lamp is a characteristic which is often neglected. They retain all the simplicity of the ordinary incandescent lamp and require but little extra care.

Mr. Fisher was followed by Fred Masterson, of Grand Rapids, who read a paper entitled "Care of Tungsten Street Lamps."

Mr. Masterson's paper was devoted to a study of the installation of tungsten lamps for street illumination in Grand Rapids. He described the installation briefly and said that considerable trouble was experienced at first in renewing burned-out lamps, as it was necessary to draw the arches to one side of the street so that the lamps could be reached from a ladder placed against the building. This system required four men and also did considerable damage to lamps which did not need attention and also to the wiring. This original method was superseded by a tower wagon, similar to the ones used by traction companies for repairing trolley wires, and a considerable saving has been the result.

On June 8, 1909, the first installation of 270 lamps had been in operation one year. During this time the lamps burned 1,920 hours and consumed 41,000 kilowatt-hours of energy. The number of lamps renewed was 196, which cost the company $225; this makes the cost of renewals for lamps only $0.0055 per kilowatt-hour. The labor necessary to care for 270 lamps is $50, which makes the total cost of renewals $0.0067 per kilowatt-hour.

The one drawback of the series tungsten lamp, operating from a constant potential circuit, is the extinguishing of all the lamps in the arch when one lamp burns out. However, this is not very serious, if the lamps are inspected every morning.

The next paper, entitled "The Tungsten Lamp in the Residence," was submitted by John Vanderliet. Owing to the absence of the author, the president called upon William Constable to read Mr. Vanderliet's paper. The author said in part:

The residence lighting of the central-station business not only increases the popularity of electricity, but many times is the means of procuring new power customers.

It seems that the fixture manufacturers have in the past given very little attention to the art of illuminating engineering. The many kinds, sizes and shapes of shades found in the residences are proof of the fixture manufacturer's idea of what would sell rather than what would be useful for proper illumination. In most of the cases that he had personally investigated he found that the lamps were hung on an angle of about forty-five degrees, with a close-fitting frosted or colored shade, and very often in addition to this a frosted carbon-filament lamp is used. In very few cases did he find the proper shades used.

The policy of Mr. Vanderliet's company is to have two men make a systematic canvass of the residence customers and install a combination of forty-watt tungsten lamps, with the E5 Holophane reflectors, using Benjamin tungsten adapters on thirty days' trial, after which they send a man to see how the consumers are satisfied, and in nearly every case the customer sees enough improvement in his light to warrant the purchasing of the outfit.

The tungsten lamp, he believes, is the salvation of electricity against the gas mantle in the home.

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Mr. Vanderliet's paper was followed by an address by J. R. Cravath, of Chicago. Mr. Cravath selected for his subject "Illumination," reviewing the reflector situation and discussing problems in illuminating engineering to be met with in modern installations, particularly regarding reflectors. By means of a blackboard Mr. Cravath illustrated the various angles of reflection obtained from several satisfactory and unsatisfactory reflectors now in general use.

Mr. Benson, of the General Electric Company, read letters from several central-station companies from outside the state of Michigan giving their opinions of tungsten lamps. His collection consisted of letters from the Union Power Company, St. Louis, Mo.; Commonwealth Edison Company, Chicago, Ill., and Kansas City Electric Company. Every letter spoke of the tungsten lamp as holding the same position in the electric-lighting industry that the Welsbach mantle has in the gas industry.

Mr. Benson was followed by W. J. Trotte, who said that his town was inaugurating the tungsten street-lighting system as installed in Grand Rapids, and with much success. He also added that with the general adoption of the tungsten lamp for both interior and street lighting the central stations were starting on a new era of prosperity.

Following the reading of the papers A. C. Marshall, of Port Huron, related the progress of the tungsten lamps in Port Huron. He said that the first installation of tungsten lamps was invariably followed by the customer reducing his lighting bill, but this reduction was more than covered by increase in number of people desiring electric lights.

Mr. Phillips, of Detroit, said, from statistics he was able to show, that in the various suburbs of Detroit the tungsten lamp was the means by which the central station was undoubtedly getting business from the gas companies.

Harry Fee, of Adrian, Mich., said that formerly the gas company in Adrian controlled the greater share of business, but with the introduction of tungsten lamps for street and residence lighting the business of the central station was increasing and that of the gas company decreasing. There is a successful installation in Adrian of twenty-two arches of forty-watt tungsten lamps for street lighting.

Messrs. Prindle, Wilkins and Brown all spoke of similar successful installations of tungsten lamps for both interior and exterior lighting.

WEDNESDAY MORNING SESSION.

The second session was held at 10 o'clock Wednesday morning. The first paper to be read was one by M. S. Mead, entitled "Electric Power Equipment in the Brunswick-Balke Company's Plant." Owing to the absence of Mr. Mead, F. F. Masterson read the paper.

In 1906 the Brunswick-Balke-Collender Company erected three large factory buildings for manufacturing billiard and pool tables, modern bowling alleys and store fixtures. When investigating the matter of power, the company was appealed to with arguments in favor of its own steam and electric plant, likewise with many in favor of purchasing the power from the Grand Rapids-Muskegon Power Company.

The latter proposition included the entire supply of power at the switchboard, eliminating any initial expense. The management was attracted to the simple arrangement of producing steam only for dry kilns and for heat without complications required for manufacturing its own power.

In October, 1906, there were installed ninety-two 440-volt, three-phase, Fort Wayne induction motors and four Westinghouse elevator motors, making a total of 923 horsepower connected. The power company installed two Westinghouse 6,600 440-volt, oil-cooled transformers, of 350-kilowatt capacity each, and commenced to furnish us power under a three-year contract.

In the fall of 1908 two additional factory buildings were completed. Instead of having to consider extensions of boiler, engine and generator capacity, the company simply purchased new motors, arranged for wiring the buildings and the supply was taken from the transformers which were ample in size for increased facilities. There was installed an additional equipment of twenty-one General Electric motors, a Fort Wayne elevator motor and a General Electric elevator motor, making a total of 390 horsepower.

In March, 1909, another contract was closed with the Grand Rapids-Muskegon Power Company and the Brunswick-Balke company, covering about 1,300 horsepower connected. Before making this last contract the most exhaustive tests were made to determine the amount of steam heat required, the amount of refuse available and the amount of additional coal necessary for steam heat, as well as the total amount of horsepower-hours which would be required from the power company. This test proved that the then existing system of boilers especially arranged for steam heat and the supply of current for light and power from the power company was the most economical arrangement that could be adopted.

Mr. Masterson was followed by Chas. H. Scott, of the General Electric Company, who read a paper also dealing with electrical installation of woodworking plants.

At the conclusion of the reading of Mr. Scott's paper, W. B. Wreaks, of the Westinghouse Company, made an introductory address on the papers by J. M. Van Splunter and Paul MacGahan, on "Graphic Recording and Curve-Drawing Wattmeters." Mr. Wreaks said in part:

"I have been requested to make a brief introductory address on a subject of the greatest importance and interest to all of you, who are operating central stations, in the intelligent building up of your business, and that subject is the curve-drawing wattmeter and the very great importance of its use to increase your motor business.

"I think you will all recognize and will admit of the importance of equalizing the load on your power-generating stations, and the fact that the higher your average all-day load and the lower your peak is compared with the rated capacity of the plant installed, the more economically you are operating, and consequently the greater your percentage of profit per horsepower generated or per dollar invested.

"With the great advance of electricity today almost every factory can be operated at a lower cost by driving machines by electric motors. Many manufacturers are far-sighted enough to see this, but there are, unfortunately, many who are not yet convinced of this economy. When such a factory manager, wno has been driving his machinery by steam power, is approached by you to install motors, he tells you he is making his power for a much smaller rate than you can quote him. As a matter of fact, he has not usually any knowledge at all of the cost of his power, for he bases his conclusions on the readings of his indicator cards taken from his engine, and this is very incomplete, for it gives him instantaneous power readings only, and does not show load variations. It is up to you, gentlemen, to show him wherein he is wrong by an accurate power test, for in electricity you have the only possible accurate method for determining these results.

"This can be shown by a trial installation of motors properly applied to the machines. How many of you use the proper means to determine accurately the results of such tests?

"The curve-drawing wattmeter will give a graphic record during every minute of the day with the load variations of every machine, or group of machines, and give you the load factor and the record of running time and rest of every machine and group of machines.

"Gentlemen, every one of you who are operating central-station power plants should not only have a curve-drawing wattmeter on your switchboard for permanent use, but you should have at least two such instruments for the use of your power solicitors, to assist them in getting motor customers."

Following Mr. Wreaks' address, Paul MacGahan read a paper entitled "Graphic Recording Meters." An abstract of Mr. MacGahan's paper follows:

The subject of graphic or recording electrical instruments is in general by no means a new one, but the advantages accruing from the use of these devices have only recently been properly understood.

Graphic meters may be classified in a manner similar to other electrical instruments, with regard to character of service and accuracy desired. The service classification falls naturally into two groups: (1) Switchboard or permanent location and (2) Portable Service. The classification as to accuracy is subject to almost as radical a distinction as that of service, and may be stated as follows: (A) Meters in which simplicity of parts

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or manipulation as well as low cost have been the determining factors in the design. (B) Meters in which accuracy has been made the prime requisite.

The instruments under class A consist generally of a very simple electrical movement, such as stationary coils attracting movable iron armatures and actuating directly a pen-arm fitted with a rudimentary pen. The pen travels in the arc of a circle, across a circular dial plate, which is made to rotate by means of a clock. This type of instrument, on the whole, is exceedingly simple, easily understood and manipulated, and reasonably reliable, but very much lacking in absolute accuracy.

In order to increase the accuracy of the instruments (class B), it is necessary to separate the functions of the measuring element and of the marking device, for the reason that the friction introduced by the pen on the paper interferes seriously with the accuracy. This cannot be satisfactorily overcome by increasing the power of the meter coils, owing to the electrical errors thereby introduced. Moreover, increased accuracy also requires a broader and more legible chart, which would still further increase the work required of the meter element.

Among the numerous applications which the advent of these higher accuracy types of instruments have developed and which were not previously considered possible, may be mentioned the following:

A basis for charging for power according to the maximum demand, or the peaks lasting a certain length of time; the analysis of power requirements for motor drive of machine tools, rolling mills, etc.; a complete record of the speed and output of printing presses, where speed and output are of prime importance.

"Curve-Drawing Instruments and Some of Their Applications" was the title of a paper by J. M. Van Splunter that was read by Mr. Freeman, following Mr. MacGahan's paper.

In this paper the author pointed out that in keeping with the rapid advance in the design of electrical apparatus have come improved methods in their use, for instance, in power equipment of factories and in the records kept showing the distribution of the load over the factory, the power used per machine and the character of the load. To obtain these results, data obtained from the records of curve-drawing instruments are so complete that the situation can be sized up in every detail and necessary corrections and changes made at the correct point.

If central stations would procure a curve-drawing wattmeter for demonstration purposes, it would soon result in increased motor sales, as the record would forcibly show the actual conditions throughout the day.

The cost of such an instrument is but nominal, but it must be pointed out that first cost must not be the only thing to consider, as the saving made by its various uses is of prime importance.

There are several types of curve-drawing instruments on the market, and in selecting instruments it is well to consider the different types and select one which at a nominal cost will give results which are within the limits of accuracy allowable.

By using curve-drawing instruments it is possible to show just how much power each machine takes, how long each day it is in use, and the cost of power for its operation. Such records also show with what promptness the employes start to work and also their time of shutting down. Furthermore, they tell when it is necessary to install new machines, and when by some changes fewer machines can be made to do the required work.

Mr. Fleming, of the Westinghouse Company, presented a number of lantern slides showing curves obtained from curve-drawing wattmeters.

After the reading of the above papers Miss Sheridun, of Detroit, started the discussion. She spoke in favor of the curve-drawing wattmeter, expressing a desire that they would become universally used. A number of cases were cited in which the instrument settled many complaints.

Mr. Denman, of Detroit, was not so enthusiastic over the subject, saying that the field for the instruments is limited. He added that in cases of dispute over bills, if the meters are read every morning and every evening for a week, the same general result can be obtained as with a curve-drawing wattmeter.

A. C. MARSHALL,
President-Elect Michigan Electric Association.

President H. W. Hillman ended the discussion by adding, that, in his opinion, there is nothing in the steam industry that can approach the curve-drawing wattmeter in the electrical industry.

THURSDAY MORNING SESSION.

The third and final session of this convention was held at 10 o'clock Thursday morning, and was opened by the reading of a paper entitled "The Extension of the Heating-Service Business," by J. D. A. Cross.

Mr. Cross took up the growth of electric heating and cooking appliances and described a complete hotel equipment of kitchen and laundry devices. He discussed flatirons and electric toasters, advising central stations to pay more attention to this branch of the industry. Mr. Cross called the attention of central-station men to the oil-tempering bath, showing the advantages of the electric over differently heated baths. Electrically heated ornamental ware, such as chafing dishes, percolators and teakettles, was discussed, Mr. Cross outlining methods of demonstrating this to the trade.

Following the reading of the paper by Mr. Cross, the president called for the report of the electric heating committee, which was read by William Constable, the chairman.

The report covers the entire field of electric heating, citing those branches which have advanced more rapidly than others. The range of possible uses of electric heat for industrial purposes was discussed, showing the variety of applications in which electric heat is used, such as in electric welders, printing and publishing trades, leather trades, clothing and textile trade, and branches of the woodworking trades.

Mr. Hillman read an abstract of a paper by Charles J. Russel, that was presented before the National Electric Light Association at Atlantic City, N. J., last June, entitled "Electric Heating Devices for Industrial Purposes."

Mr. Little read a paper on central-station advertising, outlining methods of successful advertising that have been employed by a number of central stations.

The report of the treasurer was read and accepted on motion.

The nominating committee announced the candidates for officers and, on motion, their recommendations were adopted and the following officers declared duly elected:

President, A. C. Marshall, Port Huron.

Vice-president, Geo. Westover, Cadillac.

Secretary and treasurer, A. P. Biggs, Detroit.

A. C. Marshall, president-elect, has been identified with the officers of this association for several years, his previous office being that of secretary and treasurer. He is general manager of the Port Huron Light and Power Company, Port Huron, Mich.

ENTERTAINMENT.

The entertainment committee is to be congratulated on the excellent programme they provided for the entertainment of the members and guests.

On Wednesday morning the ladies were taken on a delightful automobile trip through the principal business and residence districts, the boulevards and drives.

In the afternoon the delegates and guests with their ladies were taken to Bennett Park in special cars to witness an interesting ball game between the Chicago and Detroit teams.

The entire party also attended, in a body, a very pleasing vaudeville enter-

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tainment at the Temple Theatre Wednesday night.

On Thursday afternoon a special boat was secured for the exclusive use of the ladies, guests and members for a delightful and refreshing trip down the Detroit River to the Bois Blanc Island, where supper was served. En route the boat stopped at Livingston Cut, one of the great engineering projects of the present time. Returning, the boat passed by the entire illuminated river front and landed at the dock at 10:30 p. m.

MANUFACTURERS' EXHIBITS.

The Westinghouse Electric and Manufacturing Company made an elaborate exhibit of carbon and flaming-arc lamps, fans, small motors, sewing-machine motors, electric heaters, electric iron, cooking appliances, transformers and precision instruments. W. B. Wreaks, F. H. Adams, David Whiting and B. A. Harris represented the company.

The Nernst Lamp Company made a very interesting exhibit, showing its new form of ceiling lamp, special pendants and various ornate fixtures, equipped with screw-base and instantaneous-lighting units of low and high candlepower. The company was represented by Max Harris, of Pittsburg, Pa., J. J. Sorber, of Chicago, Ill., H. M. Brown, of Detroit, Mich., and Frank A. Chapman, of Pittsburg, Pa.

The Shelby Electric Company made an exhibit of its lamps. It was represented by William H. Meyers and William Love.

The Excess Indicator Company made an interesting exhibit of its indicators; Bernard Gaines represented the company.

The Central Electric Company also made an interesting exhibit. R. L. Kimble represented the company.

Among other manufacturing and supply representatives present were: J. E. Hart, Banner Electric Company, Youngstown, Ohio; Fred M. Odena, Allis-Chalmers Company, Milwaukee, Wis.; J. R. Wiley, Standard Underground Cable Company, Chicago, Ill.; E. H. Cheney, Wagner Electric Company, Chicago, Ill.; C. H. Froelich, Federal Sign System-Electric, Chicago, Ill.; F. E. Case, Bryan-Marsh Company, Chicago, Ill.

That Ideal Storage Battery?

An inventor named Gross, living at Christiania, Norway, claims to have constructed an electric storage battery which is said to have the characteristics early predicted for the battery that long has occupied the attention of Thomas A. Edison.

Baltimore's Electric Light and Power Companies.

That the Susquehanna Electric Power Company, which has the only charter giving the right to engage in the electric-light and power business in Baltimore not controlled by the Consolidated Gas, Electric Light and Power Company, may exercise the rights of its charter and compete with the local company in distributing electric current was the statement made recently in Baltimore by William H. Surratt, vice-president of the corporation.

The company having paid its bonus tax of $15,000 on its capitalization of $12,000,000 at Annapolis, intends, according to Mr. Surratt, to begin the construction of a hydroelectric plant on the Susquehanna River as soon as several more millions of dollars are supplied by those interested in the corporation. Of the capital, more than $1,000,000 has been paid in, and Mr. Surratt said the indications were that the substantial interests behind the company would soon subscribe the additional money necessary to start the work of building a dam and power plant. Much property along the river above Conowingo, Md., has been acquired, he said, and the further financing of the enterprise within a short time is assured.

Besides selling its own current in Baltimore in competition with the Consolidated, it was stated by Mr. Surratt that the company might purchase current from the McCall Ferry Power Company and distribute it in Baltimore in conjunction with its own power, provided the market be found. The distribution of the McCall company's power, he declared, was contingent upon the action of the receivers of that company in regard to the contract held by the Consolidated for the exclusive distribution of the McCall power within a radius of twenty-five miles of the Washington Monument in Baltimore.

The Susquehanna Electric Power Company was incorporated in Howard County in 1895 by Charles T. Davis, Randolph N. Brown, M. H. Houseman and William Gilmor. None of these gentlemen is now in control.

The following officers were elected at a meeting of the directors and stockholders in January of this year at Belair:

President, Joseph W. Marsh, Pittsburg.

Vice-president, William H. Surratt, Baltimore.

Secretary, John Henry Miller, Baltimore.

The directors are mostly Baltimoreans.

Faster Telegraph Service.

The Postal Telegraph Company announces that beginning with August 2 it had perfected a new and improved system which is styled "Special Rush Service."

By this service it claims to have reduced the time of sending and receiving messages by fifty per cent in more than 5,000 offices in all the important centers in the United States.

C. C. Adams, vice-president of the company, said that the new service had been made possible by a rigid supervision of all the processes incidental to the sending and receiving of a message and the fixing of a maximum time limit for these operations. In addition, the actual telegraphing of a message has been hastened by a new type of operating table which permits of the concentration of circuits.

The average elapsed time from the moment a messenger is called in New York to delivery in Chicago is now fifteen minutes; and recently one was sent from St. Louis to New Orleans in four minutes. The improved methods in expediting traffic over the wires has reduced the time of transit, so that now one may send a message and receive an answer from Chicago, Boston, St. Louis, Denver, San Francisco, and New Orleans in less than thirty minutes after the messenger has been signaled for.

Paris-New York by Wireless.

Advices from Paris state that the wireless station on the Eiffel Tower is receiving almost daily communications from New York, and it often picks up messages from Canada. The present installation, which belongs to the War Department, is only a temporary one. When a definite installation has been completed, the fittings of which, except, of course, the external ones, will be all under ground. Captain Ferie, director of the service, expects to talk regularly with New York without trouble. This condition, it is expected, will be reached about the end of September, if present plans are followed.

New Zealand Mine Tries Electric Pumping.

It is reported that the Crown Mines at Karankahake, North Island, New Zealand, will install a 550-kilowatt three-phase alternator, with motors and duplex pumps, having a capacity of 1,135 gallons of water a minute from a depth of 1,000 feet.

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Another Atlantic Cable.

The Commercial company is now making ready to lay what is virtually a new Atlantic cable and one which will mark a radical departure in the development of cable telegraphy.

One of the existing cables that belongs to this company and runs between Cornwall, Eng., and Canso, N. S., will be cut in mid-ocean, east of the Grand Banks, and a new section laid from there to St. Johns, whence it will be continued direct to New York, the portion stretching from the point of severance to Canso, a distance of 1,300 miles, being picked up and used otherwise subsequently.

The new arrangement will increase by one-third the capacity of the cable, as it will divide it into two equal sections from New York to St. Johns and from St. Johns to London, with repeating instruments at St. Johns.

Early telegraphers would marvel at the speed and efficiency that cabling has now attained. The first Atlantic message, from Queen Victoria to President Buchanan, of sixty-seven words, took ninety minutes to transmit. Today two messages, one each way, can be sent at the same time along an undersea wire at the speed of fifty words a minute each. Almost beyond belief are some of the records achieved.

In 1891 the experiments over one Atlantic cable, to determine the longitude of McGill Observatory, Montreal, disclosed that electric signals were flashed from Montreal to Greenwich and back, some 8,000 miles, in one second.

Three years later the British Admiralty sent a message to Vancouver by cable and land line and received a reply within ninety seconds, the distance both ways being 13,000 miles.

In 1896 a message from Washington to London, in the inter-parliamentary chess match of that year, was transmitted by cable and a reply received within fourteen seconds.

Messages from President McKinley to the battlefield of Santiago in July, 1898, were sent and responses returned within twelve minutes.

On July 4, 1903, President Roosevelt sent a message around the world to inaugurate the cable at Manila, and it made the circuit of the globe in nine minutes, traveling 33,700 miles by cable and land lines.

In 1904 the results of the Anglo-Australian cricket matches were sent from Sydney to London, 14,341 miles, in exactly three minutes, though involving twelve repetitions, and 20,000 words of press dispatches, detailing the capture of Port Arthur, were forwarded in January, 1905, to New York and London, within twelve hours.

United Railways Investment's Recently Organized Companies.

The recent incorporation in Maine of the Railroads and Power Development Company is the latest move in the organization by the United Railways Investment Company of a succession of companies to take care of the increasing public-utility requirements of San Francisco. This new company is to be the holding company for the Stanislaus Power Development Company and the San Francisco Electric Railways (which is to acquire and operate street railroads in San Francisco) and will also hold $10,000,000 of the $18,800,000 common stock of the United Railroads of San Francisco, which will be sold to it by the Investment company.

There will be no public offering of the new company's stock, which is all to be owned by the Investment company. If any public offering of securities of the subsidiary companies of the Investment company is made, they will be issued by the Stanislaus Power Development Company. The latter is to acquire the properties of the Stanislaus Electric Power and the Tuolumne Water Power companies under a plan of reorganization which provides for the issuance of a first mortgage on the property to furnish funds for the acquisition and completion of the plant and transmission lines and payment of existing obligations, and also an issue of $6,000,000 second mortgage five per cent bonds to be exchanged for the $6,000,000 first mortgage bonds of the Stanislaus Electric Power Company. In 1910 the Stanislaus Power Development Company will, it is believed, be in a position to deliver power to the United Railroads, and it is expected that when the property has been fully developed there will be a large amount of surplus power to sell.

The following table gives the combined statement of the earnings of the Investment company's properties for the six months ended June 30:

SIX MONTHS GROSS.

	1909.	1908.	Changes.
Philadelphia Co...	$ 8,952,383	$ 8,620,949	*$331,434
United Rys. of S. F.	3,568,904	3,341,452	*227,452
Total	$12,521,287	$11,962,401	*$558,886

OPERATING EXPENSES.

Philadelphia Co...	$ 4,751,634	$ 5,064,544	†$312,910
United Rys. of S. F.	2,085,332	2,209,116	†123,784
Total	$ 6,836,966	$ 7,273,660	†$436,694

NET.

Philadelphia Co...	$ 4,200,749	$ 3,558,405	*$642,344
United Rys. of S. F.	1,483,571	1,132,336	*351,235
Total	$ 5,684,320	$ 4,690,741	*$993,579

* Increase. † Decrease.

The Investment company itself, the income of which is dependent upon dividends paid on the stock of the two abovementioned properties, should show a surplus available for dividends for the year 1909 of approximately $550,000. Before any dividends can be paid on the company's preferred stock, however, nearly a million and a half outstanding interest-bearing scrip, which was issued in lieu of cash dividends in April and July, 1906, and January, 1907, must be paid off.

Long Island Electric.

A hearing was held last week before New York Public Service Commissioner Bassett on the application of the Long Island Electric Railway Company for a reduction of its capital stock from $2,100,000 to $600,000. The Long Island company owns and operates a line of seventeen miles long, extending from the Borough of Brooklyn to Jamaica and Far Rockaway, with a branch running to Belmont Park.

The company was originally organized with an authorized capital of $600,000 and was afterward consolidated with the New York & North Shore Railway Company. This company had an authorized capital of $1,000,000, and previous to the consolidation agreement mortgaged its property and issued bonds to the par value of $1,261,000.

A $10,000 Prize for Inventors.

The Turin Chamber of Commerce will award a prize of 50,000 francs to the owner of an invention or discovery (not discovered or published before 1908) that will prove in practice advantageous to the national economy, this in connection with the Turin Exposition of 1911. Applications must be made in French or Italian, and submitted on or before March 31, 1911, to the Commissione per il concorso a premis, Camera di Commercio, Torino, Italy, from whom particulars may also be obtained.

To Hire Out Electric Cookers.

The city of Aberdeen, Scotland, has decided to purchase a stock of electric heating and cooking apparatus, to hire out the same at a low figure.

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DETAILS OF WATT-HOUR METER MANUFACTURE.—III.

BY JOSEPH B. BAKER.

REGISTERS.

General Construction.—The register is an important element of the electric meter, not only because it is the device by which the commercial operation of the meter is observed, but because careful construction is necessary to avoid undue friction, which would vitiate the most careful design and construction in other parts of the meter.

The gears and pinions of the train are manufactured on automatic machines and subjected to careful examination for imperfect teeth, and the assembled register is inspected for bad alinement, loose or bent dial hands, etc., which might cause excessive friction at some positions of the wheels.

In order to simplify the manufacture, by having a minimum number of different designs, many of the meter-manufacturing companies provide a small "intermediate" train, interposed between the meter shaft and the register. This enables a single pattern of register to serve for meters of several different capacities by changing the ratio of the intermediate train. Fig. 16 shows a direct-reading five-dial register for a T R W meter.

The register of the principal makes of motor meters consists of the frame, gear wheels and pinions, worm and worm wheel, staffs (wheel shafts), and dials and pointers. The register of the Westinghouse type C house-service meter, a rear view of which is shown in Fig. 17, is of the direct-reading type, no multiplying constants being employed. It has a large "counting train" (carrying the dials on its front, and hereafter termed the "dial train"), and an "intermediate train," which serves to transmit the motion of the rotating system to the dial train. The dial train is uniform for all meters of this line, and contains four gears and pinions having a gear ratio of ten to one, different values being assigned to the dials, according to the capacity of the meter. The intermediate train contains always the same number of gears and pinions—though of different ratios—between the "first drive" (pinion at top of meter shaft) and worm.

In the Westinghouse meter register the worm and worm wheel, constituting one drive of the register train, and the one having the highest ratio of reduction, is made the link between the intermediate train and the dial train, instead of being made the first drive from the meter shaft, as in other makes of meter—the T R W, Duncan, etc. The first drive in this meter is from a steel pinion on the meter shaft to a gear wheel in the intermediate train.

The advantages claimed for this design over the more usual one are that the transmission from worm to worm wheel absorbs less power when placed back in the intermediate train, on account of the comparatively low velocity of the worm at the stated distance from the first drive from the meter shaft; and that in a pinion and gear-wheel drive from the meter shaft there is much less practical liability of incipient binding, inaccurate meshing, and other causes of undue friction, due either to inaccurate construction or to dirt or defects of alinement coming in during the service life of the meter. Thus, an error in the height of the shaft in the meter, or in height of the disk on the shaft, would not affect the meshing of a pinion and gear-wheel drive, whereas it would affect the meshing of a worm and worm-wheel drive.

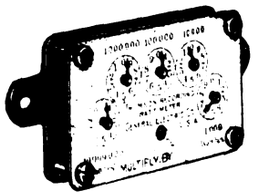

FIG. 16.—FIVE-DIAL REGISTER FOR T R W METER.

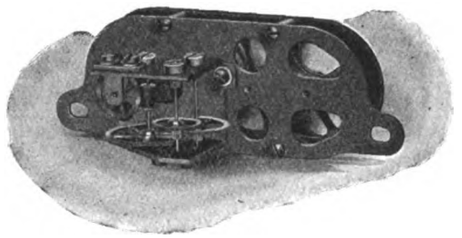

FIG. 17.—TYPE C METER REGISTERING MECHANISM.

The accurate adjustment of the meshing of the pinion and gear wheel at the first drive is facilitated by designing the intermediate train to give a lateral offset between the staff of the first gear wheel and the meter shaft. That is, the staff is located to the left of and behind the meter shaft (looking from the back of the meter), so that for a given distance to right or left through which the register is shifted in assembling the latter on the meter shield, the gear wheel is shifted only a comparatively short distance obliquely.

Frames.—The register frame of the above meter is made in two parts, the frame of the dial train and the frame of the intermediate train. These are machined and assembled separately, each with its set of gears, and then connected together on the meter, so that the last drive of the intermediate train (a pinion) meshes with the first drive of the dial train (a gear wheel).

The frame of the dial train consists of a pair of brass plates, joined by four brass pillars. The plates, which are of one-sixteenth-inch brass, are blanked out to shape on a gang die. The next operation is to straighten the blanks, which come from the gang die more or less buckled. They are then drilled on jigs; the holes for the pillar supports which join the two plates of the frame, and for holding the intermediate train on the back of the dial train and the dial plate on the front of the same, being drilled full size at one operation; and the four holes in each blank for the four "staffs" (wheel shafts) being drilled under size. The blanks are next sent to the dip shop, where they are pickled in potash and acid baths, washed, and dried in sawdust. They are then treated to prevent corrosion, and the bearing holes reamed and burnished to exact size, employing a taper burnisher with a shoulder, which polishes not only the bearing surface in the thickness of the plate, but also a zone on the inner surface of the latter, adjacent to the hole, thereby preventing corrosion in or near the bearing. This feature, moreover, gives a free-running and a long-running register movement.

The above construction enables the two plates ultimately to be assembled on their pillars accurately parallel to each other, forming a rigid frame, with the bearing holes for the staff in true alinement.

The frame of the intermediate train is a U-shaped piece of one-sixteenth-inch brass, which goes through the following processes:

The frame is blanked out in the flat by a gang die, then bent up to shape, and drilled, tapped and countersunk in jigs, with special precautions to secure alinement. The train is designed differently from the dial train. The bottom ends of the three staffs each pass through a loose hole in the frame and bear on a hardened, polished steel plate, termed the "jewel," screwed on to the underside of

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the frame; and the top ends bearing in the tips of bearing screws, which are tapped into the upper side of the frame. This construction gives a low-friction train, rendered advisable by the fact that the train includes a worm and worm wheel, and is immediately driven by the rotating element of the meter, or, in other words, by the high velocity of its members compared to the velocity of the members of the dial train. Although the members of the step bearing thus formed are of the same metal (steel and steel), the extreme lightness of the moving part and its low absolute velocity makes this form of bearing effective. The deposit of verdigris is prevented by the burnishing that the sleeve bearings and bearing screws receive in the process of reaming to size.

Gear Wheels and Pinions.—In making the gears, circular blanks of 0.025-inch

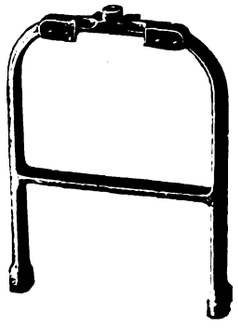

FIG. 18.—FRAME OF INTERMEDIATE TRAIN.

"watch-wheel brass" are mounted, eighty or more at a time, on a mandrel, which is placed in an automatic gear-cutting machine having a cutter revolving at about 3,000 revolutions per minute. The first and last wheels of each lot are thrown away, on account of the burs which are formed on them by the cutter The diameter of the blanks is greater than that of the finished wheel, so that there is no chance of producing imperfect teeth, *i. e.*, every portion of every tooth has a cut surface.

The gear unit—gear wheel, pinion and staff—of the dial train is assembled by the following four successive operations, formed on a monitor machine. With the wheel held in a revolving chuck, the center of the wheel is first countersunk to guide the drill, next the hole for the staff is drilled, and then reamed; lastly, with the chuck stationary, the staff fitted with its pinion is driven home. The position of the pinion close against the wheel gives a long friction surface for the staff, and the bind of the wheel on the staff is assisted by upsetting the surface of the former, adjacent to the hole. The front end of the staff consists of a straight portion constituting the front journal and a taper portion over which the hand or pointer is forced.

In the fourth gear unit of the dial train, and in the units of the intermediate train, the wheels are fitted with bosses forced into the center of the wheel and upset on the farther side; this construction is required by the fact that the wheel has no pinion adjacent to it, as in the gear units of the dial train. The assembling of the gear unit is affected by a monitor machine similar to the one used for the wheels of the dial train, performing the following operations in order: With the wheel held in a revolving chuck the center of the wheel is first countersunk to guide the drill; next the hole for the staff is drilled, and then

FIG. 19.—METER BASE.

reamed; lastly, with the chuck stationary, the staff is driven home, the pinion being forced on afterward.

In order to prevent corrosion of the register, all wheels and pinions are gold plated, a thin deposit of gold sufficing to prevent the formation of verdigris which might otherwise be caused by exposure of the meter to a corrosive atmosphere at its place of installation. The frames of the dial train and intermediate train do not need to be gold-plated, inasmuch as the bearing surfaces of the staff are burnished, as described above.

The pinions used in this meter register comprise brass pinions used in the dial and intermediate trains, and the steel pinion fixed to the top of the meter shaft and engaging with the first gear of the intermediate train to constitute the "first drive" of the register.

The brass pinions are cut from a fluted rod of pinion cross-section and finished individually. The steel pinions, which have a shoulder, are made from Stubbs' steel rod in a single automatic machine which does all but the finishing.

A point in connection with the assembling of the register on the meter shield should be mentioned here. In order to prevent risk of imperfect meshing of the shaft pinion with the first drive of the intermediate train at any time—as, for example, after swinging the latter away to turn back the register dials to zero position after final factory test—dowel pins are provided alongside the screws that hold the register on the shield. These dowels have to be put in after the meter

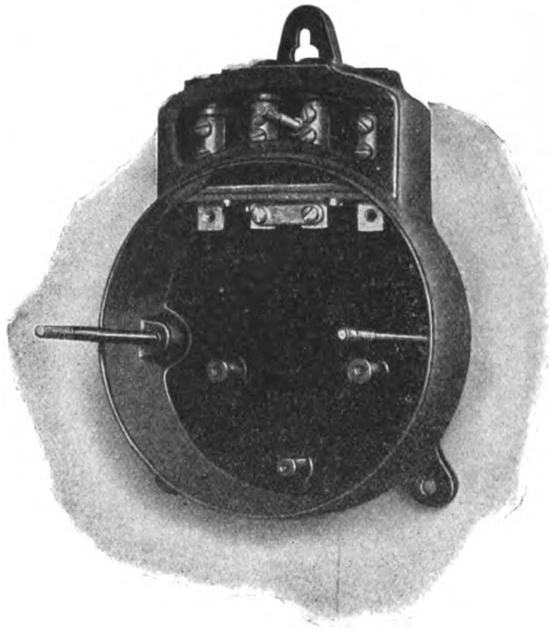

FIG. 20.—TYPE C ROUND PATTERN METER CASE.

is assembled, *i. e.*, after the first drive is meshed. Therefore, in drilling the holes for these dowel pins, an air suction is provided with an opening at the drill point, to carry away all metal borings that might otherwise get into the meter and cause trouble later.

Worms and Worm Wheels.—Worms are of brass, having single or double threads, and are made by an exact "chasing" method, similar to that employed on the Pratt & Whitney monitor lathe. In this method the cutting tool is held in a carriage which is moved along by a thread. The method is therefore superior to the ordinary method of cutting the worm with a die, which exerts torsion on the rod, and destroys the mathematical accuracy of the worm. Pains are expended in making the tool in such form that it may be sharpened, by grinding, without altering the shape or spacing of the cutting teeth.

Worm wheels are of brass, of thinner stock than the gear wheels described above. In cutting their teeth a mandrel filled with blanks is fed past a revolving

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cutter, with a twisting motion given by a cam, which develops the desired pitch of the tooth to conform to the pitch of the worm. This method is superior to the usual method of cutting worm wheels, which is termed "hobbing with a tap;" and which consists in making an ordinary gear wheel and then finishing its teeth to pitch by a cutting steel worm.

Staffs.—In the design of the bearing surfaces of the staff, considerable end play is allowed. The staffs are made on an automatic machine, taking Stubbs' steel wire of a diameter equal to the largest diameter of the finished staff. The machine turns down the journal surfaces, and shoulders and cuts off the staff. The staffs made by this machine are more uniform as to length and diameter of bearing surfaces than hand-made staffs.

After hardening the staffs—which is done by quenching in oil to insure uniformity in temper—and burnishing their journal surfaces, they are ready for forcing into the wheels and pinions, or worm, as described above. The last operation on the staff and gear unit before assembling into the register train is to true up the staff by holding one end in a rapidly revolving lathe clutch, bearing on the other (or free) end with a tool so as to bend the shaft uniformly in every direction, and thereby force it to find its true central position.

Dial and Hands.—The dial is of porcelain on a copper plate, which is secured to the front plate of the dial train, preferably by two screws. This method of fastening the dial is superior to soldering, which has sometimes been employed, and which is liable to cause the dial plate to work loose, owing to corrosion of the solder in an acid or alkaline atmosphere. The dial circles, figures, etc., are fired on the porcelain.

The hands are stamped from sheet metal, finished dead black, and perforated at one end for a tight driving fit, which holds them firmly on the end of the dial train staff.

SHIELDS.

The shield of the meter is the main frame or base upon which the various parts of the meter are assembled. The use of the term "shield" is due to its incidental function, in many makes of meter, as a magnetic shield interposed between the field winding of the meter and the damping magnets, to prevent the latter from becoming demagnetized or reversed by powerful stray fields due to short-circuits or overloads through the meter. The shield is made of cast-iron for this purpose and provided with a partition between the meter magnets on one side and the field winding on the other. The term "shield" persists as a designation of this part, though the part is not now necessarily made of cast-iron.

The meter shield has undergone considerable improvement in recent years, in the direction of making all the parts of the meter mounted upon it accessible for inspection and adjustment. It may consist of a single light but rigid casting, designed to require a minimum amount of machine work upon it and to facilitate the assembling of the meter parts upon it with minimum labor cost. A two-piece frame made by the General Electric Company is shown in Figs. 18 and 19 on the preceding page.

Some manufacturers make their meter shields of an aluminum alloy high in aluminum, which gives a shield which is not only light, but free from danger of rust or corrosion. Certain other makers use cast-iron, as in the shield described below, and protect the iron after it has been machined by a non-rusting coating.

The shield of the Westinghouse type C induction meter is of gray iron, machine-molded, and nickel-plated after the first machining to protect from rust. The shield is machined on gang tools, with special precautions to make all surfaces and holes true with reference to the axis of the meter bearings. The two holes for these bearings—top bearing and jewel bearing—are reamed and then tapped by the use of guide reamers and taps. By reaming the top-bearing hole by a reamer having a spindle extension guided by the jewel-bearing hole, and then vice versa, the two holes are accurately alined with each other. The two holes are then tapped in the same manner.

All other holes in the shield are tapped before nickeling, and retapped afterward. This is done to clean out the iron dust which remains in the hole, owing to the use of oil required in the first tapping, and which would cause trouble sooner or later in the operation of the meter, by getting in between the jaws of the damping magnets.

The shield of the type C house-service meter, with parts assembled upon it, is held in the case by three screws, tapped with machined parts cast on the inside back of the case, as shown in Fig. 20, which is a view of a round-pattern meter case. The same screws pass through and secure the shunt-field core. The two top ones serve also to clamp the light-load adjustment loops after they have been set in calibrating the meter, as described elsewhere. The induction-meter shield described above is in marked contrast to the more open design of frames and bases for commutator meters, shown in Figs. 18 and 19.

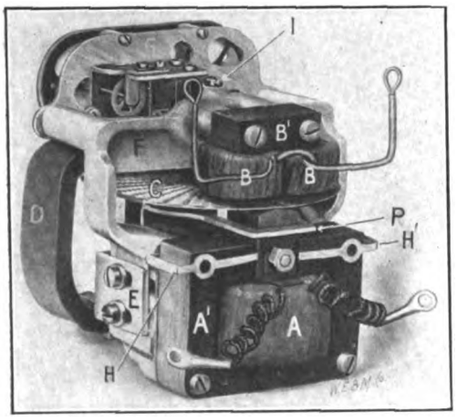

FIG. 21.—MECHANISM OF TYPE C HOUSE-SERVICE METER.

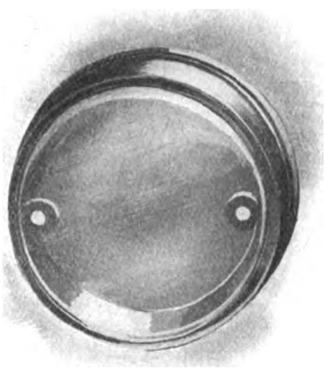

FIG. 22.—GLASS COVER FOR WESTINGHOUSE METER.

FIG. 23.—ALUMINUM COVER FOR WESTINGHOUSE ROUND PATTERN METER.

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CASES AND COVERS.

The meter case, Fig. 20, may be of gray cast-iron, machine molded, of same quality as the cast-iron shield. In the above meter, the case is a rather shallow one, from which the meter proper (see Fig. 21) projects. It is accessible for repairs and adjustment, when the cover, which is relatively deep, is removed. It carries the lugs or hangers by means of which the meter is mounted at its place of installation; it forms the support for the shield, which is screwed to it; and it forms a support for the cover, which is held against it by threaded posts and wing nuts, with a gasket fitted between the shield and edge of cover.

The case is surfaced and profiled, drilled and tapped on gang machines to fit it for the meter base, cover and terminals. In order to secure the two cover posts firmly in the case, the tapped holes in the latter are broached into taper, square shape at the back of the case, and the ends of the posts are spread to fill the holes, after the latter are screwed

FIG. 24.—STYLE B COVER FOR DUNCAN SWITCHBOARD METERS.

home, thereby preventing the posts from turning or working loose.

The finish of this meter case is japan, applied by spraying. This method is preferable to brushing, as it insures that every crevice and cranny of the iron is penetrated and evenly coated with japan. Two coats are applied, baked on separately, to thoroughly protect the iron from rust.

Meter covers (Figs. 22 to 25) are made in a variety of shapes to conform to the design of the meter. In modern meters all-glass, all-metal, and glass and metal covers are used—the vogue of the first-mentioned being at present on the increase. The fact that the meter is equipped with a glass cover tends to insure better handling, not only of the cover, but of the meter, since it causes the workman or meter inspector to become more careful, instinctively. Another advantage is that it makes the meter more difficult to "beat," inasmuch as holes cannot be made in it, as they can in a metal cover, through which wires, etc., may be introduced to tamper with the mechanism. The latter is in plain sight through the cover, so that any mechanical or electrical tampering with the mechanism cannot be concealed from the next employe of the central-station company who may visit the installation. The installation of a glass-covered meter does not, of course, prevent the slowing down or even reversing of the meter by a magnet concealed nearby. Occasionally the electrical journals contain accounts of successful or unsuccessful attempts to defraud central-station companies by tampering with installed meters.

The glass covers used by the best makes are of strong, heavy molded glass. In the round-pattern Westinghouse meter cover shown in Fig. 22, the only toolwork on the cover after the molding and annealing is the grinding of the pads for the cover-post, wing nuts and washers. The round shape and certain features of design of this cover make it particularly strong; it is, in fact, more sturdy than the round aluminum cover which is furnished with the same meters. The glass cover is fitted with a gasket of rubber tubing, glued into the flanged rim.

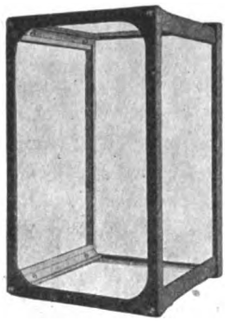

FIG. 25.—STYLE C COVER FOR DUNCAN SWITCHBOARD METERS.

The round aluminum Westinghouse meter cover, shown in the back view, Fig. 23, is pressed from pure sheet aluminum. The piece of glass for the windows through which the dials are read and the revolution of the disk observed has no frame, which facilitates its renewal if it is accidentally broken. The glass is held in place by three lugs, secured by brass nuts on the inside of the cover, and is sealed to the latter by putty, as shown, to make it insect, dust and moisture proof. The gasket is of felt, cemented to the flanged rim of the cover.

Metal and glass covers are employed mainly for switchboard meters, and usually consist of a metal skeleton frame of special finish to harmonize with the switchboard or its equipment, with plane glass let into it to make the meter visible from all sides. Typical covers of this type are shown, Figs. 24 and 25, respectively, the "Style B" and "Style C" covers of the Duncan Electric Manufacturing Company.

[*To be continued.*]

Long Island Railroad Company Wants $16,500,000.

The Public Service Commission, Second District, New York State, has received an application from the Long Island Railroad Company asking for an order authorizing it to issue debentures not to exceed in amount $16,500,000. It is stated in the petition that the Pennsylvania Railroad Company owns and holds 135,958 shares of the 240,000 shares of capital stock. The proceeds of the bonds are to be used to repay the Pennsylvania Railroad Company $6,032,951 loaned by that company and expended for various improvements during the years 1905 to 1908, inclusive.

The company states that it will require within the next three years additional capital for construction work and for equipment necessary to continue the improvements which have been commenced and on which large sums of money have been expended, to provide adequate and proper facilities and accommodations for continuing its business economically.

It is stated that the Pennsylvania company is willing to make further loans in addition to its existing indebtedness of $6,032,951 of $10,500,000, loans to be secured by the issue of ten-year four per cent debentures, and in such years that interest thereon cannot be paid by petitioner out of earnings authority is asked for permission to issue non-interest bearing debenture script convertible into debentures to be issued therefor, such debentures to be payable in cash or redeemed by the issue of some more permanent form of security when the financial condition of the company and its increased earnings justify an application for authority to issue such securities.

Montevideo's Trolley Systems.

There are two trolley systems in Montevideo, Uruguay, viz., Sociedad Commercial and Sociedad Transatlantica and one, via y Ferrocarri del Norte owned partly by the Uraguayan government and partly by private parties.

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Electrical Days at the Alaska-Yukon-Pacific Exposition.

As previously announced, the recently organized Northwest Electric Light and Power Association will hold a joint meeting with the Seattle Section of the American Institute of Electrical Engineers at the Alaska-Yukon-Pacific Exposition on September 7, 8 and 9. The exposition management has set apart these three dates as special electrical days in honor of the members and guests of both these organizations.

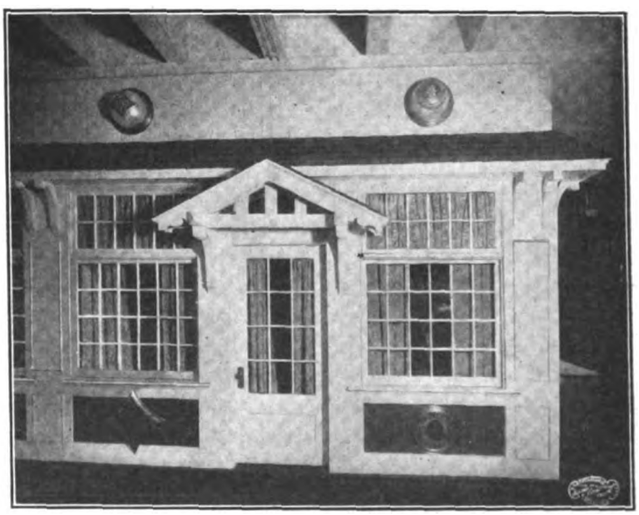
A special booth for the joint use of both societies has been completed at the exposition and is shown in the illustrations herewith. While it will be the particular center of interest on the three days in question, it has become regularly the headquarters of visiting electrical engineers in particular and of the engineering fraternity in general. The booth is in charge of an attractive young woman, who is ready to supply all necessary information concerning the exposition, the electrical features and the two societies. A supply of A. I. E. E. and other electrical literature is available. Visitors are expected to register with their business and residence addresses. The booth will remain open on week days throughout the exposition.

The regular meeting place of the Seattle Section of the American Institute of Electrical Engineers is on the eighth floor of the Central Building, in the business district of Seattle. The rooms are in the southwest corner of the building, directly under the observatory, and are very comfortably, though not luxuriously, arranged.

CENTRAL BUILDING, SEATTLE, WASH., HOME OF THE SEATTLE SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

INTERIOR VIEW IN THE CENTRAL BUILDING, HEADQUARTERS OF THE SEATTLE SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

INTERIOR OF THE ELECTRICAL BOOTH AT THE ALASKA-YUKON-PACIFIC EXPOSITION.



EXTERIOR OF THE ELECTRICAL BOOTH AT THE ALASKA-YUKON-PACIFIC EXPOSITION.

Went "Dry" and Goes Dark.

The town of Mattoon, Ill., has been obliged to close down the city lighting plant for want of enough funds to operate it. The city fathers at their last meeting heard representations as to the embarrassment of the city treasury, said to be due to the elimination of saloon-license contributions as a result of the town voting "dry" last fall. At that time nineteen saloons were voted out. City officials said public improvements would have to suspend and the publication of funds for the next school term will have to be considered. There was a brisk demand for lamps and tallow candles when the power house shut down last week.

Buys Chicago Property.

The property at the southwest corner of Fifth Avenue and Jackson Boulevard, Chicago, has been sold by William W. Cole, of New York city, to George A. McKinlock, president of the Central Electric Company, of Chicago, for $750,000.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

DENVER GAS AND ELECTRIC.

The Denver Gas and Electric Company reports earnings for the month of July, 1909, and twelve months ended July 31, 1909, which compare as follows:

	1909.	1908.
Net earnings	$ 75,422	$ 60,702
Interest, coupons, etc.	33,800	32,273
Surplus	$ 41,622	$ 28,429

Twelve months ended July 31:

	1909.	1908.
Gross earnings	$2,315,519	$2,086,106
Expenses	1,302,240	1,219,785
Net earnings	$1,013,279	$ 866,321
Interest, coupons, etc.	393,675	379,909
Surplus	$ 619,604	$ 486,412

AMERICAN LIGHT AND TRACTION.

The report of the American Light and Traction Company for the month of July and twelve months ended July 31, 1909, compares as follows:

	1909.	1908.
July gross	$ 234,101	$ 193,421
Expenses	9,403	4,000
July net	$ 224,698	$ 189,421
Twelve months gross	3,093,296	2,563,892
Expenses	80,190	37,563
Twelve months net	$3,013,106	$2,526,329

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways of St. Louis for the month of July and seven months ended July 31 compares as follows:

	1909.	1908.
July gross	$ 948,240	$ 898,210
Expenses	597,509	578,528
July net	$ 350,731	$ 319,682
Charges	232,449	232,852
July surplus	$ 118,282	$ 86,830
Seven months gross	6,339,815	6,061,765
Expenses	4,028,708	3,946,037
Seven months net	$2,311,107	$2,115,728
Charges	1,637,079	1,618,399
Seven months surplus	$ 674,028	$ 497,329

ILLINOIS TRACTION COMPANY.

The report of the Illinois Traction Company for the six months ended June 30 compares as follows:

	1909.	1908.
Six months gross	$2,054,217	$1,913,517
Expenses	1,218,121	1,138,593
Six months net	$ 836,096	$ 774,924

KEYSTONE TELEPHONE COMPANY.

The report of the Keystone Telephone Company, of Philadelphia, for the month of July, 1909, compares as follows:

	1909.	1908.
July gross	$91,020	$88,336
Expenses and taxes	45,533	45,098
July net	$45,487	$43 238
Bonded interest and reserve	34,135	34,531
July surplus	$11,352	$ 8,707

AMERICAN TELEGRAPH AND TELEPHONE.

The American Telephone and Telegraph Company reports earnings for the month of July and for seven months ended July 31, 1909, compared as follows:

Month July—	1909.	1908.
Dividends	$ 2,670,722	$ 2,619,578
Interest and other revenue from associated companies	980,345	774,706
*Telephone traffic (net)	337,423	260,527
Real estate	6,494	15,692
Other sources	106,816	117,394
Total earnings	$ 4,101,802	$ 3,787,900
Expenses	205,887	173,991
Net earnings	$ 3,895,914	$ 3,613,908
Deduct interest	526,015	614,493
Surplus	$ 3,369,899	$ 2,999,415

January 1 to July 31—

Dividends	$ 9,794,637	$ 9,062,922
Interest and other revenue from associated companies	6,134,869	5 726,495
*Telephone traffic (net)	2,426,553	2,076,39?
Real estate	55,986	71,428
Other sources	902,587	459,053
Total earnings	$19,314,634	$17,336,292
Expenses	1,432,840	1,247,761
Net earnings	$17,881,794	$16,148,530
Deduct interest	4,418,639	4,486,169
Surplus	$13,463,154	$11,662,361
Dividends	7,631,291	6,120,092
Net surplus	$ 5,831,862	$ 5,542,269

*In 1909, all maintenance and depreciation is charged against expenses monthly instead of being partly provided for by an extraordinary charge in December, as heretofore. In order that a true comparison may be made between 1908 and 1909, the 1908 figures as now presented include in expense for each month one-twelfth of the extraordinary provision for depreciation which was made in December, 1908.

AMERICAN CITIES RAILWAY AND LIGHT.

The American Cities Railway and Light Company reports the combined earnings of its operating companies for the month of July and for seven months ended July 30, 1909, compared as follows:

July—	1909.	1908.
Gross earnings	$ 483,072	$ 446,835
Operating expenses and taxes	279,548	272,109
Net earnings	$ 203,524	$ 174,726
Interest and sinking fund.	106,250	105,742
Surplus applicable to dividends and reserves	$ 97,274	$ 68,984
American Cities companies' proportion of surplus on basis of stock ownership	$ 86,114	$ 61,080
American Cities' preferred dividend	34,530	34,530
Balance applicable to stock and reserves	$ 51,584	$ 26,550
Equivalent on outstanding American Cities' stock to	5.75%	2.96%

January 1 to July 31—

Gross earnings	$ 3,258,818	$ 3,076,358
Operating expenses and taxes	1,888,309	1,856,856
Net earnings	$ 1,370,509	$ 1,219,502
Interest and sinking fund.	743,324	726,809
Surplus applicable to dividends and reserves	$ 627,185	$ 492,693
American Cities' companies' proportion of surplus on basis of stock ownership	$ 554,095	$ 439,596
American Cities preferred dividend	241,713	241,713
Balance applicable to common stock and reserves	$ 312,382	$ 188,883
Equivalent on outstanding American Cities common stock to	4.98%	3.0%

The American Cities Company has outstanding $6,906,177 six per cent cumulative preferred and $10,761,165 common stock. It has no funded or floating debt.

The last annual report shows that the controlled companies are practically without floating debt and indicates that the companies' financial plans are sufficiently broad to take care of additional construction for many years to come.

The policy of the American Cities Company has been to better and enlarge its properties. Since the control of these properties by the present interests, including the period prior to their being acquired by the American Cities Company, there has been expended in betterments, improvements and extensions approximately $13,000,000, of which about $10,000,000 has been expended in the last five to six years. Gross earnings have nearly doubled in the last five years.

Commonwealth Edison Stockholders to Vote on Increasing Capital Stock.

The stockholders of the Commonwealth Edison Company, of Chicago, will vote, on November 9, the date of stockholders' annual meeting, on the proposition of increasing the authorized capitalization of the corporation from $30,000,000 to $40,000,000. It is the present intention, if the proposition carries, to offer $3,000,000 of the new capital stock to the stockholders at par, up to ten per cent of their present holdings. The proceeds of the sale of the stock will be used to cover cost of improvements and extensions during the coming year.

Would Divide Power Company.

The Cliff Electrical Distributing Company was given a hearing last week by the New York Public Service Commission, Second District, on an application for an increase of its capital stock to $500,000 and to issue $1,500,000 mortgage bonds and for approval of the transfer to it of that part of the franchise and works of the Niagara Falls Hydraulic Power and Manufacturing Company relating to the generating and distribution of electric power, in which part of the petition the latter company joins.

The company was incorporated as a means to separate the electrical development and distributing properties of the Niagara Falls Hydraulic Power and Manufacturing Company from its other properties, the latter company, besides its hydraulic canal in Niagara Falls for furnishing water for power purposes, owning two flour mills and various pieces of real estate not connected with the electrical generating and distributing business.

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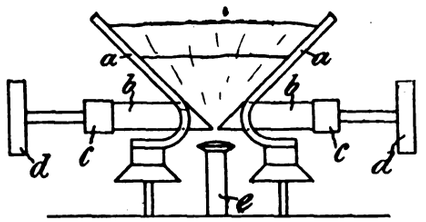
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

THE MANUFACTURE OF NITRIC ACID FROM THE AIR IN AUSTRIA BY THE PROCESS OF THE SALPETERSAEURE-INDUSTRIE-GESELLSCHAFT.

A method of obtaining nitric acid from the air has come into existence quietly in Austria, while the attention of the technical world was attracted by developments in this field in Norway. The inventors of this process are the brothers H. and G. Pauling, and it is being operated near Innsbruck by means of the waterpower of the Sill. The process is based on the utilization of flaming arcs, produced between electrodes having the form of the horn lightning arrester, as shown in the accompanying illustration. An arc started at the narrowest point of this lightning arrester travels upward, breaks at every half period of the alternating current and ignites again at the lowest or narrowest point. When an air current of high velocity is blown between the electrodes the arc is driven still further upward and may be made to reach a considerable length. The smallest distance between the electrodes must be sufficient to allow the passage of the enormous quantity of air to be burned, but as the starting of the arc between electrodes at such distance from each other would require an extremely high tension, a special igniting device is employed. The main electrodes *a* have slots at the point of smallest distance, through which so-called igniting blades, that can be approached to each other within a few millimetres, are introduced. These blades are very thin and do not disturb the movement of the air, so that it can enter the arc with full effect. The smallest distance between the main electrodes is about forty millimetres. Heated air is introduced through a nozzle, shaped so that the air spreads and flows along the electrodes. The length of the arc flame used in practice is about one metre. The water-cooled electrodes are of iron and last about 200 working hours. The igniting blades are consumed more quickly, and have to be adjusted to the necessary distance from time to time. The cooling of the gases is effected by so-called circulating air, that is, cooled reaction mixture, which enters from the sides into the upper part of the flame at a smaller velocity than that of the main air current and exerts a suction effect on the arc, thus increasing its length. Nitrous oxide concentration of about 1.5 per cent is obtained by this cooling method in operation on a large scale. The furnaces are of masonry, and the two arcs burning in each consume 400 kilowatts under a tension of about 4,000 volts. Six hundred cubic metres of air pass through the furnace in an hour, not including the circulating air. At the present time twenty-four such furnaces have been erected in the factory at Innsbruck. The gases leave the furnace at a temperature of 700 to 800 degrees centigrade, and are then worked up into nitric acid and nitrate of sodium. One of the difficult problems is the util-



APPARATUS FOR MANUFACTURING NITRIC ACID FROM THE AIR.

ization of the heat contained in the furnace gases. It is used for heating the air and for evaporating the acid. The condensation is effected in a system of pipes and towers, and an acid of about forty per cent is obtained, which is concentrated to commercial acid of sixty per cent by utilizing the heat of the furnace gases. A plant for the manufacture of nitrate of sodium is connected with the installation, in which the nitrous oxides remaining in the air after absorption with water are utilized without waste. The yield amounts to sixty grammes nitrous acid per kilowatt-hour. The twenty-four furnaces so far installed at Innsbruck have a total capacity of 15,000 horsepower. Two other factories of 10,000 horsepower each are being erected, one in southern France, and one in northern Italy.—*Translated and abstracted from Zeitschrift für Elektrochemie (Halle), August 1.*

AN ELECTRIC PLANT.

In the forests of India occurs a strange plant which is said to possess to a high degree astonishing magnetic power. The hand which breaks a leaf from it immediately receives a strong electric shock. At a distance of twenty feet a magnetic needle is affected by it, and it will be quite deranged if brought near. The energy of this singular influence varies with the hour of the day. It is most pronounced about two o'clock in the afternoon, but is ineffective during the night. At times of storm its intensity augments to striking proportions. While rain falls the plant seems to succumb, and it bends its head during a thunder shower; it remains there without force or virtue, even if one should shelter it with an umbrella. No shock is felt at that time in breaking the leaves, and the needle is unaffected beside it. It is stated that one never by any chance sees a bird or insect alight on the electric plant; an instinct seems to warn them that they would find sudden death. It is also important to remark that where it grows none of the magnetic metals are found, neither iron nor cobalt, nickel, an undeniable proof that the electric force belongs exclusively to the plant.—*Abstracted from The Engineer and Iron Trades Advertiser (Glasgow), July 20.*

AUTOMATIC TEMPERATURE REGULATION OF ELECTRIC FURNACES.

A novel and ingenious device for automatically regulating the temperature of an electric furnace was described recently by M. Kolswrat at a meeting of the French Physical Society. A pyrometer consisting of a platinum-platinum-rhodium thermo-couple is placed in the furnace, and is connected in the usual way to a galvanometer. On the pointer of the instrument is mounted a small mirror measuring four centimetres by five centimetres, and this mirror is so arranged that, when the temperature of the furnace increases and consequently the pointer moves over the scale of the galvanometer, at a predetermined point the rays of a Nernst lamp fall on the mirror and are reflected back on a sensitive thermopile, consisting of twenty copper-constantan junctions. The current generated in this latter thermopile is sufficient to actuate a system of relays, by means of which re-

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sistances are introduced into the main circuit of the furnace. As soon as the resistance is switched in, the temperature of the furnace falls, and the pointer of the galvanometer with the mirror moves back to the zero point. The rays of the Nernst lamp are then no longer reflected on to the thermopile, and, the current in the latter falling to zero, the resistances are shunted out of the main circuit, and the temperature of the furnace commences to rise until the mirror comes into action again. This arrangement forms a very sensitive governor; it is especially sensitive when the apparatus is arranged on the potentiometer principle; that is to say, the electromotive-force generated by the thermo-couple in the furnace is balanced by a counter electromotive-force (from a standard cell with resistance), so that the galvanometer stands at zero when the temperature of the furnace is of the desired degree. Obviously the apparatus is easily adjustable for different temperatures. In a furnace working at 1,000 degrees centigrade the apparatus only permitted a variation of from two per cent to three per cent on either side. For all practical purposes that variation is sufficiently accurate, but this sensibility could be improved upon by employing a type of furnace which would respond more readily to an alteration of the current density.—*Abstracted from The Electrical Magazine and Engineering Monthly (London), August 14.*

SCHOOLS OF ELECTRIC COOKING.

An undeveloped field for electrical enterprise lies in the provision of schools in which cooking by electricity may be taught. Few existing cookery schools employ anything but gas, and in order that electric cooking may become popular it is advisable to give capable instruction to potential users before they purchase any apparatus at all. Few ladies could turn out a satisfactory dinner by the aid of a gas cooker used for the first time, and they cannot be expected to become adepts with an electric oven without some previous experience. Much of the difficulty which contractors meet with in selling such appliances is due to the disinclination of the average housewife to try something of which she has no knowledge. It is useless to describe the merits of an oven in the showroom, and it is nearly as useless, and it is expensive, to install one on trial. But invite a lady to attend a class or a course of private instruction, free of cost if necessary, without any suggestion as to buying, and she soon realizes for herself the possibilities of electric cooking and its superiority over any other system. Knowing how to use an electric oven, she would never afterward wish to employ anything else, and to sell apparatus to those who have had experience of its workings in practice is quite a simple matter. A novice may easily waste current and yet fail to get satisfactory results, but with the very same apparatus an experienced cook would be able to produce a well-cooked meal with perhaps fifty per cent less current consumption and in shorter time. If some enterprising contractor were to start a school, under the care of a capable cook, he would find that the demand for ovens, grills, and other domestic appliances would come of itself. In any such undertaking, he could rely upon the active support of manufacturers, and apart from the benefit which a cooking load would prove to central stations, there should be money in the scheme for the contractor.—*Abstracted from The Electrical Times (London), August 12.*

ELECTRIC DRIVE ON SHIPS.

Admitting that the steam turbine has made the four-crank triple-expansion engine practically obsolete, few will concede this to be the final solution of the problem of propelling ships. Suggestions for utilizing the reaction of explosive gas discharges may be dismissed without further consideration as being out of the question, if only for mechanical reasons. The amenability of electric drive would seem to recommend electricity as a means for propelling ships, although of course there are some very real difficulties to be overcome before its practicability can be assured. Some of these difficulties will require careful consideration, but they can all be overcome if boldly faced. A Liverpool critic points out that a serious obstacle arises from the liability of electrical insulation to break down under the influence of dampness. No doubt a breakdown such as is here suggested would be more than serious; would, indeed, under many conditions, quickly become disastrous. But hard as are the problems of effective insulation, they are by no means insuperable. We may take the comparatively and extremely humble example of trading laundries, where electricity is used not only for lighting, but as motive power, and as a means of heating irons and other appliances. In these cases constant annoyance was caused owing to the steam-laden atmosphere attacking the insulation. A little ingenuity has overcome the trouble. In marine engineering the problem is more intricate, though it is only a question of degree. Undoubtedly the designing of a suitable main motor is a formidable task. However, the prize is so enormous that it should prove a sufficient incentive to set our keenest wits to work on the problem, the chief features of which are: Constant running without liability to overheating; reversibility by controllers of large size; large initial torque, and yet capable of being run dead slow and at varying speeds for long periods without the windings and resistances becoming too hot; means to overcome difficulties arising from fluctuations of voltage, due to starting the main motors from a generator, and the variations of amperage due to drop of voltage at starting, and in maneuvering a ship on leaving or entering a port. Other points there are which assuredly cannot be settled in a day or in the course of a paper or two. As for the alarm as to a possible shortage of sea-going expert electricians, that may be set aside, for the demand will soon create the supply, as it has done in providing us with the competent steam-using engineers of today. For some time to come we must devote our attention to promote discussion, to experimentation, and to enlisting the interest and good-will of shipowners.—*Abstracted from The Electrical Engineer (London), August 13.*

The Interstate Commerce Commission.

While the Interstate Commerce Commission does not make any formal report covering the work of the commission for the fiscal year, yet it has just been announced that more work was completed by the commission during the past fiscal year, ended June 30, 1909, than during any previous year of its history.

On September 1, there were on the docket of the commission 416 cases, and from that time until June 30, 1909, there were 968 additional complaints filed, making a total of 1,384 live cases on the calendar during the fiscal year. It is also stated that during the year 629 cases were disposed of. Complainants' pleas for relief were granted in 252 cases and dismissed in 206 instances.

On June 30, 1909, there still remained on the docket 755 cases, many of which will be assigned during the next week or ten days for hearing, and it is said that as about 300 of the above cases involve the same principles they will be combined into four cases. A. F. T.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

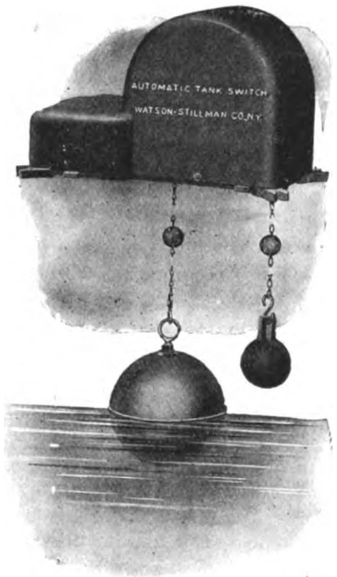
The New Watson-Stillman Automatic Tank Switch.

The automatic tank switch, illustrated herewith, is offered as a decided improvement over other switches for automatically maintaining the water level between desired limits in open tank or sump systems. The construction is novel, permitting the switch to be placed on top of the tank or sump cover, and permitting any desired variation in water levels to be carried without relocating the electrical apparatus. When the switch is placed on top of the tank, as in this instance, there is no necessity for boring a hole into the side of the tank and there is no danger of the switch flooding and becoming short-circuited.

The operation of the Watson-Stillman switch in starting and stopping the motor is dependent upon the movement of a falling hammer, the movement of which in turn is governed by a freely suspended copper float nearly counterbalanced by a cast-iron ball. Referring to the illustration, the two small wooden balls on the chain are adjustable and their position determines the variation of water level between operations of the pump. The switch is shown as when the pump is in operation. As the float rises, the ball comes into contact with the projection on the hammer and carries the hammer past the center. The hammer then falls to the other side of the pulley shaft by gravity, and in doing this a lug strikes a projection on the switch and disengages the knife, thus stopping the motor and pump The switch movement is quick. There is no chance for arcing, and as the hammer remains in contact with the switch arm, there can be no rebound. The hammer holds the switch arm in this position until falling of the water level brings the other wooden ball into contact with the hammer lug, which reverses the hammer, throws the knife into contact and starts the pump again. The wheel acts merely as a carrier for the copper chain. It plays no other part in the operation of the switch.

As arranged for draining sumps, the copper float and iron ball are reversed. This reverses the switch action to start the pump when the water level gets too high. Dampness will not affect the working qualities of the switch when it is placed in the pit.

The knife arm is thoroughly insulated from every other part of the switch, and the two contact points are mounted upon a slate block. A suitable opening is provided in the body for inserting the tube and making the connection to the binding posts. No parts of the switch need oiling or other attention. The shaft is of bronze, to prevent corrosion, and all parts are extra strong. All working parts are enclosed in a heavy cast-iron



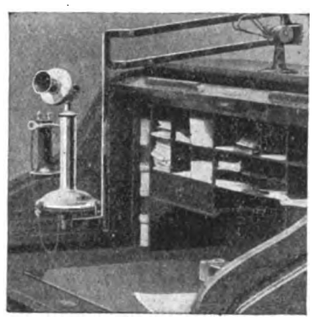
EXTERIOR VIEW OF THE WATSON-STILLMAN SWITCH AS ARRANGED FOR TANK WORK.

case, which protects them from the weather and from sudden injury.

This switch may be had single or double pole and for all ordinary currents and voltages. It is made by the Watson-Stillman Company, 50 Church Street, New York, N. Y.

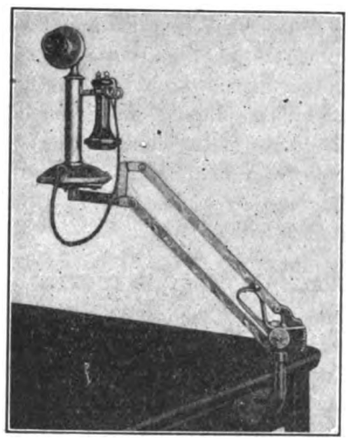
A Convenient and Practical Telephone Bracket.

The accompanying illustrations show the adaptability of the "Phone-Eze" telephone bracket which has been designed to eliminate a number of the troubles which obtain with the telephone instrument on a busy man's desk. This device can be attached to either a flat-top or a roll-top desk, and it takes the telephone off of the desk away from papers, inkwells, etc., and saves a considerable amount of lifting and moving around.



BRACKET ADJUSTED TO A ROLL-TOP DESK.

The cords are kept entirely out of the way, preventing entanglement with anything upon the desk. The apparatus is



BRACKET ADJUSTED TO A FLAT-TOP DESK.

durably made, all of the parts are interchangeable and adjustable, and it is being received with considerable favor as a very useful adjunct to the business office.

J. C. Freeman, 514 Monadnock Block, Chicago, Ill., is the western manager of sales for this device.

A Motor-Driven Centrifuge.

Mixtures of liquids of different specific gravities, or liquids containing sediments, may be separated in the course of time by the simple process of settling under the force of gravitation. But if the liquid is viscous, the difference in weight comparatively slight, or, as most frequently arises, the separation must be

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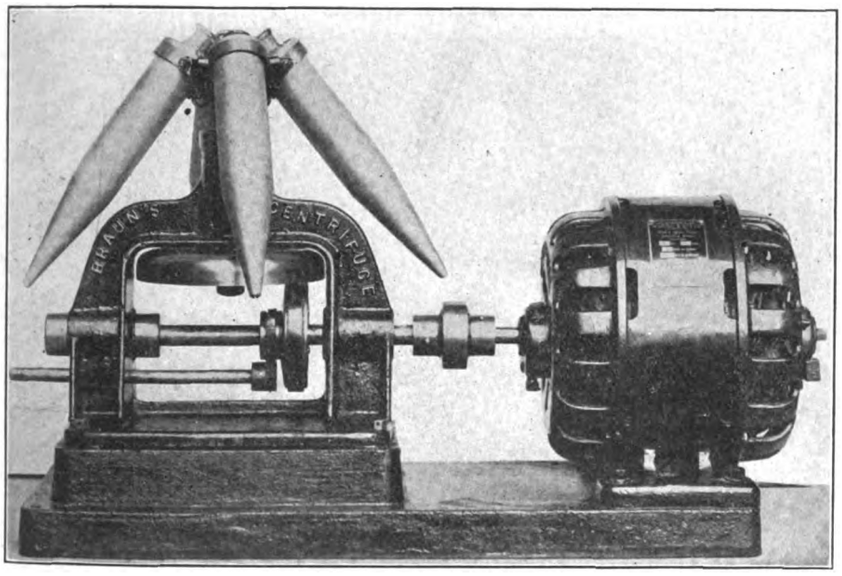
carried out quickly, in order to make an analysis without delay, some greater force than that of gravitation must be called into play. This is most conveniently supplied by rapidly rotating the materials at a high speed, setting up a tremendous centrifugal force, many times that of gravity.

In the motor-driven "centrifuge" used for this kind of separation, and which, as shown in the accompanying illustration, consists of pivoted receptacles mounted to rotate about a vertical axis, the speed reaches more than 1,500 revolutions per minute. Under these conditions the pound mass of the centrifuge tube exerts a centrifugal pull of about 320 pounds, so that a sort of artificial gravitation is produced, 320 times as strong, and consequently 320 times as effective in separating mixtures, as the force of gravity. Since, when in use, the containers swing out horizontally, the centrifugal force on the material in their extreme tips is about twice that at the center of gravity of the containers. Accordingly, separations can be made with this apparatus in a very short time, while the adjustable-speed friction drive enables the tubes to be started gradually, and brought up to any desired speed.



A MOTOR-DRIVEN CENTRIFUGE.

The little motor shown, a quarter-horsepower, type A Westinghouse, is direct-connected to the friction-wheel shaft, which communicates its motion to the face-wheel, giving a range of 1,000 to 2,000 revolutions per minute. The glass container tubes are surrounded by water and enclosed in an aluminum case, furnishing a cushioning surface, which prevents breakage. The tubes contain 100 cubic centimetres, and are calibrated to tenths of a cubic centimetre, so that the results are easily and quickly read off. The motor-driven centrifuge is of recurring use in the laboratory, and is almost an absolute necessity in the separation of heavy, thick, viscous liquids, such as crude oils, etc. The Braun centrifuge is manufactured by F. W. Braun, Los Angeles, Cal.

"Electrocuted" Air for the Chicago Public Library.

Ever since the Chicago Public Library, at the corner of Michigan Avenue and Washington Street, Chicago, has been built, complaints have been constantly made about the musty flavor of the air in some of the rooms of this great institution. Especially was this the case in regard to the reading room and patents department in the north end of the building.

It appears that the library is a favorite resort for many of the unfortunates who are out of employment, and who, being without the means to keep themselves in as sanitary a condition as is compatible with public decency, consciously or unconsciously emit an odor from their persons which, to say the least, is decidedly annoying to the better-class element which naturally desires to share the benefit of the library; and this, notwithstanding the excellent system of purified air-ventilation which is installed in the building.

So great had this nuisance become that Dr. W. A. Evans, the Health Commissioner of Chicago, decided that something must be done to mitigate this state of affairs. Accordingly, Arthur D. Lord, manager of the National Air Filter Company, of Chicago, was requested to consult with the engineers of the library with a view to installing an ozonizing apparatus, to be used in conjunction with the ventilating devices, which should renovate the air and charge it with sufficient ozone to kill all the objectionable odors in the rooms mentioned. As a result a special ozonizer was designed by Samuel C. Shaffner and S. T. Hutton, electrical engineers, which has proved even a greater success than was thought possible.

The apparatus is located in the basement of the building, and the principles of design are similar to those of the ozonizer described in our issue of June 26 last. Direct current at 110 volts is taken from the mains into a "Peerless" rotary converter regulated by a Cutler-Hammer starting box. This in conjunction with a pressure-regulating apparatus converts it into alternating current at 120 volts which is then stepped up to about 8,000 volts by a special transformer. The high-tension secondary current discharges with a violet-colored silent cold discharge between the plates of the ozonizer through which air is sucked into the air-duct uptake leading from the ventilating apparatus to the floors above. R. G. Allison, one of the library engineers, has facetiously put a placard opposite the ozonizer, which reads "Danger, 66,000,000 volts!" Mr. Allison explained that he would have added a few more zeros, only that he ran out of ciphers in his stencil box.

The air in passing between the plates is, to use Mr. Shaffner's humorous expression, completely "electrocuted;" that is to say, every living organism is annihilated and a large part of the air is converted into ozone, which mixes with the air in the uptake and dissipates any kind of odor with which it comes into contact.

The air drawn into the building by the electrically-driven suction pump is washed and dried before being ozonized. The washing is accomplished by driving it through sprays of pure water and drying is effected by forcing it through a series of baffle plates with upturned edges so as to throw off the moisture by a sort of centrifugal action.

Mr. Allison told our representative that at first he was afraid that the air should be washed after being ozonized on account of the nitrous fumes which are usually generated by electric ozonizing apparatus, but a series of tests convinced him that

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the Shaffner ozonizer generated practically no nitrogenous compounds, and that the present method of installation was the best that could be devised. He further told of a friend of his, a Grand Army man, troubled with blood spitting, who came frequently to the library on the advice of his physician to inhale the ozonized air, and who consequently was rapidly being cured of his complaint.

C. R. Barnes, superintendent of the patents department of the library, also gave evidence of the health-giving properties of the ozonized air. Mr. Barnes stated that since the installation of the ozonizer, his catarrh, which he had come to regard as chronic, had entirely disappeared.

A visit to the reading room proved the efficacy of the new apparatus, the room no longer smelling like a cheap lodging house, but approximating the breeziness of the hurricane deck of a liner in mid ocean. Mr. Allison stated that upward of 1,200,000 cubic feet of ozonized air were passed through the room and the whole of the air renewed upward of five times, every hour.

Thanks are due to R. G. Allison, J. Reitz, engineers, and C. R. Barnes, patents department, all of the Chicago Public Library, for their courtesy in giving the details of the new installation.

An Electric-Driven Well Driller.

In order to satisfy the demand for a portable blast-hole drilling machine operated by an electric motor instead of boiler and engine, the Keystone Driller Company, Beaver Falls, Pa., has designed the motor-driven drill shown in the accompanying illustrations.

The Keystone electric-driven machine, recently tried out at the James and A. C. O'Laughlin quarry, at Belwood, near Chicago, was equipped with a ten-horsepower motor placed over the rear truck of the machine and belted to the back-geared drilling mechanism.

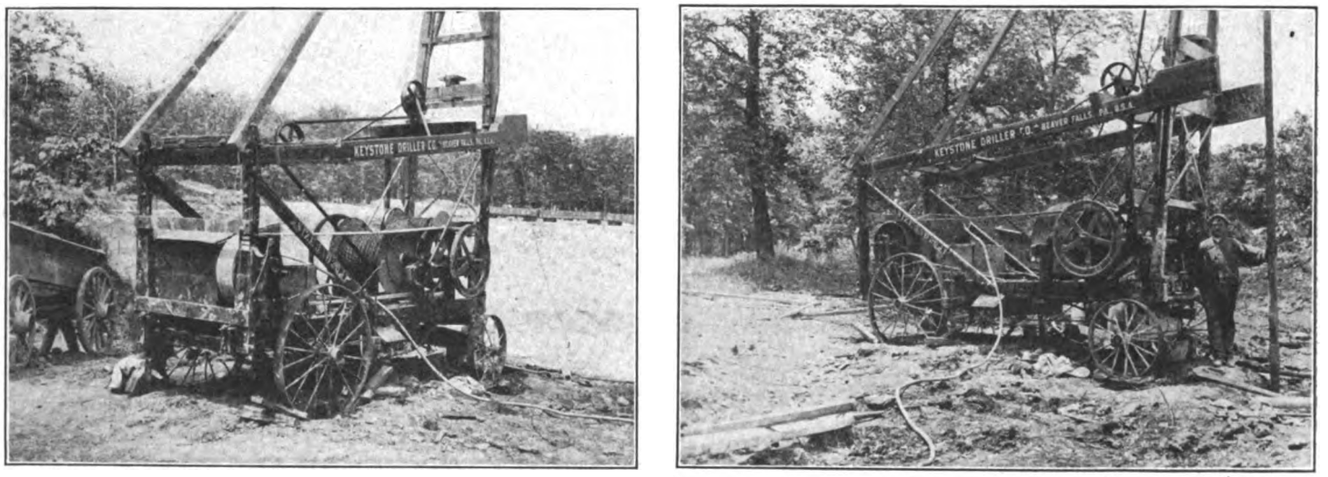
The controller box is placed at the drill operator's hand, in front, along with the other levers which regulate and control the various operations of drilling. The manipulation of the motor is very simple and the ordinary drill man will become thoroughly competent to handle it with a few minutes' instruction from the electrician. The laying of feed wires and other like adjustments will be looked after by the electrician in charge. One man can easily handle the machine without assistance, except when sand-pumping or moving the rig to a new hole. This is another saving in the cost of operating the steam machine, which requires the constant attention of a fireman, besides the driller.

The motor, drilling mechanism, derrick, etc., are all unified in a machine which is moved from hole to hole in its entirety. For short moves the derrick is not taken down.

At the full speed of the motor the drilling tools drop about sixty strokes per minute, which is ample in all cases to obtain the maximum drilling speed. As the hole becomes deeper or clogged with cuttings, before sand pumping, the rapidity of the stroke is gradually reduced to, say, fifty strokes per minute, in order that the cutting bit may deliver its blow with best effect. This can be done by reducing the speed of the motor.

The drilling tools used with this outfit comprise a stem, weighing about 1,000 pounds, drill bit of 150 pounds, and rope socket of about fifty pounds, or about 1,200 pounds in all. The bit cuts a five-and-five-eighths-inch hole and the stem is three-and-three-fourths inches in diameter and twenty-two feet long. The stroke being from thirty to thirty-six inches, a blow equivalent to about 3,000 to 3,500 foot-pounds can be obtained at each and every stroke.

The results of the test at the O'Laughlin quarry were as follows: The machine was set up at 5 p. m. Saturday, June 5 last, and began drilling. It was operated for one hour, during which nine feet were drilled in fairly hard limestone. From this time until the following Friday forenoon four sixty-six-foot holes, five-and-five-eighths inches in diameter, were drilled, the work being done without a hitch and without the necessity of any change whatever in the machine. In the following week four holes 105 feet in depth were drilled, the machine running ten hours a day in all cases. The record of a similar machine at Racine, Wis., in slightly harder rock was 900 feet in 200 hours, including all stops and delays in moving machine.



THE KEYSTONE ELECTRIC-DRIVEN WELL DRILLER.

This machine is built with gear hoist, capacity 500 feet, or with friction hoist, capacity 350 feet. The latter style is probably the better for quarry and cut drilling, where the tools are being constantly raised and lowered, as in tamping in a charge. The machine is also made with traction attachment (for self-propulsion) and, while it is impracticable to move it over great distances, on account of carrying along the electric feed wires, for short moves, from hole to hole, or from one side of the quarry to the other, it is a great advantage. The delay in waiting for a team of horses is saved, as well as the expense. For short moves the self-braced derrick is left standing.

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Lifting Magnets.

Although the first commercial lifting magnet was made more than a dozen years ago it is only within the past two or three years that they have come to be regarded as indispensable adjuncts to plants handling large quantities of pig iron, scrap or heavy castings.

The Cutler-Hammer Clutch Company, Milwaukee, Wis., has placed on the market a lifting magnet possessing several distinctive features which are essential to good lifting-magnet design, a sectional view of which is shown in Fig. 1. The coil is made up of alternate layers of strap copper and asbestos ribbon. This makes it possible to crowd more copper into a given space and the asbestos insulation renders the magnet fireproof, permitting it to be worked at high temperatures without detrimental effects. The under face of the body of the magnet is protected by removable pole shoes on which the brunt of the wear and tear of the metal handled falls, and which can be renewed at small cost when worn out.

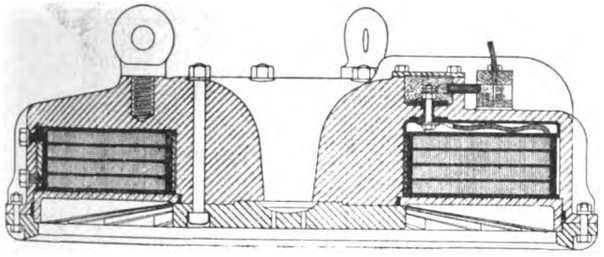


FIG. 1.—CROSS-SECTION OF LIFTING MAGNET SHOWING TERMINAL CONNECTIONS.

The coil-shield is constructed of manganese steel. This metal is quite suitable for the purpose, being able to withstand a great amount of hammering.

The single limitation to the lifting magnet's field of usefulness is that the objects to be handled shall possess magnetic properties. Wherever pig-iron, metal plates, tubes, rails, beams, scrap or heavy castings of iron or steel are handled, lifting magnets can be advantageously employed. The time saved due to the fact that hoisting tackle need not be adjusted to the object to be raised is worthy of consideration.

A Cutler-Hammer lifting magnet picking up axle butts from a scrap pile is shown in Fig. 2. Larger clusters than this are frequently picked up.

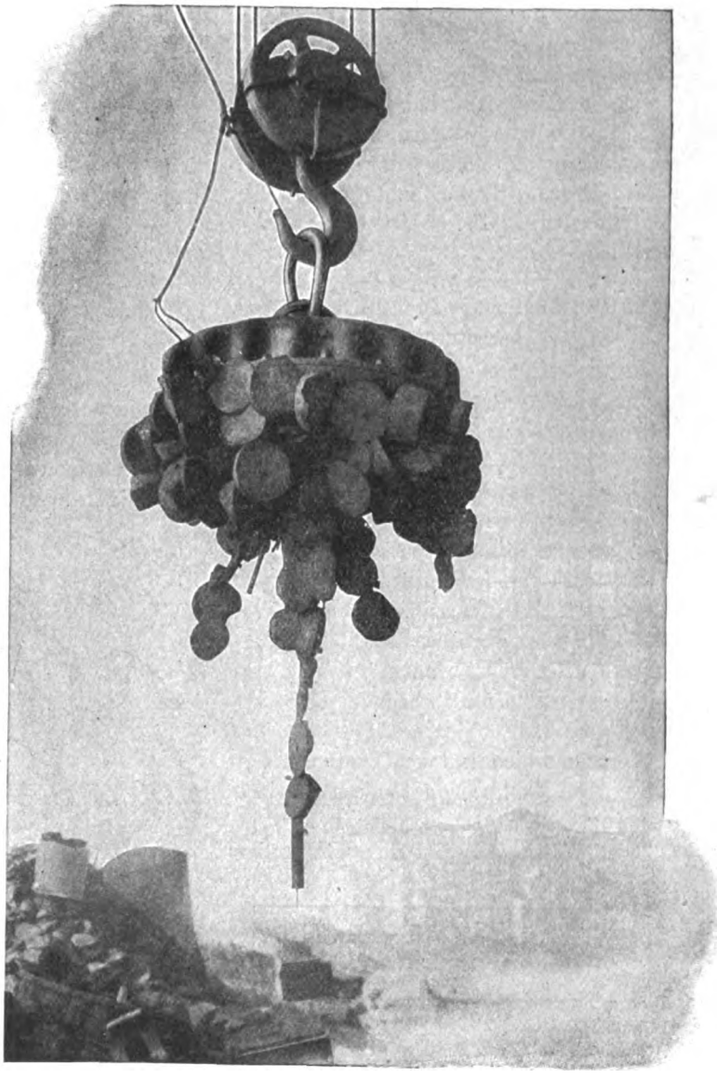
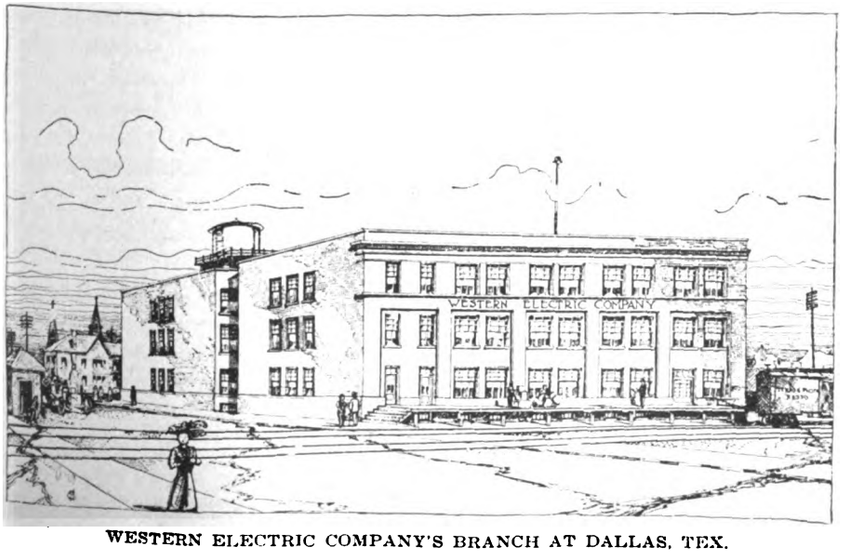


FIG. 2.—LIFTING MAGNET PICKING UP AXLE BUTTS.

The Dallas House of the Western Electric Company.

The Dallas branch of the Western Electric Company recently moved into its new quarters in its own building at Pacific and Evay streets. The new house is a three-story and full-basement model structure, equipped with a 25,000-gallon tank to supply the fire protection apparatus.



WESTERN ELECTRIC COMPANY'S BRANCH AT DALLAS, TEX.

The Western Electric Company has been in Dallas two years, but during this time business has increased to such an extent that the old quarters were found inadequate, and as a result this new structure, costing approximately $100,000, has been built. In this building, which acts as a storehouse and contains the offices of the company, is also included a large repair shop, to take care of the ordinary repairs of the apparatus handled by the company. This is one of the main features of the Dallas house, as they will give the same service as is given in the other large houses of the company.

Employment will be given to about 125 men, which is an increase of fifty per cent over those formerly employed by the company.

One of the main points in the building of the new warehouse has been the convenient location of the transportation

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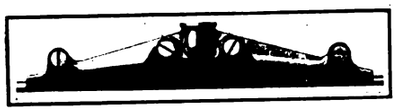
facilities. There is ample trackage lying along the building to take care of all southwestern shipments, and this will add greatly to the prompt handling of orders.

Heretofore the Western Electric Company occupied offices downtown and leased the Fulton Bag and Cotton Mill Building, near the Union Depot, as a warehouse.

The Westinghouse Type "R" Trolley Ear.

As the result of extensive practical experience in trolley-line construction the new Westinghouse type "R" trolley ear has been designed with a special view to giving long service and satisfactory performance. As shown by the accompanying sketches, this ear provides a straight and smooth run for the trolley wheel; at the same time the latter is prevented from wearing the wire on account of the great depth of the bronze runner. It is, therefore, impossible for the conductor to become loosened or leave the suspension. The curve which is taken by the trolley wire when clamped in the ear prevents slipping.

The Westinghouse type "R" trolley



WESTINGHOUSE TYPE "R" TROLLEY EAR.

ear is said to last from five to six times as long as any clinch ear, and its wearing part is renewable at small cost. The malleable iron yoke is attached permanently to the stud of the suspension, while the bronze runner is readily removable to be reversed or renewed. The ear may be quickly attached without soldering or

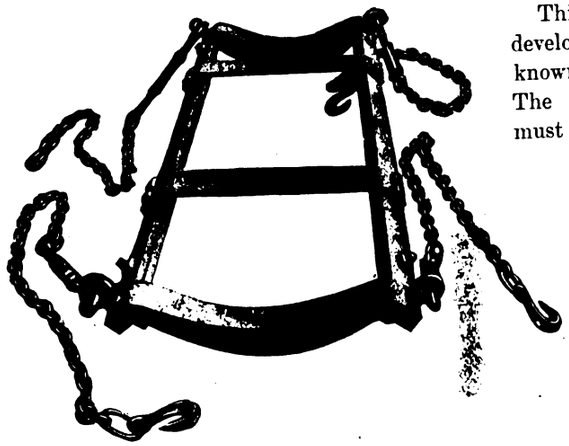
TYPE "R" TROLLEY EAR—OPENED.

hammering, and may also be used to feed into the trolley wire. The Westinghouse type "R" trolley ear is made in a number of sizes to take the standard sizes of round trolley conductor, and is equally suitable for installation on tangents and moderate curves.

The Bradshaw Car Skid.

The skid, illustrated herewith, is for the purpose of providing a quick and reliable means of avoiding delay in the schedule caused by a car with broken wheel, axle or crippled truck. A crippled car is raised from the track but three inches when the skid is in position. The skid is held to the truck by four chains, one at each corner. The chains are provided with turnbuckles. The skid is so made that the wheels may rest in the frame or it may bear directly on the motor or truck.

The construction is such as to allow easy and quick attachment to any car under all conditions. The position of the broken parts makes no difference to the attachment of the skid. The shoes are made of a metal composition which is nearly frictionless and will not wear the rail. The shoes weigh forty-five pounds



THE BRADSHAW CAR SKID.

each. With a twenty-eight-ton car the shoes will give from fifty to seventy-five miles service under the most severe conditions. Only the shoes need to be replaced. The rest of the skid will last indefinitely.

Crippled cars equipped with the Bradshaw car skid have passed around curves of forty-foot radius roads at full speed test. The skid will safely carry the heaviest car, at any speed, forward or backward, with little difference in the motion of the car. With this device crippled cars go in under their own power.

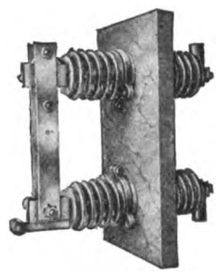
It is advisable to have several skids, each located at a convenient point on the line, so as to be accessible in case of accident. The skid may be carried on the platform of any car. When word is received that a car is crippled on the line the skid can be put on any car that is handy and quickly run to the broken-down car. Four men can handle it. The car may be raised by jacks and the skid slid under the damaged truck. The center of the shoe should be directly in the center of the axle bearing. After the car is lowered on the skid the chains may be hooked in place and the turnbuckles set. It is adjustable to any single or double-truck car, on horse, steam or electric railroads.

The Bradshaw car skid is manufactured by the Lord Electric Company, New York, N. Y.

Condit Disconnecting Switches.

It has grown to be a practice in all high-tension stations to equip the high-tension apparatus, such as transformers, oil switches, etc., with an air-break switch whose functions are not to open the circuit under load, but to isolate the apparatus from the line, so that it is absolutely safe to handle.

This practice has called for the development of a line of switches known as disconnecting switches. The insulation on these switches must be ample, the break distance



CONDIT DISCONNECTING SWITCH.

large, in order to form sufficient air space between the terminals where the switches open, and the switch must be comparatively inexpensive and at the same time rugged and substantial.

The switch shown in the accompanying illustration is made by the Condit Electrical Manufacturing Company and possesses these features. The insulators are of corrugated porcelain and are so arranged that the switches can easily be made either back connected, front connected or half back connected and half front connected. The blades and clips are double and the construction allows the use of heavy copper and at the same time gives spring enough to make a good contact.

The switches are all provided with a stop, as clearly shown, to hold the switch at right angles when open and with a spring catch which prevents the switch from falling open, even when mounted upside down.

These switches are manufactured for various voltages and amperes up to and including 1,200 amperes and 40,000 volts.

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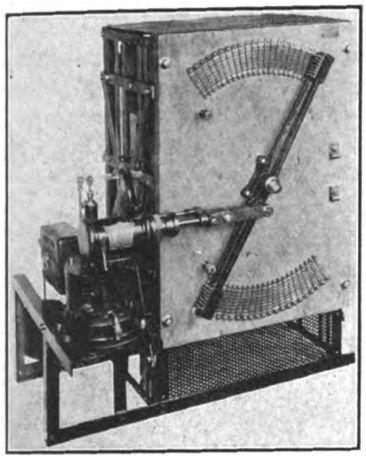
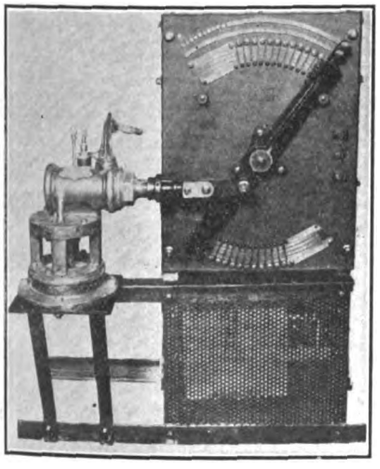
Pressure-Controlled Motor-Speed Regulators.

In the electric pumping of fluids it is often desired to keep the pump in continuous operation, but at variable speed so as to produce a constant pressure regardless of the rate of discharge. This requires that there shall be provided in the circuit of the motor driving the pump or blower an automatic regulator of its speed that is capable of being controlled by slight variations in the pressure of the liquid or gas that is being pumped. A type of regulator designed to meet these difficult requirements has been placed on the market and found to give excellent service.



VIEW OF SPEED REGULATOR ARRANGED FOR REGULATION OF ARMATURE ONLY.



VIEW OF SPEED REGULATOR ARRANGED FOR BOTH ARMATURE AND SHUNT FIELD REGULATION.

Particular application of these speed regulators has been made for motors operating boiler-feed pumps, and mechanical draft blowers in connection with stokers. In each of these cases the steam pressure of the boiler is maintained practically constant. The operation of gas-pressure blowers has also been successfully carried out. In fact, these regulators are adaptable to any service where the pressure of the air, gas, water or other fluid is kept above twenty-five pounds per square inch.

For controlling direct-current motors the equipment consists of a standard rheostat with no-voltage release and the special speed regulator referred to. For lowering the speed below normal, resistance is inserted in the armature circuit step by step. To raise the speed of shunt or compound motors above normal, the field is weakened by the insertion of resistance in the shunt-field circuit. By either or both these methods a wide range of speed control is secured.

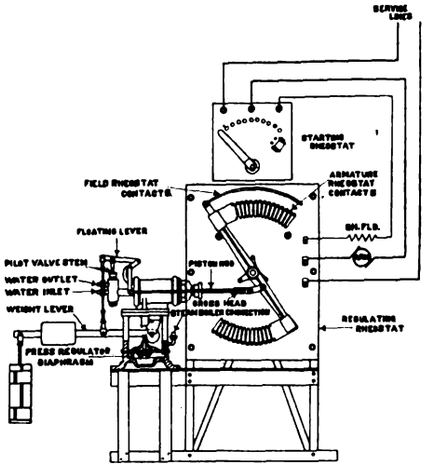


DIAGRAM OF SPEED REGULATOR FOR DIRECT-CURRENT MOTOR.

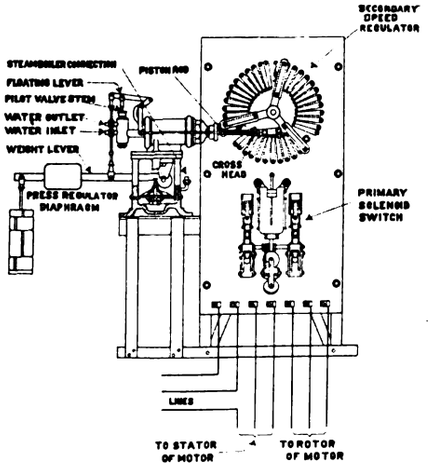


DIAGRAM OF SPEED REGULATOR FOR THREE-PHASE ALTERNATING-CURRENT MOTOR.

For alternating-current induction motors it is customary to provide a solenoid switch in the primary or stator circuit and a speed-regulating rheostat in the secondary or rotor circuit. Diagrams of the direct-current and alternating-current control equipments and photographs of the two chief classes of the former are reproduced herewith. These illustrations also show the principal features of the pressure-controlled mechanism that governs the speed-regulating rheostat arm, as applied to a forced-draft system.

The rheostat arm is actuated by the piston of a hydraulic cylinder, the admission and exhaust port valves of which are in turn controlled by the movement of a pressure-regulator diaphragm, one side of which is subjected to the boiler pressure. The normal boiler pressure on the under side of the diaphragm is balanced by a weighted lever bearing upon the top of the diaphragm in such a way that this lever will rise or fall as the boiler pressure rises above or falls below the normal pressure for which the lever is counterbalanced. This up-and-down movement of the lever operates a pilot valve controlling the admission of water to the hydraulic cylinder shown to the left of the slate panel and, due to this pressure, the piston of the cylinder is moved back and forth operating in turn the double-ended rheostat arm which rides over the contact segments of the rheostat mounted on the slate slab.

In the particular application referred to, when the boiler pressure is low, the arm is in the full-speed position. As the pressure rises the resistance in the field circuit is first cut out, assuming a direct-current shunt motor to be used, and then the armature resistance cut in, thus gradually slowing down the motor. Upon a decrease of pressure the reverse cycle of operations is carried out. By means of an ingenious contrivance the cutting in or out of resistance proceeds in a step-by-step manner, thus preventing violent changes in motor speed and their accompanying wear and tear of the machinery and sudden current fluctuations in the supply circuit. Although the cylinder at the left side of the panel is usually a hydraulic cylinder, it is not necessarily so, for when water pressure is not available the same results can be obtained by connection with a compressed-air tank or similar device.

In the design of these speed regulators, the extended experience of their manufacturer, the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., was productive in arranging their details so as to make a rugged construction capable of severe and continuous service without arcing or overheating. These regulators, moreover, require practically no attention except occasional dusting, and their performance has been exceptionally successful.

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Adjustable Speed Commutation Pole Motors.

The Triumph Electric Company, Cincinnati, Ohio, is placing on the market adjustable speed commutation pole motors which are particularly suitable for machine tool drive.

The construction is practically identical with that of the constant speed motors, with the exception that the commutation poles are placed midway between the main field poles and are firmly bolted to the field yoke. These poles are formed of the best quality of wrought iron obtainable and are carefully wound and insulated.

The coils are in series with the armature circuit, so that the strength of these poles depends upon the load on the motor, and is therefore proportional to the armature reaction. This is true irrespective of the direction of rotation, so that the points of commutation are always in a field of such strength that sparkless commutation at all loads and all speed variations is obtained.

Another commendable feature in these motors is the heavy overload capacity which is possible on account of the peculiar mechanical construction of the machines.

Fig. 1 is a view of the Triumph adjustable speed commutation pole motor, and Fig. 2 shows one with the front bracket removed, revealing the commutation or auxiliary poles.

These motors are built in all standard sizes.

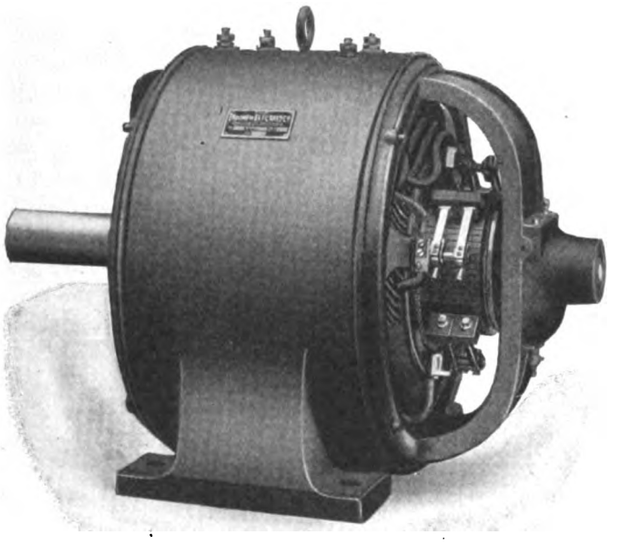


FIG. 1.—TRIUMPH COMMUTATION POLE MOTOR.

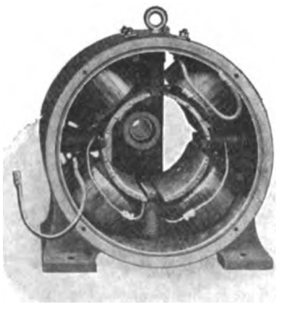


FIG. 2.—TRIUMPH MOTOR WITH BRACKET REMOVED.

Westinghouse Electric Company.

A representative of the Westinghouse Electric and Manufacturing Company says: "We have at the present time between 10,000 and 11,000 employes on our payrolls, which compares with about 6,000 at the low point of the depression.

"Gross business is now running at the rate of $2,500,000 per month, or $30,000,000 per annum, which is an increase of 130 per cent from the low. July gross was at the rate of $3,000,000 per month, but it is hardly fair to accept this as the monthly average. July was an exceedingly good month for us, every one of our commercial departments having shown a substantially larger gross amount of business than any previous month this year. There was but a single order that might be called out of the ordinary in point of size.

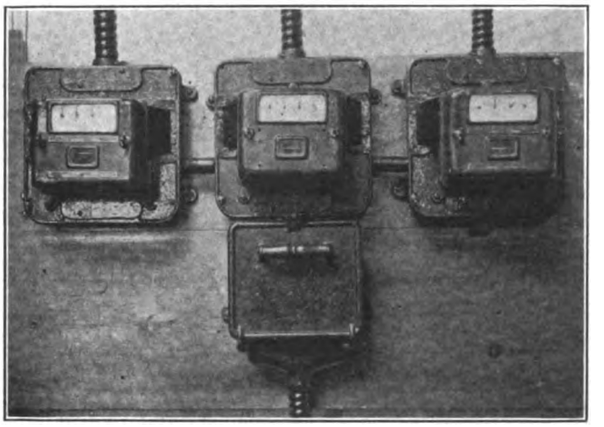
"August is a vacation period, and we do not expect business for the current month to be quite as large as last. There is, however, every indication that our July gross will be greatly exceeded in the coming fall months."

A favorable feature of Westinghouse Electric operations is the excellent results the foreign companies are making.

The Hemere Combined Meter Panel and Cut-Out.

A number of important installations of the Hemere combined meter panel and cut-out have been made recently that have demonstrated the utility and marked advantages of this appliance. It has been adopted by several central stations for use in placing meters in buildings where there are a number of consumers.

The service wires enter through a single cut-out from below and then connect with a set of horizontal busbars on the meter panel, to which any desired number of meters can be joined. This is shown by the illustration herewith. In an article describing this appliance in our issue of August 7, this illustration, through an unfortunate error of the printers, was shown upside down.



HEMERE COMBINED METER PANEL.

William Charnley, of 59 Leonard Street, New York city, who supplies this Hemere specialty, states that the absolute security against tampering and fire, as well as the speed with which it can be installed and its neatness when finished, are points that have particularly appealed to the purchasers of the device.

Infringement of Patent Suit.

The General Electric Company last week instituted two suits in the Federal Circuit Court at Toledo, Ohio, against the Yost Manufacturing Company, also of Toledo, alleging infringement of patent. The plaintiff company claims that it has been manufacturing a certain patent lamp socket invented by Howard R. Sargent and Julius C. Tournier, both of Schenectady, N. Y., and that the plaintiff has secured the patent rights from the inventors. The petition asks for an injunction restraining the defendant from any further infringement of the patent and for damages. H.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, AUGUST 14.—A point of great interest to contractors came before the courts here this week. The Derby Corporation entered into a contract with a particular firm for the construction of tramways, and the borough engineer was appointed arbitrator to deal with any matters upon which disputes might arise. While it is true that the contractors agreed to this latter proceeding, yet they had little option, for it was decreed by the corporation, and the only alternative was to lose the contract, although it is a practice now generally discarded except on the part of municipal bodies. The majority of independent consulting engineers are greatly averse to the practice. In the construction of the Derby tramways considerable delays occurred which left the contractors liable for a large sum of money in the way of fines. The contractors, however, claimed that the delay in completion was in some measure due to the actions of the borough engineers, and that, therefore, as the points had to be arbitrated upon, the clause constituting the borough engineer arbitrator was an unfair one, as he was not a fit person to decide whether he himself had been unreasonable in his dealings with the contractors. The sum in fines being a large one, the contractors had no option but to try to secure the setting aside of the arbitration clause in the contract as a matter of common sense, and in this it is pleasing to note that the courts have taken this view. It may be that this decision will have the effect of breaking down a method of dealing with contractors on the part of municipalities which is extremely unfair and creates a position open to abuse.

The latest half-yearly railway reports show that the directors of these undertakings are taking a different view of tramway completion to that formerly adopted. It is now generally conceded that it is futile to attempt to regain the purely local traffic which has been abstracted from the railways by the trams, as the latter give facilities for this traffic which railways do not, and that the railway companies' energies will be better employed in improving the service in order to induce more people to live greater distances out, beyond the sphere of influence of the trams. Very opposite opinions are also held by different railway chairmen as to the best method of proceeding with electrification of the existing steam railways. The Southeastern and Chatham Company's chairman disagrees with the London, Brighton and South Coast Company's policy of dealing with their line in this matter piecemeal, and predicts that the London County Council tramway officials will concentrate all their efforts upon the single-phase line about to be opened, in an endeavor to render the experiment unsuccessful commercially. This is rather a flight of the imagination, but it is sufficient to show the obstacles which electrical engineers in Great Britain have to overcome before any considerable extension of steam-railway electrification will take place here. Fare-cutting seems to be the policy adopted by railway companies just now for minimizing the effect of tramway competition.

The Railless Electric Traction Company will shortly be putting into operation an experimental installation of its electric trolley omnibuses on the outskirts of London, a large British-made vehicle being now on the spot. So far as this country is concerned, however, there is not much likelihood of any corporation adopting it for another twelve months, owing to the necessity for obtaining Parliamentary powers. For some unexplained reason, the ratepayers of Liverpool and Manchester, at the beginning of the present session of Parliament, insisted upon powers to adopt the system being withdrawn from bills which were then being promoted.

As the result of a further extension this week of the London County Council tramways, it is now possible to travel by tramcar from the extreme south of the Greater London area to the extreme north, a distance of twenty-two miles. To do this, a passenger travels over the lines of two municipalities and one company.

The Yorkshire Electric Power Company, a feature of whose power station is the first Curtis turbine installed in this country, is making rapid financial progress. For the half-year to June last, the net profit was $5,350, compared with $1,800 for the corresponding period of the previous year, and a heavy loss in the year before that. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, AUGUST 15.—An extensive plant has been erected in France for the manufacture of carbide and also for cyanamide, the new fertilizing product which is obtained by treating carbide with nitrogen. The two factories for these products are located at Notre Dame de Brancon, and they now employ a large amount of current. This, as we already noted, is brought to the spot from two hydraulic plants which lie at some distance off. The first of the hydraulic plants utilizes 3,000 horsepower from the torrent of Eau Rousse, while the second station is situated on the St. Jean torrent. As to the first of these plants, it uses a 230-metre head of water, with a penstock of 1,382 metres length. In the station are seven turbines of the Duvillard type, five of them being of 700-horsepower size and the others for the exciters. Thury alternators are coupled to the wheels. For the plant on the Belleville torrent there is used a tunnel 4,500 metres long leading to the settling basin, from which a penstock in ferro-concrete leads for 100 metres to the turbines. At present there are used three turbines of 2,550 horsepower, these being coupled to Oerlikon alternators. Eventually the plant is to have seven groups of this size. The three-phase current is brought over a 15-000-volt power line for seven miles to the electrolytic plant, where transformers supply current at 150 volts.

The Municipal Council of Milan decided not long since to make a considerable increase in the system of underground conduits for electric lighting throughout the city, and has awarded the contract for this work to the Italian Edison Company.

In carrying out his reform upon the French postal, telegraph and telephone services, the new minister, M. Millerand, proposes to take a measure which is much needed, that is to separate these three services completely and thus avoid the confusion which now exists. This project will take some time to carry out, however. One of the first steps made by M. Millerand is to reinstate a number of the employes who had been revoked during the recent troubles. As most of their places have been taken meanwhile, this can only be done gradually and when there are vacancies in the service. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, AUGUST 21.—What is said to be the first exhaust-steam-turbine in Canada is shortly to be erected in the Central Electric power house of the Dominion Coal Company, at Glace Bay, Nova Scotia. The plant will consist of one 1,000-kilowatt generating unit.

The grading for the electric railway from Cobalt to Haileybury, Ont., is about completed. The only delay now is that the Haileybury end, where, in deference to the representations of many citizens, the proposed line has been slightly altered.

The work of installing the electrical apparatus for turning the big railway swing bridge over the Welland Canal, just above Thorold, Ont., is proceeding without delay, and the bridge will very shortly be turned by electricity. Hitherto, it has taken three or four men to turn it, and it was an exceedingly slow process, electric cars being held up while boats passed the canal.

A complete change in the method of management of the Manitoba government telephones has been decided on, and will go into effect on September 1, when functional organization will be adopted. The arrangement is similar to that by which railway companies, as well as the Bell and other telephone companies, are governed, the business being divided into several independent departments. The province will be divided into districts, and the management will be under three heads: Commercial agents, superintendent of plant, and superintendent of service. One important new post will be created, that of general superintendent of plant for the province.

Rapid progress is being made with the work of erecting the steel towers for the transmission line from Niagara of the Ontario Hydroelectric Commission. So far, eighty-five towers have been put in place, and the work is proceeding at the rate of eight towers per day. The completed system will involve the longest transmission line in the world. With branches, it will be 297 miles in length, and will carry a current of 110,000 volts. The engineers have been able to allay the fears of farmers along the line, as to the element of risk involved in the stringing of high-potential wires over barns and out-buildings, and not a few of the farmers now anticipate the time when they will be able to use power from the government line to lighten farm labor.

A big and costly plant is to be erected on the property of the Cobalt Mines Power Company, of Cobalt, Ont. The

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various manufacturers of mining machinery in Eastern Canada are now bidding on the supply and installation of the machinery. This plant is an electrical one, situate on the Matibitchewan River, about twenty-five miles from Cobalt. The company has the right to raise lakes feeding this power to the extent of forty feet. The company will have a head of 312 feet, which will be brought to the turbines through two steel tubes, five feet in diameter. The electrical installation will consist of four generators, 2,500 horsepower each, or 10,000 horsepower in all. It is proposed to keep one unit in reserve. There will be two transmission lines to Cobalt, to prevent any breakdown, and the right-of-way will be 135 feet. The current will be brought into camp at 44,000 volts, and the different mines will be fed at a voltage of 2,200. The plans call for the installation of one or two electrically driven air compressors, and they undertake to supply the mines with compressed air, as well as electrical power. The cost per horsepower will be about $50 per annum for a twenty-four-hour service. There will be two intake pipes, eight feet in diameter, and an outlet pipe of twenty-two feet. The blow-off pipe will be twelve inches in diameter. This plant is situated six-and-three-fourth miles south of the Temiskaming & Northern Ontario Railway, at Kerr Lake, at Ragged Chutes, on the Montreal River. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, AUGUST 22.—Lacombe, Alta., is now without electric light or power and there is little prospect of the evil being remedied this year. It is due to the washing out of the dam of the Blindman's River and Power Company a few days ago.

The Calgary Power and Transmission Company will shortly call for tenders for the erection of its power plant, forty-five miles west of Calgary, Alta., and the construction of the necessary transmission lines. Smith, Kerry & Chace, consulting engineers, Toronto, Ont., have the plans and will also supervise the work.

In answer to a question in the Winnipeg (Man.) City Council a few days ago, Alderman Willoughby stated that the civic power plant at Lac du Bonnet, now being constructed at a cost of $3,500,000, will be in operation by 1912.

The City Council at Ladysmith, B. C., has awarded a contract for a complete municipal electric-light and power plant to the Canadian Westinghouse Company. George M. Turner is city electrical engineer.

The Winnipeg Electric Street Railway Company, of Winnipeg, Man., has completed plans for a nine-track car barn, subpower station and freight sheds to cost over $100,000. They will be erected in the north end of the city. Wilford Phillips, general superintendent.

The Rainy River Radial Railroad Company is applying for incorporation under Dominion laws to operate an electric street-railway system in and around Fort Francis, Ont. Among the lines planned is one to the international boundary.

Plans are being considered by the City Council at Regina, Sask., for a municipal electric street railway to be built in that city and it is expected tenders for construction will be called before the end of the month. Address Alderman Peverett.

That the municipal street railway system at Calgary, Alta., is a paying proposition, is evidenced by the report for July, which shows net profits of $3,995.36 after expenses amounting to $1,398.41 had been paid. Several extensions are planned by the Council.

The Manitoba Government Telephone Commission, with headquarters at Winnipeg, Man., has decided to divide the province up into districts. Each district will be under the direct responsibility of a commercial agent, superintendent of plant and superintendent of service. These officials will be under similar officials for the whole province, who will be responsible to the commission. H. S. Patterson is chairman of the commission.

Before the end of the year officials of the Canadian Pacific Railroad will go over the Columbia & Western branch with a view to ascertaining the feasibility of operating it by electricity. At Bonnington Falls there is 35,000 electrical horsepower available and several other undeveloped powers along the route of the line. Lorne A. Campbell, Nelson, B. C., is in charge.

The International Railway and Development Company, of New Westminster, B. C., has given official notice that it is about to construct an electric street-railway system in the Municipality of Sutton. Bowser, Reid & Wallbridge, Vancouver, B. C., are attorneys for the company. R.

LIGHTING AND POWER.

(Special Correspondence.)

RUSSELL, KAN.—A $65,000 bond issue has been voted for waterworks and electric-light systems.

MELROSE, CAL.—An electric-light district has been formed here in conformity with the new state law.

PORTALES, M. M.—The United States Sugar and Land Company, of Garden City, Kan., has contracted with farmers about this place to construct a power plant near this place to furnish power for pumping water sufficient to irrigate 12,000 acres of land.

BENTON, ARK.—The Atkinson Water Power Company has been organized and will put in a power plant.

COUNCIL GROVE, KAN.—An electric-light franchise has been granted to H. H. Sparks, of Junction City, Kan.

LUBBOCK, TEX.—The Lubbock Light, Ice and Power Company has been organized with a capital stock of $25,000.

ST. MARIES, IDAHO—The City Council has awarded to G. H. Jay the electric-lighting franchise recently applied for by him.

ROCKY MOUNT, N. C.—The new city electric and pumping plant has been completed and power is now available for all uses in the town. L.

ALBEMARLE, N. C.—An issue of $27,000 municipal bonds for lights, water, etc., has been carried by a large majority in a recent election in the town. L.

YUMA, ARIZ.—A bond election will soon be held here for the purpose of voting on a bond issue of $200,000 for an electric-light plant and a water plant.

UNION, ORE.—A special election has been called for the purpose of voting on the issuing of bonds for the erection of a municipal electric-lighting plant.

TUCSON, ARIZ.—A. M. Conrad, of the Sonora Copper Company, is preparing to install an electric power plant and an aerial tramway in the Caracahui Mountains, in Northern Mexico.

EVERETT, WASH.—J. E. Wickstrom, of Seattle, has bought the Snohomish Electric Light and Water Company, of this place, and is planning to partially reconstruct the distributing system.

COLUMBIA CITY, IND.—The City Council is asking for bids for the installation of two 350-horsepower vertical water-tube boilers, with steel stacks, in the electric-light plant. F. T. Schultz, superintendent. S.

TACOMA, WASH.—The Northwestern Electric Company has been incorporated here, with a capital stock of $300,000, by F. H. Lauzon, E. L. Hollingstead, H. D. Nowlin, F. McFarland and J. P. Covert.

BOSTON, MASS.—The gas commissioners have approved the sale of the Cohasset Electric Light Company to the Electric Light and Power Company, of Abington and Rockland. The price paid for the property is $18,000.

SAND POINT, IDAHO—The Northern Idaho and Montana Power Company has begun construction on its power line from Sand Point to Newport and other towns. It is given out that the expenditures will reach $2,000,000.

BRECKENRIDGE, COLO.—W. B. LeWald, manager of the New Pennsylvania Mines Company, and the Colorado-Toledo Mining Company, has announced that he is having plans drawn for a new 100-ton concentrating mill for the Colorado-Toledo mine, at Montezuma.

PRESCOTT, ARIZ.—Attorney E. S. Clark has been in Chicago on business connected with the issuing of bonds for the construction of the proposed plant for the Pacific Water Power Company, of which E. H. Meek of this city is president and principal promoter.

SEATTLE, WASH.—The management of the Alaska-Yukon-Pacific Exposition at this place has been notified of the appropriation by Congress of $30,000 for the completion of the illumination of the four United States government buildings on the exposition grounds.

ESPANOLA, N. M.—The Espanola Milling and Elevator Company is preparing to install a 2,000-horsepower electric plant. The company has been incorporated, with a capital stock of $25,000, by Geo. Bond, of Trinidad, Colo., Frank Bond, of Espanola, and others.

LONG BEACH, CAL.—The Harbor Electric Light and Power Company has been incorporated here, with a capital stock of $250,000, by S. N. Butters, A. C. Green and J. R. Mason. The incorporators have a site near Long Beach, and will develop electric power for lighting purposes.

SAVANNAH, GA.—The Twin City Power Company, holding a franchise to build a dam and construct an electric plant on the Savannah River, at Augusta, has applied to the city of Savannah and Mayor Tiedeman for a franchise to sell power in Savannah. The power company was represented by Judge Joseph R. Lamar and two officers of the Twin City Company. It is expected that similar franchises will be asked of numerous other cities and towns in the state of Georgia. L.

PETERSBURG, VA.—As required by law, the charter of the newly organized or reorganized properties, under the title of the Virginia Railway and Power Company, having been granted, and a mortgage deed given in favor of the Equitable Trust Company, of New York, to secure a fifteen million dollar first and refunding

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mortgage bond issue of five per cent gold bonds, this mortgage has been filed with the court here to be copied. It is a lengthy manuscript of some 125 pages of printed matter.

SUNBURY, PA.—The Edison Company, of this city, has closed a deal with the Eyre-Shoemaker contractors to furnish sixty arc lights and 500 incandescent lights on their big job in building the classification yards at Northumberland.

PORTLAND, ME.—The work on the new hydroelectric power station in the Brunswick cove, which has been built for the Brunswick Electric Light and Power Company, is now practically complete. The machinery is nearly installed and there is but little work still to be done.

RENO, NEV.—C. D. Galvin and F. H. Hall, of San Francisco, have bought out the power rights of Hayden Henderson and J. J. Hylton on the South Fork of the Humboldt River, in this state. The new owners will develop power for the use of the mining companies in and about Ely.

INDIANAPOLIS, IND.—The Merchants' Heat and Light Company will build a substation on Susquehanna Street. This and other improvements will cost nearly $1,000,000. The substation will be equipped with high-priced machines and electrical apparatus. Edward L. McKee is president. S.

INDIANAPOLIS, IND.—A 7,500-horsepower turbine, the largest in the state, is being installed in the Mill Street station of the Indianapolis Light and Heat Company. The turbine was built in Schenectady, N. Y., and nearly two months will be required to set the monster piece of machinery. S.

DOUGLASVILLE, GA.—The sum of $10,000 electric-light bonds, issued by this town, have been purchased by the Central Bank and Trust Corporation of Atlanta, Ga., Carter & Gillespie, of Atlanta, having the contract to complete the work on the lighting system. The bonds were sold, it is reported, for considerably more than par value. L.

OAKLAND, CAL.—The power transmission franchise applied for by the Great Western Power Company will be offered for sale on September 15. A provision has been inserted in the franchise restricting the current carried over the lines to 15,000 volts. This does not apply to the main line leading to the company's substation at the head of Fourth Avenue.

WAKE FOREST, N. C.—The machinery outfit and the material for the power house has been ordered for the new power and lighting plant at Wake Forest, and the current is expected to be ready for use by the middle of September. The entire college plant also has been wired and will be furnished by electric current for lighting from the new power station. L.

GARDNER, MISS.—The annual meeting of the stockholders of the Gardner Electric Light Company was held last week. It was reported that the gross receipts of the company for the year were $42,000, an increase of $7,000 over any other year in the history of the company. These officers were elected: President, A. P. Derby; vice-pres., T. B. Dunn; treasurer, F. S. Whittemore.

RICHMOND, VA.—All of the contracts that have been awarded by the city for the various material, machinery, work, etc., for the new municipal lighting plant, up to this time, have been properly signed by the city representatives. All certified checks of bidders have been returned, amounting to $46,000, except that of the General Electric Company, which is expected to be reached in a short time. L.

HANFORD, WASH.—The Hanford Irrigation and Power Company has contracted with the Allis-Chalmers Company for a 1,000-horsepower vertical triplex open-flume turbine, an oil-pressure governor, a 900-kilowatt, sixty-cycle, 2,200-volt vertical alternator, three 400-kilowatt oil-filled water-cooled transformers and a switchboard, this being a duplication of the company's present installation at Priest Rapids.

RUTLAND, VT.—The first commercial power to be used by any company from the Connecticut River Power Company was used by the Estey Organ Company, of Brattleboro. The Estey company has a complete substation equipment and steps down the voltage from 19,000, at which it is transmitted to Brattleboro, from the power station to Vernon, to 550, the voltage at which the induction motors are run.

TACOMA, WASH.—F. C. Kelsey has completed surveys for the municipality's electric plant, and it is expected that contracts will be let before the end of the year. It is planned to develop 30,000 horsepower. The plans include the construction of a dam 300 feet long and forty-five feet high, the boring of a tunnel 10,000 feet long, and the laying across the river of a riveted steel pipe supported on concrete arches.

ATLANTIC CITY, N. J.—A huge new electric-light plant is to be erected by the Atlantic City Electric Company on the banks of the Thoroughfare, to more than double the capacity of the present plant on Kentucky Avenue, and furnish the city with capacity for maybe half a million more lights. At present the plans are not entirely perfected, but at least $150,000 is to be expended in the erection of a new supply station.

ELECTRIC RAILWAYS.

(Special Correspondence.)

EL PASO, TEX.—The El Paso Electric Street Railway Company has secured concessions for its proposed extensions in Juarez.

OGDEN, UTAH—The Salt Lake & Ogden Railway Company has been granted a franchise for an electric railway on Lincoln Avenue.

SAN DIEGO, CAL.—G. W. Purcell, of the San Diego & Escondido Railway Company, announces that he has secured the entire right-of-way for the company's line between this place and San Diego.

HARRISBURG, ORE.—A. Welch, president of the Willamette Valley Company, has announced that by October the Willamette Valley will be completely electrified, at a cost of more than $1,000,000.

PEORIA, ILL.—There will be no decision of the famous electrolysis case of the Peoria Water Company vs. the Peoria Railway Company before September, as all the federal courts are not in session before that time. V.

KINGMAN, IND.—Work is progressing rapidly in the construction of the Covington and Southeastern Traction Company's line through Fountain County. Steel rails are now arriving and track laying will be begun at once. S.

INDIANAPOLIS, IND.—The U. S. Express Company reports the largest Indiana business during July in the history of the company. The new lines it has on the trolley systems in Indiana are proving a handsome feeder, and the officials say traction lines are very profitable to the company. S.

COQUILLE, ORE.—It is announced here that a syndicate in Portland has raised $3,000,000, and an eastern man has another million, which they propose to put into an electric road between Coos Bay and Portland, and they will start work inside of three months. J. P. Allen, of Tacoma, Wash., is interested.

SOUTH BEND, IND.—A seven-car trolley train was successfully operated on the South Shore traction line, between this city and Michigan City, August 10. The train was run to the city limits in two sections, when they were coupled together and made the trip without any mishap. The train made the usual number of stops on fast time. S.

MORRIS, ILL.—The Illinois Traction Company has had surveys run between Morris and Joliet and also to Yorkville, Ill., and as soon as the officials have decided which route will be used the work of construction will be started on that part of the lines, which means that the Traction Company is surely heading toward the city of Chicago. V.

SAN ANGELO, TEX.—The San Angelo Street Railway Company has been organized here. It was decided to place the authorized capital stock at $100,000. A board of directors was elected, and everything is being placed in readiness for the opening of street-car service in time for the fall fair. Eight new cars of the latest pattern are to be ordered at once.

BRUNSWICK, GA.—The extended franchise of the City and Suburban Railway Company expiring on September 26, it is estimated that a minimum of five miles of tracks will have been completed by that date, and that the system will be in operation within sixty days' time. Work was begun on grading and track-laying during the last ten days in June, and is being pushed with vigor. L.

ATLANTA, GA.—The possibility of effecting a merger of the local street-railway system in Macon, and the Central Georgia Power Company, and the proposed interurban electric line from Atlanta to Macon, has been made possible by a bill which was passed by both houses of the Georgia Legislature during the closing days of that body, after a long delay and much effort on the part of those interested.

MACON, GA.—The Boyd bill, permitting the consolidation of the Atlanta-Macon interurban line, the Macon-Albany interurban line, and the Central Georgia Power Company, will undoubtedly mean the formation of a $10,000,000 merger of the three concerns named, with the local electric systems, the source of power being the Central Georgia Power Company, while the local lines of Macon will furnish all required routes of ingress and egress of that city. L.

PEORIA, ILL.—The Peoria Railway Terminal have been granted the franchise that they have so long sought through the city, giving them an entrance to the center of the city without having to pay a mileage fee to the Peoria Railway Company, over whose tracks they now are operating. Much difficulty has been experienced to secure a franchise that was satisfactory to all concerned, as it will operate over the only street that makes a good entrance to the city. The company will build up the street at once and comply with the terms of the ordinance, which makes it possible for other companies wishing to come to the city to rent the tracks at a reasonable price for their use. Much value is in

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this grant, as the factories are along this street, which means that much freight can be had, as switching is allowed at stated times, which will make it possible for the company to handle carload shipments to the steam roads. In fact, the impression is that one or two of the steam roads will furnish the money to build the line up Washington Street. V.

COLORADO SPRINGS, COLO.—The Pike's Peak Cog road is to be double tracked and an electric third rail installed. C. W. Sells, general manager, is authority for the statement that these improvements will be made. They will cost approximately $750,000 and will be completed in time for next season's business. Already engineers are at work on the plans. Work on the reconstruction of the road will be begun at the end of the present season, or within two months.

SACRAMENTO, CAL.—Engineer Graham, of the Sierra-Sacramento Railway Company, has arrived here to take charge of the construction of that company's line from Sacramento to Lake Tahoe. The line will have a total length of 126½ miles. It is given out that General Manager Warner, of the company, who is now in Europe, will start for the United States on August 15, and that he will place orders for ties, rails and rolling stock as soon as he reaches Minneapolis.

EAST LIVERPOOL, OHIO—Plans for the newly-proposed electric road between Beaver Falls, Pa., and East Palestine and New Waterford, in Ohio, are now well under way, and work on the project is expected to be commenced within a few weeks. The proposed road will run from Beaver Falls to Columbiana via Darlington, East Palestine and New Waterford, and thus providing an outlet to the west over the Y. & S. and Stark Electric, and to the east over the Beaver Valley lines.

COLORADO SPRINGS, COLO.—To build a scenic electric railroad to the summit of Cheyenne Mountain, and thereby furnish another splendid tourist attraction to Colorado Springs, is the latest enterprise of a number of Colorado Springs business men. The road, which is to be three-and-one-quarter miles long, will run from the street-car loop at Broadmoor to the famous "Horn" on the top of Cheyenne Mountain. The estimated cost is $225,000, but subsequently an investment of $500,000 will be represented.

TOLEDO, OHIO—John Kilgour was elected to the presidency of the Toledo-Bowling Green & Southern Railway Company, at a meeting of the directors held in Cincinnati, last week. He succeeds George Kerper. The other officers elected are Henry L. Gibson, vice-president, and Albert J. Becht, secretary-treasurer. The directorate consists of these officers, together with S. C. Schenck and George E. Pomeroy, of Toledo; Baird L. Kilgour, George Kerper, F. C. Lawson and A. L. Andrews, of Cincinnati. H.

MARION, OHIO—George Whysall, general manager of the Columbus, Delaware & Marion Railroad, has been appointed receiver for the road by Judge Boston G. Young. Mr. Whysall immediately qualified and gave bond in the sum of $100,000. The action was brought by N. J. Catrow, treasurer of the company and president of the First National Bank of Miamisburg, Ohio, and is for the purpose of securing the payment of loans for which Catrow holds a collateral note signed by the Columbus, Delaware & Marion Railway Company, executed to the company's president, John G. Webb, and by him made over to Catrow. The note is for the sum of $372,381.81. It is dated June 1, 1907, and was due September 1, 1907.

BOSTON, MASS.—Several street-railway companies have been authorized by the Railroad Commission to issue new capital. The Boston & Northern and Old Colony Street Railway companies are authorized to issue, respectively, 5,883 and 4,042 shares of preferred stock, at $115, to supply working capital, the price of $115 having been fixed by directors in accordance with act of the recent Legislature. The Worcester Street Railway may issue $3,182,000 twenty-year five per cent bonds, proceeds to refund bonds previously issued, for taking over the Worcester & Marlboro, Worcester & Clinton and Leominster & Clinton companies. The Berkshire Street Railway Company is authorized to issue $190,000 bonds to pay floating indebtedness and cost of permanent additions.

FINDLAY, OHIO—The capital stock of the Toledo, Bowling Green and Southern Traction Company will be increased by the issue of $750,000 of preferred stock, entitled to dividends of five per cent per annum prior to and before the payment of any dividends upon the common stock of this company. The Toledo Urban & Interurban Railway will be purchased, payment for the same being $500,000 in five per cent bonds and $375,000 of the $750,000 preferred stock, thus giving to the bondholders of the Toledo Urban & Interurban Railway Company fifty per cent in bonds and thirty-seven-and-one half per cent in preferred stock; the remaining $375,000 preferred stock to be given to the stockholders of the Toledo, Bowling Green & Southern Traction Company pro rata in exchange for common stock, i. e., each stockholder may surrender twenty-five per cent of his holding of common stock and receive in exchange a like number of shares of preferred stock. Bonds for $500,000 will be issued, which will be secured by a first mortgage of the property, to be acquired of the Toledo Urban & Interurban Railway Company, and a second mortgage on the Toledo, Bowling Green & Southern Traction Company.

DUBLIN, GA.—An application has been made to the mayor and Council of Dublin for a franchise to build a street railway in this city. The petition was presented by Hon. P. L. Wade and was signed by the following gentlemen: S. M. Kellam, W. W. Bush, A. W. Garrett, W. R. Brigham, A. P. Hilton, W. W. Robinson and P. L. Wade. The petitioners asked for a franchise for a period of twenty-five years, and asked for the use of certain streets exclusively. The promoters of the street railway are fully able to finance the enterprise, and if a reasonable franchise can be obtained, it is likely that work will begin just as soon as a charter has been obtained.

MT. VERNON, ILL.—It is announced that the erection of the proposed street-car plant here is assured. The business men and others have raised $100,000, after weeks of hard work, to purchase ground for the proposed plant. The proposition of the car company was that it would erect a fully equipped plant for the building of modern steel cars now coming into universal use on all railways, if ground sufficient for the plant was donated by the city. The ground has been donated. This plant means more to Mt. Vernon than anything that has ever happened in its history, business men declare. A plant will be erected costing not less than $800,000, and 2,000 men will find employment.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

REINBECK, IOWA—The local telephone plant is being rebuilt. C.

OGEMA, MINN.—A. L. Fredenburg of Waubun is about to install a telephone system here.

MALMO, NEB.—This city has voted bonds for the establishment of an electric-light plant.

COWLINGTON, OKLA.—The Cowlington-Spiro Telephone Company has been incorporated.

ALVA, OKLA.—The Valley Telephone Company has been incorporated with a capital of $3,000.

VALLEY, NEB.—Bonds to the amount of $17,000 have been voted here for an electric-light plant.

COUNCIL GROVE, KAN.—H. H. Sparks has been granted a franchise for an electric-light plant.

MUSKOGEE, OKLA.—L. H. McHenry has asked for a franchise to establish an electric-light plant.

BONDUEL, WIS.—The Bonduel Telephone Company has been incorporated with a capital stock of $5,000.

SAN DIEGO, TEXAS—The S. G. Smith Telephone Company has been organized with a capital of $11,000.

NEW RICHMOND, WIS.—The Wisconsin Telephone Company will rebuild its plant, at a cost of $2,000.

HOQUIAM, WASH.—The American District Telegraph Company has been granted a franchise in this place.

PRAIRIE GROVE, ARK.—The Prairie Grove Telephone Company has increased its capital from $6,000 to $12,000.

GLASGOW, MONT.—The Moore Telephone Company here is planning the erection of seventy-five miles of new line.

LITTLE ROCK, ARK.—B. F. Kendrick and others propose to buy the Little Rock Telephone Co. and rebuild the system.

ONTARIO, ORE.—The Ontario Independent Telephone Company has incorporated here for $10,000. Incorporators, Harry B. Granell and others.

SALINAS, CAL.—The county supervisors have granted to the Buena Vista Telephone Company a telephone franchise along the county highways.

WALLA WALLA, WASH.—According to Manager Van Hutte, of the local exchange, several thousand dollars will be expended in enlarging the telephone system.

HOQUIAM, WASH.—The Bell Telephone Company has accepted the franchise recently granted by the city, and will spend about $25,000 on the system here.

RENSSELAER, IND.—The Home Telephone Company has been incorporated to build and operate a telephone system in Jasper, White and Newton counties. The home office will be in Rensselaer. S.

BUENOS AIRES, ARGENTINA—As the representative of the River Plate Telegraph Company has offered to lay a direct cable from Buenos Aires to Europe via Tristan da Cunha free of all cost to Argentina, there appears to be little likelihood that the syndicate reported to have been formed in London with a

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capital of $10,000,000 will obtain the desired concessions to carry out this same work, asking to be paid in five per cent government bonds.

LARSEN, WIS.—The Larsen Telephone Company has increased its capital stock from $5,000 to $10,000. Niels Jensen, president, and Louis Sorensen, secretary. C.

HAILEY, IDAHO—The application of C. E. Woods, forest supervisor, for permission to construct a telephone line along the county roads from Ketchum north, has been approved.

MONTROSE, COLO.—The Colorado Telephone Company will expend many thousands of dollars in the next few months in improvements, especially in the Uncompahgre Valley, and new extensions will be made.

BILLINGS, MONT.—The Bell Telephone Company has contracted with the Eastern Montana Independent Telephone Company for the construction of a line from Forsyth to Billings, to connect with the Bell lines here. C.

RUSHVILLE, IND.—The Rushville Gas, Light, Heat & Water Company has incorporated with a capital of $100,000 to supply the city of Rushville with the named commodities. Fred C. Carroll, John A. Walter and H. G. Walter are the directors. S.

GREAT FALLS, MONT.—The contract for the erection of the proposed exchange building of the Great Falls Automatic Telephone Company has been let to George Nelson, of Butte, Mont. The building will be erected at First Avenue, North, and Third Street and will cost $25,000. C.

EVANSVILLE, IND.—The contract for the lighting of this city for the next five years has been awarded to the Evansville Gas & Electric Light Company. Under the new contract the city will save a considerable sum as compared with the old contract for the lighting of the streets. S.

PERU, IND.—The Logansport & Wabash Valley Light Company and the American Gas & Light Company have merged and the latter company has shut down its plant and will get its supply from the former company's plant. G. M. Dally will manage both concerns or the merged business. S.

HILDESHEIM, GERMANY—The first automatic telephone exchange system to be used in this part of Germany has been installed at Hildesheim by the Imperial German Postoffice Department. It is believed that the German government will extend the use of automatic telephones, since they have been found very satisfactory.

PORT ARTHUR, TEXAS—This city will soon have as fine and modern telephone service as may be found anywhere. The South Texas Telephone Company has recently purchased a complete equipment of one of the largest electrical houses in the United States, and the new exchange will be in operation in about two months. The improvements will cost in the neighborhood of $15,000.

AMARILLO, TEX.—Negotiations whereby the Southwestern Telegraph and Telephone Company becomes the possessor of the long-distance lines between this city and Memphis, Tex., have been closed. The Northwest Texas Telephone Company is now engaged in an extension that will connect Lubbock, Tex., and Roswell, N. M. Amarillo is thus assured telephonic communication to all outside points when the improvements are made.

TECUMSEH, NEB.—The Crab Orchard Telephone Company, operating lines at Crab Orchard and out from that town, has sold its property to the Nebraska Telephone Company. The Crab Orchard Telephone Company was owned by O. A. Bailey, C. L. Rothell and Mrs. Etta Rothell. The transfer was made to Edgar M. Morsman, attorney for the Nebraska company, and A. D. Lane, special agent, both of Omaha, and to C. L. Rothell of the old Crab Orchard company. The consideration was $19,500, and the new management is now in charge.

BOLTON, CONN.—The Bolton and Coventry Telephone Company, one of the very few private telephone companies in Connecticut, voted at its annual meeting to incorporate under the joint stock act of Connecticut. The annual report showed that not only had the concern's business increased largely during the year, but the number of new instruments put in was constantly growing. The company is owned in a large measure by Dr. M. M. Maine and is a neighborhood affair grown into something more extensive and covering two towns now. It has no connection with the Southern New England Telephone Company.

ATLANTA, GA.—It is believed that the North Georgia Power Company will soon become a competitor for supplying power in the City of Atlanta, the company having filed a petition with the City Council asking for an extension of twelve months of its franchise to operate in Atlanta. The matter has been discussed between the company and the Council committee on electric and other roads. Already steel towers have been built up to the city limits from Gainesville and are supplying several large suburban manufacturing plants near the City of Atlanta. It is said that the company would have been in Atlanta before but for the stringent times of the fall and winter of 1907-08. L.

ELECTRICAL SECURITIES.

Toward the close of the week transactions on the stock exchange became quite narrow. The return of Mr. Harriman with the same optimistic views that he had when he went away did not particularly help prices, as there is anxiety over the state of his health and what he is going to do. Some industrial securities showed substantial gains, but it was a cross-saw market almost all week, with transactions confined almost exclusively to professionals. There are as yet no basic disturbing influences to a sound situation, no matter what form speculative rumors may take.

DIVIDENDS.

American Railways Company; the regular quarterly dividend of one-and-one-half per cent, payable September 15 to stock of record August 27. Books closed August 27, and reopen September 3.

General Electric Company; the regular quarterly dividend of $2 per share, payable October 15, to stock of record September 4.

NEW YORK.	Aug. 23.	Aug. 16.
Allis-Chalmers common	15¾	15⅛
Allis-Chalmers preferred	53¾	53⅞
Amalgamated Copper	85⅜	86⅛
American Tel. & Cable	80*	80*
American Tel. & Tel.	140	141⅝
Brooklyn Rapid Transit	81	80¼
General Electric	168	169⅝
Interborough-Metropolitan common	15	14½
Interborough-Metropolitan preferred	47½	47¾
Kings County Electric	130	135
Mackay Companies (Postal Telegraph and Cables) common	82	81
Mackay Companies (Postal Telegraph and Cables) preferred	74½	74½
Manhattan Elevated	141	143½
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	142	142
U. S. Steel common	76¾	78½
U. S. Steel preferred	125	127
Western Union	73½	74
Westinghouse common	86¼	87⅛
Westinghouse preferred	129	120

*Last price quoted.

BOSTON.	Aug. 23.	Aug. 16.
American Tel. & Tel.	140	141⅝
Edison Elec. Illuminating	252	254
General Electric	168	169⅝
Massachusetts Electric common	14	13
Massachusetts Electric preferred	73½	73
New England Telephone	137	137
Western Tel. & Tel. common	11	11⅛
Western Tel. & Tel. preferred	89½	90

PHILADELPHIA.	Aug. 23.	Aug. 16.
American Railways	46	45⅞
Electric Company of America	12⅜	12¼
Electric Storage Battery common	60½	61
Electric Storage Battery preferred	60½	61
Philadelphia Electric (ex-dividend)	11⅛	12⅜
Philadelphia Rapid Transit	30¼	30¼
Philadelphia Traction	90	91
Union Traction	54	54⅝

CHICAGO.	Aug. 23.	Aug. 16.
Chicago Railways, Series 1	108	108
Chicago Railways, Series 2	37¼	38⅛
Chicago Subway	19½	20½
Chicago Telephone	135½	135½
Commonwealth Edison	120⅞	121
Metropolitan Elevated common	15⅛	17¾
Metropolitan Elevated preferred	49	49
National Carbon common	95	98
National Carbon preferred	119	119

NEW MANUFACTURING COMPANIES.

(Special Correspondence.)

CHARLOTTE, N. C.—The Carolina Automobile Company has been incorporated at Charlotte by E. A. and C. A. Robbins and others, capital stock $30,000, to deal in, sell, rent or manufacture, automobiles. L.

CHICAGO, ILL.—The Western Telephone Manufacturing Company has been incorporated to manufacture telephone apparatus. The capital is $25,000 and the incorporators are H. E. Anderson, H. E. Simonton and H. P. Simonton.

CAMDEN, N. J.—The Phoenix Meter Company has been incorporated to manufacture meters for water, gas and electric service, with a capital of $60,000. The incorporators are G. H. Hobdell, L. A. Stecklair and G. E. Lucas, of Camden.

NEW YORK, N. Y.—The New York Self-Winding Electric Clock Company has been incorporated to manufacture electric clocks, batteries, etc. The capital is $50,000, and the incorporators are S. W. Livingston, H. A. St. George, C. R. Frazier, New York city.

ANDERSON, IND.—The Welchel Electric Company has filed articles of incorporation with the secretary of state. The capital stock is $25,000, divided into 250 shares of par value of $100 each. The object of the corporation is to establish and equip a factory to manufacture magnetos and general electrical appliances and electric machines and in connection carry on a general repairing business of electrical appliances and machines of all kinds. Bert Welchel, John W. Jones, Albert S. McCall and John Ricks, incorporators. S.

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PERSONAL MENTION.

DR. H. W. WILEY, chief of the United States Bureau of Chemistry, has been awarded the Cross of the Legion of Honor by the French Government.

PROF. F. B. CROCKER, of the electrical department of Columbia University, has obtained leave of absence and will start in October on a trip around the world.

DR. J. FRANKLIN MEYER, formerly professor of physics at the Pennsylvania State College, has resigned from that institution to accept a position with the Westinghouse Lamp Company, Bloomfield, N. J., in charge of the physical research.

F. C. ARMSTEAD, supervising engineer of the stoker department of the Westinghouse Machine Company, who, for a number of years, has been located at East Pittsburg, Pa., has moved his headquarters to the Westinghouse Works, Attica, N. Y., where the stokers are manufactured.

RALPH W. POPE, secretary of the American Institute of Electrical Engineers, arrived in Chicago on August 19, on the Twentieth Century Limited, going directly on to Seattle via the Chicago, Burlington & Quincy and Canadian Pacific Railway. Mr. Pope has been delegated to represent the Institute at the first national conservation congress at the Alaska-Yukon-Pacific Exposition, August 26, 27 and 28. Mr. Pope will also represent the Institute at the joint meeting at the Seattle section of the Institute and the Northwest Electric Light and Power Association September 7, 8 and 9. After this meeting he will visit and address sections at Portland, San Francisco and Los Angeles. He has arranged to meet the members of the Institute at Vancouver, B. C., Salt Lake City and Provo, Utah, and Telluride and Denver, Colo. While at Denver, Mr. Pope will attend the convention of the American Street and Interurban Railway Association and the convention of the Colorado Electric Light, Railway and Power Association. President Stilwell believes that this tour will be of very great benefit to the Institute, and Mr. Pope's present visit will be followed during the coming season by considerable attention to the sections in the Central States. Recently Mr. Pope has attended meetings at Boston and Philadelphia and taken a leading part in the smokers and dinners at Washington, Pittsfield and Schenectady.

OBITUARY.

CHARLES S. KNIGHT, for many years prominently identified with the electrical business throughout the country, died at his home in Fort Wayne, Ind., August 14. In the early '80's Mr. Knight was manager of the Fort Wayne Gas Company. In 1885 he became associated with the late R. T. McDonald in the old Fort Wayne Electric Company and was vice-president and sales manager of that company until 1898, when he removed to Chicago to become general manager of the Siemens & Halske Electric Company. After this company was sold to the General Electric Company, Mr. Knight returned to Fort Wayne and for the past several years devoted his time to his mining interests.

INDUSTRIAL ITEMS.

FRANK W. PARDEE, of 56 Fifth Avenue, Chicago, has just been appointed western agent of the Sundh Electric Company, of 113 Cedar Street, New York city, makers of all kinds of motor controllers, starters and rheostats.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, Chicago, states that the company's business for the first six months of this year was considerably ahead of the business transacted during the same period of 1908. The company's fan business so far this year has been extraordinarily large. The Metropolitan company, which supplies everything electrical, now carries a more complete stock than ever. W. H. McKinlock, the president, anticipates a heavy fall trade, which his company will be well prepared to handle.

THE NERNST LAMP COMPANY, Pittsburg, Pa., in a circular letter over the signature of its president, George Westinghouse, announces that the receivers appointed October 24, 1907, by the Circuit Court of the United States for the Western District of Pennsylvania, were on July 24, 1909, discharged by the same authority. H. T. Herr has been made vice-president, and W. D. Uptegraff vice-president and general manager. Business will, of course, be continued uninterruptedly, and the company's position has been greatly strengthened by the temporary receivership.

DATES AHEAD.

Association of Edison Illuminating Companies. Annual convention, Briarcliff, N. Y., August 31 to September 3, inclusive.

Northwest Electric Light and Power Association. Annual convention and joint session with Seattle branch, A. I. E. E., Seattle, September 7-9.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8-10.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 14-16.

Kansas Gas, Water, Electric Light and Street Railway Association. Next meeting, Wichita, Kan., September 23-24.

Illuminating Engineering Society. Annual convention, New York, N. Y., September 27, 28 and 29.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Railway Signal Association. Annual meeting, Louisville, Ky., October 12-14.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 18.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) August 17, 1909.

931,033. LIGHTNING-ARRESTER. William E. Butler, David City, Neb. Filed July 16, 1908. A bare circuit terminal is separated by an air gap from a grounded body of mercury and by insulating material of small thickness, bridging the gap.

931,034. X-RAY APPARATUS. Eugene W. Caldwell, New York, N. Y. Filed March 5, 1906. An X-ray tube is mounted in front of an impervious shield for the operator.

931,055. AUTOMATIC TELEGRAPH AND SELECTIVE SYSTEM THEREFOR. Alfred C. Gilmore, Chicago, Ill., assignor to James H. Peirce, trustee, Chicago, Ill. Filed October 6, 1904. An electrically-operated step-by-step controller acts in response to the varied number and order of impulses in the different code combinations for effecting the shift of a series of independently shiftable selectors.

931,065. ELECTRICAL INTERRUPTER FOR EXPLOSIVE-ENGINES. Gottlob Honold, Stuttgart, Germany. Filed December 18, 1905. Has one fixed and one movable electrode.

931,066. ELECTROMAGNETIC IGNITER FOR EXPLOSION-ENGINES. Gottlob Honold, Stuttgart, Germany. Filed August 7, 1906. Describes an electromagnetic igniter.

931,068. GALVANIC SOLE. Frank Kennedy and Joseph V. Davis, Bournemouth, England. Filed August 8, 1908. A grid is formed of dissimilar metallic wires.

931,072. AUTOMATIC TELEPHONE-EXCHANGE SELECTOR. Frederick H. Loveridge, Chicago, Ill., assignor to Western Electric Company. Filed August 2, 1906. A carriage, on which is mounted a rotatable contact arm, is adapted to move on vertical guide rods, and means are provided for rotating the contact arm to select one of a series of vertical rows of terminals and to move the carriage to bring the arm to a desired terminal in the selected row.

931,081. PROCESS OF PREPARING STORAGE-BATTERY ELEMENTS. David P. Perry, Chicago, Ill., assignor of two-thirds to William Morrison, Chicago, Ill., and one-third to M. A. Lumbard, Des Moines, Iowa. Filed December 26, 1903. Copper and cadmium are suitably dissolved together and hydrates of the metals precipitated, from which their oxides are prepared and obtained in a suitable support.

931,082. PROCESS OF PREPARING ALKALINE ELECTROLYTES FOR STORAGE BATTERIES. David P. Perry, Chicago, Ill., assignor of two-thirds to William Morrison, Chicago, Ill., and one-third to M. A. Lumbard, Des Moines, Iowa. Filed December 26, 1903. Renewed March 18, 1908. The process consists in placing an alkaline zincate electrolyte in a storage battery, charging the battery, pouring off the solution and washing out the battery, and then replacing the solution thus poured off with an electrolytically purified alkaline solution and then discharging the battery.

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931,092. ELECTROLYTIC PRODUCTION OF MAGNESIUM. George O. Seward and Franz von Kügelgen, Holcombs Rock, Va., assignors to Virginia Laboratory Company, New York, N. Y. Filed March 28, 1906. Magnesium is produced by electrolyzing fused magnesium chloride to which is added enough of a denser alkali-earth chloride to render the bath heavier than the separated magnesium.

931,105. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES. John E. Webster, Pittsburg, Pa., assignor, by mesne assignments, to Westinghouse Electric and Manufacturing Company. Filed September 8, 1908. Comprises a series of commutator disks having a plurality of wedge-shaped blocks or segments, and means for electrically connecting the corresponding segments of the several commutator disks together.

931,114. SYSTEM FOR VAPOR ELECTRIC APPARATUS. Frank Conrad, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 10, 1908. In combination with an alternating-current circuit, and a current-rectifying device, is a transformer interposed between the circuit and the device and embodying means for introducing inductance into both the primary and secondary circuits.

931,115. SYSTEM OF DISTRIBUTION FOR MERCURY-VAPOR RECTIFIERS. Frank Conrad, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed December 6, 1907. Renewed March 8, 1909. Uses a special form of transformer in combination with a rectifying device.

931,116. DYNAMO-ELECTRIC MACHINE. Joseph D. Forrer, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed October 7, 1908. Comprises a stationary frame, a rotatable member having clamping bolts arranged with their center lines parallel to the axis of rotation and an annular member having a cylindrical surface for locking the bolts against independent rotation.

931,124. CURRENT-RECTIFYING APPARATUS. Ray P. Jackson, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed March 9, 1908. A transformer comprising a magnetizable core has two legs, a plurality of coils surrounding each core leg, those occupying intermediate positions being subdivided, and leakage paths of relatively low reluctance between coils.

931,126. CONTROL SWITCH AND SYSTEM. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed December 14, 1908. An electrical switch is provided with a blow-out coil, etc.

931,127. TELEPHONE-TRANSMITTER. Adolph G. Kaufman, New York, N. Y., assignor to American Callaphone Company, New York, N. Y. Filed August 28, 1907. Resilient means are provided whereby a device for vertically adjusting telephone transmitters may be supported, and a sound-insulating means is interposed between the adjusting device and the transmitters.

931,130. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed October 7, 1908. Comprises a number of notched bars or segments radially disposed and separated by relatively short wedge-shaped blocks located adjacent to the notches and electrically connected in longitudinal rows.

931,132. MEASURED-SERVICE AUTOMATIC TELEPHONE-EXCHANGE SYSTEM. Winfield W. Leach, Chicago, Ill., assignor to Rhoda A. Leach, Chicago, Ill. Filed October 15, 1906. Automatic line-switching mechanism is operative upon deposit of a coin.

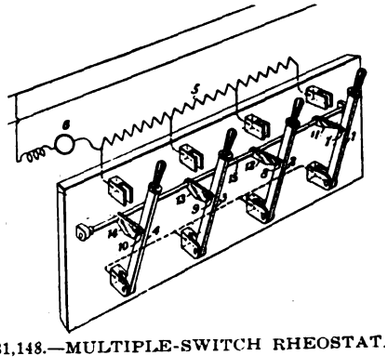
931,133. ARC-LAMP ELECTRODE. George M. Little, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 3, 1907. One electrode contains a material which is a conductor when fused, and the other a granulated alloy of iron and chromium.

931,136. VARIABLE-SPEED ALTERNATING-CURRENT MOTOR. Ralph D. Mershon, New York, N. Y. Filed May 28, 1906. Comprises a primary winding having poles produced therein; a secondary element adapted to have current induced therein corresponding to poles in the primary winding, and capable of inducing other poles in the primary winding; means for closing the circuit or circuits of current induced in the primary winding; and means for regulating such induced current or currents.

931,138. PRIVATE BRANCH INTERCOMMUNICATING TELEPHONE SYSTEM. James L. McQuarrie, Oak Park, Ill., assignor to Western Electric Company. Filed November 23, 1907. Switching mechanism at each station connects the telephone set of that station to the trunk line and controls the magnetization or demagnetization of a differential relay.

931,148. MULTIPLE-SWITCH RHEOSTAT. Otto S. Schairer, Pittsburg, Pa., assignor, by mesne assignments, to Westinghouse Electric and Manufacturing Company. Filed November 8, 1907. Comprises a series of independently actuated switches, and interconnected dogs mounted for rotative movement to prevent each switch, except the first of the series, from closing unless the next preceding switch is closed.

931,150. WINDING OF ARMATURES FOR ALTERNATING-CURRENT MOTORS. Bennet C. Shipman, Baltimore, Md. Filed January 29, 1906. An auxiliary winding for the armature has sections which are independent and symmetrically disposed, and serve as connections from the junctions of the sections of the main armature winding to the commutator.



931,148.—MULTIPLE-SWITCH RHEOSTAT.

931,156. WINDING FOR DYNAMO-ELECTRIC MACHINES. Hans C. Specht, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed July 26, 1906. In an induction motor are a relatively slow speed winding, and an auxiliary winding adapted to produce a fraction of the number of poles produced by the slow speed winding and having one end connected to an intermediate point in the slow speed winding.

931,157. ELECTRIC SELF-WINDING CLOCK. Jacob Steiger and James Besancon, La Chaux-de-Fonds, Switzerland. Filed February 11, 1907. Is automatically wound by an electric motor.

931,162. ADJUSTABLE DROP-LIGHT BRACKET. Perry L. Tenney, Alameda, Cal. Filed October 31, 1908. Has an S-shaped friction wire-engaging member mounted on an arm secured to the lamp holder.

931,168. ARC-LAMP. Samuel P. Wilbur, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 28, 1906. A cut-out switch establishes a circuit in shunt to the arc, and a magnetic winding maintains the switch in closed position when the electrodes are separated.

931,169. ELECTRODE FOR ARC-LAMPS. Samuel P. Wilbur, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 28, 1906. A tubular arc lamp electrode of uniform diameter from end to end is provided with lateral apertures adjacent to one end and with a hood that surrounds the apertured end.

931,175. SAFETY ELEVATOR MECHANISM. Harry O. Barnes, Lansing, Mich. Filed February 18, 1909. Comprises a main electric circuit, an alarm in this circuit, a shunt circuit to cut out the alarm, an elevator car, means carried by the car to open and close the shunt circuit, doors, and means carried by the doors to open and close the shunt circuit.

931,179. TELEPHONE DESK-STAND. Jules A. Birsfield, Chicago, Ill., assignor to Alfred Stromberg, Chicago, Ill. Filed October 24, 1906. A telephone desk stand includes a tubular shaft, a cap piece threaded upon the shaft, and a hook-supporting cross member in the cap and locked by the engagement therewith of the end of the shaft.

931,188. ADVERTISING-SIGN. James W. Ellis, Denver, Colo., assignor to the Ellis Electric Sign Company. Filed July 28, 1908. Describes the details of an electric-lamp sign device.

931,202. SWITCH-KEY. Newman H. Holland, Chicago, Ill., assignor to Western Electric Company. Filed November 23, 1907. An additional contact, or contacts, is, or are, depressed by a main plunger when the latter is partly depressed.

931,205. CONTROL SYSTEM AND SWITCH. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed December 14, 1908. In combination with separable contact terminals is a blow-out magnet with a movable armature or core.

931,231. MOUNTING FOR TELEPHONE INSTRUMENTS. Herbert E. Shreeve, Wyoming, N. J., assignor to American Telephone and Telegraph Company. Filed August 21, 1908. A back-plate secured to the casing is provided at one end with a suspending means and at the other with an angular portion extending over the side of the casing, and a handle is attached to the angular portion.

931,242. AUTOMATIC POLE-CHANGER. Frank H. Williams and Charles W. Welch, Greene, N. Y. Filed March 8, 1907. De-

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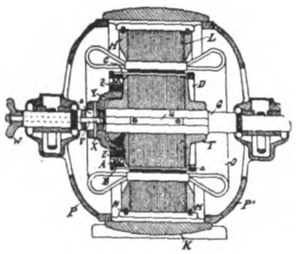
scribes in detail a pole-changing apparatus for the signaling circuit of a telephone system.

931,264. CIRCUIT-BREAKER. Robert L. Browne and Alexander R. Howell, New York, N. Y. Filed May 11, 1906. A liquid column of low conductivity connects two of a number of conductors and is adapted to divide the current passing therethrough until the path through one of the conductors is broken, and to be volatilized by the current after the path is broken, and an insulating substance is adapted to displace the liquid column upon the volatilization of the latter and to open the circuit.

931,281. ELECTRICAL MUSICAL INSTRUMENT. George H. Davis, Llewellyn Park, West Orange, N. J. Filed June 3, 1903. A note-selecting device comprises a longitudinally movable bar carrying a number of selector fingers and a contact member common to all of these fingers and with which they are adapted to make contact, and means for moving the bar longitudinally relatively to the contact member.

931,292. TROLLEY AND SUPPORT THEREFOR. Samuel S. Goldman, St. Louis, Mo., assignor of one-fourth to Charles J. Malecek, St. Louis, Mo. Filed September 14, 1908. The harp has a pair of side arms in which is mounted a shaft provided with an oil duct; a journal sleeve carried by the shaft has a convex external surface and is provided with an oil duct in communication with the oil duct in the shaft; and a trolley wheel is provided with a box surrounding the journal sleeve and having a concave journal surface for contact with the convex surface of the journal sleeve.

931,301. TROLLEY-WIRE HANGER. Roland B. Heimbecker, Wilkinsburg, and Samuel R. M. Orum, Philadelphia, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed February 24, 1908. Comprises a rod, a single-piece gripping member having crossed integral jaws, and means for producing a clamping action between the jaws.



931,302.—INDUCTION MOTOR.

931,302. INDUCTION MOTOR. Rudolf E. Hellmund, Pittsburg, Pa., assignor to Hellmund-Collbohm Electric Company. Filed December 4, 1907. Describes a form of squirrel-cage motor.

931,307. PRIVATE-BRANCH INTERCOMMUNICATING TELEPHONE SYSTEM. Newman H. Holland, Chicago, Ill., assignor to Western Electric Company. Filed November 23, 1907. A single-ringing key at each of two or more of the stations applies ringing current to the local circuits and also serves as a transfer key to produce circuit connections for maintaining the circuit for direct current on the trunk line when the telephone set at a particular station is connected to the trunk line.

931,330. TELEPHONE-EXCHANGE SWITCHBOARD APPARATUS. James L. McQuarrie, Oak Park, Ill., assignor to Western Electric Company. Filed March 8, 1906. A line-signal magnet has two windings, one in each line conductor, disposed in close inductive relation to each other, and a connection switch is adapted to establish a second telephone circuit in shunt in one of the windings. The windings are included in the talking circuit and connected to neutralize one another with respect to telephone currents in the united circuit flowing through the magnet.

931,331. TELEPHONE-KEY. James L. McQuarrie, Oak Park, Ill., assignor to Western Electric Company. Filed November 23, 1907. In combination with a number of spring-retracted plunger rods, each provided with a contact operating plunger, are contacts individual to each plunger and arranged to be operated thereby, a plate co-operating with the plungers for locking the plunger rods, a contact common to the plunger rods, and a second plate movable by the plungers to control the common contact.

931,336. PROCESS AND APPARATUS FOR PRODUCING DIRECT CURRENTS HAVING LIMITED STRENGTH. Menahem M. Osnos, Frankfort-on-the-Main, Germany, assignor to firm of Felten & Guilleaume-Lahmeyerwerke Actien-Gesellschaft, Frankfort-on-the-Main, Germany. Filed October 29, 1907. A direct-current dynamo has an over-compensating coil and a second coil for regulating the action of the first coil, and means whereby the electromotive-force produced in the armature by the over-compensating coil opposes the flow of current in the main field upon an increase of the working current.

931,345. TROLLEY-CLAMP. Edward E. Rose, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 6, 1907. Renewed June 24, 1909. Has a pair of detachably hinged jaws with projecting shanks forming a screw-threaded tapered sleeve into which is screwed a hanger rod to separate the shanks.

931,353. TROLLEY-HANGER. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 1, 1905. A supporting hanger for an electrical conductor comprises an extensible body member having a screw-thread upon its lower end, a pair of clamping jaws having external screw-threads, and an internally threaded sleeve which engages the body member and the jaws.

931,354. OVERHEAD-LINE CONSTRUCTION FOR ELECTRIC RAILWAYS. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 5, 1907. Trolley conductor clamps are situated at the respective ends of longitudinally disposed insulating bars and a metal-clamping means supports and spaces the bars in pairs from the wire or cable.

931,355. TROLLEY-CLAMP. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 6, 1907. Comprises a cup having end walls and downwardly and inwardly tapering side walls, a pair of jaws having flaring shanks the ends of which are located in the cup, and a hanger rod adapted both to force the jaws together and to suspend the cup.

931,356. TROLLEY-HANGER. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed March 9, 1908. A hanger for electric lines comprises two clamping members and two hinge-connected links which are respectively hinge-connected to the clamping members.

931,357. TROLLEY-CLAMP. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed November 6, 1908. A trolley wire clamp comprises two hinge-connected members forming jaws at one side and a double-tapering split socket at the other side of the hinge-connections, and means adapted to engage the tapering walls of the socket to close the jaws.

931,358. TROLLEY-HANGER. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed December 31, 1908. Two hinge-connected members are interposed between two relatively offset clamps and means are provided for limiting relative movement of the hanger to a small angle in the plane of the clamps.

931,366. TROLLEY-HANGER AND CLAMP. Christian Aalborg, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 9, 1907. The hanger comprises a rod, two complementary members having hollow body portions and jaws and provided with segmental sleeve projections to embrace the rod, and means co-operating with the rod to force the jaws toward each other.

931,367. HANGER AND CLAMP FOR WIRES AND CABLES. Christian Aalborg, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 9, 1907. The hanger comprises a rod, two complementary jaw members, one of which has a hollow body portion and a beveled outer end surface and the other of which has a projection located within the hollow body portion and into which the end of the rod is screwed, and a nut mounted on the rod to engage the beveled end surface.

931,368. CLAMP FOR TROLLEY-CONDUCTORS. Christian Aalborg, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 9, 1907. Has a hanger rod, a clamping member with side wings to engage the inclined outer surfaces of the complementary end projections of interchangeable jaw members, and means to draw the latter and the clamping member toward each other in order to produce a clamping action between the jaws.

931,375. DYNAMO-ELECTRIC MACHINE. Bernard A. Behrend, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company and Allis-Chalmers Company. Filed September 19, 1904. Describes a form of high-speed rotating-field dynamo-electric machine.

931,377. AUTOMATIC FIRE-ALARM. Pietro Bonini, New York, N. Y. Filed August 13, 1908. Describes a form of thermostat.

931,380. PUSH-BUTTON APPARATUS. Ralph D. Burk, New York, N. Y. Filed October 4, 1907. Comprises a manually-operated, normally spring-retracted, push-button device, acting in co-operation with a ratchet and a magneto.

931,384. MOTOR-CONTROLLER. Herbert W. Cheney, Norwood, Ohio, assignor to Allis-Chalmers Company. Filed February

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29, 1908. A rotatable drum having off, starting and running positions is provided with means for releasing it from the spring that tends to move it back from the starting to the off position.

931,385. SECTION-INSULATOR. Henry B. Clarke, Highland Park, Ill. Filed May 21, 1906. Describes a section insulator for trolley wires.

931,390 and 931,391. TROLLEY-CLAMP. Harry P. Davis, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed October 5, 1907. Describes a kind of jaw clamp for wires or cables.

931,392. TROLLEY-HANGER. Harry P. Davis, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 10, 1908. A triangular supporting frame has cable clamps at two corners, a sleeve member at the other corner and means for suspending a gripping sleeve in the sleeve member to permit a certain amount of play.

931,393. TROLLEY-CONDUCTOR HANGER. Harry P. Davis, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed December 14, 1908. In combination with a messenger wire or cable and a trolley conductor, are a cable clamp, a trolley-conductor clamp comprising a pair of interchangeable jaw members having shanks projecting therefrom to form a loop and a single link pivotally secured to the cable clamp and interlinked with the trolley-clamp.

931,397. TROLLEY-HANGER. George B. Dusinberre, Cleveland, Ohio, assignor to Westinghouse Electric and Manufacturing Company. Filed September 9, 1907. Comprises two jaw members having interlacing teeth and divergent sides, clips which embrace the upper edges of these members, and means for preventing accidental removal of the clips.

931,398. TROLLEY-HANGER. George B. Dusinberre, Cleveland, Ohio, assignor to Westinghouse Electric and Manufacturing Company. Filed December 9, 1907. A clamp is provided for the trolley wire and a gripping device for the supporting wire, also a single fastening means for the clamp and the gripping device.

931,399. CABLE-HANGER CLAMP. Samuel B. Dusinberre, Pittsburg, Pa., and George B. Dusinberre, Cleveland, Ohio, assignors to Westinghouse Electric and Manufacturing Company. Filed December 9, 1907. Comprises a bar having a longitudinal slot, and a leverage member having a neck located in the slot, also a head provided with means for preventing enlargement of the slot.

931,400. TROLLEY-HANGER. George B. Dusinberre, Cleveland, Ohio, assignor to Westinghouse Electric and Manufacturing Company. Filed February 25, 1908. In combination with a pair of crossed bell crank levers having interlacing jaw teeth are means for exerting pressure upon both arms of these levers to close the jaws.

931,404. SYSTEM OF ELECTRICAL DISTRIBUTION. Budd Frankenfield, Norwood, Ohio, assignor to Allis-Chalmers Company, and to the Bullock Electric Manufacturing Company. Filed March 30, 1907. A number of motors are mechanically connected to rotate at proportional speeds and to drive a common load and having their armatures connected in parallel, and a shunt field winding for each of these motors is connected in series with a shunt field winding of another of the motors.

931,408. LIGHTNING-ARRESTER. William Gifford, Traverse City, Mich. Filed July 24, 1908. Has an impedance coil provided with a core of magnetic material, which core is included in the circuit between the line and the instrument to be protected, and an air gap is included in a ground branch connected to the line on the line side of the impedance coil.

931,412. GAS-LAMP LIGHTING AND EXTINGUISHING SYSTEM. August Grossmann, Rheydt, Germany, assignor to Kabelwerk Rheydt Actien-Gesellschaft, Rheydt, Germany. Filed December 16, 1908. A spark gap for each burner is included in the secondary circuit of an induction coil, and electromagnetic means are provided for sending a number of consecutive impulses through the conductors.

931,415. BRUSH-HOLDER FOR MOTORS. Harry C. Grant, Bayonne, N. J., assignor to the Lionell Manufacturing Company. Filed January 22, 1908. Has a yoke-shaped member of spring sheet metal and a brush-holding member also of sheet metal and engaged with the yoke member, the engagement permitting a rocking of the brush-holding member relative to the yoke member.

931,416. ELECTRIC MOTOR. Harry C. Grant, Bayonne, N. J., assignor to the Lionell Manufacturing Company. Filed January 22, 1908. Describes a compact form of small two-pole motor.

931,417. ELECTRIC TOY MOTOR. Harry C. Grant, Bayonne, N. J., assignor to the Lionell Manufacturing Company. Filed June 6, 1908. A cover supported by the frame has a disk with a projection on it adjustable relative to the cover, and a gear wheel carried by the disk and engaging a gear wheel on the armature shaft.

931,425. TELEGRAPH AND TELEPHONE POLE. John H. Hile, Belton, Ark. Filed August 4, 1908. Describes a form of composite pole of metal rods supported on a plastic base.

931,427. ELECTRIC GAS-IGNITING DEVICE. Henry Jameson, Joplin, Mo. Filed June 17, 1908. Describes a jump-spark ignition device.

931,445. ELECTROMAGNET-COIL CONSTRUCTION. Abbot A. Low, Horseshoe, N. Y., assignor to Abbot A. Low, Horseshoe, N. Y., Maurice J. Wohl, New York, N. Y., and Harry Hertzberg, Brooklyn, N. Y., trustees. Filed December 12, 1908. The coil is wound with alternate turns of copper wire and aluminum wire, one partially inclosed by the other.

931,448. DYNAMO-ELECTRIC MACHINE. Emil Mattman, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed January 30, 1909. The rotor has an armature winding, commutator segments, and flat commutator leads connecting the former with the latter, the planes of these leads making an angle with the axis of rotation.

931,452. TELEPHONE-TRANSMITTER MOUTHPIECE. Robert E. Miller, Dayton, N. M. Filed September 24, 1908. A screened space is provided for disinfecting material.

931,464. METERING PANEL-BOARD. Arthur C. McWilliams, Chicago, Ill. Filed June 29, 1907. Two rows of electrically connected sockets (with a contact for each) extend alternately to opposite sides of the board, the contacts being arranged in rows transverse to the rows of sockets and the contacts of a single row belonging to two different groups, the members of a group being electrically connected together.

931,476. INCLOSED FUSE. Frederick P. Poole, Bridgeport, Conn., assignor to the Bryant Electric Company. Filed July 8, 1908. Has a sheath with conductors and between the conductors a link in accordion-like folds lengthwise of the link.

931,477. INCLOSED FUSE. Frederick P. Poole, Bridgeport, Conn., assignor to the Bryant Electric Company. Filed December 17, 1908. Has a sheath with conductors and between the conductors a link piece, the edges of which are cut away to form a fusing point, intermediate the ends and the latter rolled.

931,478. INCLOSED FUSE. Frederick P. Poole, Bridgeport, Conn., assignor to the Bryant Electric Company. Filed December 17, 1908. Comprises a sheath with conductors and between the conductors a link having its edges lengthwise of its axis rolled up to form, in cross-section, a figure 8, the conductors serving to close the ends of the chambers in the link so formed.

931,507. INSULATOR FOR ELECTRIC WIRES. Aaron V. Siler, Newark, Ohio, assignor of one-half to Andrew Jasper Siler, Massillon, Ohio. Filed June 9, 1909. The body has therein a slot with a convex bottom between which and pins projecting through from the side of the body is gripped the line wire.

931,513. ELECTRODE. Heinrich Specketer, Griesheim, Germany, assignor to Chemische Fabrik Griesheim Electron, Frankfort-on-the-Main, Germany, a corporation of Germany. Filed March 21, 1907. Describes a process of manufacturing electrodes for electrolytic purposes which consists in adding to molten triferrous tetroxide, while it is still in a liquid state, such metal oxide as will result in forming a homogeneous crystallizing melt, and pouring the mixture into suitable molds, allowing it to cool and solidify superficially, inserting in the center molten portion of the mass a rod of good conducting material and then permitting the mass to harden.

931,518. ELECTRICAL APPLIANCE. James S. Stewart, New York, N. Y., assignor to Annie Stewart, New York, N. Y. Filed January 29, 1908. Describes a form of terminal device.

931,521. OUTLET-BOX CONSTRUCTION. Emmett W. Stull, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed April 15, 1909. Describes an outlet box for electric cars.

931,540. ELECTROMAGNET-COIL CONSTRUCTION. Maurice J. Wohl, New York, and Harry Hertzberg, Brooklyn, N. Y., assignors to Abbot A. Low, Horseshoe, N. Y., Maurice J. Wohl, New York, N. Y., and Harry Hertzberg, Brooklyn, N. Y., trustees. Filed April 21, 1908. A solenoid or coil adapted for use in an arc lamp is wound with aluminum wire and comprises a number of layers, insulation between the layers consisting of a composite strip which has a central layer of insulating material and outer layers of readily combustible material.

931,541. ELECTROMAGNET-COIL CONSTRUCTION. Maurice J. Wohl, New York, and Harry Hertzberg, Brooklyn, N. Y., assignors to Abbot A. Low, Horseshoe, N. Y., Maurice J. Wohl, New York, N. Y., and Harry Hertzberg, Brooklyn, N. Y., trustees. Filed November 18, 1908. Describes a method of mak-

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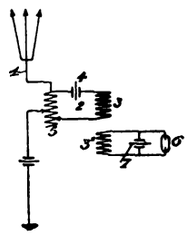
ing an electromagnet coil which consists in winding a number of layers, each layer having successive turns of a conducting winding alternately positioned with successive turns of an insulator, and successively winding upon the layers a composite strip comprising a central layer of insulating material and outer layers of combustible material.

931,542. ELECTROMAGNET-COIL CONSTRUCTION. Maurice J. Wohl, New York, and Harry Hertzberg, Brooklyn, N. Y., assignors to Abbot A. Low, Horseshoe, N. Y., Maurice J. Wohl, New York, N. Y., and Harry Hertzberg, Brooklyn, N. Y., trustees. Filed November 18, 1908. Describes a method of making an electromagnet coil which consists in winding a number of layers, each layer having successive turns of a conducting winding positioned within an insulating winding, and successively winding upon the layers a composite strip comprising a central layer of insulating material and outer layers of combustible material.

931,547. RENT-COLLECTING MEANS FOR TELEPHONE SERVICE. Richard Yearneau, Clark, S. D. Filed October 8, 1908. An electrically controlled toll mechanism.

931,548. ANNUNCIATOR-BOARD. Julius Zickel, Berlin, Germany. Filed January 14, 1909. A series of electromagnets is arranged in a circle. Annunciator disks associated with the magnet armatures are journaled in circularly arranged bearings.



931,586.—RECEIVER FOR WIRELESS TELEGRAPHY AND TELEPHONY.

931,556. DYNAMO-ELECTRIC MACHINE. Herbert A. Balcome and Anton Freier, Boston, Mass., assignors to Holtzer-Cabot Electric Company. Filed February 10, 1908. An enclosing frame is of sheet steel divided in two parts and carries the armature bearings and supports the laminated field.

931,573. CONNECTION-BOARD FOR ELECTRIC MACHINES. John G. Crawford, La Grange, Ill., assignor to Western Electric Company. Filed September 8, 1906. The board is made of two similar castings of insulating material having a series of recesses for terminal lugs that lie freely therein and are held against removal therefrom.

931,586. RECEIVER FOR WIRELESS TELEGRAPHY AND TELEPHONY. Simon Eisenstein, Kiew, Russia. Filed March 27, 1908. Combined with a resonant circuit is a primary receiving transformer coil, a secondary transformer coil outside the circuit arranged to be continuously moved into and out of the field of the primary coil, and a detector connected with the secondary coil.

931,592. TROLLEY-HARP. Thomas A. Gannoe, Warren, Pa., assignor of three-eighths to John Schmutz, Warren, Pa. Filed April 1, 1908. The pressure between the trolley wheel and overhead wire normally keeps a wheel guard depressed.

931,594. FLAME INDICATOR FOR FURNACES. Frederick Gelstharp, Ford City, Pa. Filed December 26, 1908. An electric circuit is closed when its terminals in the furnace are in contact with a reducing atmosphere and broken when the terminals are surrounded by an oxidizing atmosphere.

931,604. SIGNAL DEVICE. Henry J. Heeney, Boston, Mass., assignor to Holtzer-Cabot Electric Company. Filed October 10, 1907. A fire-alarm box has a glass door which must be broken before the electric alarm can be actuated.

931,605. ELECTRICALLY-HEATED GRATE. Marcus Hermansen and Andrew Tygerson, Ephraim, Utah. Filed May 11, 1908. Between two pipes containing the heating coils are transverse rods forming the grate.

931,606. DYNAMO-ELECTRIC MACHINE. Fritz E. Hirt, Milwaukee, Wis., assignor to Allis-Chalmers Company. Filed May 1, 1909. Describes the construction of the collector rings and connections thereto from the windings through an end cover for the projecting portions of the winding.

931,613. TRAIN-LIGHTING SYSTEM. Dugald C. Jackson, Madison, Wis., assignor to Dugald C. Jackson and William B. Jackson, Madison, Wis. Filed May 5, 1906. In connection with an axle-driven alternating-current generator is a rotary converter for charging storage batteries that carry the lighting load of the train and also operate the converter from the direct-current end when the generator has stopped, or is running below speed, until it has attained the speed again where it automatically synchronizes with the converter.

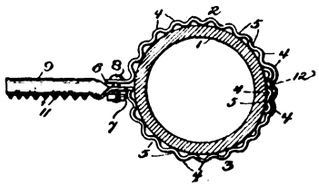
931,617. ELECTRIC TIME-SWITCH. James Jones and James Jones, Jr., New York, N. Y. Filed March 10, 1908. Two cam-disks connected with the clock mechanism operate hammer levers that release the spring switch.

931,620. DYNAMO-ELECTRIC MACHINE. Walter S. Kelley, Brookline, Mass. Filed February 10, 1908. The field structure of a multipolar machine is laminated and held together between two annular end frames that are secured by bolts passing through tubes across the laminas.

931,632. ELECTRIC SIGNALING. Johann Mlâdek, Prague, Austria-Hungary. Filed April 19, 1907. In telegraphy by induced currents of opposite polarity the receiver has a sensitive easily springing contact device arranged in its core.

931,661. TELEGRAPH-POLE ARM. Lee Tyreman, Stroudsburg, Pa., assignor of one-half to William H. Lawell, Stroudsburg, Pa. Filed October 15, 1908. The cross arm is made of a channel iron having pivoted clamping members passing around the pole and swinging in between the flanges of the channel when not in use.

931,704. SUPERVISORY SIGNAL SYSTEM. Charles F. Patterson, New York, N. Y. Original application filed June 14, 1906. Divided and this application filed January 17, 1907. Relates to the supervisory signals of a telephone switchboard.



931,706.—ELECTRIC GROUND-CLAMP.

931,706. ELECTRIC GROUND-CLAMP. Frank Stevens, Philadelphia, Pa., assignor to George F. Stevens, Philadelphia, Pa. Filed June 4, 1908. A ground clamp for attachment to pipes comprises two corrugated sections, a bolt securing the ends of the sections together, a tubular socket on one of the sections for the reception of the conductor wire, and teeth on the socket member for biting the wire.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired August 23, 1909:

481,220. ELECTRIC MOTOR AND GENERATOR. C. S. Bradley, Avon, N. Y., and J. J. Wood, Fort Wayne, Ind.

481,223. SHIP'S TELEGRAPH. A. B. W. H. Cords, Hamburg, Germany.

481,246. THERMAL CUT-OUT. A. P. Seymour, Syracuse, N. Y.

481,247. TELEGRAPHY. J. G. Smith, New York, N. Y.

481,284. TELEPHONE. A. Rettig, Saarbrucken, Germany.

481,285. SHADE FOR INCANDESCENT ELECTRIC LAMPS. C. J. Salick and E. Sipp, Watertown, Wis.

481,288. REFLECTING SHADE FOR INCANDESCENT ELECTRIC LAMPS. L. T. Stanley, Brooklyn, N. Y.

481,291. ELECTRIC WATER HEATER. T. Ahearn, Ottawa, Canada.

481,297. ELECTRIC SWITCH. J. H. Clark, Boston, Mass.

481,386. ELECTRIC ELEVATOR. Wm. Baxter, Jr., Baltimore, Md.

481,401. TROLLEY FOR ELECTRIC RAILWAYS. W. F. Jenkins, Richmond, Va.

481,402. TROLLEY FOR ELECTRIC-RAILWAY CONDUITS. W. F. Jenkins, Richmond, Va.

481,403. CONDUIT FOR ELECTRIC RAILWAYS. W. F. Jenkins, Richmond, Va.

481,430. PNEUMATIC ELECTRIC-CIRCUIT CONTROLLING AND INTERLOCKING APPARATUS. W. W. Slater and H. C. Barnes, Oakland, Cal.

481,457. INSULATOR. A. J. Wylie, Rome, N. Y.

481,483. TELEPHONE SYSTEM. R. N. Dyer, East Orange, N. J.

481,529. TELEPHONY. J. W. Gibboney, Lynn, Mass.

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CONTENTS.

EDITORIAL:
Rates for Boston Street Lamps . . . 411
Output of a Hydroelectric Plant . . . 412
Going Value . . . 413
The Equipment of the Hotel La Salle . . . 413
Power Used in the Re-Manufacture of Lumber with Special Reference to Central-Station Energy for that Purpose . . . 414
Coney Island & Brooklyn Railroad . . . 416
Production of Coal in 1908 . . . 417
Telegraphers in Convention . . . 417
The Electrical and Mechanical Installation in the Hotel La Salle . . . 418
Ethyl Alcohol from Wood Waste . . . 425
Details of Watt-Hour Meter Manufacture.—IV . . . 426
To Help American Exports . . . 428
Important Electrical Papers at the British Association's Convention . . 428
Boston Electrical Show . . . 429
Public Service Investigation . . . 429
Japanese-British Exhibition . . . 429
Telephones in Brazil . . . 429
German Taxes on Electric Lamps . . . 430
Brooklyn Rapid Transit Company's Annual Report . . . 430
Navy Department Supplies . . . 430
Aluminum Casting Foundries Merged . . . 431
American Exposition, Berlin, 1910 . . . 431
New Electrical Industry for South Africa . . . 431
Reports on Electric Meters . . . 432
New York Service Board to Exhibit . . . 432
No All-Red Cable Line . . . 432
Reduction in St. Louis Lighting Rates . . . 432
Chicago Adopts a Systematic Scheme of House Numbering . . . 433
Installing Telephones for Train Dispatching . . . 433
Western Society of Engineers . . . 433
QUESTIONS AND ANSWERS . . . 434
To Test Improved Wireless . . . 435
$5,000,000 Telephone Company . . . 435
Western Union-American Telephone . . . 435
FINANCIAL REPORTS OF ELECTRICAL COMPANIES . . . 436
General Electric's Earnings Helped by Steadiness of Prices . . . 437
Attach Waterpower Rights . . . 437
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE . . . 438
Youngest Town in the Country Has Electric Light and Power Plant . . 439
INDUSTRIAL SECTION:
The Elliott Mechanical Stoker . . . 440
The Middleton Magnetic Fault Finder . . . 441
The Westinghouse Core-Loss Voltmeter . . . 442
Twenty-four-Hour Service at Appleton, Minn . . . 442
Wagner Generators and Synchronous Motors . . . 443
Electric Motor Boats . . . 443
Lagonda Automatic Cut-Off Valve . . . 444
Successful Buckeye Conference . . . 444
CURRENT ELECTRICAL NEWS . . . 445
RECORD OF ELECTRICAL PATENTS . . . 452

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RATES FOR BOSTON STREET LAMPS.

In the recent Boston contract for electric street lighting the rate paid by the city per lamp is made up of a fixed annual cost and a running cost per hour of operation, as set out in that document.

Added interest attaches to this method of making rates because it also applies in more than a score of other cities and towns that are supplied by the Edison Company, in some of which the hours of operation for street lamps are less than one-half as great annually as they are in Boston.

The rates named in the Boston contract apply to forty, sixty and eighty-candlepower tungsten lamps, and to 425-watt alternating-current, to 500-watt direct-current, to 500-watt magnetite and to 500-watt General Electric flame arc lamps.

Each of these lamps operates 3,828 hours per year, and the total rate as computed is subject to a discount of five per cent because of the length of the contract.

The fixed yearly rate is $10.80 for the forty-candlepower, $12 for the sixty, and $14 for the eighty-candle tungsten lamp. On the 425-watt alternating-current arc lamp and on the 500-watt enclosed direct-current arc the fixed rate is $36 per year, while on both the magnetite and the General Electric flame arc it is $42 per year.

The running cost to the city per hour of operation is 0.25 cent for the forty-candle, 0.30 cent for the sixty-candle, and 0.40 cent for the eighty-candle tungsten lamp; also 1.5 cents for the alternating-current arc, 1.6 cents for the direct-current enclosed arc, 1.75 cents for the magnetite arc, and 3.2 cents for the flame arc.

For the 3,828 hours of operation the above fixed and running costs, less five per cent, amount to the following total annual rates per lamp: Forty-candlepower tungsten, $19.55; sixty-candlepower tungsten, $22.31; eighty-candlepower tungsten, $27.85; 425-watt alternating-current arc, $88.75; 500-watt enclosed direct-current arc, $92.39; 500-watt magnetite arc, $103.54; 500-watt General Electric flame arc, $156.27.

On the basis of 3,828 hours of operation per year, the fixed rate for the forty-candlepower tungsten is 0.28 cent and its total rate is 0.53 cent per lamp-hour. For the sixty-candlepower tungsten lamp the fixed rate is 0.31 cent and the total rate 0.61 cent per lamp-hour, while for the eighty-candlepower the fixed rate is 0.36 cent and the total 0.76 cent.

With the same number of hours, the 425-watt alternating-

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current arc has a fixed rate of 0.94 cent and a total rate of 2.44 cents per hour of operation, the 500-watt enclosed direct-current arc has a fixed rate of 0.94 cent and a total rate of 2.54 cents per hour, the magnetite arc a fixed rate of 1.09 and a total rate of 2.84 cents per hour, and the flame arc a fixed rate of 1.09 and a total rate of 4.29 cents per hour.

A division of the total rate per lamp-hour in each case by the fraction of a kilowatt required to operate the lamp gives the following total rates in cents per kilowatt-hour: Forty-candlepower tungsten, 10.64 cents; sixty-candlepower tungsten, 7.66 cents; eighty-candlepower tungsten, 7.65 cents; 425-watt alternating-current arc, 5.74 cents; 500-watt direct-current arc, 5.08 cents; 500-watt magnetite, 5.69 cents; 500-watt flame arc, 8.59 cents.

With a small number of operating hours yearly, the fixed rates per lamp-hour and the total rates per kilowatt-hour, of course, increase, as the fixed annual rate in all cases remains the same.

Thus with only 1,600 hours of annual operation, the fixed rate per hour is 0.67 cent, and the rate per kilowatt-hour is 18.40 cents, for a forty-candle tungsten lamp, while the fixed rate is 0.75 cent and the rate per kilowatt-hour 13.12 cents, for a sixty-candle lamp.

On a 425-watt alternating-current arc lamp in use 1,600 hours annually, the fixed rate amounts to 2.25 cents per lamp-hour, and the rate per kilowatt-hour is 8.82 cents.

OUTPUT OF A HYDROELECTRIC PLANT.

Two variable factors affect the output of a hydroelectric plant, namely, the run of the river and the demand for electric power.

Only when this demand and the run of water correspond to the generator capacity can the station operate at full load.

Results on different streams vary with the local conditions, but a record of the output of one plant, together with the main factors of the situation, gives more or less indication of what can be done at others. Such a record is here presented for a hydroelectric plant that generated approximately one-half of the energy distributed by the electrical supply system in an important city, during a number of years. This hydroelectric plant and the steam-driven station and distributing system in the city are all owned in common, so that it is for the interest of the lighting company to use the waterpower as far as practicable.

A river of only moderate volume drives the wheels of this hydroelectric plant, its drainage area above the dam is about 570 square miles and contains 3,400 acres of storage surface in ponds and reservoirs, and this storage is regulated to some extent for the benefit of all the waterpower plants on the stream. The average rainfall over the drainage area of this river is about forty-five inches annually, with not less than ten inches in each of the four seasons.

At the hydroelectric plant in question the fall of this river at ordinary stages is twenty-three feet, and the flow is estimated at 290 cubic feet per second for the minimum and about 24,000 cubic feet for the maximum, that has occurred only once in half a century. The ordinary flow during ten months in the year is put at about 450 cubic feet per second, but the discharge rate is often greater than this figure.

The hydroelectric plant with an operating head of twenty-three feet was equipped with alternators of 1,500 kilowatts total capacity, and also with an equal capacity in transformers to step up the voltage for a transmission of about eleven miles. At the substation in the city where the energy from this plant was distributed another set of transformers reduced the voltage to about 2,300.

With a combined efficiency of seventy-one per cent for the waterwheels and electric generators in this plant, which is probably as much as could be expected on the average, 1,080 cubic feet of water per second is necessary for operation at the full load of 1,500 kilowatts. This requirement at full load of 1,080 cubic feet of water per second is 3.7 times the reported minimum flow of 290 cubic feet, and 2.4 times the ordinary flow of 450 cubic feet per second during ten months of the year.

If the efficiency of the step-up and step-down transformers and of the transmission line together be assumed at eighty-five per cent under full load, it would be possible to deliver 1,275 kilowatts in the form of 2,300-volt current at the substation, when the generators are delivering 1,500 kilowatts in the hydroelectric station.

The output of the hydroelectric plant in this case was measured on the 2,300-volt side of the transformer at the substation, so that the load factor may be computed on the possible delivery of energy at this substation with operation twenty-four hours per day at full load, if the above efficiency of transmission or some other be assumed.

During the first year of operation the run of the river was low and the total energy delivered at the substation from the 1,500-kilowatt hydroelectric plant amounted to an average load of 410 kilowatts for 8,760 hours. This average load amounts to 27.3 per cent of the 1,500 kilowatts capacity at the hydroelectric plant. In the following year more water came down stream, and the substation received 550 kilowatts on an average during the 8,760 hours, or 36.6 per cent of the generator capacity at the waterpower.

An average delivery of 756 kilowatts was made to the substation from the waterpower during the 8,760 hours of the following year, or 50.4 per cent of the capacity of the alternators. For the fourth year of operation the average power received at the substation over the transmission line amounted to 801 kilowatts on a twenty-four-hour basis, and this was 53.4 per cent of the rated generator capacity. During the fifth and last year here recorded the waterpower furnished an average of 769 kilowatts at the 2,300-volt switches in the substation, or 51.2 per cent of the capacity of the generators at the other end of the line.

For the five years together the average load on a twenty-

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four-hour basis carried by the waterpower, as measured at the substation, was 657 kilowatts, with a variation of the average from 410 to 801 kilowatts in the different years. This average for the five years was 43.8 per cent of the generator capacity at the hydroelectric station.

As this generator capacity required 3.7 times the minimum run of the river for its operation at full load, the average delivery of 43.8 per cent of this capacity at the substation during every hour for five years is an excellent working result. This result was made possible by a large load factor for the electrical supply system that distributed the waterpower, and by the use of storage batteries.

In the second year of the period under consideration, the load factor of the electrical system was sixty-four per cent on a normal June day and forty-seven per cent on a normal December day, on a twenty-four-hour basis, as the result of a large motor load.

The storage battery had a capacity of about 900 kilowatts during five hours, and was used to transfer the unused waterpower to the time of maximum load.

GOING VALUE.

In a number of cases the courts and commissions have affirmed the existence of a "going value" in connection with public-service properties, beyond their mere cost of construction.

This question has come up only within the past score of years, and the first case to award a "going value" on a public-service property sold to a municipality appears to have been National Waterworks *vs.* Kansas City, 62 Federal Reporter, 853, decided in 1894. Here the city exercised its right under a statute to purchase a waterworks, and the commissioners appointed to value the property awarded a sum to the company based merely on the present structural cost of the plant. On appeal from this award by the commissioners, the court increased its amount by $286,000, and gave its reasons thus:

"It is obvious that the mere cost of purchasing the land, constructing the buildings, putting in the machinery, and laying the pipes in the streets—in other words, the cost of reproduction—does not give the value of the property as it is today. A completed system of waterworks, such as the company has, without a single connection between the pipes in the streets and the buildings of the city, would be a property of much less value than that system connected, as it is, with so many buildings, and earning, in consequence thereof, the money which it does earn."

Another case was Gloucester Water Company *vs.* Gloucester, 179 Mass., 365, decided in 1901, where the company exercised its right to sell its property to the city. Commissioners here added a sum for the fact that the plant was "a going concern" to its cost of reproduction, less depreciation, and said that this addition was "as much a part of the property valuation as any other part of it." In affirming this award the court said:

"It is plain that the real, commercial market value of the property of the water company is, or may be, in fact, greater than 'the cost of duplication, less depreciation,' of the different features of the physical plant."

The award of the commissioners for the value of the Holyoke gas and electric plants was made in 1902, and included an item for "going plant." In explanation of this added value for "going," the commissioners said:

"The company, therefore, will turn over to the city these plants, not only with a capacity to earn a profit, but having brought both into a prosperous and profit-paying condition. For this reason we think the value of the property has been enhanced in the market, and have allowed for the same in finding the fair market value."

Kennebec Water District *vs.* Waterville, 97 Maine 185, again presented the question whether an allowance for being a "going concern" should be added to the structural value of a public-service plant, and the court answered in the affirmative, saying:

"Of course, a plant, as such, already equipped for business, is worth more, if the business be a profitable one, than the mere cost of reproduction."

In a later Maine case, Brunswick Water District *vs.* Maine Water Company, 99 Maine, 371, where a company sold its waterworks to a municipality, the court thus stated the existence of going value, after discussing the structure of the plant:

"Nevertheless, it has value as a structure. But more than this, it is a structure in actual use, a use remunerative to some extent. It has customers. It is actually engaged in business. It is a going concern. The value of the structure is enhanced by the fact that it is being used in, and, in fact, is essential to, a going-concern business."

The above cases appear to show a general recognition by courts and commissions of a going value that results from the development of public-service business, and depends to some extent, at least, on the amount and profits of that business.

THE EQUIPMENT OF THE HOTEL LA SALLE.

The new Hotel La Salle, a description of the electrical and mechanical equipment of which may be found on other pages of this issue, has been constructed in record time, notwithstanding the fact that the builders have been inconvenienced by numerous labor difficulties. A great amount of attention has been centered on the building of this hotel for that reason as well as because its power plant is probably the largest and most complete isolated plant in Chicago. The conditions in a hotel of this size are peculiarly suited for an isolated power plant on account of the large amount of steam constantly required for heating and other purposes.

Individual motor drive has been used wherever practicable and some very interesting applications thereof have been made. The lighting fixtures, particularly in the various public rooms, are noteworthy because of the highly effective character of their design. However, it is singular that the management has not provided, to a greater extent, for the use of high-efficiency incandescent lamps for lighting this hotel.

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POWER USED IN THE RE-MANUFACTURE OF LUMBER, WITH SPECIAL REFERENCE TO CENTRAL-STATION ENERGY FOR THAT PURPOSE.[1]

BY C. H. SICOTT.

PART I.

Data are readily available which would furnish material for a number of papers embodying academic and practical phases of the problems involved in applying electric motors to woodworking machinery, and the manifold advantages resultant from such application. However, when we attempt to anticipate reply to certain pointed questions which central-station managers might logically put up to us, for example, "To what extent has metered power for woodworking business been developed—is the field profitable—what are other central stations doing in this special line throughout the country, and how may I benefit by the results achieved elsewhere?" there is really too little of real working value at hand. Nevertheless, the exact needs of the situation are realized and immediate steps are being taken to collect and tabulate this data.

I have extracted from the United States Census reports for 1905 some statistics bearing upon the re-manufacture of lumber and the power used in that industry. As indicating the importance of the lumber and timber industry in the United States it may be stated that in 1905 these products ranked second in the number of establishments, fifth in capacity, third in the number of wage-earners, sixth in total cost of material and fourth in value of products. The total dollar value was $1,223,730,336 for 1905, an increase of twenty-one per cent over 1900, in which year the total dollar value amounted to $1,000,900,778.

The total horsepower used in Michigan during 1905 for all purposes is given as 468,449, of which 376,000 is credited to steam, 10,534 to gas, 39,342 to water, 27,559 to electric isolated plants generating their own electric power, 12,441 to central-station power.

The total horsepower in Michigan devoted to lumber re-manufacture was twenty-five per cent of the total for all purposes in that state; rented electric power being only 0.06 per cent of this total and but two-and-three-tenths per cent of the total central-station rented power.

[1] Abstract of a paper read before the sixth annual convention of the Michigan Electric Association at Detroit, August 18, 1909.

Present-day statistics would undoubtedly show a more favorable condition of affairs as regards the central-station proportion of the total of all or specified industrial power loads. Still, the writer believes that the situation is capable of much improvement from the central-station standpoint, even admitting that great strides have been made in securing industrial power customers during the last five years and also making due allowance for those woodworking plants where central-station power could not, save under very exceptional conditions, be made attractive, due to the availability of excessively large quantities of waste fuel produced in manufacturing.

SOLICITING POWER LOAD.

It is generally admitted, I think, that the broadest and most profitable field for the acquisition of power by central stations lies among industrial establishments. The size of the plant and the capital outlay usually represented by the same demand, require, however, a very careful analysis of present operating and fixed costs, in order that the prospective customer may be convinced that the central station in predicting results has, as far as possible, eliminated the element of chance and based its promise upon a logical and exact study of the factors at stake.

In soliciting power for woodworking, as well as other industrial establishments, a great proportion of success depends upon the aptitude on the part of the central-station power solicitor to correctly analyze existing plant-operating expenses and fixed charges. Ability to do this readily and correctly will go far to demonstrate definitely and convincingly to a prospect the flaws and waste and general field for improvement in his power layout. A great deal of good power business has been lost due to the use of the "rule of thumb" or "hit and miss" methods which are as fatal to success in securing motor business as in any other line where specialized knowledge is the indispensable condition to a favorable issue. Much depends then on the solicitor, who should possess sufficient technical knowledege relating to design, construction and operation of electrical apparatus in general, and of motors in particular, besides having a good amount of practical training, so that he may understandingly approach on equal ground the managers, engineers, foremen, etc., of the lumber plants which he is called upon to visit. I also believe it a most excellent plan for the solicitor to familiarize himself, as far as possible, with the names, operation and functions of the different machines ordinarily used in the different classes of lumber re-manufacture, since a knowledge of the driven tool is essential, if the proper motor is to be adapted to same. In addition, the superintendent or owner is certain to be impressed favorably if the solicitor can converse understandingly regarding the re-manufacture of lumber and the machinery used for that purpose and will be apt to assume that such knowledge presupposes an equal facility in applying the proper electric drive.

The solicitor should tabulate for record all the essential data in connection with each installation made, since the value of the accumulated knowledge thus obtained and the ability to readily analyze and solve future power problems will in time prove invaluable additions to the central station's technical data and to the solicitor himself, who each year will thus profit by the experience gained, naturally becoming a better "business getter" and commanding a larger pecuniary return in proportion with his increased efficiency.

Central-station managers should make it obligatory that power men should make out and file for permanent record the data suggested. While I recognize that this is done among the greater proportion of the larger central stations, the practice often prevails of keeping information properly belonging to the employer, "under the hat" of the employe. A high-grade solicitor should make careful studies and accumulate working data concerning steam and internal-combustion isolated plants and should be able to promptly estimate the numerous items which make up fixed and variable charges. He should also know the water rates of different types of steam prime movers and pumps commercially used, the cost in that particular locality of coal, lubricants, water, supplies, etc., cost per horsepower installed for complete small plants and in general be prepared to rebut the arguments which may be brought forward in favor of isolated-plant service.

Admitting that the use of central-station energy by large industrial plants is one of the most difficult lines of power business to secure, the re-planning of each isolated-plant layout should receive the closest attention. The power engineer should, in company with his customer, or his engineer, first consider carefully if the existing grouping of machines is the best possible to secure the most conven-

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ient handling and advantageous sequence of operation throughout the various processes of manufacture, effecting whatever transposals may be conducive to better light, greater cleanliness, more ample passageways, less danger to operators, the exclusion of all losses between the power source and the cutting edge of the tool, and in general taking advantage of every chance to effect the physical betterment of the shop and to increase its production. Notes should be made of the class of material handled, maker's name, the designated number of each machine, the average time it is on duty, the speed, diameter and face of its driven pulley, etc., all that each productive unit may be studied to determine both its individual requirements and proper co-relation with the rest of the machines making up the plant's equipment.

METHODS OF MACHINE DRIVING.

Let us for a moment consider some alternative methods of laying out the drive for a typical woodworking shop consisting of one or several buildings. There are several ways of applying electrical power, each varying in the amount of first cost, the advantages in operative economy, etc., being proportionate to the capital investment decided upon.

(1) The simplest and most elementary method would be to supply electric current to each building and operate the same by a single motor of sufficient capacity to run all the machinery installed. This would do away with the existing engine plant, but would permit little or no change in the arrangement of tools or shafting, or the abolition of mainshafts and countershafts. The importance of reducing to a minimum all unnecessary friction losses is apparent if we consider the yearly cost of power constantly used; for example, one horsepower 3,000 working hours per year at a four-cent rate is equivalent to $90 per year. The arrangement suggested is also defective in that all the driven machinery is dependent upon one unit, whose breakdown might occasion the complete stoppage of the plant.

(2) An improved modification of the first method, but applying group drive in each shop by a motor for separate departments or by connection to economical sections of the main, line of countershaftings. This method, however, like the first, might not permit any more favorable arrangement of tools than method number one.

(3) An entire re-arrangement of all the tools with reference to departments and locations, providing for the best sequence of work through the shop, installing such a combination of group or individual drives as would place those tools constantly used as far as possible in groups and providing individual drives for those machines which are more or less isolated and used intermittently.

(4) Provide an individual motor for each machine except in those particular cases where groups or machines may be so operated as to give a high load factor, or in those cases where the instantaneous demands for power may make it advisable to draw upon the "diversity factor" of a motor made to operate more than one machine and where maximum demands for power do not come upon all machines simultaneously.

The last method suggested offers so many advantages, both from an operating standpoint and as regards the cost of metered current, that in the majority of cases the additional capital outlay is justified to secure such advantages. A carefully prepared report would allow the solicitor a chance to demonstrate the successive advantages of the four methods outlined.

SIZE OF MOTORS.

The power required to drive woodworking machinery varies widely, according to the hardness and relative humidity of the wood used, the speed and depth of the cut, the physical condition of the knives, saw teeth, or other cutting tools. New and stiff machines, such as triple-drum sanders, may take considerable more power at first than after a few weeks' limbering up, and dull or wrongly adjusted knives may result in a drain of 200 to 300 per cent on the power source over what would be required if the machines were in the very best order.

Particular care should be taken in recommending motors for large planers, matchers, surfacers, band resaws, etc., where a wide variety may exist between the classes of lumber re-manufactured and the feed and speed used. With light machines, such as dado, variety and combination saws, jointers, tenoning machines, column and drum sanders, bench borers, etc., the general character of the work and margin of power usually allowed by manufacturers in specifying horsepower to drive minimize to some extent the danger of under-motoring.

The majority of woodworking establishments are devoted to certain classes of work—those using soft wood seldom use the harder variety. When they do have a small amount of hardwood to be re-manufactured, the overload capacity of a good motor is usually ample to take care of such occasional overstrain on the driving unit. It is well to remember that the power required by woodworking machines varies directly with the speed, so that the load is diminished by not forcing the material through the machine at so fast a rate. Therefore, hardwood, if machined at a slow feed, may not take more power than would be required by soft wood with the feed and cut run at maximum. Where machines are constantly to use very hard wood, such as lignum vitæ, the motors should be at least twice the ordinary horsepower employed for soft wood re-manufacture.

Again, the load on a woodworking machine is under most conditions of an intermittent character, and the driving motor may often be rated at its temporary overload capacity, since the rapidity of feed and the consequent quick completion of cut allows frequent intervals of rest before another piece of work can be fed in or made ready.

POWER REQUIRED TO DRIVE WOODWORKING TOOLS.

The power required to drive a given machine or machines may be obtained with exactitude or approximately estimated as follows:

Exact Methods.—(1) Guarantees from manufactures regarding the performance and power of a given machine with stated feed, cut and material.

(2) By the use of a temporarily installed motor with proper indicating or graphic-recording instrument to record the wattage input to the motor, and therefrom the power required by the working machine.

As a means of obtaining a continuous and exact record of the performance of a given machine or machines, the graphic or curve-drawing wattmeter is for many reasons usually preferable to instruments of the recording or indicating type. In brief, the graphic instrument possesses the following cardinal points of advantage in the test and analysis of electric-motor drive:

(A) As a means of immediately ascertaining whether the capacity of the driven machine is sustained at maximum, as well as showing the time wasted by operators prior and subsequent to "bell time" and in removing finished work to start new work; also as providing a test of the relative efficiency of both men and ma-

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chines to perform a given operative function. (B) In determining the proper horsepower and type of winding best suited to the requirements of the driven machine. (C) In checking up the cause for alleged abnormal power bills as well as the physical condition of the driven machine and its cutting edges. (D) To correct error in shop operation and provide a means of determining the unit cost to be debited against power. To enable the central station to determine the power rate which a given customer should pay based upon his maximum demand for a given time limit.

I am particularly in favor of using curve-drawing instruments in preliminary tests made by the central station to prove in general the advantages and efficiency of electric drive, since the prospect can see with his own eyes an irrefutable and easily comprehended record of the machine's cycle of productive and non-productive operation. Non-technical customers, who may become easily confused if the explanation of tests is presented couched in even the simplest electrical terminology, can understand at a glance a graphical curve representing only factors of time and horsepower.

Approximate Estimates.—(1) The power to drive may be roughly calculated by observing the speed, diameter and width of the belt to the driven pulley of the machine. This method involves, however, a decided chance for error, since the pulleys are usually proportioned so that the driven machine may, if necessary, be belted for the maximum duty. However, for ordinary service, woodworkers estimate that a belt one inch wide will transmit one horsepower at 1,000 revolutions per minute, double belting one-and-one-half horsepower under the same conditions.

(2) When group drive by engine or a single motor is used, indicator cards on the former and meter readings on the latter may be taken on one or a number of driven machines doing actual work. By repeating the test "running light," that is, with belts on loose pulleys, the friction loss may be recorded and a subtraction of the result from the full-load reading will show approximately the useful energy expended by the machines themselves. This method, due to the intangible increase of friction with increase of load, and the introduction of other variables, is liable to error, and consequently incorrect deductions, especially where the friction load may be as great or greater than the useful load. Still the results may assist in predetermining the net power required, as well as often showing great waste in the existing transmission system.

To indicate the wide difference in power required to drive, let us take at random several cases of machines tested in a woodworking plant:

1st. A motor driving a twenty-four-inch buzz planer with a cut two-and-one-half inches wide by one-eighth inch deep took 2.1 horsepower and with a cut thirteen by five-sixteenths inch, 4.5 horsepower.

2d. A motor driving a twenty-four-inch cylinder planer with a cut six inches wide by three-sixteenths inch deep (in dry spruce) took 4.1 horsepower and with a cut double the width and only one-third inch in depth (but with the same wood wet) required eighteen horsepower.

3d. A ten-inch circular saw with one-half-inch cut and easy feed took 2.7 horsepower and in two-and-one-half-inch hardwood required eight horsepower.

4th. A fifteen-inch tandem scraper (in rock maple) with one knife cutting material six-and-three-fourths inches wide with shaving 0.0035 inch in thickness required 3.25 horsepower; with two knives cutting, material thirteen-and-one-half inches wide and 0.009 thick, nine horsepower.

5th. A forty-two-inch single scraper (in rock maple) with feed eighty-two feet per minute, width of material twenty-nine inches, thickness of shaving 0.004 took 5.5 horsepower; with the same width of material and double the thickness of shaving, 9.5 horsepower.

6th. A thirty-inch single surfacer (in soft pine) with feed of thirty-four feet per minute, cutters running at 4,200 revolutions per minute, material ten inches wide, one-sixteenth inch cut, required 4.5 horsepower. With the width of material increased to twenty-nine inches and the depth of cut to one-half inch, 36.5 horsepower was required.

7th. A thirty-inch double surfacer (in soft pine) with feed of thirty-four feet per minute and cutters running at 3,800 revolutions per minute, required with cut eight inches wide and one-fourth inch at the top and one-eighth inch at the bottom, 11.5 horsepower. With feed of sixty feet per minute, cutters running at 4,200 revolutions per minute, width of material twenty-nine inches, depth of cut at top three-sixteenths inch and at bottom one-sixteenth inch, required thirty-eight horsepower.

All the above shows the necessity of studying the requirements of each machine. We find cases where data are taken from pattern shops and wrongly applied to other shops where the machinery is employed to remove heavy cuts on hardwood. In such cases machines may require double or triple the capacity of the pattern shop.

[To be continued.]

Coney Island & Brooklyn Railroad Company.

A further hearing was held August 25 on the complaint of Jonas Monheimer, against the Coney Island & Brooklyn Railroad Company for a reduction of fare to Coney Island on week days to five cents, instead of the ten-cent fare now charged. This is the second complaint of Mr. Monheimer; the first included Saturdays, Sundays and holidays, but Commissioner Bassett stated that he thought the companies justified in charging ten cents on these days, and a new complaint would have to be filed regarding week-day fares.

Commissioner Bassett called upon Henry Floy, acting chief of the commission's appraisal bureau, who testified that a complete appraisal had been made of the property of the Coney Island & Brooklyn road, and filed with the commission the following figures as being the tangible value of that line up to February 1, 1909:

Track	$ 729,852
Track special work	241,682
Paving	421,474
Overhead trolley construction	145,965
Overhead feeders	110,632
Underground conduits and cables	336 324
Power plants and substations	733,393
Buildings	579,983
Rolling stock	1,383,461
Total	$4,682,970
Add incidentals:	
Organization, engineering, etc.	$ 702,445
Total	$5,385,416
Miscellaneous stock, fixtures, etc.	103,679
Real estate (assessed value)	187,800
Grand total	$5,676,895

Attorney Kuhn, representing the railroad company, asked for an adjournment of one month for his company to verify the figures submitted, claiming that this was reasonable when it was taken into consideration that it took the commission one year with forty men on the job. Commissioner Bassett denied the motion and allowed the company two weeks, saying that they should be familiar with its own property.

The hearing was finally adjourned to September 8. The commissioner stated that on that date he would expect everything to be completed and announced that the case would probably be dismissed then.

A New Electrical Institution.

At a meeting of representative electrical engineers of South Africa, held at the Grand National Hotel, Johannesburg, South Africa, on July 12 last, a new electrical institution was founded with the name and title of the "South African Institute of Electrical Engineers." Draft rules were approved and a provisional council elected.

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Production of Coal in 1908.

The total production of coal in the United States in 1908, as reported by E. W. Parker, of the United States Geological Survey, was 415,842,698 short tons, having a spot value of $532,314,117. Of this total 74,347,102 long tons (equivalent to 83,268,754 short tons), with a spot value of $158,178,849, was Pennsylvania anthracite and 332,573,944 short tons, with a spot value of $374,135,262, was bituminous and lignite.

The following table shows the output of 1908 compared with that of 1907:

PRODUCTION AND VALUE OF COAL IN 1907 AND 1908, BY STATES AND TERRITORIES, WITH INCREASE OR DECREASE IN 1908.

State or Territory.	Production (short tons). 1907.	1908.	Increase (+) or decrease (—), 1908.	Value. 1907.	1908.	Increase (+) or decrease (—), 1908.
Alabama	14,250,454	11,604,593	— 2,645,861	$18,405,468	$14,647,891	—$3,757,577
Arkansas	2,670,438	2,078,357	— 592,081	4,473,693	3,499,470	— 974,223
California and Alaska	24,089	21,862	— 2,227	91,813	69,650	— 22,163
Colorado	10,790,236	9,634,973	— 1,155,263	15,079,449	13,586,988	— 1,492,461
Georgia	362,401	264,822	— 97,579	499,686	364,279	— 135,407
Idaho	*7,588	5,429	— 2,159	*31,119	21,832	— 9,287
Illinois	51,317,146	47,659,690	— 3,657,456	54,687,382	49,978,247	— 4,709,135
Indiana	13,985,713	12,314,890	— 1,670,823	15,114,300	13,084,297	— 2,030,003
Iowa	7,574,322	7,161,310	— 413,012	12,258,012	11,706,402	— 551,610
Kansas	7,322,449	6,245,508	— 1,076,941	11,159,698	9,292,222	— 1,867,476
Kentucky	10,753,124	10,246,553	— 506,571	11,405,038	10,317,162	— 1,087,876
Maryland	5,532,628	4,377,093	— 1,155,535	6,623,697	5,116,753	— 1,506,944
Massachusetts	.....	50	+ 50	.....	150	+ 150
Michigan	2,035,853	1,835,019	— 200,839	3,660,833	3,322,904	— 37,929
Missouri	3,997,936	3,317,315	— 680,621	6,540,709	5,444,907	— 1,095,802
Montana	2,016,857	1,920,190	— 96,667	3,907,082	3,771,248	— 135,834
New Mexico	2,628,959	2,467,937	— 161,022	3,832,128	3,368,753	— 463,375
North Dakota	347,760	320,742	— 27,018	560,199	522,116	— 38,083
Ohio	32,142,419	26,270,639	— 5,871,780	35,324,746	27,897,704	— 7,427,042
Oklahoma	3,642,658	2,948,116	— 694,542	7,433,914	5,976,504	— 1,457,410
Oregon	70,981	86,259	+ 15,278	166,304	236,021	+ 69,717
Pennsylvania	150,143,177	117,179,527	—32,963,650	155,664,026	118,816,303	—36,847,723
Tennessee	6,810,243	6,199,171	— 611,072	8,490,334	7,118,499	— 1,371,835
Texas	1,648,069	1,895,377	+ 247,308	2,778,811	3,419,481	+ 640,670
Utah	1,947,607	1,846,792	— 100,815	2,959,769	3,119,338	+ 159,569
Virginia	4,710,895	4,259,042	— 451,853	4,807,533	3,868,524	— 939,009
Washington	3,680,532	3,024,943	— 655,589	7,679,801	6,690,412	— 989,389
West Virginia	48,091,583	41,897,843	— 6,193,740	47,846,630	40,009,054	— 7,837,576
Wyoming	6,252,990	5,489,902	— 763,088	9,732,668	8,868,157	— 864,511
Total bituminous	394,759,112	332,573,944	—62,185,168	$451,214,842	$374,135,268	—$77,079,574
Pennsylvania anthracite	85,604,312	83,268,754	— 2,335,558	163,584,056	158,178,849	— 5,405,207
Grand total	480,363,424	415,842,698	—64,520,726	$614,798,898	$532,314,117	—$82,484,781

*Includes production of Nebraska and Nevada.

The total quantity of bituminous coal mined by machines in 1908 amounted to 123,183,334 short tons. The total production of coal in the states where machines were employed was 328,270,373 short tons, so that the machine-mined product was equivalent to 37.5 per cent of the total output of these states. The machine production in 1908 was less than in 1907, but there has been a steady increase in the percentage that the machine-mined coal bears to the total output of the states where mining machines have been installed, and also in the number of machines in use. The number of mining machines employed was 6,658 in 1903, 7,663 in 1904, 9,184 in 1905, 10,212 in 1906, 11,144 in 1907, and 11,569 in 1908. The percentages of machine-mined production in these years have been, respectively, 28.18, 28.8, 33.67, 35.1, 35.71, and 37.5. The average production for each machine in use in 1908 was 10,648 short tons, against 12,381 tons in 1907, 11,638 tons in 1906, and 11,258 tons in 1905, the lower average in 1908 being due to the smaller number of days the mines were worked and the decrease in total tonnage. Of the machines in use in 1908, 6,380 were of the pick or puncher type, 4,992 were chain-breast machines, and 197 were long-wall machines. Thees include twenty-six pick and 238 chain shearing machines.

Pennsylvania, the leading state in the total production of bituminous coal, leads also in the number of machines employed and in the total machine-mined production, 5,103 machines being employed in 1908 with a production of 52,447,809 short tons, or 44.76 per cent of the state's total. Ohio leads in the percentage of coal mined by machines, and has for several years been second in the total quantity of machine-mined coal, although West Virginia in both 1907 and 1908 had more machines in use than did Ohio. In 1908 there were 1,343 machines employed in the coal mines of Ohio, and the machine-mined product amounted to 19,799,140 short tons, or 75.37 per cent of the total. West Virginia employed 1,574 machines, by which 16,653,174 short tons, or 39.75 per cent of the total, was mined. Illinois employed 1,217 machines and produced 15,045,004 short tons of machine-mined coal, or 31.57 per cent of the total. Kentucky, which stands seventh in the rank of coal-producing states, was second in the percentage and machine-mined coal to the total in 1908, over half of the total output of the state being machine-mined.

A movement is under foot in Germany to utilize the flow due to the tides in a branch of the Elbe River to generate electric power.

Telephone Openings in the West Indies.

An American minister in the West Indies forwards particulars and a copy of the law relative to a long-distance telephone concession that will be granted by the state. A copy of the report and of the law may be had by interested firms upon application (file No. 3794) to the Bureau of Manufactures, Washington, D. C.

In a recent report of an American consul in Latin America, information is given regarding a telephone concession lately granted in that district. The line is to have a length of 125 miles, which does not include a branch system that is projected. The name and address of the concessionaire can be furnished on application to file No. 3786, Bureau of Manufactures, Washington, D. C.

Telegraphers in Convention.

A joint convention of the Old Time Telegraphers' and Historical Association and the Society of the United States Military Telegraph Corps opened in the Fort Pitt Hotel, Pittsburg, Pa., on August 17. The meeting proved very enjoyable and instructive and many reunions of old friends occurred.

Both organizations are national in scope, and many men of prominence who have risen from the keys were in attendance on the three days of the convention. Thomas A. Edison is perhaps the most famous living telegrapher. A noticeable incident was the bitter denunciation of various administrations since the close of the Civil War, which have refused to consider their claim for pensions, made at the opening session of the Society of United States Military Telegraph Corps' convention. On Wednesday, August 18, the members were the guests of J. B. Yohe, general manager of the Pittsburg & Lake Erie Railroad, and were taken on a special train to Monessen, where an inspection was made of the plant of the Pittsburg Steel Company.

Approve Bridge Stock Sale.

Without passing upon the reasonableness of the price of $300 a share, which the New York Metropolitan receivers offered to pay the New York City Railway Company for 500 shares of the Bridge Operating Company, of which the par value is $100 a share, the Public Service Commission has granted its approval of the proposed transfer of the Bridge Operating stock from the New York City receiver to the Metropolitan receivers.

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The Electrical and Mechanical Installation in the Hotel La Salle.

One of the Most Complete Equipments in Private Service—Chicago's Newest and Largest Hotel.

BY HOWARD EHRLICH.

Although statistics show that for the past few years Chicago has led the country in building operations, the city has long felt the need of hotels in keeping with its progress. In view of this need it is fitting that there should be erected here one of the largest hotels ever built under an original contract, a hotel the construction of which will be considered one of the great engineering feats of the day. A consideration of the electrical and mechanical features of this hotel will prove of more than passing interest.

The Hotel La Salle, which will be formally opened for public inspection next week, is located on the northwest corner of La Salle and Madison streets, in the center of Chicago's business district. It covers a space of 162.5 feet by 178 feet, is twenty-four stories in height, twenty-two above the street level and two below, and contains 1,172 rooms in all. This hotel is one of the most perfect examples of modern steel-frame fireproof construction, and in thus embodying convenience, quality and beauty the owners have achieved a distinctive and peculiar degree of success.

POWER PLANT.

Owing to the high value of the land upon which the hotel is erected, the design of the power plant and the selection of its equipment, necessitated an extended study as to the conditions and the requirements to be met with.

The power plant is located in the sub-basement. A general plan view is shown herewith. No effort was spared in making it a model of its kind. It is built on the broad and up-to-date lines, which are characteristic of the construction of the entire hotel.

BOILER ROOM.

For convenience in obtaining coal, the boiler room is located in the north end of the plant, adjacent to the alley. As is shown in the plan, six coal chutes are provided, along the alley, which connect with the coal bunkers in front of the boilers. Coal coming to the hotel in wagons, will enter the alley from the La Salle Street side, and be thrown into any of the chutes. Coal can also be brought to the hotel through the Illinois Tunnel system, this method being the more preferable. A tunnel connection is provided at the northwest corner of the boiler room, which is equipped with suitable conveying machinery. An elevator will convey the coal from the tunnel cars to the top of the bunker, where it will be discharged into a screw conveyor and be distributed. The conveyor is operated by a seven-and-one-half-horsepower Crocker-Wheeler motor. Each boiler has a chute of its own, conveying coal from the bunker to the stoker hopper.

HOTEL LA SALLE, CHICAGO.

The steam is supplied by five 400-horsepower Lyons boilers, of the combination fire and water-tube type, in single settings, located in a row directly back of the coal bunker. They are of an unusually large type of boiler and are capable of an overload of fifty per cent. The pressure carried is 160 pounds. The boiler consists of the usual shell and tubes, but has in addition one row of tubes beneath the shell connecting the water saddles at each end. This lower row of tubes is covered by a special fire tile and is used as an arch for the furnace.

The furnaces are equipped with McKenzie improved chain-grate stokers. A feature worthy of note in this installation is that each stoker is independently

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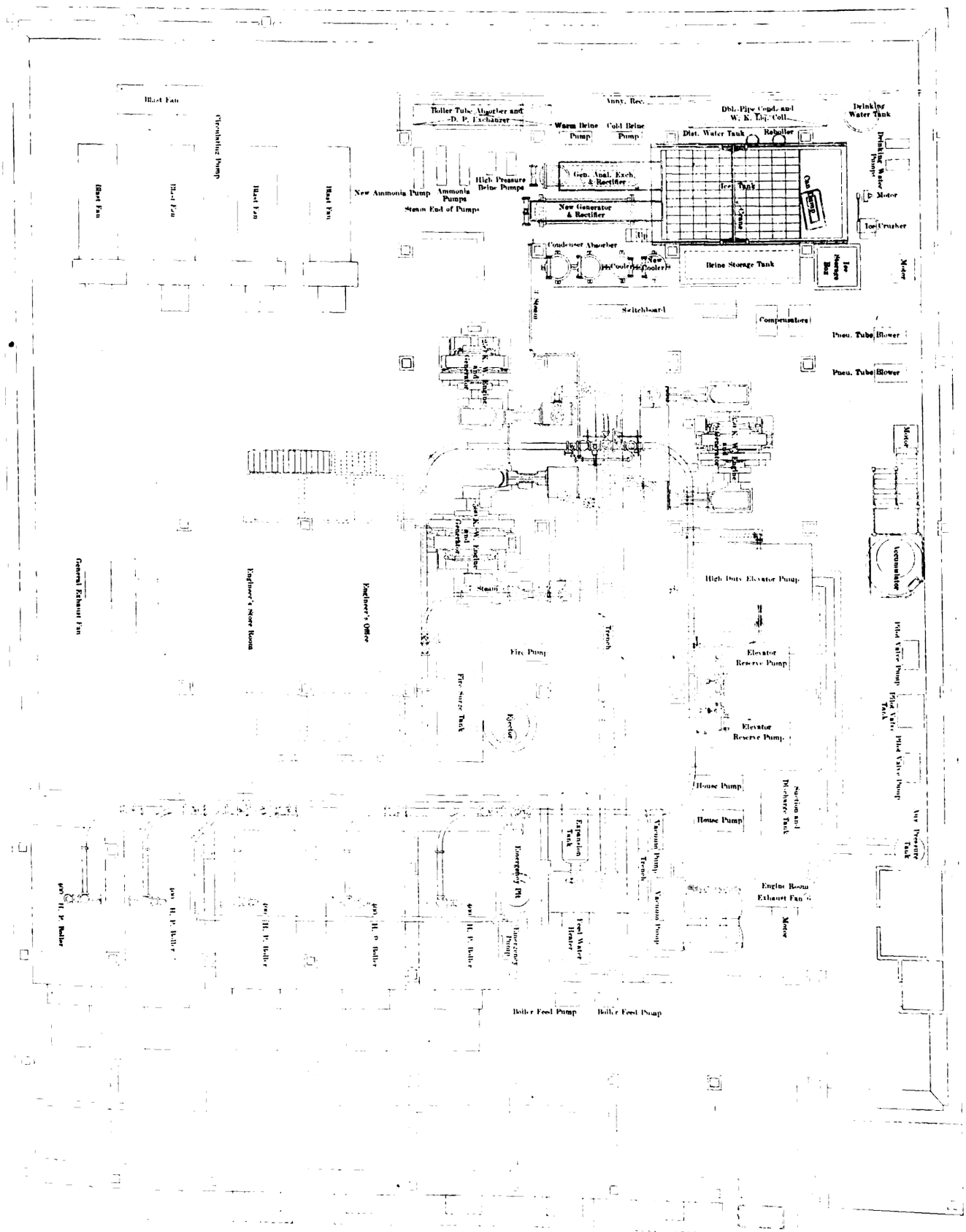
driven by a two-and-one-half-horsepower, 220-volt, Crocker-Wheeler motor, thus doing away with the danger of having all the stokers out of commission on account of an accident to any one. A spare motor is provided for use in case of an emergency. Each motor is controlled by a Cutler-Hammer starting box.

The tops of the ash pits are arched over so that the fine coal which sifts through the grates will not be wasted, but is thrown back into the stoker hoppers. Ashes are at intervals discharged from the dump grate into a steel car on tracks in the ash pit, which extend from the



GENERAL PLAN OF POWER PLANT, HOTEL LA SALLE.

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bridge wall to about four feet in front of the stokers. The ashes are hoisted from these cars into wheelbarrows and dumped into a chute leading to Illinois Tunnel cars.

Just west of the boilers and located side by side are two twelve by eight by twelve-inch vertical, duplex pumps, built by the Platt Iron Works, for feeding the boilers. These are the only pumps in the boiler room with the exception of the emergency pump, which is used in case of floods or bursting water mains and is located between the boilers and feed-water pumps.

PIPING.

The steam piping presents some novel features in mechanical engineering. The fourteen-inch main steam header is divided into three sections with auxiliary connections to the engine-room header, so that the boilers may be cut into three units, if necessary, for the purpose of making repairs on the engine-room header.

The engine-room piping is taken care of by a ten-inch loop, which is so connected that either half section of the header can be cut out and the operation of the hotel not interfered with. With the exception of three improved Jenkins gate valves on both main boiler header and engine-room loop, all valves in high-pressure piping are the Jenkins copper disk globe valves.

The exhaust piping from all the engines and auxiliaries is connected to a common expansion tank, which supplies the heating system, a Cookson open feed-water heater and three service heaters. The service heaters are used for heating water used in the kitchens and the house water.

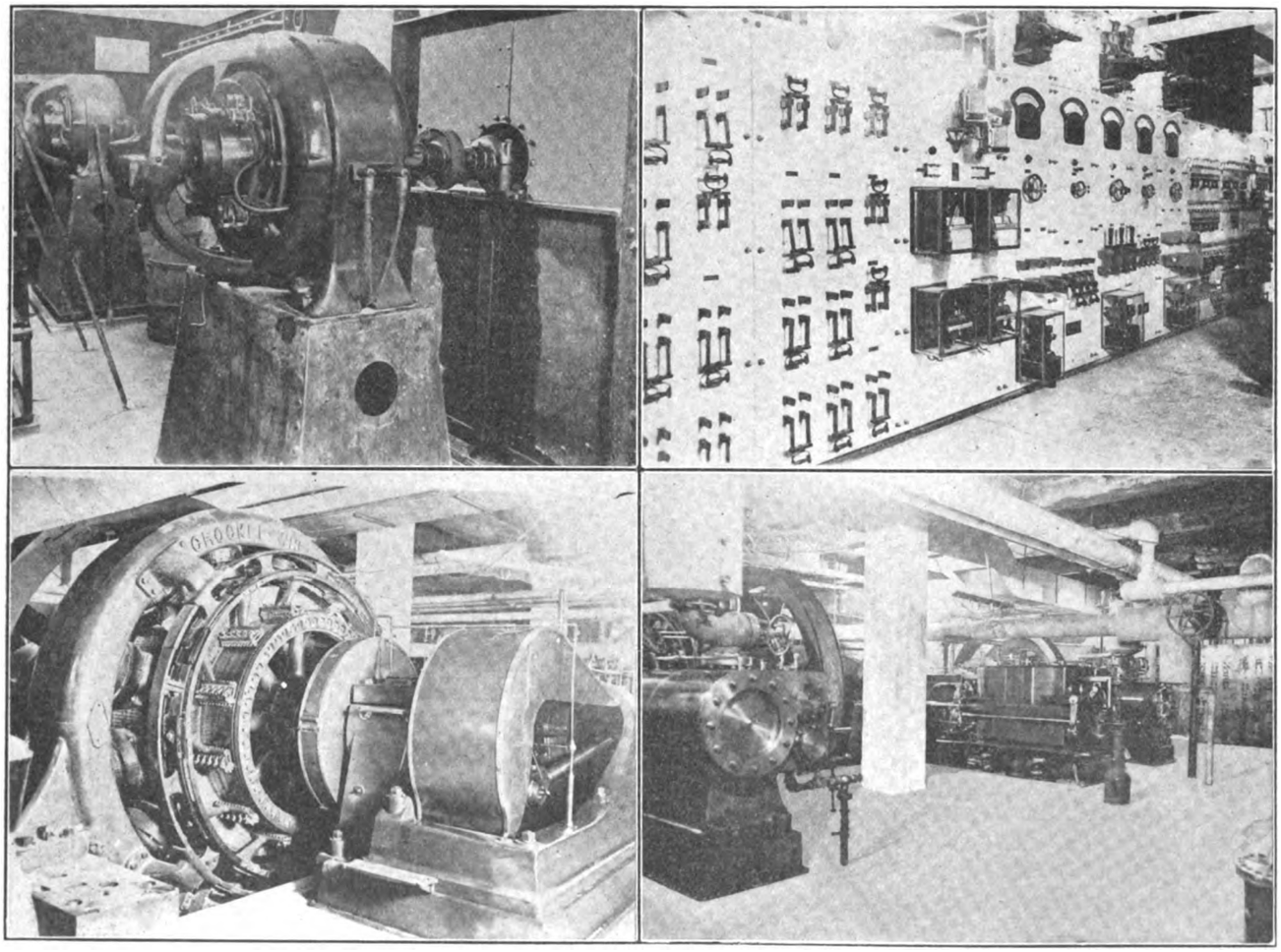
ENGINE ROOM.

The engine room is on a higher level than the boiler room and occupies the remaining area of the sub-basement.

There are three Fitchburg, four-valve, improved engines of the cam-valve-motion type, direct-connected to Crocker-Wheeler engine-type generators. The smallest engine of the three is a simple engine, running at 150 revolutions per minute and operates a 250-kilowatt generator. The two larger engines are of the cross-compound type. The smaller of these is direct-connected to a 350-kilowatt generator and the larger to a 500-kilowatt generator. The generators are 250-volt, compound-wound, direct-current machines and are guaranteed for a fifty per cent overload for two hours and a twenty-five per cent overload continuously. In addition to the generators there are two Crocker-Wheeler 125v/125v balancing sets for the three-wire lighting system, located directly west of the switchboard. One set is of the capacity of 250 amperes unbalance in neutral and the other set with a capacity of 350 amperes unbalance in neutral.

The normal lighting and power load is about 500 kilowatts and the complete connected load will be about 800 kilowatts. As the rated generator capacity is 1,100 kilowatts, an extra 300-kilowatt load is provided for.

In the southwest corner of the engine



Motors Driving Ventilating Fans.
500-Kilowatt Generator.

Main Switchboard.
350 and 250-Kilowatt Generating Units.

VIEWS IN ENGINE ROOM, HOTEL LA SALLE.

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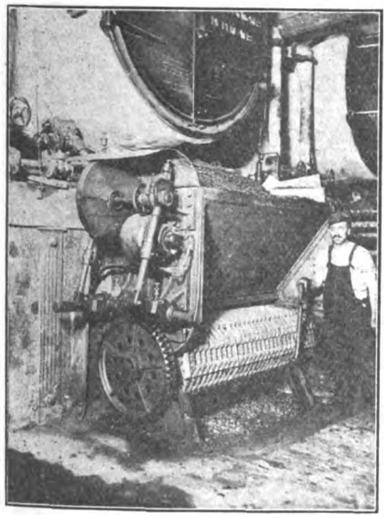
room and directly back of the switchboard is installed a complete refrigerating plant, consisting of two Carbondale absorption machines, a brine cooler, and a storage tank with a capacity of 1,000 gallons. The larger of the two absorption machines is a fifty-ton machine and will be used for the manufacture of ice for cooling drinking water and for the cooling of the various refrigerators and ice-boxes. The smaller is a forty-ton machine and will be used for cooling air for various rooms. A motor-driven ice crusher is also provided for crushing ice for kitchen and buffet purposes.

In about the center of the engine room and near the west wall are located the elevator pumps for operating the nine Otis hydraulic elevators provided for this hotel. These elevators are of the inverted ram type and are equipped with electric annunciators and flashlight signals. The main fire pump is located adjacent to the 500-kilowatt generator.



VIEW IN BOILER ROOM, HOTEL LA SALLE.

SWITCHBOARD.

The switchboard in this hotel is a model of its kind. It is of the self-supporting angle-iron frame type and was made by the Western Electric Company. The board is thirty feet long and consists of eleven panels of white Italian marble about two inches thick. There are two power panels, one totalizing panel, three generator, two compensator and three lighting panels. The totalizing panel is equipped with a Weston voltmeter, a Westinghouse graphic-recording ammeter and a similar voltmeter for the 220-volt power system and a Weston voltmeter and two Westinghouse graphic-recording ammeters for the 110-volt lighting system. The generator panels consist of Weston ammeters, Thompson recording wattmeters and Cutter "I T E" circuit-breakers. Each generator panel is equipped with a pilot lamp, which is lighted when the machine is in operation. The two compensator panels are equipped with Weston ammeters. There are thirty-six lighting circuits controlled by the lighting panels and the power panels control eighteen power circuits.

The wiring of the board presents some novel features in switchboard wiring, probably the most notable being the simplifying of the busbar connections. The fuses, which are located on two small panels behind the main board, are connected to corresponding switches on the switchboard by threaded copper studs. The studs are terminated on slate terminal plates, located on top of the board directly over corresponding lugs. This does away with the threading of wire of busbars from the top of the board to lugs on switches, by extending bars to the panel at the top of the board. The generator leads run in iron conduits, underground, to the switchboard.

The mains from the switchboard are carried through one-and-one-quarter-inch iron conduits to the first basement, where they are distributed to the corners of the building and carried up four separate shafts, each shaft containing about four feeder circuits. There are over 1,500 separate circuits to be fed from these four shafts. All of the wire used in this hotel is Habirshaw red core wire.

VENTILATING SYSTEM.

In a single building which will be constantly occupied by from 500 to 1,500 persons, the ventilating system is of great importance. In the Hotel La Salle this system is complete in all of its details. The various rooms will be equipped for an entire change of air at certain intervals, while certain public rooms will be supplied with artificially cooled air.

The ventilating equipment inclues nineteen large, motor-driven fans, located on the twenty-first floor and in the sub-basement. Fresh air enters the air stack and is conveyed to the blast fans in the sub-basement, which are located in the southeast corner of the engine room, and from there supplied to the different rooms. These blast fans are equipped with Acme air washers. For furnishing the spray water the washers are equipped with pumps operated by five-horsepower C & C motors. The fans on the twenty-first floor are exhaust fans. All the fans are operated by C & C 220-volt motors, ranging in size from ten to twenty-five horsepower.

PNEUMATIC-TUBE SYSTEM.

For the transmission of orders, letters, etc., a pneumatic-tube system of the vacuum type has been installed. This system is particularly adapted for conveying orders from the various dining rooms to the main kitchen and will insure prompt and accurate service. For its operation two No. 4 Connersville blowers and two General Electric fifteen-horsepower, variable-speed motors are used, located just west of the switchboard. The speed of the motors is automatically controlled, so that power is consumed only while the carriers are being transmitted. For automatically controlling the motors and blowers and for regulating their speed a special panel is provided.

KITCHEN.

The kitchen of the Hotel La Salle embodies all modern conveniences known and contains such appliances as electrically operated potato peelers, meat grinders, coffee grinders, silver-polishing machines and ice-cream machines, also a system of electric dumb-waiters.

The dumb-waiters, installed by the Burdett-Rowntree Manufacturing Company, are of the most advanced type. The hoisting machinery is of the direct-connected, worm-gear drum type, with the drum and motor mounted on the same bed plate. These dumb-waiters are provided with limit stops, so that they will stop automatically at the top and bottom landings. They are controlled from a special panel in the kitchen.

GUEST ROOMS.

All of the guest rooms are provided with local and long-distance telephones. The 1,200 lines run through iron conduits and terminate in a six-position, lamp-signal, Western Electric switchboard. A majority of the rooms have connecting private bathrooms, which in every instance are equipped with electric curling-iron attachments. Every room is provided with door switches for automatically controlling the lights in the closets.

LIGHTING.

For lighting this hotel about 16,000 Westinghouse lamps are used. There are a large number of special size and special candlepower lamps provided for use in various large fixtures. The lamps in some of the larger rooms are controlled by special panel boards which control part of the lamps on each outlet.

In attaining electric lamp fixtures of

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highly artistic worth, the manufacturers, W. T. Wilmarth Company, of Chicago, have also given due consideration to the mechanical problems to be met with, and the result is that the fixtures throughout the building represent the highest type of workmanship, and do much toward creating a harmonious feeling from the basement to the top floor.

FLOOR STANDARD AND ELECTROLIER IN BANQUET HALL, HOTEL LA SALLE.

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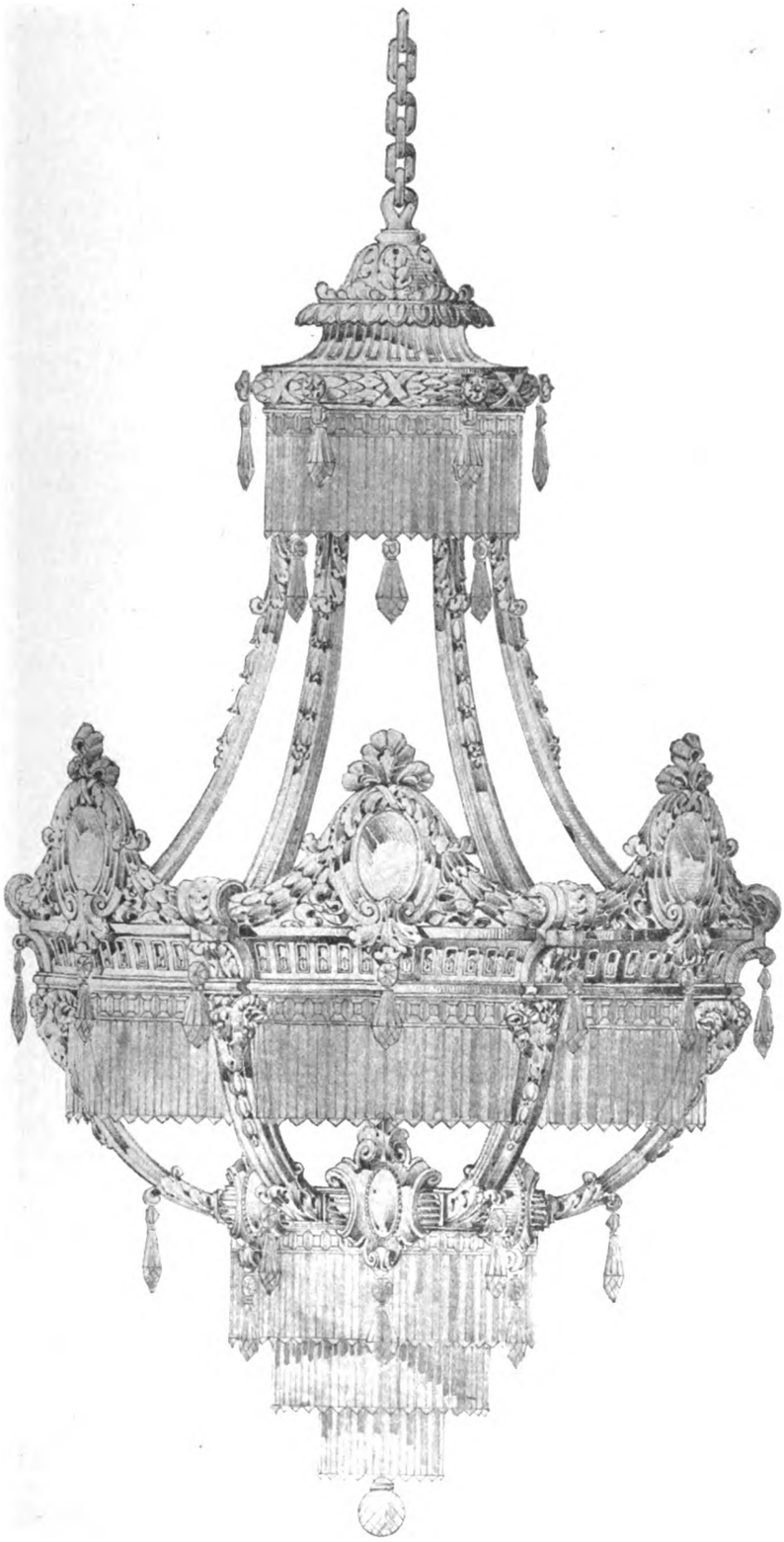
As the hotel is of the Louis XIV design, all of the lighting fixtures in the public rooms, with but few exceptions, are of that design



ELECTROLIER IN MAIN DINING ROOM, HOTEL LA SALLE.

All of the larger fixtures are made of a special composition and are finished to match the decorations of the rooms in which they are used. An effort has been made to digress from the conventional dome type of fixture, and nearly all are of the pendant chandelier type.

In the main banquet hall several forms of fixtures are used. Along the walls are bracket lanterns with artistic trimmings. The main chandeliers, suspended from the ceiling by ornamental chains, are of very elaborate design and are trimmed with crystal. These fixtures are so designed that the crystal elaboration can be removed without in any way detracting from the general design. This arrangement is for summer and winter use, to give either a cool or warm effect to the room. In addition, there are provided a number of floor standards which add to the artistic beauty. All are finished in gold-leaf to harmonize with the gold decorations. Views of these fixtures are shown herewith.

On the same floor with the main banquet room is one of smaller size. The fixtures in this room are also finished in gold-leaf and are hung with silk cords and tassels.

In the main dining room are unique brackets with a vase attachment on top arranged to hold cut flowers. These brackets and also the chandeliers in this room are finished in gold.

The brackets in the dining room on the mezzanine floor are of gold basketwork design and are decorated with fruit and flowers.

Fixtures of Italian design are used throughout the palm room, located on the main floor. They are all finished in the dull shades of purple and yellow and are also decorated with fruit and flowers. Italian lanterns are suspended from the ceiling and along the walls are brackets of the same design and finish. A view of these lanterns is shown in the accompanying illustration.

A German restaurant, located in the basement, contains fixtures of wrought-iron material and of odd design and finish.

Around the exterior of the building, about eight feet above the street level, there are installed fourteen lanterns arranged for direct-current, enclosed arc lamps. The lanterns are of antique copper finish and harmonize with other exterior trimmings. They are suspended by ornamental chains.

LAUNDRY.

On the twenty-first floor is located a laundry, complete in all of its equipment. The machines, all of which are driven by individual motors, include eight washing machines, four extractors, two mangles, a clothes tumbler and other incidental machinery necessary in a laundry of this size. For operating these machines Crocker-Wheeler motors are used, ranging in size from one-half to ten horsepower.

BANQUET HALL.

In designing the banquet hall, located on the nineteenth floor, the engineers considered and provided for all facilities in-

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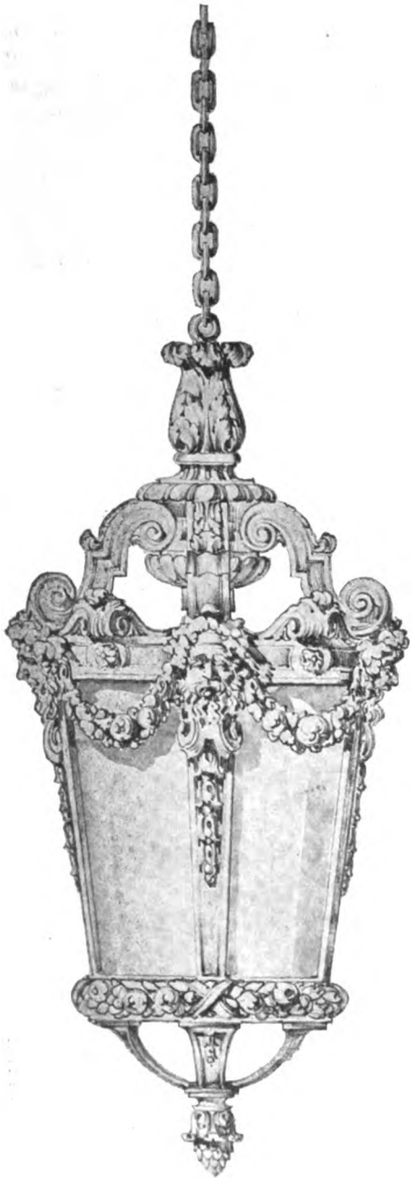
cidental to convenience and entertainment. A stage is provided for, which is complete in its electrical equipment. All necessary wiring for foot-lights, border-lights, spot-lights and a stereopticon machine is included.

ELECTRIC CALL SIGN.

In the construction of the Hotel La Salle many striking features in electrical



ONE OF THE ITALIAN LANTERNS IN THE PALM ROOM, HOTEL LA SALLE.

devices have been incorporated by the architects, and among these is the silent system for calling carriages and automobiles. The calling will be done by electric signals installed by the Chase Electric Company. On the north and south ends of the marquise in the ornamental ironwork, there will be a nest of specially arranged receptacles, concealed by a leaded-glass face, as shown in an accompanying diagram. Controlling wires will run into the lobby of the hotel to a typewriter-like switchboard with numbered keys. To operate the call, the keys on the switchboard are pressed and corresponding numerals will flash on both signs.

ELECTRIC CARRIAGE CALL, HOTEL LA SALLE.

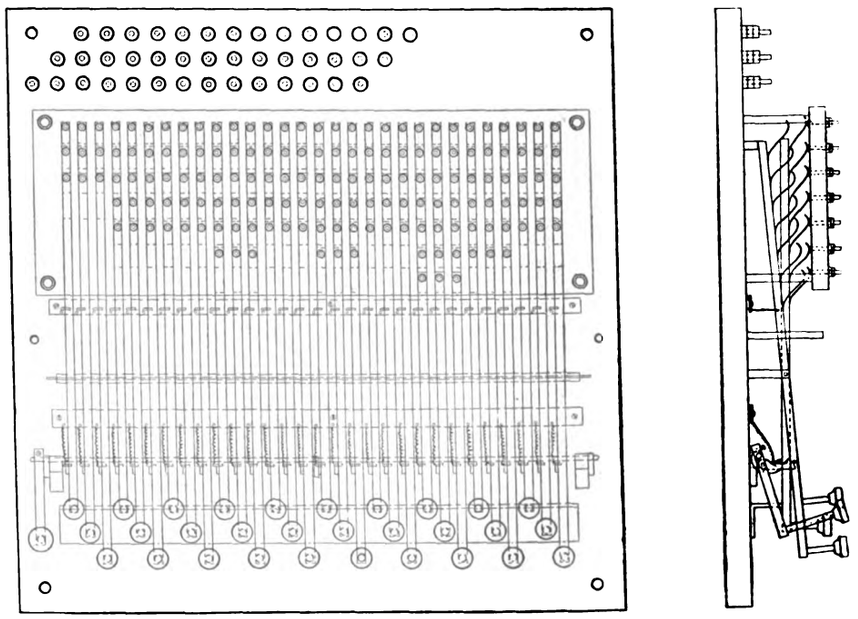
By pressing a key to the left of the keyboard, the contacts are released and the numerals disappear.

REVOLVING DOORS.

Another unique feature in the equipment of this hotel is the equipment of electrically operated revolving doors for the two main entrances. The revolving wings for both main entrances are constructed of bronze and are of the collapsible panic-proof type. They will be furnished with a 220-volt motor outfit placed over the tops of the doors in such a manner that the revolving wings may be folded and removed to one side of the opening. The electrical outfit can be arranged in such a manner that an attendant at the door can, at will, by the pressure of a push-button, start or stop the door. The motor used is a one-quarter-horsepower, shunt-wound Roth motor. It drives through a five-eighths round twisted endless belt running from the grooved motor pulley over two idler pulleys, which changes the horizontal-shaft drive to a vertical drive. The driven pulley is geared to a spur gear on the door to revolve it at a maximum of seven revolutions per minute. A speed regulator is provided for reducing the speed if required. By lifting the center gears out of mesh with its driver, the door is allowed to operate perfectly free.

From the foregoing brief account it will be seen that every improvement known to both the electrical and mechanical industries has been embodied in the Hotel La Salle, in an effort to make it one that will long hold a position of prominence as an example of perfection in hotel construction.

The architects of this hotel were Holabird & Roche. The Geo. A. Fuller Company were the builders, and the Arthur Frantzen Company, the electrical contractors. The writer is indebted to the various firms mentioned for much of the information herein contained.



KEYBOARD OF ELECTRIC CARRIAGE CALL, HOTEL LA SALLE.

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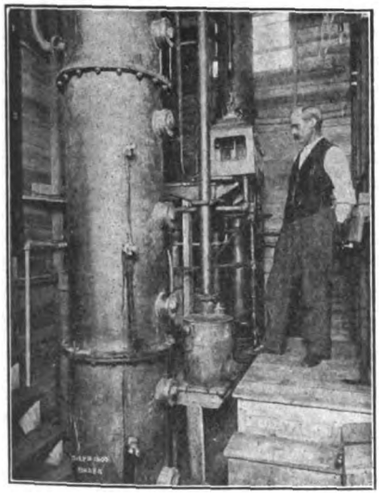
ETHYL ALCOHOL FROM WOOD WASTE.

BY GEORGE W. CRAVENS.

The old saying, to the effect that there is nothing new under the sun, has been proven wrong once more. This has happened so frequently during the last few years that it seldom excites comment to learn of something new. But when a discovery or invention which would cause radical changes in any art is made, then it is worthy of special emphasis. To claim that any development would cause a "revolution" in several lines of business is generally put down as being too broad a statement, but when the Department of



STILL AND RECTIFIER IN CHARGE OF U. S. GOVERNMENT GAUGER.

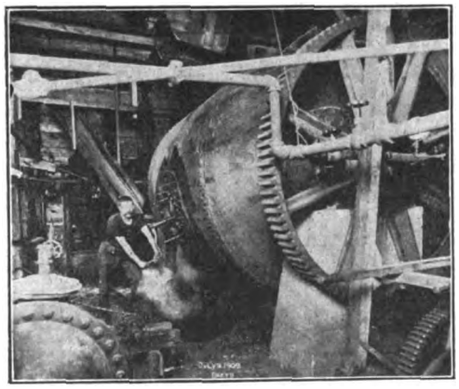
Agriculture of the United States brands an invention as "A Revolutionary Discovery" it is time to sit up and take notice.

Patents for making alcohol from sawdust and lumber waste have recently been granted to Malcolm F. Ewen and George H. Tomlinson, of Chicago. These patents were granted not because of certain claims based on theoretical considerations, nor because the discovery was accidental, but as the result of a great many years' experimenting and an expenditure of a large sum of money. In fact, a complete alcohol manufacturing plant is in operation at Chicago Heights, Ill., which represents an expenditure of $70,000.

For over half a century chemists all over the world have been seeking a practical method of manufacturing alcohol from the enormous amounts of wood scrap which annually goes to waste in the form of sawdust, shavings, slabs, etc.

In 1893, the president of the International Congress of Chemists, at the World's Fair, Chicago, declared: "The next great discovery in chemistry will be the manufacture of alcohol from lumber refuse." This great discovery has been made, and, what is more, the alcohol manufactured under the new process is purer than grain alcohol and can be manufactured at approximately one-fifth the cost.

The importance of this discovery is so great that it is impossible of comprehension without considerable thought. By putting a low-priced fuel of high calorific value in the field there springs up a new competitor of coal, wood, gasoline and kerosene, as well as of both grain and denatured alcohol. Alcohol manufactured under the Ewen-Tomlinson process costs but seven cents per gallon. It is 190 degrees proof, and when denatured should be the cheapest liquid fuel on the market. It might be made a serious competitor of gasoline for automobile purposes, and plans are already under way to enter this market.



CONVERTER IN SUGAR HOUSE BEING EMPTIED.

This discovery is of considerable interest to the electrical industry in many ways. Alcohol is a constituent of a great many oils and varnishes and other insulating compounds and is used for many other purposes in electrical establishments. The use of a low-priced alcohol instead of gasoline for internal-combustion motors will undoubtedly increase the number of small isolated power plants, with the consequent increase in the amount of electric lighting and power applications on a small scale. One of the fields that the electric industry has found it hard to enter has been that of the lumber mills, because they have had so much wood waste to dispose of that they have used it under their boilers for the making of steam to drive their machinery. Now that there is a market for this wood waste, either through selling it to large alcohol manufacturers or the establishment of a by-product plant at the mill, this should open up a good field for the central stations.

Another important feature of this new process will be that annually millions of bushels of corn and barley now used in the manufacture of grain alcohol, will be released for food purposes. The new process should add greatly to the world's food supply and keep down the price of corn, and allow large quantities of the annual crop to flow into the food-manufacturing channels instead of to the alcohol makers. The present annual consumption of alcohol in the United States, including that used in beverages and in the arts and crafts, is placed at 125,000,000 gallons at 100 degree proof. The development of a process of manufacturing cheap alcohol will not only reduce the large amounts expended annually along present lines, but should also allow the use of it in a great many directions where the present high price has prevented its adoption.

The process of turning sawdust and other lumber waste into alcohol consists chiefly of supplying raw material to a large metallic revolving drum, where it is treated under steam pressure for a short time, in the presence of acid. A portion of the wood is converted into glucose, which is then washed off and carried to large tanks, where it is fermented. From these tanks it passes through large stills and is then rectified, producing 190-degree proof ethyl alcohol. This work is carried on in the presence of one of the United States government gaugers and is subject to the regulations of the internal revenue laws.

The great value in the process as developed by the Standard Alcohol Company lies in the short time required for the acid treatment, and the consequent economy in handling large quantities of material. The waste from this process may be briquetted and dried, giving a fuel of approximately the same calorific value as wood containing an equal amount of moisture.

Havana Winter Festivities.

The City Council of Havana, Cuba, plans this year for an elaborate programme during the Winter Festivities. This will call for a lot of electrical work. Manufacturers, supply houses, contractors, and others interested, should communicate with Remigio Jimenez, engineer, Malecon 240 Altos, Havana, Cuba.

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DETAILS OF WATT-HOUR METER MANUFACTURE.—IV.

BY JOSEPH B. BAKER.

FIELDS OF COMMUTATOR METERS.

Series Fields.—The series fields of commutator meters, through which the load current passes, are form-wound, and rigidly supported from the meter shield by brass straps or shoes. It was formerly the practice to shellac and bake the field windings, but the blistering of the shellac and carbonizing of the cotton caused by accidental overloads or short-circuits in service, and the still more objectionable "gumming up" of the register and top bearing caused by the condensation of shellac-laden fumes after such overloads, have caused many manufacturers to give up the use of shellac in favor of other insulating compounds that are not subject to this trouble.

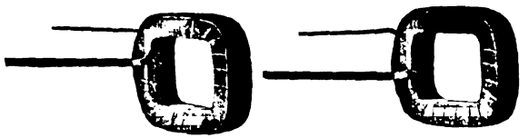

FIG. 26.—SERIES FIELD COILS OF OLD-STYLE T R W METER.

The coils are usually wound with a single strand, in several layers, with a sufficient number of turns to give the requisite strength of field throughout the range of the meter. Switchboard meters, and other meters of large capacity, however, have fields of special design, sometimes in the form of heavy copper castings or forgings of very large carrying capacity.

Old-style commutator meters were equipped with rectangular fields (Fig. 26 is a view of the right-hand and left-hand field coils of an old-style T R W meter), corresponding to the armature of rectangular cross-section that was then employed; but new-style meters of practically all makes have circular fields, which are more compact and efficient electrically in conjunction with the new-style spherical armature, since they give a powerful field with relatively low "drop loss." The idea of concentration is further carried out by the use of ribbon wire in the field winding.

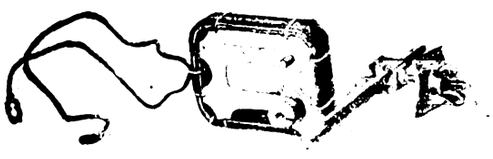

FIG. 27.—ADJUSTABLE SHUNT-FIELD COIL FOR T R W METER.

In the type C-6 T R W meter the series fields are edgewise wound of copper strip, insulated with enamel, which is baked on at a temperature that would destroy the cotton and shellac insulation formerly used. These new field coils will thus withstand overloads which would destroy the older meters without giving off any fumes or smoke. One coil is placed in front of the armature and the other behind it, the coils being supported from the meter frame. Each coil is made with an outer and an inner section, a construction which facilitates the building of both two-wire and three-wire meters of an extended range of capacities. For the lower capacity meters the field-coil sections are all placed in series; for the higher capacity meters the sections are placed in parallel, or each section may consist of a number of strips wound in parallel.

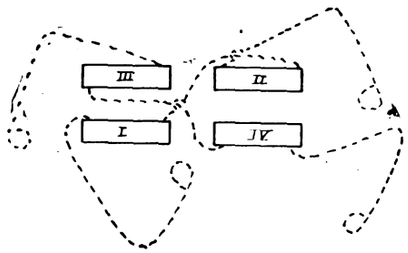

FIG. 28.—CONNECTION OF SERIES COILS IN WESTINGHOUSE TYPE C INDUCTION METER.

Shunt Fields.—The shunt fields (friction-compensating coils) for commutator meters are of fine wire, and are placed in series with the armature and resistance and bridged across the mains. They are either form-wound or wound on spools, according to the make and capacity of the meter. They are also either adjustably supported inside of and in alinement with the main fields, as, for example, in the General Electric and Westinghouse meters, or provided with taps, whereby a greater or less number of the turns in the coil may be cut into the shunt circuit of the meter, as in the Duncan meter. Fig. 27 is a view of an adjustable shunt-field coil for a rectangular-armature type T R W meter.

The combining of the shunt-field coil and resistance card in one coil is a feature of certain modern commutator meters. In the first forms of T R W type C meters, the resistance in series with the armature was wound upon a tube in two sections, connected non-inductively. These resistance coils, as well as the shunt-field coil for friction compensation, were wound upon universal winding machines. The present type C-6 meters for circuits up to 250 volts have the resistance and shunt field combined in one coil. This coil is wound on the universal winding machine, but in two sections, so connected as to oppose each other's magnetic effect, one section having an excess of turns just sufficient to produce the necessary field for friction compensation. Thus the entire coil acts as the resistance, whereas the effective turns, only, give the friction compensation.

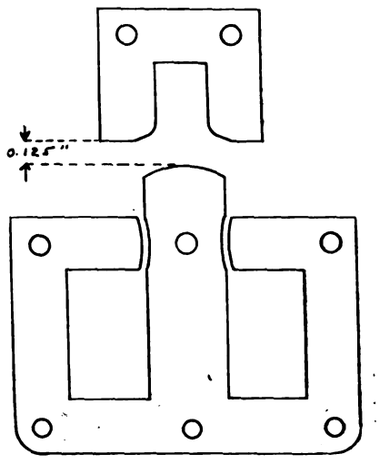

FIG. 29.—LAMINATIONS FOR FIELD CORES OF INDUCTION METER.

FIELDS OF INDUCTION METERS.

Series Fields.—Series coils of Westinghouse type C induction meter (BB in Fig. 21, page 388 of the preceding issue) are form-wound, taped with silk ribbon, dipped in insulating varnish, and baked. Two-wire and three-wire single-phase and polyphase meters of five-ampere to eighty-ampere capacity comprise perhaps ninety-five per cent of the induction meters that are manufactured. In this range of capacities, the current coils are of wound insulated wire in the five-ampere size, of square insulated wire in the ten-ampere and twenty-ampere sizes, and of square, bare copper strap in the forty-ampere and eighty-ampere sizes. All of these coils are guaranteed to carry fifty per cent overload continuously.

A special feature of all series windings is that they are made without joint of any kind between the two coils of the winding; each winding consists of a single length of wire, or strap, carried over from one coil to the other. A soldered joint would be liable to become heated and open up when the coil was overloaded. Such overloading is liable to occur for long periods, because central-station companies have a tendency to install undersized meters on consumers' loads, on ac-

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count of their comparatively low cost and good light-load accuracy.

In all meters the series windings are made up to have eighty ampere-turns on each pole-piece. For example, the eighty-ampere winding has one turn per coil, and the five-ampere winding has sixteen turns per coil.

The "series" for three-wire meters consist of two separate windings, each with two coils. Each winding is like the winding for two-wire meters, except that more length is allowed in the "loop"—*i. e.*, the length of wire or strap continuous with and joining the two coils—in order to permit the four coils of the complete series field to be laid up, as shown in Fig. 28, for mounting on the core. Coils I and II constitute one winding, and coils III and IV the other winding. In this sketch the coils are shown spread apart compared to their actual position, in order to facilitate tracing the terminals. This arrangement gives the same current-winding flux from one winding as from the other, since the average distance of both coils of each winding from the disk is the same.

A breakdown potential of 4,000 volts is applied to the pair of windings for three-wire meters—after they are laid up together as shown in Fig. 28, but before assembling—to detect any weakness of insulation between the two windings; and a breakdown potential of 2,000 volts is applied after assembling on the iron core. A potential of 1,250 volts is applied between series and shunt coils and core, on both two-wire and three-wire meters, at various stages of the manufacture of the meter, the final test being applied after the meter is finished and calibrated ready for sealing.

The laminations for the series field core are U-shaped stampings of a special quality of transformer steel, 0.013 inch thick. The shape of these stampings is shown in the upper outline of Fig. 29, which also shows the relative positions of the series and shunt fields as mounted in the meter. The core (B_1, in Fig. 21) consists of a bundle of these stampings, over which the coils are slipped, as shown in the three views of the series fields of the ten-ampere, two-wire meter, Fig. 30, in position in the meter looking from the back, up from the bottom, and down from the top, respectively. For clearness the terminals are omitted in the two lower views.

The work of assembling the core and windings is done by girls, who make up a bundle of the stampings containing fewer pieces than the full core, so that when packed together the coils will slip easily over the two limbs of the core without danger of cutting through the insulation of the coils. Then the pack of stampings is pried open in the middle with a blade, and additional stampings inserted to bring the core up to the full gauge thickness, three-fourths inch. Lastly, the coils are held in place on the core by turning over—*i. e.*, bending at right angles—the ends of the last two stampings at each end of the core, as shown in the two upper views of Fig. 30. This operation secures the coils against any possibility of shifting on the limb of the core, which would destroy the calibration by altering the mean distance of the coils from the disk air gap.

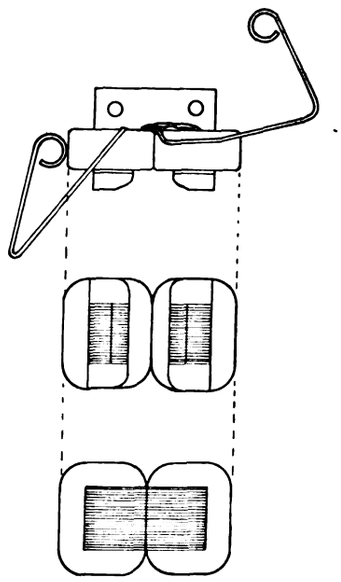

FIG. 30.—VIEWS OF SERIES FIELD OF INDUCTION METER.

Shunt Fields.—Shunt coils of type C meter (A in Fig. 21) are identical for meters of the same potential, irrespective of the capacity of the meter, and comprise coils for meters for 100, 200, 400, and 500 volts and over, potential transformers being used to excite the shunt field for potentials above the last mentioned.

These coils are machine-wound, on the Varley automatic winding machine, using double silk-covered wire. This machine turns out eight coils at a time, on the same form, with paper of high dielectric strength between every two layers. It gives a much better product than hand winding, by insuring evenness of tension and compactness of wire. Moreover, the coil is a more powerful one, inasmuch as a given number of turns are in a smaller space, with lower resistance. These machine-wound coils seldom have opens, short-circuits or grounds, and are very sturdy under extraordinary high potentials, such as surges from lightning discharges. After cutting apart the form for the coils, each coil is taped with "empire cloth," to insulate the coil as a whole, and well-insulated flexible leads having open-hook terminal clips are soldered on. The leads are nine inches long, from coil to end of terminal clip. The connection of the clips is made secure by bringing the flexible strand through the sleeve of the clip, and then through a small hole beyond the hook end of the sleeve, before sweating the solder in. This construction holds the strand of wire in firm contact with the clip, independent of the solder. The coils are then taped with silk, and dipped and baked, before mounting on the field core. The coil is tested for opens and short-circuits, and after mounting on the core, for grounds.

The apparatus for testing for short-circuits and grounds may consist of a step-up transformer, with its primary connected to 100-volt mains. The secondary is provided with taps for giving various testing potentials, and a fuse. Tests for grounds are made after assembling on the shield, before assembling shield and coils in case, and just before shipment of meter.

The lower outline in Fig. 29 shows the shape of the shunt-field core stampings. It is of transformer steel, of the same thickness and quality as the steel for the series-field core, described above. Figs. 31, 32 and 33 are views of the complete shunt field assembled; in position looking down from the top, looking from the side, and looking from the back of the meter, respectively (see also A and A', Fig. 21). The terminals are omitted from Figs. 31 and 32 for clearness. In assembling the core, essentially the same method is employed as for the series fields—by making up a partially complete pack of stampings, over the center limb of which the shunt coil is slipped, and then making up the correct number—except that the last stampings are added at the end of the pack, on account of their shape. The thickness of the complete core is gauged to three-fourths inch by a C gauge. The coil is held in place by the brass angles *a*, *a*, having one limb slotted to take the flat-head screw *b*, passing through the top hole in the center limb of the core. With the coil forced down against the inside bottom of the core, the nut is tightened on the screw, thereby securing the coil against shifting.

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TERMINALS AND TERMINAL CHAMBERS.

Fig. 34 is a sketch, partly in cross-section and partly in elevation, of the four-binding-post terminal strip with which Westinghouse type C single-phase induction meters of five, ten, and twenty-amperes capacity for house service are equipped. The forty-ampere and eighty-ampere meters have a strip of similar design, but of heavier construction, throughout. This terminal chamber is separate, and separately sealed, from the meter compartment proper (see Fig. 20), so that the installation man and inspector can get at the binding posts without having to take off the meter cover. The terminal chamber is a light cast-iron plate. The cover posts are now put in the same way as the meter-compartment cover posts.

In Fig. 34, the left-hand binding post is shown in side and front elevation, and the adjacent one in section, the center lines only of the remaining two binding posts being indicated. The strip on which the binding posts are mounted is built up of the two thicknesses of fiber *A, A,* which are punched to receive the half-round bottom ends of the binding posts, and of a similarly punched strip of felt B, which serves as an insect, dust, and moisture-proof gasket, or seal, between the terminal chamber and the meter compartment.

On all two-wire meters below eighty-ampere capacity, the two middle terminals are connected by a brass short-circuiting strip. The terminal strip, assembled, is mounted in the case after the latter has been japanned, by forcing the strip up against the partition between the top of the meter compartment of the case and the bottom of the terminal chamber, under heavy pressure, employing a toggle cam, and then securing it by four screws passing through the fiber strip and tapped into a pair of short brass punchings (not shown in the sketch) resting against the lower edges of the terminal chamber. The center lines of the holes for these screws appear in the sketch.

Each binding post consists of a round brass body, having the bottom end, where it passes through the felt and fiber strip, milled off to half-round shape as a terminal for the meter contact. The part above the strip is drilled longitudinally to receive the wire of the consumer's installation, the connection to this wire being made by the two iron screws *D*. The binding post is insulated from the meter case, where it passes through the latter, by the hard-rubber bushing *C*.

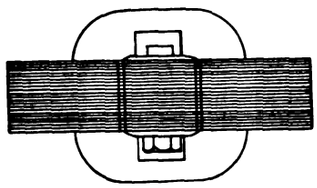

FIG. 31.—TOP VIEW OF SHUNT FIELD ASSEMBLED.

The polyphase meters for house service have two terminal chambers, one on each side of the meter case. The single-phase and polyphase meters for switchboard service have binding posts of the regular type, mounted on insulating blocks on the flange of the meter case. The direct-current meter, which has no separately sealed terminal chamber, has binding posts of special type, located in the back of the case and accessible from the front when the cover is removed.

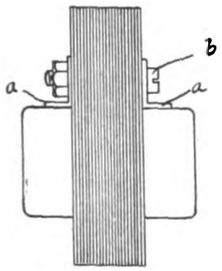

Fig. 32.—Side View.

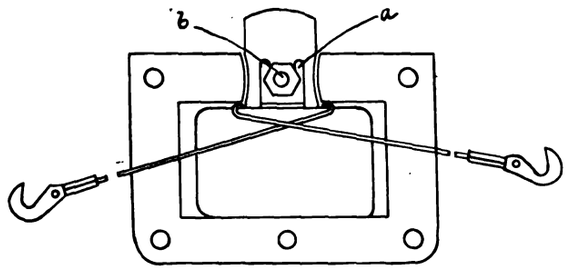

Fig. 33.—View from Back of Meter.

SHUNT FIELD ASSEMBLED ON CORE.

NAME PLATES.

The meter name plate may be of plain or nickel-plated brass, etc., riveted or screwed to the bottom of the shield, and is stamped with the ampere capacity, volts, cycles, style, and serial number (factory number) of the meter.

More than one name plate is sometimes provided, to facilitate the ascertaining of the capacity, number, etc., by the meter inspector, when the meter is installed in a dark corner or other difficult place. For example, in meters with glass covers a duplicate name plate may be placed on the front of the damping magnets' shoe, with the factory number in large figures, which can easily be read through the glass. On metal-cover meters the factory number may be stamped on the cover, near the bottom.

[*To be continued.*]

To Help American Exports.

At the suggestion of the State Department instructions have been issued to consular agents by Acting Secretary McHarg of the Department of Commerce and Labor to make collections of commercial laws of all of the Central and South American republics. These laws will be printed in the English language and distributed in this country for the purpose of encouraging trade in Central and South America.

The Department of Commerce and Labor will loan to the State Department two of its special agents to aid in investigating trade conditions. These men will be paid out of the special fund of $100,000 given to the State Department during the special session of Congress. The men to be used are William E. Davis, of Minnesota, who has been investigating milling conditions, and Charles N. Pepper, of Washington, D. C.

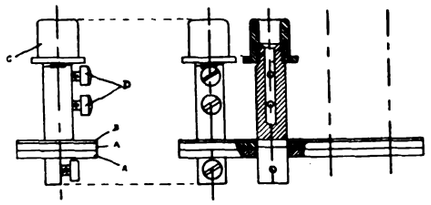

FIG. 34.—TERMINALS OF TYPE C INDUCTION METER.

Important Electrical Papers at the British Association's Convention.

The principal electrical papers which were read before the engineering section of the British Association at the Winnipeg convention, which began on August 25, were as follows: "Distribution of Dielectric Stress in Three-Phase Cables," by Dr. W. M. Thornton (Durham College of Science) and O. J. Williams; "Losses from High-Tension Overhead Lines Due to Brush Discharge," by E. A. Watson, and "The Calculation of the Charging Currents in Three-Core Cables and Overhead Transmission Lines Supplied with Three-Phase Currents," by Prof. E. W. Marchant, Liverpool University.

Sir William H. White, late chief constructor to the British Navy, was chairman of the Section.

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The Boston Electrical Show.

An electrical show, the first of its kind in Boston, will be held in the great exhibition hall of the Mechanics' Building on November 15 to 25, inclusive, as already briefly announced in a previous issue. Exhibits will be made by the leading electricians and electric supply houses in America, and all the novelties in time, labor-saving and comfort-giving devices, in fact, everything up-to-date in the electrical world, will be displayed and operated.

The decorations and lighting effects will be novel and elaborate. Expense will not be spared to this end. Chester I. Campbell, the well-known exposition promoter, will have entire charge of all the details.

Many of the exhibitors have already submitted plans for their spaces which involve the expenditure of thousands of dollars, and, from present indications and the enthusiasm displayed upon the part of the general trade, the exposition will prove an educational treat.

Special departments will consist of exhibits of the amateur wireless operators and unique inventions and ideas of amateurs. Prizes will be awarded to the deserving suggestors or inventors of practical ideas.

The association promoting the exposition is known as The Electrical Exposition Association, and is composed of many of the leading concerns and individuals in the electrical trade. C. W. Holtzer is the president, A. B. Tenney, of the Malden Electric Light Company, is the vice-president, and the executive committee includes G. M. Stuart, of the Stuart-Howland Company, W. H. Atkins, of the Boston Edison Company, J. N. Keller, of the New England Telephone and Telegraph Company, Herbert S. Potter and Frank J. Stone, of the Electric Storage Battery Company. The advisory board includes prominent officials of the Westinghouse, Cooper Hewitt, General Electric, and other well-known companies.

Any exhibitor may become a member of the association and share in its profits, the object being, by the hearty co-operation of its members, to hold exhibitions that will advance the interests of the trade. All communications as to particulars, plans and applications for membership or space should be addressed to Chester I. Campbell, General Manager, 5 Park Square, Boston, Mass.

It is hoped that the Boston electrical show will become an annual feature like the shows of Chicago and New York.

Public Service Investigation.

Senator George A. Davis, chairman of the legislative committee which has been appointed to look into the question of whether the public-service commission laws of New York state should be modified so as to place the telephone and telegraph companies under the supervision of the two commissions, in speaking of the committee's future work, states that the committee will first "investigate the telephone and telegraph question, and ascertain if the companies are giving efficient service, and whether we should place them under the jurisdiction of the Public Service Commission. It is hard to say just what we will do, but our scope of resolution is broad enough to pursue the widest form of investigation, and we shall not only confine our attention to Manhattan, but to other cities up-state that need the matter of telephone service looked into.

"It is rumored that we are to investigate the Public Service Commission itself and determine whether that board has rendered the services it was created for. This, of course, we can do, and doubtless we shall probe into the alleged failure of the commission to act speedily on the B. R. T.'s right to charge ten cents to Coney Island, which question has been before the commission for nearly eighteen months.

"We hope to begin public hearings about December 1, and clear the whole matter up in time to submit our report to the Legislature at the opening of the session."

The Japanese-British Exhibition.

The plans have been completed for the Japanese-British Exhibition, to be held next year at the White City, Shepherd's Bush, London, Eng., under the auspices of the Japanese Government and with the approval of the British Government. It is announced, says the (London) *Electrical Times,* that on the occasion of this exhibition the nobles of Japan will pour out, from the treasures they have accumulated for centuries, works of art never before seen in this country and only by a favored few in Japan. Prince Arthur of Connaught, as honorary president, and the Duke of Norfolk, as president, have issued an appeal to possessors of the treasures of British art to make a like revelation of their works, many of which are but little known to the general public, so as to equal, and if possible eclipse the display made at the Franco-British Exhibition.

Telephones in Brazil.

Consul-General George E. Anderson, of Rio de Janeiro, reports as follows on telephones in Brazil and the demand for supplies which the extension of the system will create:

An American company which is constructing a system for the state of Rio de Janeiro secured its concession about three months ago, and already has the construction of the system well under way. One of the chief objects of the enterprise is to afford communication by telephone between the city of Rio de Janeiro and the country surrounding it, including Petropolis, the summer capital of the country, Nictheroy, the capital of the state of Campos, and other important points.

There is great need in Brazil of telephone service in many parts of the country not reached by the government telegraph system, or in which the telegraph system does not meet the requirements of business. Although Brazil has twenty states and a territory substantially the same as that of the contiguous territory of the United States, it has no interstate telephone line, and, by reason of the interstate restriction, it has few telephone lines serving rural districts within the several states themselves. The telephone business in Brazil is little developed in either extent or service.

According to official returns, there exist in Brazil a total of thirty-nine telephone systems, ranging from twenty-two to 2,503 subscribers, of which at the time the statistics were prepared, last year, fifteen were Berliner, nine Kellogg, three Bell, four American, and the others German, Swedish, Norwegian, and French. The total number of subscribers in all the systems is 9,200. The capital of the companies ranges from $900 to $1,190,000. Of these companies, only five have more than 500 subscribers, viz., Bahia, Rio de Janeiro, Pernambuco, Pelotas and Sao Paulo.

[A list of telephone companies doing business in Brazil, with data for each, is on file in the Bureau of Manufactures.]

New Supply of Radium.

According to reports from San Francisco, a new immense supply of pitchblende, said to be enough to supply the world with radium for a long time to come, has been discovered on the McCloud River, north of Kennetta, Cal. It is expected that the price of the rare element will be reduced in consequence.

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German Taxes on Electric Lamps.

The new taxes on electric lamps and gas mantles have been approved by the German Reichstag and will go into effect in October next. The estimated annual income from this source is $5,000,000.

The scale of taxes is as follows, the first figure in the parentheses referring to carbon-filament lamps, and the other to metallic-filament, Nernst, and other incandescent or glow lamps: Lamps consuming up to fifteen watts (1.25 cents; 2.5 cents); from fifteen to twenty-five watts (2.5; 5.0); from twenty-five to sixty watts (5.0; 9.6); sixty to 100 watts (7.5; 14.5); from 100 to 200 watts (12.0; 24.0).

Carbon-filament lamps of over 200 watts are taxed twelve cents for the first 200 watts and six cents each for each further 100 watts or fraction thereof, and metallic-filament, Nernst and other lamps twenty-four cents, plus 9.6 cents per lamp for each 100 watts or portion thereof in excess of 200 watts consumption.

Gas mantles are taxed 2.5 cents each.

Arc-lamp carbons are taxed 14.4 cents per kilogramme of weight when made of pure carbon, and twenty-four cents per kilogramme for special carbons, as for flaming arcs. Mercury-vapor tubes, etc., are taxed twenty-four cents for each 100 watts or fraction thereof.

The tax is to be paid by the manufacturer by the use of revenue labels on the packages, before the finished and packed products are removed from the rooms of the place of production.

In the case of imported articles, the tax has to be paid by the importer on clearing the Customs House, or, if this does not take place, it has to be paid within a period of three days after reception.

Telephone Train Dispatching.

The telephone is to take the place of the telegraph in the dispatching of trains on the Fitchburg division of the Boston & Maine Railroad. The officials expect that the new equipment will facilitate the handling of traffic, and it is likely that other divisions of the Boston & Maine will be similarly equipped.

Following the innovation of other railroads, the Lehigh Valley Railroad has decided to install a telephone system along its line, believing this method of running trains superior to the telegraph. Work has been begun on the installation of a telephone line from Mt. Carmel to Easton, Pa., at a cost of $10,000.

Brooklyn Rapid Transit Company's Annual Report.

The annual report of the Brooklyn Rapid Transit Company, made public last week, shows gross earnings from operation for the year ended June 30, last, of $19,694,462, which is a decrease of $176,104 from the preceding fiscal year. There was, however, a reduction in the operating expenses of $544,923, which leaves an actual gain of $368,819 in the year's net earning from operation. The report shows that the slight loss in the gross was due to a variety of causes—chief among them the general depression in business which brought about a considerable decrease—$358,479—in the last six months of 1908, as compared with a similar period of 1907. In addition to this, the railroad's contracts with the American Express Company and through the American Railway Traffic Company for final disposition of the city's waste expired in December last, which represented a decrease of $265,809 in the gross earnings. Passenger traffic improved radically from the beginning of the calendar year, so that the fiscal year represented an increase of $128,529 in this feature of the company's earnings.

From the $19,694,462, which represents the company's gross earnings for the year, $11,394,654 is deducted for operating expenses, leaving a balance of $8,299,807, to which is added $605,817 as income from other sources, making a total income of $8,905,624, an increase of $296,812. Deducted from total income, $6,969,015 is taken for taxes and fixed charges, which leaves a net income of $1,936,609. A surplus in the company's treasury of $3,853,459 was carried forth from June 30, 1908, and after adding to this the net income of the fiscal year just closed and deducting from it bond discounts, the two initial quarterly dividends of the company and other charges, the substantial surplus of $4,387,229 remained in the company's treasury at the close of June 30, last. President Winter calls attention to the fact that his company expends $200,000 annually maintaining city paving, moving tracks for sewer construction and the like, and gives over $300,000 worth of free transportation to members of the police and fire departments in the course of a year. These, to the company, are, in effect, additions to its regular tax burdens. Mr. Winter also issues a protest against the recent federal tax on corporation net income. This, if upheld by the courts, will entail an additional annual charge of about $50,000 upon the companies of the Brooklyn Rapid Transit system.

The president of the Brooklyn Rapid Transit also draws attention to the extent the railroad is becoming insurer and co-insurer of its properties. Of the insurance fund, which has been invested in outside securities by the insurance trustees, $51,428 was accumulated prior to November 15, 1907. The balance of $57,070 represents the amount set aside since that date from operations under the insurance agreement entered into between the respective companies of the Brooklyn Rapid Transit system nearly two years ago. The insurance funds have been invested in securities of a par value of $110,000, which yield an annual income of $4,950.

The report shows that the property was brought through a year of financial depression with slightly increased net earnings at the end of the twelvemonth.

Navy Department Supplies.

The Bureau of Supplies and Accounts, United States Navy Department, will open bids in Washington, D. C., on the date stated below, for the following material. Bidders interested therein should fill out application card, giving the schedule numbers desired, and forward same to the bureau without delay. Applications will be filed as soon as the schedules are received from the public printer. Schedules can also be obtained upon application to the Navy Pay Office nearest each navy yard:

OPENING SEPTEMBER 28, 1909—MISCELLANEOUS.

Compressor, motor-driven	1	Mare Island, Cal.	1612
Equipment, turret-turning	Miscellaneous	Puget Sound, Wash.	1612
Pipe, air	100 feet	Mare Island, Cal.	1612

OPENING SEPTEMBER 14, 1909—ELECTRICAL SUPPLIES.

Drills, electric	Miscellaneous	Washington, D. C.	1647
Fuses, switch	6	Boston, Mass.	1629
Conductors	Miscellaneous	Boston, Mass.	1629

Bids will be opened on September 21 for three motor cranes and one motor-driven pump, for delivery at Mare Island, Cal.

3,000-Mile Wireless.

Army officers at Washington, D. C., having in charge the selection of a site for the erection of a 3,000-mile wireless-telegraph station, are now considering several proposed locations near Washington. A site in Georgetown, D. C., is said most likely to be selected.

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Aluminum Casting Foundries Merged.

Announcement is made by officials of the Allyne Brass Foundry Company, of Detroit, Mich., of an important consolidation of aluminum casting establishments throughout the country, and that the principal plant is to be located in Detroit.

The Aluminum Castings Company, just incorporated in Ohio, is the absorbing company. The position it occupies in the industrial world is something like that of the General Motors Company, which has been acquiring the stock of automobile companies. The Aluminum Castings Company, with a capitalization of $800,000, acquires the properties of the Allyne Brass Foundry Company, Cleveland; the Allyne Brass Foundry Company, Detroit; the Allyne Brass Foundry Company, Buffalo; the Syracuse Aluminum and Bronze Company, Syracuse; the Eclipse Foundry Company, Detroit, and the United States Aluminum Company, New Kensington, Pa. All these acquisitions are made at one time. The capitalization hardly represents the business, for the Allyne Company of Detroit alone turns out $1,000,000 worth of castings a year.

The announcement of the consolidation follows on the heels of the purchase by the Allyne people of twenty-three acres of land on Chene Street, not far from the Boulevard, Detroit, on which large foundry buildings are to be erected at once.

May Enlarge Subway System.

According to some tunnel builders, the Hudson & Manhattan Railway Company is likely to build a few years hence a tunnel from Constable Point, at Bayonne, N. J., to New Brighton, Staten Island, connecting with the lines of the Staten Island Rapid Transit Company at St. George.

Between Constable Point and Jersey City trains will run, it is said, over tracks built on the surface, which may be constructed through Bayonne at comparatively small expense, thus affording a practical solution of the problem for transportation between Manhattan and the large, attractive residential areas in Staten Island.

The estimated time between St. George, Staten Island and the Terminal Building, New York city, is given as seventeen minutes.

The General Electric Company is employing at present about 25,000 workmen, an increase of about 1,500 since February 1.

Lights for Hudson Fete.

Some 10,000 men are adding to the electric lights New York city always has in service tens of thousands more for the Hudson-Fulton Celebration. The wiring of the four bridges over the East River has been completed, and fully half a million lights will be used in this public illumination. The battery of lamps which will illuminate the Palisades will consist of some one hundred searchlights of several hundred thousand candlepower.

Private enthusiasm for illuminating the city will supplement the work by the municipal authorities. It is planned to make Fifth Avenue, from the Washington Arch to Fifty-ninth Street, one blaze of light, the Fifth Avenue Association having taken this enterprise in hand. Along the North River the steamship and railway piers are being strung with electric lights, and the people whose homes front the Hudson River are letting contracts for big illuminations.

The American Exposition, Berlin, 1910.

In connection with the American Exposition at Berlin, in 1910, it is announced that Prince Henry, of Prussia, has accepted the honorary presidency of the exposition, and that J. Pierpont Morgan and Thomas A. Edison have joined the honorary American committee.

The Hamburg-American Line and the North German-Lloyd have announced a further reduction of freight charges, making a total reduction of thirty per cent.

Arrangements have been made whereby exhibitors who do not intend to send a man of their own to Berlin can have their exhibits unpacked, installed and demonstrated, for a moderate charge, by a special Sales Office and Bureau of Information, established in the Exposition Palace, so that it will only be necessary for them to ship the goods to New York to be taken entire care of from there on by the exposition managers.

As already announced, the exposition aims, by bringing together in a magnificent Exposition Palace, much larger than Madison Square Garden, New York, in the commercial heart of Europe, a representative collection of the best that American ingenuity, skill and experience can produce, to foster and strengthen our trade relations with Germany and to increase American exports generally. It will be a unique enterprise also in that it will be an exposition without extras, all incidentals being included in the space-rental.

Staten Island Subway Plan.

George von Kromer, chairman of the Citizens' Tunnel Committee of Staten Island, called upon the New York Public Service Commission recently with plans for a subway route that will, according to Mr. von Kromer, prove a solution of the transportation difficulties of Staten Island.

The line will be a continuation of the Brooklyn Fourth Avenue route and will run from One Hundred and First Street and Fourth Avenue, in the Borough of Brooklyn, under the Narrows to Rosebank, Staten Island. A similar plan was filed with the commission last May, but in the new route suggested a far better service will be operated to Staten Island if this line is constructed.

New Electrical Industry for South Africa.

Consul Edwin N. Gunsaulus, of Johannesburg, writes that in addition to the great scheme for supplying power to the Rand, a new company, to be known as the Pretoria Power Company, is being formed to supply power and to manufacture, at a hydroelectric station on Crocodile River, nitrate of lime and nitric acid. Three large banks in Europe are said to be supplying the capital. For the initial works, which are to furnish 20,000 to 25,000 horsepower, $3,469,875 will be required, and for the nitrate of lime and nitric-acid works $1,250,000 additional will be necessary. The present cost of nitrate of soda delivered to South African ports is about $54 per ton, while nitrate of lime, which serves the same purpose as a fertilizer, can be produced and sold, it is said, at half of that price in the Transvaal. There is at present a very considerable demand for nitric acid in South Africa for use in the manufacture of dynamite for mining purposes.

Electric Cargo-Handling Appliances.

The British vice-consul at Spezia, Italy, in a recent report describes some of the electrical appliances now in course of erection at that port. Four electric cranes will raise coal, or ore, in buckets from the holds of ships, transport it horizontally, and discharge it into wagons or on the wharf at the rate of 2,000 tons of coal or ore per day of ten hours. Two electric cranes are also being fitted with grain-discharging apparatus, each being capable of handling about thirty-six tons per hour.

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Reports on Electric Meters.

The New York Public Service Commission has held a hearing on August 30 for the purpose of determining whether, in order to insure the reporting of all tests of electric meters, according to a standard form of report, an order should be issued by the commission containing substantially the following provisions:

That every electrical corporation operating within the First District shall file a monthly report stating the results of all tests of electric meters tested for accuracy by the company during that month; and every such corporation operating in both the First and Second districts shall report to the commission for the First District as to meters installed upon premises within the First District only; such reports to be filed not later than the fifteenth of the following month; all tests to be made in conformity with the regulations of the commission and under actual operating conditions. Each meter is to be tested independently, and not while connected in series with one or more other meters unless the potential circuits of each meter is so arranged as not to be fed through the field of any meter under test or rotating standard.

Direct-reading indicating wattmeters shall not be used as standard instruments in making tests of consumers' meters, and wherever possible tests shall be made on three loads, namely, at one-tenth of the full rated capacity of the meter at normal load and at the full rated capacity of the meter, and the average of these three tests shall be deemed the condition of the meter, and reported to the commission. Where it is impossible to reach either ten per cent of the rated capacity or 100 per cent of the rated capacity, tests shall be made at minimum, maximum and normal load and values given in the ratios stated above.

Coal-Cutting Machinery in Great Britain.

In a recent issue of the *Iron and Coal Trades Review,* of London, Eng., some interesting figures are given of the increased use of electrically driven coal-cutting machines. The latter made a gain of eighty-three machines in Great Britain in 1908 over 1907, while compressed air made a gain of only seventy-two machines. In Scotland the preponderance is greatly in favor of electrical machines, and slightly so in the Midlands, although as yet the compressed-air machine is still on the whole in the ascendancy.

New York Service Board to Exhibit.

In response to an invitation from the New York State Commissioner of Agriculture, the Public Service Commission for the First District of the state of New York will make an exhibit at the State Fair, which opens at Syracuse September 14. Space in one of the buildings has been allotted to the commission, and the exhibit will be installed early next month.

Some of the charts, maps, etc., which formed a part of the City Planning Exhibition, held in New York last winter, will be a part of the exhibit, and much new matter will be added. There will be charts showing the immensity of passenger-transportation business in Greater New York, as compared with other large cities of the world; maps showing the various transportation lines in the city; a graphic chart illustrating the hourly ticket sales on subway and elevated lines and at the East River ferries; a map showing the scenes of accidents on railroads and street railroads and the districts in which most accidents occur; a series of photographs showing the results of the commission's fender tests at Schenectady and Pittsburg; statements of accidents on railroads and street railroads covering the last two years; photographs of the testing of gas and electric meters and of the electric-meter laboratory of the commission; maps showing proposed rapid-transit lines and the existing subway and elevated roads; photographs of typical subway construction and various other photographs, maps and documents illustrating the work of the commission.

No All-Red Cable Line.

The negotiations which Canada entered into with Great Britain and the other states of the empire contemplating a cheaper cable and telegraphic service around the empire, are at an end. Three weeks ago Canadian Postmaster-General Rodolphe Lemieux was still under the impression that the cheap empire service was possible, but at one of the last meetings of the cabinet that he attended it was determined that Canada would not at present become a party in any such movement.

The Parsons Turbine in Shipbuilding.

According to the new volume of Lloyd's Register, just published, no less than thirty-four out of 101 steamers listed as being capable of making over twenty knots an hour, are fitted with Parsons turbines.

Hudson & Manhattan Railroad.

The Hudson & Manhattan Railroad Company announces that the subway stations at Twenty-eighth Street and Thirty-third Street, borough of Manhattan, will be opened on May 1 next. They would have been opened at an earlier date, but owing to the fact that the subway is to be extended north to Bryant Square and under Forty-second Street, it has become necessary to change the plan somewhat, so as to put the subway on a lower level at Thirty-third Street than had been originally intended. This is because of the fact that the subway is to go underneath the Interborough subway in Forty-second Street.

The tunnel is now entirely completed as far north as Twenty-seventh Street, and it would be possible to run through trains from the Cortlandt Street terminal to Jersey City, Pavonia, Hoboken, Christopher Street and Sixth Avenue to Twenty-third Street. This will be done as soon as the necessary car equipment is procured, but no definite date can be given at the present time because of the trouble at the Pressed Steel Car Works at Schoenville, Pa.

Reduction in St. Louis Lighting Rates.

Reductions in the lighting rates to consumers in St. Louis will result from modifications of the "guarantee requirements" of the Union Electric Light and Power Company, according to Vice-President and General Manager Alten S. Miller. The reductions will come principally from the facilities for making lower contracts and from prices paid for the current actually used.

The company, heretofore, has demanded a guarantee of no less than $2 a month on lighting contracts, and of no less than $3 a month on power-service contracts. From now on the minimum guarantee on lighting contracts will be $1 a month, instead of $2, and the minimum guarantee on power-service contracts will be $1.50 a month, instead of $3.

Consumers are at liberty, also, to combine their light and power service in one contract. Heretofore, two contracts have been made, one for lighting and one for power service. Now, if the consumer finds he can get a lower rate on both light and power service at the lighting rates, he can make one contract and use the rates in the lighting schedule. But the one contract cannot, for obvious reasons, be made on the rates of the power-service schedule.

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Chicago Adopts a Systematic Scheme of House Numbering.

In accordance with the municipal ordinance which went into effect on September 1, a very extensive renumbering of the houses in Chicago has been carried out. This was the result of much deliberation on the part of the city authorities and has been planned to facilitate greatly the location of any addresses within the city limits. As the addresses of a very large number of business firms, as well as most of the residents, have been changed by this ordinance, it will be worth while describing the system.

Madison Street has been made the base line for all numbers on the north and south streets. State Street has been made the base line for all east and west streets. Eight hundred numbers are assigned to each mile, and these are subdivided into eight groups of 100 each for each one-eighth of a mile. A number such as 3220 West Chicago Avenue will be found a little over four miles west of State Street; a number such as 1928 North Clark Street will be found between two-and-three-eighths and two-and-one-half miles north of Madison Street. As the section lines in the city are exactly one mile apart, and are the most prominent streets, it is quite easy, according to the new system, to locate any number. On the north and south streets south of Madison, the numbering between 1 and 3100 does not conform strictly to this rule, because the east and west streets on the South Side of the city have previously been numbered so that Twelfth Street is one mile south of Madison; Twenty-second Street two miles, and Thirty-first Street three miles. Beyond this point there are 800 numbers to each mile, as in the rest of the city. The numbers on the north and south streets of the South Side have, therefore, not been changed because this system had previously been applied to them.

In the central business district, between the Chicago River and Twelfth Street and Lake Michigan, there has been no change of numbering, since it was feared that too much annoyance to business firms would result. The city, and postal authorities as well, have requested that firms and residents of Chicago whose numbers have been changed should communicate with their correspondents to that effect. In order to hasten the delivery of mail, persons addressing anyone in Chicago, whose new number is not known, should write "Old No." opposite the former address.

Western Society of Engineers.

The Western Society of Engineers has prepared an attractive programme of papers to be presented before its meetings during the first half of the forthcoming season. All the meetings are held in the society rooms, on the seventeenth floor of the Monadnock Block, Chicago. The meetings of the main society are held usually on the first Wednesday of each month, and extra meetings are arranged for the third Wednesday of each month; the electrical section of the society meets, as a rule, on the second Friday of each month. All the meetings are held in the evening, beginning at 8 o'clock.

Among the large number of papers which are in preparation the following are of particular interest to electrical engineers:

"Wood Preservation, from an Engineering Point of View," by a representative of the United States Forest Service; "The Loss of Heat Through Furnace Walls," by W. T. Ray and Henry Kreisinger, Pittsburg; "The Kilbourn Plant of the Southern Wisconsin Power Company," by D. W. Mead, Madison; "Economies in Central-Station Management," by W. L. Abbott, Chicago; "Depreciation and Reserve Fund for Electric Properties," by William B. Jackson, Chicago; "New Illuminants," Carl Wiler, Chicago.

Entertainment at the Denver Conventions.

The entertainment committee of the Manufacturers' Association is desirous of obtaining the names and addresses of amateur specialists who expect to attend the coming conventions at Denver, during the week commencing October 4 next, with a view to continuing the annual supply men's vaudeville performance, which has met with such favor in past years. A. L. Whipple, 50 Church Street, New York city, is chairman of the committee and should be addressed.

Survey Ship "Carnegie" Has Sailed.

The non-magnetic surveying ship "Carnegie," which has been building in South Brooklyn for the Carnegie Institute at Washington, last week started on its expedition for the purpose of making a magnetic survey of the Atlantic, Indian and Pacific oceans, and to gather data about the magnetic attractions and variations in waters hitherto unexplored. The "Carnegie" is proceeding to Gardiner's Bay for compass adjustment and then goes on up to St. Johns, N. F., the coast of Labrador and Hudson's Bay.

American Permanent Sample Exhibition in Germany.

All arrangements have been perfected for opening up a permanent Sample Exhibition at Berlin in the spring of 1910.

This exhibition is designed primarily as an exhibit of distinctively American products, and the management is especially desirous that American manufacturers of novelties shall take part. The intention is to make apparent to the people of Europe, and especially Germany and the Continent, the importance and excellence of American manufactures, and to this end the German committee will advertise the exhibition throughout the Continent and will co-operate with American manufacturers and exporters in every way to popularize and exploit American products.

Blank applications for space and all information in regard to the exhibition may be obtained by addressing the American Exhibition Company, 77 and 79 Broad Street, New York, N. Y.

Ambassador Hill, the Department of Commerce and Labor (Washington, D. C.), James J. Hill, and other authorities have written to express their cordial approval of the scheme.

Installing Telephones for Train Dispatching.

The Chicago & Northwestern Railway Company is installing a telephone train-dispatching system that will include Racine, Wis., as well as every other north-shore town and city along Lake Michigan.

Telephone connections, long in use at North Chicago, Lake Bluff, Lake Forest, Highland Park and other places, are now being installed at Waukegan, Zion City, Kenosha, Racine and every station on the Northwestern from Chicago to Fond du Lac.

The wires for the dispatching system are already installed in the Waukegan station and are being installed at Zion City.

The St. Paul road has a system of telephonic dispatching in operation at present, but the Northwestern system is said to be better and simpler than this one.

The system has not thus far affected the local telegraph-operating system or number of operators employed, and it is believed that in the case of Kenosha and large cities the two systems will be worked side by side.

New copper wires have been strung along this division.

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QUESTIONS AND ANSWERS.

TRANSFORMER VOLTAGES, TRANSPOSITION.—1. What primary voltage, 2,200 or 2,300, is best suited for a small lighting plant when a 110-volt secondary is desired? What is the corresponding transformer ratio? 2. When using the rolling method of transposing telephone lines, is it necessary that the same wire always cross over the other in the same direction or can the transposition be reversed? I was told that just so that the wires changed pin position is all that is necessary.—T. F. B., Presho, S. D.

1. The standard transformers of near this voltage range have a transformer ratio of twenty to one, *i. e.*, they are either 2,200/110 or 2,300/115. If exactly 110 volts at the secondary is desired, the former type is to be chosen. More generally it is desired to have a little higher secondary voltage, so as to allow of some line drop between the transformer and lamps or motors, the latter to receive exactly 110 volts. In this case 115 volts at the secondary and 2,300 volts at the primary is selected. 2. It is preferable that a system of transposition strictly uniform throughout a stretch of line between stations be chosen, but it is generally ample if the stretch of line is symmetrically balanced in regard to transposition. For example, if a twenty-mile line is "rolled" uniformly in one direction for ten miles and then equally uniformly in the reversed direction for the remaining ten miles, a balanced line will result. In that portion of a line parallel to a strongly inductive and disturbing circuit the transposition must, however, be uniform and balanced.

WATTMETERS AND WATT-HOUR METERS.—In a number of your recent articles I have noticed the words wattmeter and watt-hour meter used as if they referred to different kinds of meters. Are they not synonymous? If there is a difference between them kindly make it clear to me.—R. H. T., Denver, Colo.

The terms wattmeter and watt-hour meter are by no means synonymous, although unfortunately they have been used rather indiscriminately to designate what is commonly known as the house meter. The wattmeter strictly is not an instrument of this class at all, but it is an instrument whereby the number of watts or kilowatts (thousands of watts) of power used in a circuit or translating device is indicated at any moment. Its reading represents the instantaneous power or rate of doing work. Wattmeters are of two kinds: the indicating wattmeter, in which the reading is shown by the movement of a pointer over a calibrated scale, and the graphic-recording or curve-drawing wattmeter, in which these instantaneous readings are recorded in a continuous line or curve on a chart. Watt-hour meters are instruments that record on a set of dials the amount of electrical energy in watt-hours or kilowatt-hours, that has been consumed in the circuit. To designate them as watt-hour meters is correct and sufficient. However, they are frequently called recording or integrating watt-hour meters. The latter is really the most descriptive and appropriate title for them, as they sum up or integrate the watt-hours consumed.

DIRECT-CURRENT POWER TRANSMISSION.—Can direct current at high voltage be used in power transmission?—S. F., Camden, N. J.

Yes. In France a number of installations using the Thury direct-current system have been operating quite successfully at potentials up to nearly 60,000 volts. In this system a number of series-wound generators are connected in series so that the voltage of the line is the sum of the voltages of the respective generators, although the voltage of each machine is within the safe limit of a commutating machine. The system operates at constant current with a special Thury potential regulator. At the receiving end of the line, or at intermediate substations, corresponding sets of series motors are connected to be operated in series by the line current and to drive separate generators supplying current for the low-voltage distributing lines. This system has not been used in the United States on account of the lower initial cost, higher generating and receiving—apparatus efficiency, simplicity of equipment and operation of the three-phase alternating-current systems generally employed. The direct-current system has a higher efficiency and better characteristics as concerns the transmission line only.

EXCITERS FOR ALTERNATING-CURRENT GENERATORS.—Which is better to use, a shunt or compound machine as an exciter for a three-phase alternator?—M. B. G., Evansville, Ind.

It has become the almost invariable custom to use compound direct-current generators as the exciters for all alternating-current generators. The compound exciter is preferable because it maintains the voltage of the exciting circuit constant regardless of the load on the main generator. A shunt exciter has a tendency to drop in voltage as its load increases; therefore it gives poor regulation of the generating unit, unless it is governed by a regulator of the Tirrill type.

GROUNDED GUARD WIRES FOR TRANSMISSION LINES.—Has the installation of a grounded guard wire over a transmission line been found effective in reducing the disturbances due to lightning?—L. J. K., Waukesha, Wis.

There has been considerable difference of opinion regarding the value of such grounded wires. In many cases barbed wire has been used with the idea that its points would attract the lightning to it. Where barbed wire has been used, however, much trouble from its breaking and short-circuiting the line has resulted. This, combined with the difficulty of handling it, has caused it to be discarded in several instances. Many engineers believe that overhead ground wires are more expensive and troublesome than they are worth. On the other hand, however, there is no reason why such ground wires cannot be securely put up so as to insure that they will not short-circuit the line. Theoretically, they are of unquestionable value and from the experience of some engineers they have been found actually effective in protecting the line.

TRANSFORMER AS A BOOSTER.—We have a one-kilowatt transformer with 2,000-volt primary and 200-volt secondary, the primary of which is connected through a double-pole switch to the generator busbars, and the secondary is connected in series with a 3.5-ampere series incandescent street-lighting circuit to boost the voltage of the same, as the regulator is overloaded. The frequency is sixty cycles and there are about 110 thirty-two-candle-power lamps in series on the circuit. With switch on primary open and 3.5 amperes flowing through the secondary, what voltage is developed in the primary coil? What impedance is offered to the 3.5-ampere current flowing in the secondary coil?—C. G. K., Downers Grove, Ill.

With the primary open and normal current in the secondary there will be developed normal voltage (2,000 volts) in the primary. This voltage, however, will be opposed to that which the generator supplies when it is connected. To force the normal current through the secondary will require the supply of 200 volts across its terminals from the series circuit. The impedance offered to this circuit will be

$$\frac{200}{3.5} = 57.1 \text{ ohms.}$$

It should be noted that the current will not be in phase with the electromotive-force and therefore the power taken by the transformer will not be 200×3.5 watts. It will be desirable, however, to cut the transformer out of circuit when its primary is not connected, as it serves no useful purpose and is merely using up some of the energy supplied to the series circuit.

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To Test Improved Wireless Sets.

Both the U. S. scout cruisers, Birmingham and Salem, are now being fitted with what is claimed to be the most powerful wireless system yet devised, and as soon as the apparatus is installed a very extensive test will be made with the ships thousands of miles apart and under all conditions of weather. In this test the battleship Connecticut, Rear-Admiral Schroeder's flagship, and the wireless station at Brant Rock will also take part. Although the orders have not been given out yet, it is thought that the scout cruisers will go across the Atlantic and from some port in Europe will proceed to tropical seas. Anyway, the test calls for the sending of messages over 1,000 miles under any conditions and 3,000 miles under favorable conditions, so that the ships will have to be these distances apart.

The battleship Connecticut now has a fifteen-kilowatt Fessenden set, which it is claimed sends messages over 2,000 miles. On this ship the necessary machinery has been installed in the coal bunkers, and it is thought that such a position is detrimental to its efficiency, since power is lost while getting the current to the masts. The Salem has now a Pierce apparatus of five kilowatts, and it has succeeded in sending messages for 2,000 miles, while the Shoemaker system, which has been placed on the Birmingham, has sent them 1,800 miles.

No American Cable Monopoly.

In a letter to the Earl of Crewe, principal secretary of state for the colonies, the chairman of the Anglo-American Cable Company, B. A. Bevan, of St. Johns, Newfoundland, defends the recent repudiation by the Sir Edward Morris ministry of concessions made by the Sir Robert Bond ministry to the Commercial Cable Company. He says that the concessions would have amounted to a twenty-five-year monopoly of all cable messages passing over the government land lines in favor of the American concern and to the prejudice of the Anglo-American Company, a long-established British corporation.

He reviews the history of the case in detail, setting forth points which he maintains constituted a monopoly in favor of the Commercial Cable Company. It was in the face of these facts, he concludes, that the new ministry of Sir Edward Morris declined to ratify the agreement with the Commercial Cable Company.

$5,000,000 Telephone Company.

Organization of the Home Telephone Company, of Michigan, which succeeds to the business and properties of the Home Telephone Company, of Detroit, and the Interstate Long-Distance Telephone Company, so-called independent concerns, was effected at a meeting at Detroit, August 21. A number of St. Louis (Mo.) capitalists appear in the list of directors. Fred T. Moran, of Detroit, was elected chairman of the board and W. A. Jackson, formerly president of the Michigan State Telephone Company, was elected president. The St. Louis directors are Albert N. Edwards, E. A. Faust, A. W. Lambert, M. F. Bayard, Bliss Michael, Henry Koehler, Jr., E. F. Goltra and Samuel D. Jeffries.

The new company is capitalized at $5,000,000 and contemplates the issue of $10,000,000 first mortgage bonds. It is planned to expend $1,000,000 on immediate extensions.

Seattle Electric Company to Issue $1,150,000 New Common Stock.

Stockholders of Seattle Electric, a Stone & Webster property, will shortly be given the right to subscribe for $1,150,000 common stock at a price to show substantial rights.

Seattle Electric has an authorized issue of $7,500,000 common, of which $5,000,000 is now outstanding, while $1,350,000 is reserved to retire convertible bonds. The balance of $1,150,000 is what is to be issued shortly.

This common stock will be offered for subscription as early as possible after September 15 next, to stockholders of record that date, and in the ratio of one share of new common for each ten shares of common and preferred outstanding.

Holders of convertible bonds who convert into common stock will be given the right to participate in the new issue.

The proceeds realized from the sale of this stock will be used to finance new construction in and about Seattle.

Central-Station Plant for United States Navy Yard.

Advices from San Francisco, Cal., state that work has been commenced at the Mare Island navy yard on the construction of a large central-station power plant building, from which power is to be supplied to all the shops of the big naval station. Such a plant has long been desired by the government officials stationed there, and has been recognized as a necessity.

Bell Telephone, of St. Louis.

The Bell Telephone Company, of St. Louis, Mo., has published a new schedule of rates, effective September 1, which is substantially the same as that of the Kinloch Telephone Company. The Bell makes a reduction of $46.80 a year on the unlimited, direct; $18 on the unlimited direct two-party line, and $6 a year on residence telephones. In explaining this change in the rates, President Walbridge stated that it was made in order to make full use of the company's exchange and wire facilities, which were enlarged previous to the panic. He said his company feels it can easily accommodate 20,000 more patrons and is offering the lower rates as an inducement.

Western Union-American Telephone.

The report of Everett W. Burdett as master in the Western Union-American Telephone case was filed in the United States Circuit Court at Boston on August 21, and shows an award to the Western Union of 20,087.8257 shares of stock in thirty-seven subsidiary Bell companies and $2,579,914 in cash, which is a reduction of 18,101 shares and $3,293,377 in cash from the claim of the plaintiff.

The shares excluded from the accounting were: 5,000 American Telephone and Telegraph Company, 3,895.4 New England Telephone and Telegraph, 200.7 Bell Telephone, of Pennsylvania, 396 Chicago Telephone, and 8,609 shares in various of the companies claimed as a thirty per cent royalty, to which the master ruled the plaintiff had no claim under the famous contract of 1879.

The reduction in the cash claimed by the plaintiff represents the dividends and interest on the shares exempted from the accounting.

The following table shows the claims made by the plaintiff, the amount due on defendant's theory of apportionment and the master's award:

	Plaintiff's Claim.	Defendants Conceded.	Master's Award.
Shares (20%).....	8,188	10,816	20,087
Shares, par value.	$3,496,615	$ 958,703	.....
Total cash.....	5,873,292	1,741,474	$2,579,914
Div. to Apr. 1, '09.	3,489,295	1,036,251	.....
Int. to Apr. 1, '09.	2,315,744	683,904	.....
For franchises....	33,558	10,207	.....
Int. on franchises.	34,694	11,112	.....

Officials of the American Telephone Company have recently expressed opinion that the case is likely to be in the courts for another ten years. Probabilities are remote that the Western Union will collect in the near future $5,000,000 in cash and securities. What is more likely is a compromise and a cash settlement for a substantially smaller amount than the master's findings.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

WARREN & JAMESTOWN STREET RAILWAY.

The report of the Warren & Jamestown Street Railway Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$21,030	$20,965
Total railway operating expense.	8,740	10,074
Net railway operating revenue.	$12,289	$10,891
Taxes accrued	15	492
Operating income	$12,274	$10,398
Total deductions from gross inc.	5,250	6,564
Net corporate income	$ 7,024	$ 3,834

CUMBERLAND TELEPHONE.

The report of the Cumberland Telephone and Telegraph Company for the month of July and seven months ended July 31 compares as follows:

	1909.	1908.
July gross	$ 520,923	$ 500,094
Expenses	302,123	283,473
July net	$ 218,800	$ 216,621
Charges and taxes	41,177	37,347
July surplus	$ 177,623	$ 179,274
Seven months gross	3,701,756	3,557,072
Expenses	2,118,528	2,065,681
Seven months net	$1,583,228	$1,491,391
Charges and taxes	296,998	260,357
Seven months surplus	$1,286,230	$1,231,034

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of July and ten months ended July 31 compares as follows:

	1909.	1908.
July gross	$ 345,572	$ 326,524
Expenses	180,412	162,413
July net	$ 165,161	$ 164,111
Charges	49,883	49,345
July surplus	$ 115,278	$ 114,765
Ten months gross	3,137,547	2,999,288
Expenses	1,894,815	1,814,429
Ten months net	$1,242,731	$1,184,859
Charges	359,775	368,908
Ten months surplus	$ 882,957	$ 815,951

NORTHERN OHIO TRACTION.

The report of the Northern Ohio Traction and Light Company for the month of July and seven months ended July 31 compares as follows:

	1909.	1908.
July gross	$ 227,012	$ 200,392
Expenses	115,650	105,377
July net	$ 111,361	$ 95,015
Charges	43,391	44,052
July surplus	$ 67,970	$ 50,963
Seven months gross	1,200,953	1,038,136
Expenses	669,016	623,035
Seven months net	$ 531,938	$ 415,101
Charges	306,711	307,950
Seven months surplus	$ 225,227	$ 107,151

BIRMINGHAM RAILWAY, LIGHT AND POWER.

The report of the Birmingham Railway, Light and Power Company for the month of July, 1909, compares as follows:

	1909.	1908.
July gross	$183,186	$170,261
Expenses	101,974	99,775
July net	$ 81,212	$ 70,486

AURORA, ELGIN & CHICAGO.

The report of the Aurora, Elgin & Chicago Railroad Company for the month of July, 1909, compares as follows:

	1909.	1908.
July gross	$167,614	$148,748
Expenses	77,895	72,208
July net	$ 89,719	$ 76,540
Charges and taxes	28,899	27,778
July surplus	$ 60,820	$ 48,762

LONDON UNDERGROUND.

The Underground Electric Railways of London report operations for the week ended August 7 and for thirty-one weeks ended August 7, 1909, as follows:

	1909.	1908.
Bakerloo	£ 2,770	£ 2,650
Piccadilly	4,430	4,480
Hampstead	3,695	3,515
District	8,780	8,220
Tramways	8,950	10,767
Total	£ 28,625	£ 29,632
Bakerloo	£102,290	£ 93,630
Piccadilly	176,810	166,210
Hampstead	120,305	101,205
District	308,441	278,618
Tramways	187,490	207,566
Total	£895,336	£847,229

TOLEDO RAILWAYS AND LIGHT.

The report of the Toledo Railways and Light Company for the month of July and seven months ended July 31 compares as follows:

	1909.	1908.
July gross	$ 226,564	$ 199,237
Expenses	134,221	111,665
July net	$ 92,343	$ 87,572
Other income	267	91
Total income	$ 92,610	$ 87,663
Charges and taxes	75,506	71,751
July surplus	$ 17,104	$ 15,912
Seven months gross	1,528,054	1,429,612
Expenses	884,406	794,054
Seven months net	$ 643,648	$ 635,558
Other income	1,363	2,874
Total income	$ 645,011	$ 638,887
Charges and taxes	501,075	491,887
Seven months surplus	$ 143,936	$ 146,545

INTERBOROUGH RAPID TRANSIT.

The Interborough Rapid Transit Company reports to the New York Stock Exchange for the year ended June 30, 1909, which compare as follows:

	1909.	1908.
Gross	$25,775,392	$24,059,299
Expenses	10,747,443	10,722,694
Net	$15,027,949	$13,336,605
Other income	1,384,644	1,220,170
Total income	$16,412,593	$14,556,775
Deductions:		
Bond interest and rents	$ 5,810,750	$ 5,069,650
Taxes	1,799,807	1,586,466
Amount debt, discount, etc.	12,213	
Total deduction	$ 7,622,770	$ 6,656,116
Balance	8,789,823	7,900,659
Manhattan Ry. guarantee	4,200,000	4,200,000
	$ 4,589,823	$ 3,700,659
Dividends, nine per cent.	3,150,000	3,150,000
Surplus for year	$1,439,823	$ 550,659
Previous surplus	1,831,743	
Surplus	$ 3,271,566	
Net adjustment of items of prior period	278,121	
Profit and loss surplus June 30	$ 2,993,445	$ 1,831,743

BROOKLYN RAPID TRANSIT COMPANY.

The Brooklyn Rapid Transit Company has issued its annual report for the year ended June 30, 1909. The income account compares with former years as follows:

	1909.	1908.	1907.
Gross	$19,694,462	$19,870,566	$19,381,587
Expenses	11,394,655	11,939,578	11,465,705
Net	$ 8,299,807	$ 7,930,988	$ 7,915,882
Other income	605,817	677,824	555,166
Total income	$ 8,905,625	$ 8,608,812	$ 8,471,048
Charges and taxes	6,969,015	6,534,938	6,026,387
Balance	$ 1,936,609	$ 2,073,873	$ 2,444,661
Addition and betterment	65,430	229,781	442,062
Surplus	$ 1,871,179	$ 1,844,092	$ 2,002,598
Judgment recov.			39,798
Surp. for year.	$ 1,871,179	$ 1,844,092	$ 2,042,396
Previous surplus.	3,853,460	3,734,006	2,075,563
Total surplus.	$ 5,724,639	$ 5,578,098	$ 4,117,959
Disc. on bonds	89,575	1,457,173	371,825
Balance	$ 5,635,064	$ 4,120,925	$ 3,746,134
Reserve, expenses and losses	†342,031	*250,835	
Balance	$ 5,293,033	$ 3,870,090	$ 3,746,134
Dividends	897,076		
Balance	$ 4,395,957	$ 3,870,090	$ 3,746,134
Old account adj.	8,727	16,630	12,127
Profit and loss surplus	$ 4,387,230	$ 3,853,460	$ 3,734,007

*Depreciation in securities.
†Includes $238,457 for reserve account, special franchise and real estate taxes in litigation; $20,197 for expenses adjusted prior to June 30, 1908, and $83,376 due to losses by change of line, etc.

Brooklyn Rapid Transit earnings and operating expenses in detail for the past three years compare as follows:

	1909.	1908.	1907.
Passengers	$19,058,693	$18,930,164	$18,443,983
Freight, mail and express	254,643	315,719	349,539
Advertising	155,860	155,205	148,424
Am. Ry. Tr. Co.	225,266	469,478	439,641
Total	$19,694,462	$19,870,566	$19,381,587
Operating expenses:			
Maintenance way and structure.	$ 1,194,014	$ 1,020,104	$ 860,075
Maintenance of equipment	1,690,916	1,837,550	1,786,731
Operating power plant	1,596,759	1,653,727	1,655,400
Operating cars	4,812,556	4,979,756	4,803,820
Am. Ry. Tr. Co.	155,702	363,524	365,863
Damages and legal expenses.	1,129,396	1,242,361	1,126,248
General expenses	676,666	651,669	643,899
Freight, mail and express	138,644	190,885	233,667
Total	$11,394,655	$11,939,578	$11,465,705

The comparative statement of results of operations for the years ending June 30, 1909 and 1908, shows total earnings from operation of $19,694,462 for the year 1909, and $19,870,566 for 1908. The decrease of $176,104 in gross earnings is distributed as follows:

Passenger earnings	Inc.	$128,529
Freight earnings	Dec.	40,125
United States mail earnings	Inc.	645
American Express Co. earnings	Dec.	21,596
Advertising	Inc.	656
American Railway Traffic Company.	Dec.	244,213

The falling off in freight is explained by general depression in business. The last six months of the fiscal year, however, show an increase over the corresponding period of 1908. The decrease in express is due to the contract with the American Express Company expiring on December 31, 1908, and not renewed; the decrease

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in the American Railway Traffic Company of $244,213 is due to contract with the city expiring December 27, 1908, and not renewed.

The influence of the business depression on passenger earnings, noted in the last annual report, continued to the end of the last calendar year, and resulted in a deficit in gross passenger receipts of $358,479 for the six months (July to December, 1908, inclusive), but beginning with January of this year passenger earnings showed an increase, which at the close of the six months ending June, 1909, amounted to $487,000, or 5.4 per cent, overcoming the decrease of $358,479, and closing the fiscal year with an increase of $128,528.

The total cost of operation for the year ending June 30, 1909, was $11,394,655, as against $11,939,579 for the previous year, a decrease of $544,924, or 4.56 per cent.

The net income from operation increased $368,819, or 4.65 per cent.

Taxes show an increase of $407,613, or 43.83 per cent.

Interest and rentals show an increase for the fiscal year of $26,464, or less than one-half of one per cent.

Surplus earnings after making all deductions were $1,871,179, an increase of $27,087, or 1.47 per cent, over the preceding year.

An official of the Brooklyn Rapid Transit Company explains that the decrease of $164,351 in the amount charged out of net income for betterments and additions to the property during the year 1909 is due to the fact that there has been a revision of the accounts of the company, whereby a large proportion of the money so expended has been charged against operating expenses. He says that, whereas the income account shows a decrease in this item, as a matter of fact there was an actual increase over 1908 of somewhere in the neighborhood of $190,000.

DETROIT UNITED RAILWAYS.

The report of the Detroit United Railway Company for the month of July and seven months ended July 31, 1909, compares as follows:

	1909.	1908.
July gross	$ 771,453	$ 679,447
Expenses	466,319	*417.869
July net	$ 305,134	$ 261,577
Other income	12,670	6,462
Total income	$ 317,804	$ 268,039
Charges and taxes	162,050	135,978
July surplus	$ 155,754	$ 132,061
January 1 to July 31:		
Seven months gross	$4,410,512	$3,964,875
Expenses	2,717,679	*2,528.176
Seven months net	$1,692.833	$1,436.698
Other income	83.750	35,072
Total income	$1,776.583	$1,471.770
Charges and taxes	1,088,384	948.952
Seven months surplus	$ 688,199	$ 522,818

*Includes taxes.

UNITED ELECTRIC SECURITIES COMPANY.

The United Electric Securities Company reports for six months ended August 1, 1909, total profit, after deducting $131,306 for expensees and interest on its own collateral trust bonds, of $211,016. From this was paid dividends on the preferred and common stocks amounting to $160,000, leaving surplus for the six months of $51,016. This amount, together with the previous surplus on February 1, 1909, of $1,265,062 makes total surplus August 1, 1909, of $1,316,079.

CHICAGO RAILWAYS.

Passenger earnings of the Chicago Railways during June were $1,021,608, against $911,030 a year ago. July earnings were $1,046,723, against $937,401 a year ago.

General Electric's Earnings Helped by Steadiness of Prices.

Net earnings of the General Electric Company are being materially benefited this fiscal year by the return of prices to more nearly the normal standard.

During the fiscal year ended January 31, 1909, prices were cut right and left. This cutting in prices was indulged in by all the electrical companies, and was due not only to the competition for business on a diminishing volume of new orders, but also to the desire to tempt buyers into the market by reason of the very favorable terms offered.

Since March 1 the bulk of electrical orders coming to hand has been sufficient to warrant a gradual increase in prices, and at the present time average prices for electrical apparatus are estimated as ten per cent higher than eight months ago.

Some departments of the General Electric Company's plants are already overcrowded with orders and in others, such as the street-railway department, the outlook favors a normal volume of business by fall.

There is no question that General Electric will fully earn its eight per cent dividend this fiscal year, with a substantial surplus to spare.

Directors have not made any move in the direction of building the new plant projected at Erie, Pa., in the early part of 1907, and the plant will not be constructed until the need for it is more urgent than at present.

Delay in New Code Rule.

The Western Union and Postal Telegraph companies have decided to postpone the enforcement of a recent order restricting the length of telegraph code words, except in the case of ordinary dictionary words, to five letters. This decision is the result of numerous protests received by the companies from business organizations, notably the National Association of Manufacturers, of which John Kirby, Jr., is president.

The association's board of directors considered the new order of the telegraph companies of such importance to the 3,000 manufacturers forming the association that the board recently adopted a series of resolutions strongly protesting against the date, September 1, as selected by the telegraph companies for the enforcement of the new order.

President Clowry, of the Western Union, and Vice-President Bruch, of the Postal, have therefore agreed to a postponement until December 1. These decisions will give the business interests of the country at least three months in which to prepare for the change.

Yerkes Estate Receivership.

The United States Circuit Court of Appeals has confirmed the action of Judge Ward, of the Circuit Court, in appointing and continuing Harrington Putnam as receiver of the estate of the late Charles T. Yerkes. The receiver was appointed in a general creditors' action for the administration and distribution of the estate instituted by the Underground Electric Railways Company, of London, Limited. The appeal was taken by Louis S. Owsley, executor of the Yerkes will, and Mary A. Yerkes, the widow.

Attach Waterpower Rights.

Water rights belonging to the Sierra Nevada Water and Power Company, one of the properties of the insolvent Market Street Bank, of San Francisco, Cal., have been attached by the sheriff of Calaveras County to satisfy a judgment amounting to $10,562. The water rights affected include 20,000 inches in the South Fork of the Mokelumne River, 20,000 inches in the Middle Fork of the same river and 30,000 inches at another point in the South Fork.

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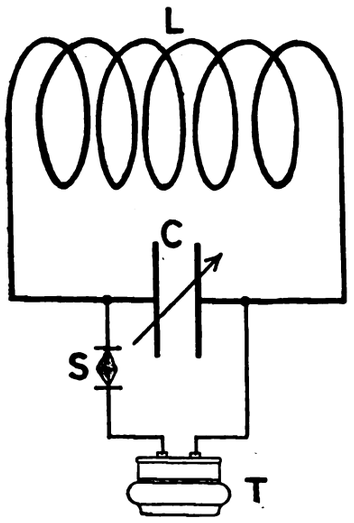
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

A PORTABLE WAVEMETER.

The new Marconi wavemeter is a light, portable instrument containing a vibratory and a detector circuit with telephone, of small dimensions and weighing less than three pounds. The vibratory circuit consists of a fixed inductance and a gradually adjustable condenser; its damping is very small. The detector circuit is connected across the condenser and comprises a telephone receiver in series with a carborundum crystal. The wave-lengths of the vibrations taking



THE MARCONI WAVEMETER.

place in a circuit are measured by approaching the wavemeter to this circuit and adjusting it to resonance which is attained when the sounds in the telephone are loudest. The wave-lengths may be ascertained from the position of the condenser and a graduated scale or a table. The exactness of the instrument is due to the fact that the entire vibrating circuit remains fixed and also that the detector is not in the vibrating, but in a parallel, circuit, the resistance of which is so high that it scarcely influences the vibrating circuit. The great sensitiveness of carborundum is also of value in this respect. The accompanying illustration is a diagram of the circuit connections of the apparatus, in which L is the inductance, of about fifteen micro-henrys, capable of furnishing all wave-lengths from 180 to 750 metres. It is wound on a square form and placed in the cover of the instrument case, so that it can be easily exchanged and replaced by inductances of different values. C is the adjustable condenser, S a spring clamp holding a small carborundum crystal, and T the telephone receiver.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), July 29.*

AN INTERESTING INSTALLATION QUESTION

Quite recently a municipal central-station engineer had before him alternative tenders for a reciprocating and turbine plant of 500 kilowatts. He could have purchased a turbo set which would have consumed less steam, but, in view of the fact that within a year or two a further small addition to this plant would be required, his final recommendation, adopted by the committee, was that a reciprocating set should be ordered, together with a suitable condenser for accommodating an exhaust turbine, the installation of which in the early future would reduce the rate of steam consumption below the figures guaranteed in the present instance for either the reciprocator or turbine. This appears to be the first case in which the development of the exhaust turbine has actually enabled reciprocating engine makers to obtain a contract in competition with the live steam turbine. It is not an example that will be followed by larger stations, but such practice might have an important bearing on the commercial survival of numerous public and private generating plants.—*Abstracted from The Times (London), Engineering Supplement, August 18.*

A NEW SOLUTION OF THE PROBLEM OF TRANSMITTING PHOTOGRAPHS.

The apparatus recently invented by Laurent Sémat represents a simple solution of the problem of transmitting handwriting, drawings, photographs, etc., to a distance. The difficult problem of obtaining synchronism between sending and receiving stations has been solved in an ingenious and simple manner. The sending cylinder is of smaller diameter than the receiving cylinder, but both are of the same length, if the picture is to be reproduced in the original size. A sheet of metal foil, on which the picture to be transmitted has been drawn or printed, is wound on the thinner sending cylinder, covering its entire surface. A stylo bearing on the foil sends current impulses into the line, by means of which the picture is reproduced, the circuit being closed when the stylo is in contact with the foil, and opened when it passes over the blackened parts. A sheet of carbon paper, and over the same a sheet of ordinary paper, is wound on the larger receiving cylinder. Assuming the difference in the circumference of the cylinders to be one-eighth, then the reproduced picture must cover only seven-eighths of the surface of the larger cylinder. The relations in the speed between the two cylinders are such that the smaller one will perform one revolution in seven-eighths of the time required by the larger one. Furthermore, the former stops after each revolution and starts again when the larger one has moved the distance of one-eighth of its circumference left free by the picture. This operation is repeated at each revolution. By starting at the same point equal surfaces of both cylinders will pass under each stylo during the same time interval, the lateral displacement on both cylinders being the same, when reproducing pictures in original size. The advantages of Sémat's apparatus consist in the simplicity and perfection of the synchronizing arrangement. Furthermore, no selenium or photographs are used, and all operations take place in daylight by means of mechanical devices. The instruments may be connected to ordinary telegraph or telephone lines, and a picture seven by twelve centimetres in size can be easily transmitted in five minutes. The apparatus was shown at the recent annual exhibition of the French Physical Society.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), August 1.*

ELECTRICALLY DRIVEN CONVERTER BLOWER IN A ROLLING MILL.

The Thomas process for the manufacture of malleable and rollable cast-iron requires for its operation large quantities of air at comparatively high pressures. The stopping of the air current, even for an instant, means danger of burning out the converter bottom, and for this reason reliably running steam engines

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have been employed exclusively for driving converter blowers until recently. The first electrically driven blower has been installed by the A. G. Peiner Rolling Mill. Polyphase current at 10,000 volts is obtained from a distant power station and transformed into direct current of 520 volts. The direct-current sides of the converter work in parallel with two storage batteries having a capacity of 2,000 and 4,000 amperes for one hour, respectively. The batteries serve for compensating load variations caused by the motors driving the rolling mill and also as a momentary reserve in the case of failure of the current supply from the transmission line. The twin-blower is capable of delivering 800 cubic metres of air per minute at a pressure of about two atmospheres when running at a speed of eighty revolutions a minute. As a regulation of forty to eighty revolutions per minute in shunt was required for the machine, the Felten & Guilleaume-Lahmeyer Works built a shunt motor with reversing poles for 500 volts with a permanent load capacity of 2,000 horsepower. Another condition was that the degree of variation in the air supply should not be more than 1:30 at fifty revolutions per minute. This required a great rotating momentum, which was provided by making the armature of large diameter, and the necessity of a special flywheel was thus circumvented. In order to carry out this construction of a so-called flywheel machine a considerable number of poles and a magnet frame of large diameter were necessary. The outside diameter of this frame is 6,300 millimetres, and the machine is probably one of the largest direct-current motors ever built.—*Translated and abstracted from Elektrotechnische Zeitschrift (Berlin), July 22 and 29.*

THERMAL AMMETER FOR CURRENTS OF GREAT INTENSITY AND HIGH FREQUENCY.

Prof. A. Broca formerly measured these currents by means of an exact electro-dynamometer. This method was inconvenient, and he constructed a new thermal ammeter, which was described by him in a lecture before the Société Internationale des Electriciens. Ten horizontal wires are stretched between two vertical plates, the wires forming the edges of a regular prism and the whole having the appearance of a squirrel cage. Connection for the current is made in the center of the two plates, and by reason of the symmetrical arrangement the current divides itself uniformly between the wires. By measuring the expansion of one of them in the usual manner an apparatus is furnished for a capacity of fifty amperes, if each wire can withstand five amperes. There is no induction between any two adjacent wires, as they act in an inverse sense. A variable sensitiveness is obtained by combining symmetrically a different number of wires. It has been ascertained that the multiplying power is the same as with direct current. An inconvenience is the changing of the zero when the instrument is used with ten wires for fifty amperes, on account of the central bronze column, which has the same coefficient of expansion as the wires, but cools at a different rate. This effect, which amounts to four to five per cent, attains its maximum value in about ten minutes. It could be avoided by using insulating material, but then the zero would vary with the exterior temperature. However, in place of having a cause of error of unknown value, it has been considered preferable to retain this imperfection in the apparatus and to have an error of definite value. By blackening the metallic parts in order to increase the heat radiation, and by insulating the central column from the end plates with mica, the effect has been decreased, and the indications of the instrument are correct within two per cent. Ammeters for currents of any intensity may be constructed on this principle by increasing the number of wires and the size of the plates.—*Translated and abstracted from Bulletin de la Société Internationale des Electriciens (Paris), for July.*

SILUNDUM AS A HEATING MATERIAL.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for May 15, 1909, an account was given of the manufacture of silundum, a new product of the electric furnace. This article shows its use as a heating element. The comparatively low efficiency of the radiant-heat electric radiator and the cheerlessness of the ordinary black electric radiator have long been realized. As a means of heating a room the electric radiator has so far only been a partial success; it is either cheerful and inefficient, as in the case of a luminous radiator, or cheerless and efficient, as in the case of a non-luminous radiator, and between the two there is not much to choose. For cooking purposes electricity occupies a distinctly more favorable position; its efficiency is unquestioned, as much as ninety-seven per cent of the energy supplied to an electric kettle or similar vessel reaching the contents, and in this respect it has no rival at all, even if such appliances did not have the collateral advantages of cleanliness, portability and freedom from the risk of fire. Many efforts have been made to produce a more or less refractory material which would, while giving all the advantages of existing electric heaters, prove an efficient radiator and give the much-desired cheerful glow. The electric furnace has now produced a material which is beginning to be known commercially as silundum, which can be heated in the atmosphere to a temperature of 3,000° Fahrenheit without entering into any combination with oxygen nor apparently losing any of the electrical or physical properties which are so valuable. It appears impossible to melt it; it is therefore truly refractory, and it will withstand the attacks of acid and is unaffected electrically by water. The material is produced in rods, bars, sheets or other suitable shape, and is used for electric stoves, radiators, grills, toasters, and cooking purposes generally, for the work can be done over a bright red or even incandescent material, just like a bright coal or coke fire. For cooking, such a material cannot approach the resistance methods now so common, because of the great heat dispersion into the surrounding atmosphere; but for many purposes, where a glow combined with a high temperature is desirable, the new material will prove invaluable. No reliable information as to the composition of silundum is yet available, but the foregoing information is sufficient to indicate that the new material will prove of very great value for many purposes.—*Abstracted from The Engineering Review (London), for August.*

Youngest Town in the Country Has Electric Light and Power Plant.

The little town of Luzon, Wash., sixty miles west of Pasco, on the S. P. & S. Railroad, has the distinction of being the youngest town in the country which is lighted with electricity.

The town is now but five months old, the plats having been filed on April 5, 1909. During the intervening time a power plant has been installed, consisting of a 125-horsepower Smith gas producer, and a 120-horsepower Riverside gas engine, directly connected to an eighty-five-kilowatt Western Electric generator. The plant is now also being used to pump water for irrigation.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Elliott Mechanical Stoker.

The Elliott mechanical stoker, illustrated herewith, not only performs the function of automatic stoking, but in addition grinds up the fuel, regulates the feed of the coal to the furnace, distributes it over the grate surface, and finally removes the ashes from under the grate.

Fig. 1 illustrates two of these stokers side by side, the one on the right (to which the following description applies) having parts of the casing removed to show the mechanism. In the middle, at the top, is shown the crusher and regulator, to which coal is fed from a storage bin over the boiler. The rate of operation of this device (and simultaneously of the worm conveyor mentioned later) is governed by the change gear to the right, which is regulated by the hand wheel just above it. The crushed coal passes from the crusher and regulator on either side and is forced along by the worm conveyors (shown half uncovered in Fig. 1) to the rotary turbine devices, one at each end, by which it is distributed to the delivery chutes underneath the latter, and which are shown protruding from the faceplates in Fig. 2.

The passage of the coal is assisted by means of two steam jets, one-thirty-second of an inch each in diameter, in the base of the turbines, a three-eighths-inch steam pipe supplying both jets.

The worm conveyor is driven by a noiseless chain belt, and the shaft across the front of the stokers may be coupled to as many stokers in line as may be desired.

Fig. 3 shows the front of a complete installation in which the two stokers are driven by an electric motor belt-connected to the driving shaft. This particular view is from a photograph of two boilers at the plant of the Ridgway Dynamo and Engine Company, Ridgway, Pa., the complete plant of four boilers being now equipped with Elliott stokers. The first pair was installed in August, 1907.

Fig. 2 gives a good idea of the grate mechanism. The grates incline downward to the center at an angle of sixteen degrees. They are actuated by the gearing shown uncovered in the bottom of Fig. 1, which provides a slow oscillating movement designed to remove the ashes, stir the fire to prevent coking, and ventilate the burning fuel. When extremely poor fuel is used, the clinker and refuse can be dumped, if desirable, through the two center grates by means of the hand lever shown to the extreme left in the lower part of Fig. 1, and at all other times these "dump grates" oscillate in unison with the balance of the grates.

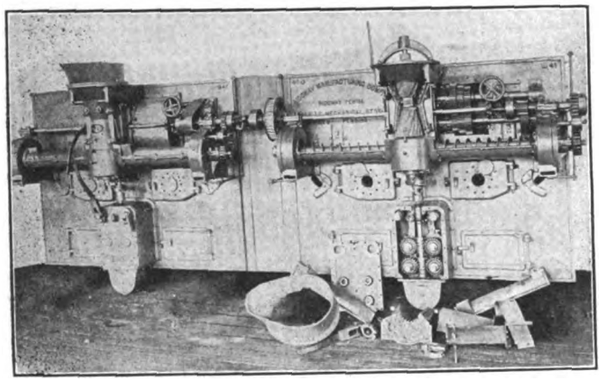

FIG. 1.—ELLIOTT STOKER—FRONT VIEW WITH PARTS OF CASING REMOVED.

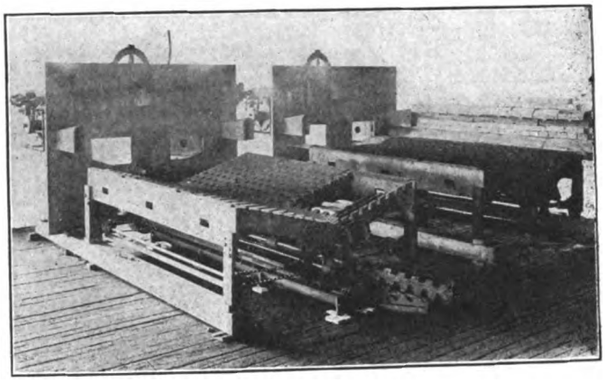

FIG. 2.—ELLIOTT STOKER—BACK VIEW, SHOWING GRATES, WORM CONVEYOR, ETC.

This stoker, which is made by the Ridgway Manufacturing Company, Ridgway, Pa., has proved very successful in operation, and is remarkable for its continued reliability under the severest condition of service.

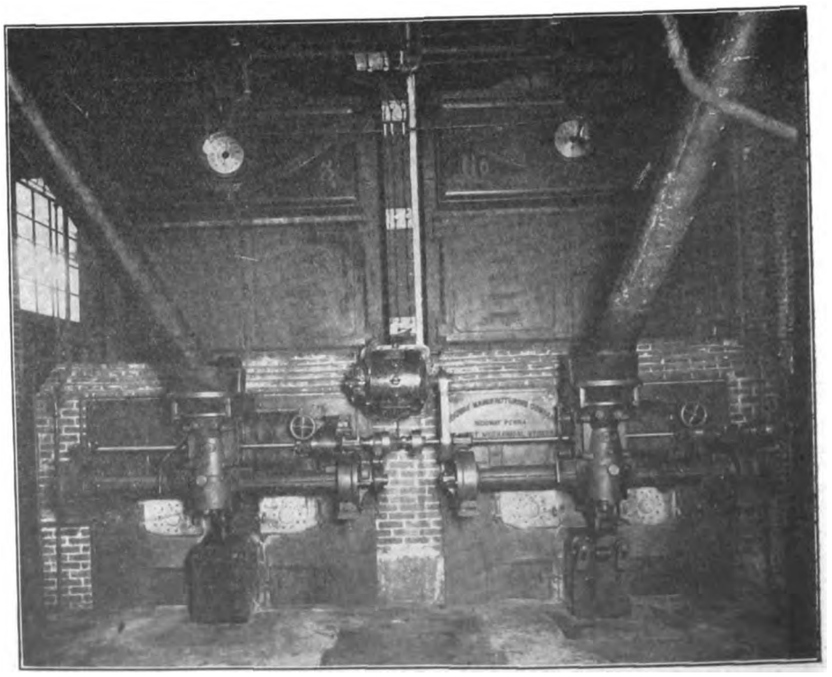

FIG. 3.—ELLIOTT STOKERS AT THE PLANT OF THE RIDGWAY DYNAMO AND ENGINE COMPANY, RIDGWAY, PA.

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The Middleton Magnetic Fault Finder.

The exact location of faults in lead-covered high-tension and other multiple-conductor cables is frequently rendered very difficult by the well-known loop methods involving resistance measurement. Thus a proper loop can sometimes not be obtained, as all three phases may be burned and "shorted" together, or one of the wires burned in two and grounded at one end, or the wire may be damaged due to the burn, so that its resistance is not in proportion to its length, or there may be more than one fault on a conductor. In cases of this kind it has been the laborious custom to explore the entire cable with a magnetic compass or to keep cutting it until the fault is found.

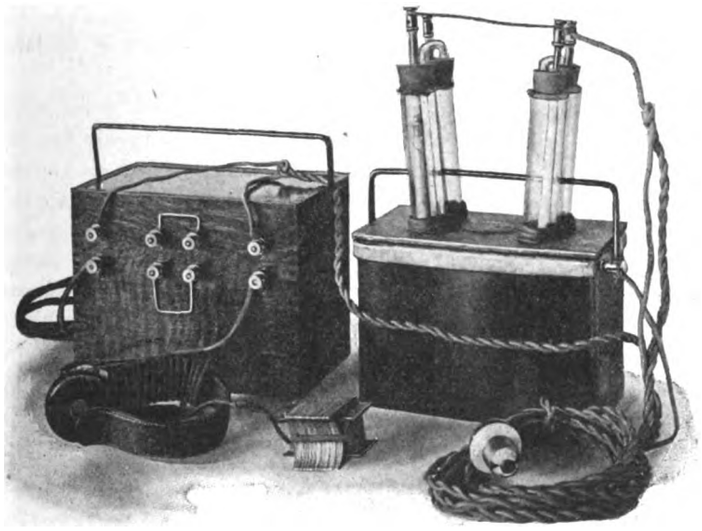

FIG. 1—THE MIDDLETON MAGNETIC FAULT FINDER.

A much simpler, quicker and less expensive method for such fault location has been devised by W. D. Middleton, of Chicago. It is the result of extended experience in telephone work and is particularly adapted to power and high-tension cables, although it is of general service for telephone, telegraph and signal cables as well. The apparatus has been called the Middleton Magnetic Fault Finder. Its operation is as follows:

An alternating current of sharp wave form is sent along the faulty conductor and listened to with a special current transformer in series with a pair of telephone receivers. The listening transformer is held close to the cable at different points and the alternating current in the faulty wire noted.

The listening transformer is unique in that its magnetic circuit is so arranged that it receives such a predominating influence from the faulty wire that the return current has little neutralizing effect. The magnetic circuit encompasses about one-third of the circumference of an underground cable. See Fig. 2.

If the magnetic circuit went around the cable and all the alternating current in the faulty wire should return over the sheath, the effect on the coil connected to the receiver would be exactly neutralized, and no sound would result. If the current returns over the sheath, it acts apparently as a wire at the center of the cable. The center of the cable being at a greater distance from the air gap than the faulty wire, one hears the sound set up till the fault is reached.

When the current returns over an adjacent wire as over one of the other phases in the case of a cross, at times one of the phases will be closer to the air gap than the other and at other times they will be exactly the same distance and again the second phases will be the closer. The current will be heard except where the phases are the same distance away.

The party listening may stand at the top of the manhole while the assistant applies the transformer at two or three points along the cable, where it is exposed. Time may be saved by starting a man at each end of a long cable, each listening every few blocks. It is not necessary to take the tiling off a high-tension cable, as the noise can be heard several inches away. Where it is possible to get on all sides of the cable, a location can be made within two or three inches, if the trouble is not between manholes, otherwise within three feet, or half of the lay of the cable.

A double receiver is used, one on each ear, with ear cushions to shut out street noises. A great variety of noises are heard from the cables. On this account it is necessary to make the interrupter give out a tone that is distinguishable from any of the other noises. To this end a multiple electrolytic interrupter is used. One of the tubes gives a high frequency, which is automatically interchanged with the low frequency of the other tube. This gives a distinctive noise.

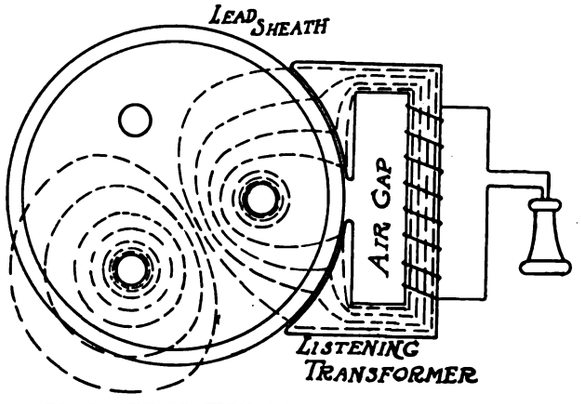

FIG. 2—APPLICATION TO THREE-PHASE CABLE.

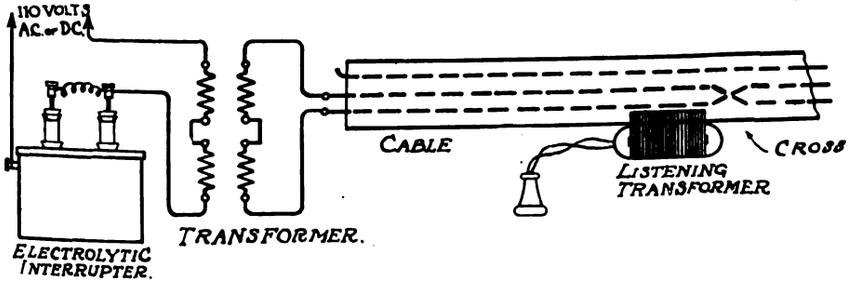

FIG. 3—CIRCUIT DIAGRAM OF MAGNETIC FAULT FINDER.

If the cross or ground is a high-resistance one, it must be brokn down till it is possibile to put fifteen or more amperes on the conductor, so that the sound in the receiver may be amply large. For this purpose the transformer is made adjustable, so that several voltages may be obtained, and long or short, large or small cables may be tested with the same efficiency.

The apparatus is generally furnished in duplicate, so that there will absolutely be no interruption to the current to which the party testing is listening at different points. This apparatus for locating troubles has been in use in Chicago with great success. It is manufactured by Middleton Brothers, 1361 Monadnock Block, Chicago; and a patent for it has been applied for.

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The Westinghouse Core-Loss Voltmeter.

An instrument which makes possible the accurate measurement of the core loss of distributing and power transformers, regardless of wave-form distortion or frequency variation, should be a valuable adjunct to a central station's testing department. Such an instrument is the core-loss voltmeter, described and illustrated herewith, which is manufactured by the Westinghouse Electric and Manufacturing Company.

The correct measurement of transformer losses is perhaps the most difficult and yet the most important test which the central station has to perform. The inaccuracies in such tests result from many causes, such as frequency, temperature and wave-form variations, inaccurate wattmeters on low power-factors, wrong meter connections, etc. Of all these the wave-form variations are the most serious. These are almost always present on ordinary commercial circuits and are the most difficult to make corrections for readings taken on ordinary instruments. A peaked voltage wave will cause a lower core-loss, and a flat wave a higher core-loss, than a sine wave of the same effective voltage.

Since guarantees of transformer core losses are generally based on a sine wave of electromotive-force, it is necessary that some method be employed to secure a sine wave shape or its equivalent, when testing transformers for the performance guaranteed. The equivalent loss due to a sine-voltage-wave at a normal frequency of, say, fifty cycles, can be secured under normal conditions of wave form and frequency by either lowering or raising the voltage. What is needed then is an indicator which will enable a voltage adjustment to be made to give a core loss equivalent to that produced by a sine wave at normal frequency and voltage. To render such an adjustment possible the core-loss voltmeter has been designed.

This meter consists essentially of a ring or core of laminated steel excited by a winding, and a wattmeter of suitable design on which to read the power input to the ring and all copper circuits in the instrument. The core and winding are mounted in the lower case with the two leads of the winding brought through the top and into the instrument case which contains the meter movement. A stationary current coil is connected in series with the winding. The shunt circuit consists of a moving coil, a non-inductive resistance and a compensating coil all in series across the instrument terminals. The compensating coil is wound parallel to the stationary current coil and has the same number of turns. The deflection of the wattmeter movement is caused by the total input of the instrument which consists of the hysteresis and eddy loss in the ring, or magnetic rheostat, and the I^2R losses in the copper circuits of the instrument.

The instrument is calibrated in parallel with an alternating-current voltmeter on a pure sine-voltage-wave of the required frequency from a small smooth-core alternator and the scale is drawn in to agree with the alternating-current instrument. Two scales are provided, one reading watts input of the instrument itself and the other volts.

In application the core-loss voltmeter is connected across the terminals of the transformer under test, in the same manner as an ordinary voltmeter. A watt-

WESTINGHOUSE CORE-LOSS VOLTMETER.

meter is also connected in the circuit in such a way as to measure total input of both transformer and core-loss voltmeter. The voltage of the circuit is then adjusted by any convenient means until the voltmeter reading is the same as the normal voltage of the transformer. The total power input is then read on the wattmeter and the watt input of the instrument read on the watt-scale of the core-loss voltmeter, the difference being the core-loss of the transformer.

The core-loss voltmeter may be used as a portable voltmeter in testing transformer core losses on any reasonably distorted wave of voltage and without any knowledge of the wave form.

There are many advantages which will result from the use of the core-loss voltmeter. Chief among these is the comparative simplicity in testing equipment since very little apparatus is required and no oscillograph is needed to determine the form factor. Another advantage is that transformers need not be tested at the source of power. Competitive tests are also very much simplified when the core-loss voltmeter is used, because there is no need of having similar conditions of wave form, frequency, etc., for each transformer tested.

The illustration shows the core-loss voltmeter as at present constructed. A new style of instrument is being made up which is more compact than the one shown. This new design will have the meter element mounted in the center of the core instead of above it. A line of double-scale voltmeters is also being manufactured which combines in one instrument the advantages of a high and low reading voltmeter.

Twenty-four-Hour Service at Appleton, Minn.

In the latter part of 1905 it was deemed advisable to maintain a twenty-four-hour service at the electric plant in Appleton, Minn., but it was found that the cost of operating the generating unit during the day would be prohibitive. The management consequently installed, in January, 1906, a battery of Chloride Accumulators, manufactured by the Electric Storage Battery Company, of Philadelphia, Pa. This battery consisted of 128 cells, with a capacity of twenty-five amperes for eight hours.

A careful comparison of the records of this plant for the year preceding and the year following the installation of the battery was kept. This comparison showed that the installation of the battery effected an increase of fourteen per cent in the gross receipts of the company. Notwithstanding this increase in the output of the plant, the fuel actually consumed in 1906 was somewhat less than that used in 1905.

The comparison further showed that after allowing the proper interest and maintenance charges on the battery equipment, a net return on the investment was shown of approximately fourteen per cent. It should be noted that this was the return effected by the battery in the first year of its service. At that time sufficient business had not been acquired to call for the complete output of the battery: as this business, however, has grown to a considerable extent since then, the net return during 1907 and 1908 has naturally been greater.

By being in a position to offer its customers light and power at any time, the Appleton plant has been able to increase the number of its customers as well as the actual plant output.

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Wagner Generators and Synchronous Motors.

The Wagner Electric Manufacturing Company, St. Louis, Mo., manufactures belt-driven generators, of the type illustrated herewith, in all sizes from sixty to 400 kilowatts, for any desired frequency, and for all the usual voltages. These generators are of the split-bearing type, permitting examination and repairs of the journals without disturbing the rotor. The field coils are wound with square wire in the smaller sizes, and with flat strip, wound edgewise, in the larger sizes. Considerable overexcitation may be resorted to when desired.

The journals have in all cases two oil-ring slots or spaces, but only one ring per slot, thus preventing jamming of the rings, while insuring a uniform and constant flow of oil. The construction is such that leakage of oil into the windings is entirely prevented.

The chief features to be taken into account in designing alternating-current generators are: (1) Capacity; (2) wave form; (3) regulation; (4) efficiency; (5) ability to operate in parallel with other generators.

In addition to the normal kilowatt capacity and the temperature rise under normal operating conditions, notice must be taken of possible overload capacity and the corresponding temperature rise.

The ideal wave form is the so-called "true sine wave." The losses in all secondary apparatus are slightly lower with the so-called peaked form of wave. For the same effective voltage, however, or indication upon the voltmeter, the top of the peak will be much higher, thereby submitting the insulation to that much greater strain. The slight saving in the losses of secondary apparatus, obtained with peak wave, by no means compensates for the increased insulation strains, and a generator having true sine wave should always be preferred.

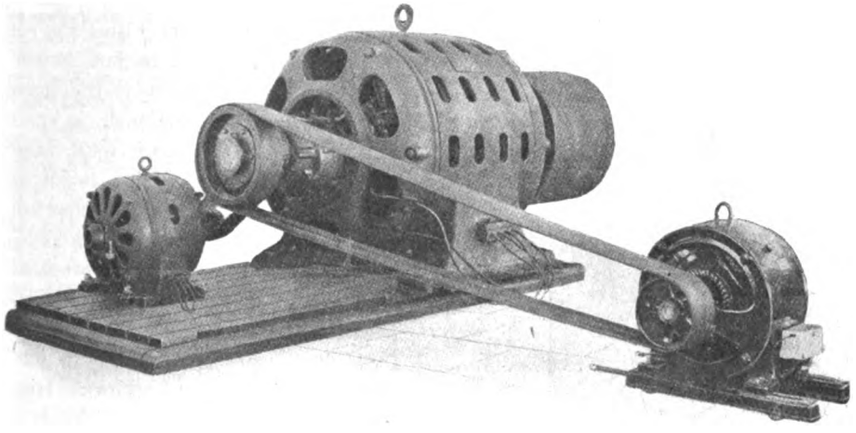
The form of this wave is determined by: (1) Number of coils per phase per pole; (2) shape of the pole-pieces; (3) eddy currents in pole-pieces; (4) air-gap.

To obtain the proper rate of cutting of the lines of force it is necessary to have, as a minimum, two coils per phase per pole in three-phase work. If but one coil per phase per pole is employed the wave form will be distorted.

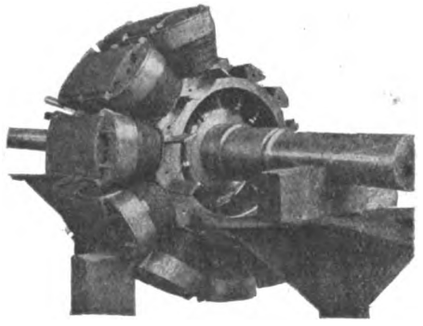
In two-phase work, however, three coils per phase per pole are desirable. Wagner three-phase generators provide in all cases at least two coils per phase per pole, and in some instances four or five. All two-phase generators provide at least three coils per phase per pole, and in some instances five or six. To prevent a concentration of the lines in the pole tips, which affords the shortest path, the pole-pieces of the Wagner generators are so shaped as to provide greater air-gap at the tips, thereby insuring proper distribution of lines of force over the entire pole area. Eddy currents in these generators are eliminated almost entirely by laminating not only the pole-pieces, but also the entire pole core. The depth of the air-gap is suitably designed with regard to its effect upon regulation and efficiency, and also (but to a less extent, as not affecting it so largely as the other two) the wave form.

The Wagner generators and synchronous motors are designed to operate upon different portions of the characteristic magnetization curve—a distinction not usually made—on account of the condition which frequently arises in plants where the starting current of any one motor is a considerable proportion of the current capacity of the generator, requiring during the starting of such motor, excess excitation of the generator. It must be remembered that the current usually required at starting for polyphase motors is considerably in excess of normal, and of low power-factor. A departure from this policy can be made, however, where it may be considered expedient.

The characteristics of the wave form can be largely predetermined, but cannot readily be changed after installation. In ordering additional equipment which is to operate in multiple with existing generators, purchasers should furnish oscillograph curves showing the wave-form characteristics of the existing apparatus.



WAGNER 200-HORSEPOWER SYNCHRONOUS MOTOR WITH EXCITER AND INDUCTION STARTING MOTOR SET UP FOR TEST.



REVOLVING FIELD FOR WAGNER GENERATOR UNDER CONSTRUCTION.

Electric Motor Boats.

A recent number of *The Electrical Times* (London) gives an account of some excellent electric motor boats at present successfully in use on the Thames near London, where they are the most popular kind of self-propelled vessels. A brief account of one of these will be of interest.

The *Merry Widow* is a canoe with torpedo stern, carvel built in half-inch Honduras mahogany, with American elm timbers, and stem and stern posts of British oak. She is twenty-two feet long, three feet ten inches wide, and draws twenty inches of water. There are punt cushions to accommodate four persons, either sitting or reclining, while the steering can be done on the right-hand side of the aft seat, and the electric motor is adjusted by the controller on the left. There are two speeds both ahead and astern. The motor was made by Blenheim and Company, of Egham, and will develop two-and-three-quarters brake-horsepower. There are twenty Leitner cells, made by the Accumulator Industries, Limited, each with its eleven plates, measuring seven by seven-and-one-half inches. This equipment supplies thirty-five amperes for five hours and affords a maximum speed of seven to eight miles an hour.

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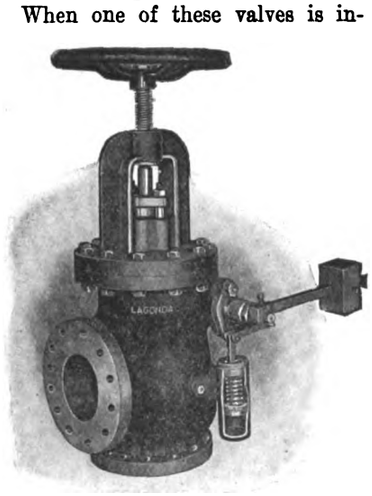
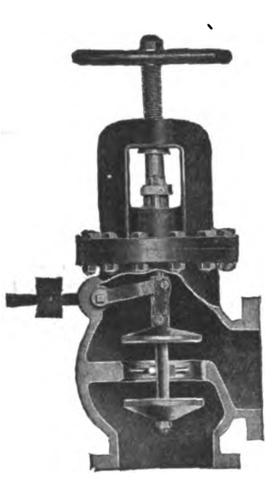
Lagonda Automatic Cut-Off Valve.

While the introduction of the water-tube boiler has greatly reduced the liability of disastrous explosions, yet the fact remains that there are still numerous casualties due to failures in this type of boiler. If a single tube ruptures, or a nest of tubes pulls out of the header, or a steam main bursts, the danger of wrecking the plant is slight, but the escaping steam is liable to scald attendants and it is usually impossible to get at the injured part. The whole plant is liable to be tied up until pressure on the whole battery has been reduced by the steam emptying through the break.

Harmful results from failures in water-tube boilers can be successfully prevented by installing an automatic cut-off valve. When one of these valves is installed between each boiler and the steam header, it forms an automatic stop, no matter where the break may occur.



LAGONDA CUT-OFF VALVE.



SECTION OF LAGONDA CUT-OFF VALVE.

The valve illustrated herewith, manufactured by the Lagonda Manufacturing Company, Springfield, Ohio, is of the double-acting type, that is, it works equally well in either direction. Should a single tube in one boiler give way this valve will instantly isolate that boiler. On the other hand, if a break occurs in the steam main between the boiler and the engine, or for that matter in any part of the steam loop, all of the valves instantly close, preventing escape of steam.

This valve depends for its action upon the actual flow of steam and not upon differences in pressures, and whenever abnormal flow occurs in either direction the valve instantly shuts. This valve takes the place of the ordinary stop valve and can be used as such, but should not be confused with the ordinary single-action, non-return valve.

One important feature of the Lagonda valve is that there are no internal working parts. The dash pot on the outside is to prevent chattering or the closing of a valve too quickly or when sudden overloads occur.

A number of tests were made in Washington, D. C., last January before a board of supervising engineers of the Department of Commerce and Labor. These tests showed that when an opening was made between the valve and the boiler, equivalent to an outlet one-and-five-sixteenths inches in diameter, that the valve closed promptly. To show the action when a break occurs on the other side of the valve a quick-release valve was opened corresponding to an outlet of one-and-one-half inches in diameter. The valve closed in two seconds and the steam pressure was only reduced from 180 to 140 pounds, the rush of steam closing the valve.

Other interesting tests were made which prove conclusively the reliability of this valve. To test its action under sudden overload a quick-release valve was opened corresponding to an opening of one-and-one-half inches. Thirty seconds was consumed in opening the quick-release valve this time, and the steam pressure dropped from 180 to ninety pounds, but the automatic valve remained open. These tests prove that the valve can take care of any unusual but legitimate demand for steam, and still be sensitive enough to close quickly in case of accidents. By means of the dashpot and weight the valve can be adjusted to suit the local conditions of steam pressure and overload.

The board of supervising engineers who witnessed these tests expressed their unqualified approval of the automatic valve and approved its use in all marine service. The valve is built in sizes from three to twelve inches. A special "low-down" type is for use where head room is limited.

Successful Buckeye Conference.

The annual conference of the Buckeye Electric Company was held during the week of August 15 at Camp Buckeye, located on the lake shore some eighteen miles east of Cleveland. Every branch manager and salesman in the employ of the company attended, twenty-four in all.

Camp Buckeye, in both location and equipment, proved an ideal spot for the conference. The camp consisted of a dozen sleeping tents, a commissary tent presided over by Howie, the leading Cleveland caterer, and the "big top" under which were held the business meetings. Heretofore the Buckeye conferences have been held in hotels, and the novelty of a week of tent life proved a popular change to the men.

Business and pleasure were mixed in about equal parts. Prior to departure for the camp, the party inspected the Buckeye factory at Cleveland and were also made familiar with the work of the engineering department of the National Electric Lamp Association. In camp, four days were given over to business sessions and one day to the entertainment of some twenty guests from the city.

Royalty Buys a Baker Electric.

It is reported that the King of Siam has purchased an electric victoria from the Baker Motor Vehicle Company, Cleveland, Ohio. While the chassis and body of this car are standard equipment, the finish and appointments are luxuriant and magnificent. The body and running gear are finished in ivory. The top is made of special leather, enameled in white. The dash and fenders are in white patent leather. The side panels and front of the hood are emblazoned with the king's crest, and the car is upholstered in a delicate pale green broadcloth, the royal color of Siam, with silver gray Persian broad lace tapestry, puff rolls and silver gray silk cord and seaming lace. All metal parts are silver-plated, and the electric lamps and metal case are of solid silver. The lever handles are of pearl. Beveled glass curtain lights are provided at each side of the hood, and also in the rear. The whole effect is in keeping with Oriental extravagance modified by the most modern and up-to-date invention and refinement.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, AUGUST 22.—The National Electrical Contractors' Association has recently taken a new lease of life and is making a determined effort to prevent the legislative establishment of a virtual monopoly of electric wiring powers on the part of municipalities. Although the Association clause in the new electric-lighting Act, to the effect that all such work can only be carried out by municipalities through a contractor, has been cut out by the House of Commons, yet the House of Lords has to approve the Commons amendments, and it is confidently asserted by the Association that the restriction as to wiring and fitting will be reinstated in the House of Lords or the whole clause deleted, leaving the position as it was. If this happens, then any municipality wishing to undertake wiring work must make a special application to Parliament, when the Contractors' Association will have the right to be heard. In the meantime, the Association is taking steps to put a stop to certain municipalities carrying out wiring work illegally, *i. e.*, without Parliamentary sanction. A test action in the law courts is to be taken against one corporation, and good legal opinion is forthcoming that the Association is bound to win the day. On top of all this, active propaganda work is being carried on throughout the country with the object of enrolling new members, one local secretary having spent his holiday in visiting a number of towns in the North of England with this object in view. In the past, the Association has regarded its functions in a somewhat lackadaisical spirit, but a new order of things has now come into existence.

A special meeting of the Institution of Electrical Engineers was held last week for the purpose of voting an expenditure of £20,000 for adapting the building recently acquired for the needs of the Institution's permanent home. The property, which has been purchased from the British Medical Association, has cost £50,000, and the extra expenditure is required for alterations, equipment and furnishing the library, which, it is claimed, will be the largest in the world. Whether in spite of or in consequence of the extended use of electricity in mines, there have lately been quite a number of accidents, mainly due to faulty electrical apparatus, and as a result of these, H. M. electrical inspector of mines has suggested one or two general considerations to be placed before manufacturers of electrical apparatus and owners of mines. In the first place, the use of cables with earthed metallic outer sheathing is recommended wherever possible; attention is called to the mechanical details of gas-tight apparatus in order to ensure that it shall be actually gas and dust tight; cables should be properly protected during shot firing; the use of oil-break switches with overload trip coils should be used wherever possible, either in substitution for or in series with ordinary fuses; live metal terminals should be avoided; or where impossible, there should be frequent inspection and cleaning. These recommendations indicate in what directions our electrical mining equipments need attention, and the value of having an electrical inspector of mines attached to the home office is emphasized by the design of at least one piece of apparatus which will remedy a defect observed in several mines. The same may be said of the electrical inspector of factories, who is also attached to the home office.

So much attention is just now being bestowed upon the possibilities of the Diesel oil engine for small installations, that it is possible that this will have an adverse effect upon the development of some of our electric power companies, especially as during recent years there has been a disposition on the part of many small local authorities to throw their electrical destinies in the hands of the power companies. An instance of this is to be seen at Rhyl, in North Wales, where extensions have become necessary. As this town is a small one and is in the area of an electric power company, this particular business is the kind that the power company might have expected. Instead, however, of taking a supply in bulk, the council have decided to dispose of one of its small steam-generating sets and to install a Diesel oil engine set. Once the advantages of this course of procedure are placed before local authorities in other districts, it is conceivable that another era of small municipal generating stations will commence—unless the power companies take steps to prevent it.

It is announced that active steps are being taken with a view to the establishment of wireless telegraph stations along the South African coast. Negotiations are being carried on with the imperial government, and one of the first sites selected is the bluff at Durban. The first scheme will include wireless stations between Delagoa Bay and Cape Colony, while another similar scheme is projected for the west coast of Africa.

The constructional iron work for the Dawson City electric power station, the contract for which was secured by Messrs. J. Booth & Son, of Bolton, in competition with American and German firms, has been sent forward, and it is anticipated will reach its destination before the Yukon River is frozen over. It is stated that the Canadian preferential tariff in favor of British goods enabled the contract to be placed in Great Britain.

A 150-ton electric crane has been completed by Sir William Arrol & Co., Ltd., of Glasgow, for the North Eastern Marine Engineering Company of Wallsend-on-Tyne, which has several extraordinary features. The square tower on which a horizontal jib of 245 feet in length is supported, is 125 feet high, and 40 feet square at the base, tapering to 35 feet at the top. The long arm of the swiveling jib has an extreme radius of 150 feet. All the operations of the cranes are carried out by fifty-horsepower Westinghouse electric motors, and all the racking and lifting machinery is placed in a steel-plated house at the tail end of the jib, the interior of which looks more like a large works than a structure used for counterbalancing a jib 125 feet above ground level. A special 2½-ton crane is fitted inside the jib house for lifting spare parts, etc., through a trap door in the floor. On test the main crane lifted 185 tons.

The urban district consul of Ventnor (Isle of Wight) contemplates the installation of a funicular railway down the face of the cliffs on which the town is built, and the operation of the cables attached to the cars will be by means of forty-horsepower electric motors, there being one for the upper and one for the lower line. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, AUGUST 21.—A company has been lately formed for operating an extensive wireless telegraph system which has Gibraltar and the Canaries as a base. It is intended to cover the Mediterranean coast region and will also be used for working with the vessels of the South American lines, so that these latter can keep up connection with the continent for a distance of 2,000 miles. The concession for the Spanish company has been accorded by the Minister of the Interior, and there is also a Paris company interested in the affair, this being the French Wireless Company, of which M. Victor Popp is the president. The latter company has been engaged for some years in erecting wireless posts in various places in Europe. All the vessels passing from the Atlantic to the Mediterranean will come into the field of the new system, so that the enterprise is one of considerable scope and it will also compete with the cable companies as regards the coast service in this region. The rates, for instance, from the Canaries to the continent will be but two-thirds of the existing cable rates in most cases.

A section of the Budapest-Fiume railroad in Austro-Hungary is to be equipped on the electric system, this being the Fiume-Kameralmoravica section. This railroad is controlled by the government, and the new section will be used as a base for further extensions of the electric system should this prove satisfactory. To supply the current which is needed for the new electric line, measures are now being taken to build a station of considerable size. The station will also furnish the current for the lighting of the depots at Fiume and Trieste. A large company has been formed for erecting the plant and Paris capital is interested in the enterprise.

Some of the regiments of the French army which will take part in the military maneuvers have been equipped with a new type of field telephone which has been designed specially for this service by the central establishment. It is of simple construction and also of light weight, besides being very convenient to use in the field. The apparatus is contained in three cases, one for the battery, a second for the telephone apparatus proper, with an extra microphone, and a third contains a reel of half a mile or more of wire which is laid along the ground.

Experiments were made near Berlin with wireless apparatus carried on board the airship "Gross" during some of the recent flights, and messages could be exchanged with Frankfort in this way. It is also expected to connect with Stuttgart. A. DE C.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

ILLINOIS TRACTION COMPANY MAKES STOCK INCREASE OF $3,000,000—The Illinois Traction Company has notified the secretary of the state of Maine of an increase in its

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capital stock from $13,000,000 to $16,000,000 by adding to the number of shares already authorized 20,000 shares of common stock and 10,000 shares of preferred stock. The company was incorporated in Maine.

KANAWHA & OHIO VALLEY TRACTION—The Kanawha & Ohio Valley Traction Company has been incorporated in West Virginia, with a preliminary capital of $100,000, for the purpose of building a traction system from Kanawha Falls to Point Pleasant, W. Va., on the Ohio River, a distance of 150 miles. Former Governor F. P. Grosscup is one of the incorporators and it is proposed to build a system that will cost $5,000,000.

MICHIGAN TELEPHONE MERGER—Organization of the Home Telephone Company, of Michigan, which succeeds in the business and properties of the Home Telephone Company, of Detroit, and the Inter-State Long-Distance Telephone Company, so-called independent concerns, has been effected. Fred T. Moran, of Detroit, has been elected chairman of the board, and W. A. Jackson, president. The new company is capitalized at $5,000,000 and contemplates the issue of $10,000,000 first-mortgage bonds.

LARGE DAM FOR ALABAMA—The United States Steel Corporation has been buying up large tracts of land between Wylam and Dolomite, Ala., options for some time having been taken on practically every acre of ground that could be secured. Fancy prices have been paid for these lands. It is stated that plans are made for the construction of a dam forty feet high across the valley that will dam Camp Creek, where it is said such a volume of water can be stored that it will run every plant of the company in the Ensley district. The structure will be the longest in Alabama, and the storage of water will solve a much-vexed question for the corporation.

PROPOSED EVANSVILLE (IND.) TRACTION MERGER—Advices from Evansville, Ind., are to the effect that agents are working for a merger of the Evansville Gas and Electric Light Company and the Evansville & Southern Indiana Traction Company, and the consolidation may take in all the other interurban traction lines of the city. The gas company is now in the Union syndicate, lately formed, with sister gas and traction corporations at Rockford and Peoria, Ill. The Clarke syndicate and Hodenpyle, Walbridge & Company, of New York, are the financiers of the concern. The Evansville merger would involve $7,000,000 if it covered the gas and all traction corporations.

NEW STREET-RAILWAY PROJECT—A new street-railway project which involves the expenditure of millions in money and the connecting of Manchester, Derry and other New Hampshire points with Massachusetts beach lines, is announced, with the news of the incorporation of the Governor's Island Company for the development of the island of that name at Island Pond, Hampstead, N. H., and the paying in of capital for the Hampstead & Haverhill Electric Railway. The list of incorporators of the railway company is made up of the following: President, Arthur M. Emerson, Hampstead; secretary and treasurer, Albert A. McReel, Exeter; directors, Arthur M. Emerson, Albert A. McReel, Roswell Annis, Manchester; Henry T. Wheeler, Derry, and George A. Sawyer, Atkinson.

WASHINGTON ROAD CHARTERED—The Spokane, Walla Walla & Western Railway Company has been incorporated under the laws of Washington with a capital of $3,000,000, to build a line through Columbia, Walla Walla and southern Washington counties to Umatilla County, Ore. E. M. Symonds, of Spokane, is president, M. S. Parker, of Spokane, is vice-president and chief engineer, and L. H. Hoffman, connected with a railway supply house, is secretary and treasurer. Announcement is made that the company has acquired the franchises, rights-of-way and surveys of the Columbia River & Walla Walla Traction Company, including franchises in the cities of Walla Walla, Waitsburg and Dayton, Wash., and Wallula, Ore. It is stated that the company expects to begin operations in a short time, and probably will have the line in operation from Wallula to Walla Walla early in May, 1910. From that point the work of construction would be pushed rapidly until the Snake River was reached and connections made for Spokane.

POWER AND IRRIGATION PLANS IN WYOMING—Asmus Boysen, of Chicago, formerly a member of Congress from Iowa, who, operating as the Big Horn Power Company, invested $400,000 in constructing a dam of concrete, reinforced with steel, thirty-five feet high and 200 feet long, across a canyon of the Wind River, twelve miles from Shoshoni, Wyo., in the Copper Mountains, has also completed his surveys and made filings in the office of the state engineer for a similar plant in the big Popo Agie Canyon, about six miles above Lander, and intends to begin the work of construction as soon as the wires are strung and the other plant has begun the sale and delivery of power. While Boysen has been the pioneer in the utilization of the many thousands of horsepower now going to waste in the Lander Valley, a number of other companies have made filings, and it will only be a short time until this valuable asset will bring in various manufacturing enterprises to take advantage of the cheap power. The Enterprise Irrigation and Power Company, an association of ranchmen owning about 5,000 acres of farm lands southwest of Lander, has constructed a ditch to convey the water to their lands, and when all their acres are put under cultivation their charter will enable them to utilize the same water to generate power for a beet sugar mill and other factories that may be needed. They will furnish light, power and, possibly, as new appliances are invented, heat, also, to supply their homes and barns in winter. It will undoubtedly enable them within a few years to organize one of the richest model farming communities in the world, and there are hundreds of similar opportunities to utilize nature's resources all over this section of Wyoming.

RAILWAY TO CROSS MISSOURI—A double-track, high-speed electric line across Missouri, following the shortest route across the state, is the project of the St. Louis & Kansas City Electric Railway Company. The corporation will have a capital of $15,000,000. W. D. Nevin, of Denver, is mentioned for the presidency W. H. Chase, formerly police commissioner; Benjamin F. Gray and Edgar R. Tilton, of St. Louis, are actively interested in the undertaking. Daniel F. Miller, a former official of the Brooklyn street-railway system, and several Kansas City bankers are associated with the organizers. According to statements of the organizers of the company a double-track right-of-way has been obtained from the Mississippi River to the Missouri. The plan is to lay a double-track road straight through the heart of Missouri from St. Louis to Kansas City. The length of the line will be 250 miles, which is twenty-six miles shorter than the shortest steam-railroad route. Trains will be operated over the whole distance in five hours. The multiphase system will be employed. According to plans under consideration, it will be virtually a gradeless road. The grade will be less than one-tenth of one per cent over eighty per cent of the distance, and less than one per cent over the remaining twenty per cent of the road. It has been estimated that the road can be constructed at approximately $50,000 a mile.

TORREON, MEXICO—The Nazas Power Company has completed all arrangements for the carrying into effect of the large projects proposed in Mexico and work will begin within sixty days. The company will first erect a power plant on the Nazas River, in the Fernandez canyon, about sixty miles southwest of Torreon. The plant will have an initial generating capacity of 20,000 horsepower, and this will be increased from time to time as the occasion demands. The cost of the plant and the transmission lines will be about $10,000,000, gold. Power will be furnished to the American Smelting and Refining Company at Valardena to Torreon for lighting and street-railway purposes. Gomez Palacio, Lerdo and many other manufacturing towns and mining camps in the surrounding country. The company expects to materially lessen the present cost of electrical power in these places. Under the terms of the concession the plant must be ready for operating by January, 1911. The dam which will furnish the power will be thirty-eight metres high and 235 metres in length. The surplus water will be used for irrigating purposes and part of the power for operating irrigating pumps. Walter F. Lineberger, of Torreon, Mexico, is the engineer in charge of the work. J. A. Spafford, of New York, is president of the Nazas Power Company and L. H. Hacker, vice-president and general manager. D.

LIGHTING AND POWER.

(Special Correspondence.)

RYAN, OKLA.—This city has voted $6,000 of electric-light bonds.

BOULDER, COLO.—A new power, light and heating plant is to be installed on the University campus here at a cost of $70,000.

WONDER, NEV.—The Nevada Wonder Company is planning the immediate construction of an electric power plant at Fallon, forty miles from Fairview.

ASHLAND, ORE.—R. I. Stewart has been awarded a contract for the erection of the municipality's hydroelectric power house, on his bid of $3,343.

DE PERE, WIS.—The De Pere Electric Company will expend about $10,000 for new machinery in order to change the alternating current to a direct one. C.

MOHAVE COUNTY, ARIZ.—At the Treasure mine, southwest of the Thomas Reed, preparations are being made to install a milling plant and electrical equipment.

SHEBOYGAN, WIS.—Estimates and plans have been prepared for the construction of a power plant at Ashby Rapids, on the Sheboygan River, four miles from here. C.

JACKSON, MISS.—The Mississippi Electric Company, of Vicksburg, has been incorporated. Capital, $10,000. Incorporators: John Hincliff, W. G. Paxton and others.

MINNEAPOLIS, MINN.—Dr. P. M. Hall, health commissioner, will ask the board of tax levy for $50,000 to $75,000 with which to install an electric-lighting plant at the crematory, to light the entire north and northeast portions of the city. The estimated cost of the installation is as follows: Engine and

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dynamo, $16,000; wiring and poles, 50 miles, $60,000; lamps, 600, at $25 each, $15,000. C.

WILMINGTON, DEL.—The Hartel Light Company has been incorporated, capital $2,500,000. Incorporators: C. F. Fox, M. L. Rogers, H. W. Davis, all of Wilmington.

GRAND RAPIDS, MINN.—It is proposed to change over the street-lighting system from the arc lamp to tungsten incandescents, similar to the system in use at Coleraine, Minn. C.

DULUTH, MINN.—An agitation has been started by property owners along East Superior Street, between First Avenue, East, and Fifth Avenue, East, for the installation of side cluster lights. C.

SOMERSET, WIS.—The Apple River Power Company has purchased the Ames-Mason mill property and will put in a dam with a forty-one-foot head and install a fifth electric power transmission plant. C.

CENTRAL CITY, COLO.—The management of the Maumee Gold Mining Company, owning a group of claims near the War Dance, contemplates the installation of a large plant, using electricity as motive power.

CLEAR CREEK COUNTY, COLO.—Surveyors have been at work for some time in going over the ground near the Doric adit, where the new mill of the Griffith Mining Company is to be erected. W. D. Hoover of Denver is manager.

SALT LAKE COUNTY, UTAH—The Silver Shield Mining and Milling Company is planning to issue five and seven year bonds to raise capital to build a sixty-ton mill and concentrating plant at its mine in Bingham Canyon. Harry S. Joseph is manager.

ABERDEEN, S. C.—The Aberdeen Light and Power Company will more than double the capacity of its plant at an expenditure of $30,000. Among the improvements planned are new buildings, and the installation of a 200-kilowatt generator, a new engine and a fourth gas producer. C.

AUSTIN, NEV.—The Austin-Manhattan Company is figuring on installing the entire equipment for a producer gas plant for mining and milling purposes. The plant is to have a capacity of 400 horsepower and will use as fuel either coal or California crude oil. The company will announce its decision on bids soon after August 20.

ST. JOHN, N. B.—Sir William Van Horne, when on the witness stand last week in an investigation into the affairs of the Grand Falls Power Company, declared that he placed the value of the power site there, still undeveloped, at a million dollars, and stated that it was not equaled on the Continent. "We have nothing to compare with it in all America," said Sir William. "It is immense and is in such close proximity with the finest timber lands of the province."

RUSSELLVILLE, ALA.—The engineers have begun making estimates and surveying the grounds for the erection of the electric-light plant in Russellville for which a franchise was given to Armes & Thornton, of Birmingham, a short time ago. Under the terms of the franchise the erection of the electric plant must be commenced by next February and completed in six months, and the water works plant to be commenced in 12 months and completed in 18 months.

COLUMBIA, N. J.—The contract for the construction of a hydroelectric development across Paulin's Kill, Columbia, N. J., for the Warren County Power Company, Meikleham & Dinsmore, engineers, has been awarded to Frank B. Gilbreth, 60 Broadway, New York city. This contract includes the construction of a Ransom hollow dam thirty feet high and 350 feet long, as designed by Ransom & Hoadley, of Providence, R. I., a reinforced concrete power house and a tailrace, etc.

SANTA BARBARA, CAL.—Negotiations are about completed for the merger of the Merchants' Mutual Light and Power Company of this city with the local gas and electric plant of the Edison Electric Company. An entirely new corporation, known as the Santa Barbara Gas and Electric Company, with a capital of $1,000,000, will result, which will be operated independently of other Edison interests in Southern California, though owned largely by the Edison stockholders.

DULUTH, MINN.—W. R. Merriam, former governor of Minnesota, has been elected president of the Superior Water, Light and Power Company by a meeting of the directors held at Superior. W. H. Winslow, who has been acting manager for some time past, was named as general manager. Among the directors who attended the meeting was Robert R. Dunn, of St. Paul. It is understood that many new improvements are planned for the company during the ensuing year.

STERLING, KAN.—The City Council of Sterling has granted a franchise to and entered into a contract with the Morris Electric Company to furnish lights to the town for a period of five years. The company agrees to furnish thirty sixty-candle lamps, fifty-eight thirty-two-candle power lamps and sufficient lights of various sizes to light the city hall, water works and other public property, for which service the company is to receive $135 a month for an all-night service on a moonlight schedule.

SACRAMENTO, CAL.—It is reported that John A. Britton, general manager of the Pacific Gas and Electric Company, has commenced the installation of a big electric power plant near Horseshoe bar, on the middle fork of the American River, some three miles from the town of Forest Hill, Placer County. The plant will furnish power for the operation of the Cash Rock mine, where the big dredger was washed out last winter at a loss of $150,000. It will be transmitted to other industries in the foothills and Sacramento Valley.

ROCKLAND, MASS.—The board of gas and electric light commissioners has given its approval to a consolidation of the Cohassett Electric Company with the Electric Light and Power Company, of Abington and Rockland. Under the terms of the consolidation the latter company is to pay $18,000 for the property of the former and to assume all of its debts. The board finds that facilities for furnishing light, heat and power will not be diminished by the consolidation, and decides that the consolidation under the terms agreed upon is consistent with the public interest.

DANVILLE, VA.—Danville will have the largest individual cotton-mill corporation in the South, following the consolidation of the Riverside Cotton Mills and the Dan River Power and Manufacturing Company, which has been effected at meetings of the stockholders of the two corporations. The new corporation will have a capital stock of $7,000,000. Stock in the Riverside mills, of the par value of $100, is to be exchanged for $175 worth of stock in the consolidated corporation. The old officials will be retained. The mills own 1,200 acres near the city and have three dams across the river.

ROCHESTER, MINN.—C. H. Armstrong, county surveyor of Olmsted County, and city engineer of Rochester, has organized the Zumbro Power Company, with offices in this city, and incorporated in Minnesota. It is capitalied at $300,000. It is intended to construct a power plant at Zumbro Falls, fourteen miles north of here. The dam will be 91 feet at its base, 50 feet high and 450 feet across the top. The current is to be supplied to the towns, cities and villages throughout southern Minnesota for lighting and power purposes. It is the greatest undertaking planned in southern Minnesota for years.

GREAT FALLS, MONT.—Work has been started here on the big transmission line which will convey electricity from the dams now being built here to Butte and Anaconda for the operation of mines and smelters. The first of the dams will probably not be ready until June next, but it is desired to have everything in readiness to deliver electricity as soon as it can be generated. The line will be of the most substantial material, heavy copper wire on high steel towers. It will run in a bee line, the distance to Butte being 129 miles. The power to be generated from the Rainbow falls will be about 38,000 horsepower, but in all there will be generated here over 100,000 horsepower.

MONTREAL, CAN.—The first sod of the Canadian Light, Heat and Power Company's new plant at St. Timothee was turned July 29 by the Hon. Rodolphe Lemieux, the Canadian postmaster-general. George Crane, engineer in charge of the works, explained the system. He said it was the intention of the company to develop at the present time 21,600 horsepower. "From the point where the water enters the canal," said Mr. Crane, "to our power house, there is a head of fifty-two feet, and all the water from the St. Lawrence to draw from. The water is taken from the canal into a forebay which is to be constructed at St. Timothee, and from which the water will be taken to run the plant. It is the intention of the company to spend about $2,400,000 in the development of 21,600 horsepower, and it is claimed that by deepening and widening the canal as high as 72,000 horsepower can be obtained."

SALISBURY, N. C.—A judgment for $325,000 has been rendered by United States Judge J. C. Pritchard, at his home in Asheville, in favor of the T. A. Gillespie Company, of New York, contractors, against the Whitney Company, of Salisbury, which has been developing a large waterpower until the concern went into the hands of a receiver. This lien, held by the construction company, has been declared by the court, prior to one held by the Bankers' Trust Company. This decision is held to be unfavorable to the Bankers' Trust Company in that the holders of the bonds in question will have to wait until the judgment has been paid before they can participate in the proceeds of the sale of this large property. The Gillespie Company built a large dam across the Yadkin River, below Salisbury, opening the way for another waterpower development of unusual size, and the distribution of electricity in large quantities. It is understood now that the formal sale of the property will be made at an early date, and the purchasers will no doubt continue the big task already instituted and on which several millions have already been expended. The judgment is against the Whitney Company and the receivers of the same, Messrs. John S. Henderson and C. W. Smith. L.

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ELECTRIC RAILWAYS.

(Special Correspondence.)

SANTA BARBARA, CAL.—The Santa Barbara Consolidated Railway Company has asked for an additional franchise in this city.

CEDAR RAPIDS, IOWA—Contracts aggregating $125,000 have been let for improvements at the plant of the Iowa City & Cedar Rapids Interurban. C.

PAULINA, IOWA—The citizens of this community will make an effort to have the Spirit Lake-Sioux City interurban include the city in its route. C.

DENVER, IOWA—The Waterloo, Cedar Falls & Northern Railway Company announces that it will extend its track to Waverly, a distance of six miles. C.

OLIVET, S. D.—L. F. Phillips, who is installing an electric-light plant at Scotland, S. D., is back of a movement to construct an electric railway to that town. C.

HOBART, IND.—Construction work will be resumed on the Gary, Hobart & Valparaiso electric line September 6. Cars are expected to be running this fall. S.

SAN DIEGO, CAL.—The San Diego Electric Railway Company is preparing plans for the erection of reinforced concrete car barns, at a cost of $100,000.

FOXBORO, WIS.—It is stated that the construction of the proposed electric Twin Cities & Lake Superior electric line is being pushed rapidly in the vicinity. C.

OGDEN, IOWA—It is reported that the Fort Dodge, Des Moines & Southern Interurban Company will commence the immediate construction of a line to Fraser Junction. C.

DANVILLE, IND.—Work has been resumed between this city and Amo on the Danville-Amo traction line, which will be controlled and operated by the Terre Haute, Indianapolis & Eastern Traction Company. S.

DAVENPORT, IOWA—J. W. Walsh let the contract to the Westinghouse Electric Company, of Pittsburg, for all the electrical equipment for the power house of the new Rock Island Southern interurban. C.

TACOMA, WASH.—The Puget Sound Electric Company, which owns an interurban electric line between Tacoma and Seattle, has purchased the lines, equipment, franchises and rights-of-way of the Pacific Traction Company.

SALEM, ORE.—Articles of incorporation have been filed in the office of the secretary of state for the Baker Interurban Railway Company; principal place of business, Baker City; capital stock, $50,000; incorporators, Thomas B. Neuhausen, A. K. Bentley and Anthony Mohr.

KINGMAN, IND.—Work is progressing on the Covington & South Western Traction Company's line between Kingman and Covington. The road will also be built to Crawfordsville. The power house at Kingman is about completed and the machinery and equipment are now being installed. S.

PALO ALTO, CAL.—The authorities of Stanford University have completed plans for the construction of an electric railway on the university campus. The line will be built and owned by the university, but arrangements have been made for the Peninsular Railway Company to run its cars on the line.

SAN FRANCISCO, CAL.—It is announced that the Peninsular Railway Company, a Harriman property, controlling a number of electric lines and franchises just south of San Francisco, will at once build the proposed line between Palo Alto and Mayfield. The new construction will amount to twelve miles.

SAN FRANCISCO, CAL.—With a capital stock of $12,000,000, the Peninsula Railway Company, which is a merger of the Peninsula Railroad Company, the San Jose-Los Gatos Interurban Railway Company and the Santa Clara Interurban Railway Company, has filed incorporation papers. The three companies own a total of 222 miles of electric railways in Santa Cruz, Santa Clara, Alameda and San Mateo counties.

AUSTIN, TEX.—The charter of the San Angelo Street Railway Company, having a capital stock of $100,000, has been filed. The company is composed of citizens of San Angelo, who have taken over the property of the street-railway company, which has been in the hands of a federal receiver. The Port Arthur Traction Company, with a capital stock of $200,000, has filed articles of incorporation. The company is composed principally of Ohioans.

ALLENTOWN, PA.—Starting with $200,000, the upset price fixed by order of court, the property of the Philadelphia, Bristol & Trenton Street Railway Company was knocked down in the Court House at Doylestown at $380,000 to Carl N. Martin and John Redmond, of Philadelphia, representing the bondholders' committee, which holds $627,000 of the issue of $650,000 of bonds of the company. The sale means, it is said, a reorganization of the company and an improvement of the line from Philadelphia to Trenton.

BOONE, IOWA—General Manager Blake announces that the Des Moines & Southern Interurban Company would within a week start the construction of an interurban line from Frazer Junction to Ogden, giving the people of that town a two-hour service to Boone, Fort Dodge and Des Moines. The work is to be pushed rapidly.

EL PASO, TEX.—The Electric Street Car Company, owning electric lines in this city and at Juarez, in the Mexican state of Chihuahua, has obtained a concession to extend its lines in the latter city to Rio Grande, Sierra Madre and Pacific Depot, and from there to the new race track of the International Racing Association.

RICHMOND, CAL.—The Holman Car Company, which recently absorbed the Pacific Power and Foundry Company, of San Francisco, has secured a ten-acre site at this place and will, it is understood, expend $300,000 in the building of a car factory. It is given out that the company will reincorporate with a capital stock of $1,000,000.

EUGENE, ORE.—The Willamette Valley Company, of which A. Welch is the head, is making arrangements for the construction of a hydroelectric plant at Martin's Rapids. The company is planning to build a number of extensions in the lower valley during this year, the first to be from Eugene to Junction City, this fall, and ultimately to Portland.

DES MOINES, IOWA—Work on the Creston and Winterset interurban line is to begin at once. It is stated by local directors of the Creston road that capitalists of Creston and Macksburg are going to put the branch between their towns in operation at once in order to test the new road, and if this test is successful the remainder will be built at once.

APPLETON, WIS.—A. L. Gettys and C. L. Robins, Chicago experts sent by Chicago capitalists to inspect the proposed route for an interurban line between this city and Marinette, stated upon their return that they would recommend the immediate construction of the line from Appleton to Seymour, and that the extension to Oconto and Marinette would come in a short time.

PEORIA, ILL.—The Peoria and Galesburg Interurban will at once let contracts for the grading for the entire road, together with the other work to finish the road. Operations to commence at the Galesburg end and complete the line towards this city. Several bridges are needed to cross the rivers on the right of way. President Stevens expects to have the line built by the first of the year. V.

HARRISBURG, PA.—The Bedford, Fulton & Franklin Street Railway Company has been granted a franchise at Bedford for a new electric line. The promoters of the company are said to be Pittsburg railway men. If the road is built it will form part of a great 'cross-state electric railroad system, which will in all probability eventually connect Pittsburg on the west and Harrisburg and Philadelphia on the east.

BLUFFTON, IND.—Master Commissioner Morris has made a finding in favor of the Moore-Mansfield Construction Company for $12,140.81 against the Bluffton, Marion & Eastern Interurban Company for construction work. The company claimed there was $125,000 due it from the traction company and the latter offered to pay $17,000. The master said there was no occasion for a foreclosure of the mechanic's lien. S.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

DAYTON, OHIO—The Central Union Telephone Company has begun work on its East End branch, which will cost $200,000. The building will have a switchboard capacity of 5,000.

MILWAUKEE, WIS.—The Sturgeon Bay and Gardner Telephone Company, of Brussels, has been incorporated. Capital stock, $1,500. Incorporators: Hubert Dandors, S. A. Geise and Jule Gerondale.

AUGUSTA, ME.—The Gulf States Telephone Corporation has been incorporated here to maintain and operate telephone and telegraph lines. Capital stock, $2,500,000. M. F. Shehan, president and treasurer.

TEMPLE, TEX.—The Temple city council at a regular session held last week finally granted a twenty-year franchise to the Southwestern Telephone and Telegraph Company, thus concluding several months' strenuous negotiations.

SAN ANTONIO, TEXAS—The announcement is made by the Southwestern Telegraph and Telephone Company of the erection of a six-story exchange building at 215 Travis Street of steel and brick construction, made necessary by increased business. Three stories are to be finished before December 1 and occupied. A new switchboard, that will accommodate 9,600 subscribers, will be installed. The company, due to the demand, is planning

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extensions of cables and a greatly increased service. A lunch room on the cost-price plan for girls and other features will be added. When the new building is finished it will be the first large central office constructed by the company.

MEXIA, TEXAS—The Mexia Telephone Company has sold its plant in this city to a new company, which will install an up-to-date flashlight system at once. The capital of the new company is $12,500, fully paid up, composed of local capital entirely.

SALEM, ORE.—Articles of incorporation have been filed in the office of the secretary of state for the United Telephone Company, home office at Woodburn, Marion County. Capital stock, $30,000. Incorporators: W. H. Waterbury, Blaine McCord and Will Mishler.

EAST HEBRON, ME.—The East Hebron Telephone Company has been organized at East Hebron for the purpose of constructing, maintaining and operating telephone lines, with a capital stock of $10,000. A. M. Fogg, of East Hebron, president; Everett E. Johnson, of Hebron, treasurer.

VANCOUVER, WASH.—The new telephone line between Vancouver and Manor, built by the Manor Telephone Company, is completed, and is fitted out with sixty-five telephones. The Manor Telephone Company is incorporated, the capital stock being $5,000, divided into 100 shares of $50 each.

SAN RAFAEL, CAL.—The Pacific Telephone and Telegraph Company has let contracts for the installation of underground cables to displace its overhead system on certain streets in this city. The same company is also laying underground a 200-pair cable from this place to San Anselmo.

DALLAS, TEXAS—The Knights of the Shield is the name of a new secret order formed here by the independent telephone men. Aaron Smith, who has taken a prominent part in the preliminary work of the new order, declares that the fraternity is not intended to supersede the Independent Telephone Association, but merely to be an auxiliary to that organization.

HOUSTON, TEX.—The Home Telephone Company will spend $600,000 for improvements in the next eight months. San Jacinto street, between Texas and Capitol avenues, is the site selected for the erection of a building for their central offices, this building to be of concrete, two stories and a high basement, with fifty-foot frontage. The site and building together will cost upward of $40,000.

ELY, NEV.—Telephone service will soon be extended by the White Pine County Telephone Company to the Magnuson and Comins ranches in Steptoe valley, and the line will probably be extended from there to the Nevada United Mines at Ward in the near future. The new lines to the mines will soon be completed, though the new power line, which is being strung to Copper Flat and the Star Pointer, forces Manager Bennett to survey a new route between those two places to avoid interference.

ST. JOSEPH, MO.—Two thousand telephones in Andrew County have been added to the system of the Home Telephone Company. Theodore A. Gary, president, has closed a contract with the Andrew County Mutual Telephone Company for forty-three years. The company has exchanges at Savannah, Avenue City, Cosby, Filmore, Helena, Rochester, Whitesville, Bolckow and Rosendale, and the Home Telephone Company will begin at once stringing new lines to tap the systems. The Selden-Breck Construction Company has been awarded the contract for building the new exchange of the Home Telephone Company on the west side of Tenth street, north of Jule. The building will cost about $80,000.

AMESBURY, MASS.—In order to compete with the New England Telephone Company, it is the plan of the promoters of the new independent concern to extend the venture to the cities of Lowell, Lawrence, Salem, Lynn and Boston, swinging around a circle, with Haverhill as the pivot. Charles A. Davis, of Haverhill, who is interested in the venture, states that he is not to manage the enterprise and he does not know who is going to do so. He asserts that two capitalists in Massachusetts are back of the movement. The venture, as they plan to undertake it, will cost about $300,000. It will necessitate exchanges at Haverhill, Lowell, Lawrence, Salem, Lynn and several in Boston, with trunk lines from place to place.

DETROIT, MICH.—Organization of the Home Telephone Company, of Michigan, which succeeds to the business and properties of the Home Telephone Company, of Detroit, and the Interstate Long Distance Telephone Company, so-called independent concerns, has been effected. A number of St. Louis, Mo., capitalists appear in the list of directors. Fred T. Moran, of Detroit, was elected chairman of the board, and W. A. Jackson, formerly president of the Michigan State Telephone Company, was elected president. The St. Louis directors are Albert N. Edwards, E. A. Faust, A. W. Lambert, M. F. Bayard, Bliss Michael, Henry Koehler, Jr., E. F. Goltra and Samuel D. Jeffries. The new company is capitalized at $5,000,000 and contemplates the issue of $10,000,000 first-mortgage bonds. It is planned to expend $1,000,000 on immediate extensions.

ELECTRICAL SECURITIES.

The market has settled down to more normal conditions in the past week, and while trading has become narrower prices do not fluctuate in the way that has characterized the transactions of the past two or three previous weeks. There have been continued signs of strength as far as industrials are concerned, General Electric and American Telephone and Telegraph Company having both recorded advances. For the present most prevailing influences have been discounted, and until the public comes in there is not much likelihood of any great movement either up or down for a while to come.

The Michigan State Telephone Company, the securities of which are owned largely in Chicago, reports for the first seven months of this year a gross revenue of $2,162,115, which is an increase of $223,420 over the gross in the corresponding period last year. The surplus earnings, after the payment of all operating and interest charges and dividends on the stock, were $175,168. The company expended out of its surplus earnings $816,306 between February, 1904, and the first of the present month. The net gain in new stations in the first seven months this year was 10,385.

There has been added to the regular list of the Philadelphia Stock Exchange $119,200 additional capital stock of the American Telephone and Telegraph Company, issued in exchange for $160,000 four per cent convertible bonds of the company, making the total amount of said bonds outstanding $69,005,000.

DIVIDENDS.

Brooklyn Rapid Transit Company; regular quarterly dividend of one per cent, payable October 1 to stock of record September 9. Rochester Railway and Light Company; regular quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable September 1 to stock of record August 24. There has been listed on the Philadelphia Exchange $650,000 additional Philadelphia Rapid Transit collateral trust five-per-cent gold bonds maturing in 1957.

NEW YORK.

	Aug. 30.	Aug. 23.
Allis-Chalmers common	15	15¾
Allis-Chalmers preferred	50½	53¾
Amalgamated Copper	83	85⅝
American Tel. & Cable	80*	80*
American Tel. & Tel.	139	140
Brooklyn Rapid Transit	78⅝	81
General Electric	165¾	168
Interborough-Metropolitan common	14	15
Interborough-Metropolitan preferred	46½	47½
Kings County Electric	131	130
Mackay Companies (Postal Telegraph and Cables) common	81	82
Mackay Companies (Postal Telegraph and Cables) preferred	74½	74½
Manhattan Elevated	141½	141
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	137½	142
U. S. Steel common	75¼	76¾
U. S. Steel preferred	124	125
Western Union	73	73½
Westinghouse common	84¾	86¼
Westinghouse preferred	120	120

*Last price quoted.

BOSTON.

	Aug. 30.	Aug. 23.
American Tel. & Tel.	139	140
Edison Elec. Illuminating	253	252
General Electric	165¾	168
Massachusetts Electric common	15	14
Massachusetts Electric preferred	74	73½
New England Telephone	..	137
Western Tel. & Tel. common	11	11
Western Tel. & Tel. preferred	89	89½

PHILADELPHIA.

	Aug. 30.	Aug. 23.
American Railways	46¾	46
Electric Company of America	12⅛	12⅜
Electric Storage Battery common	68½	60½
Electric Storage Battery preferred	68½	60½
Philadelphia Electric	12	11⅛
Philadelphia Rapid Transit	30	30¼
Philadelphia Traction	90½	90
Union Traction	53¼	54

CHICAGO.

	Aug. 30.	Aug. 23.
Chicago Railways, Series 1	108	108
Chicago Railways, Series 2	37¼	37¼
Chicago Subway	19½	19½
Chicago Telephone	135	135½
Commonwealth Edison	120½	120⅞
Metropolitan Elevated common	15⅛	15⅛
Metropolitan Elevated preferred	49	49
National Carbon common	95	95
National Carbon preferred	119	119

PERSONAL MENTION.

H. M. HIRSCHBERG, president of the Excello Arc Lamp Company, of New York, spent several days in Chicago last week, accompanied by Mrs. Hirschberg.

A. W. LEWIN was advanced on September 1 to the position of manager of the New Orleans office of the Sprague Electric Company. Mr. Lewin has been connected with the office for some time. He is a member of the American Institute of Electrical Engineers and has had extensive commercial and engineering experience in the electrical business both in North and South

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America. This experience, combined with his command of the various languages spoken in his territory, portends a successful career in his new position.

A. C. GARRISON, president and treasurer of the Columbia Incandescent Lamp Company, St. Louis, Mo., has just returned from an extended vacation in Michigan and on the St. Lawrence River.

WILLIAM RUSSELL WILLCOX, chairman of the New York Public Service Commission for the First District, returned from his vacation on August 25 on board the North German Lloyd liner Kaiser Wilhelm II.

CLAUDE L. MATTHEWS, of W. N. Matthews & Brother, St. Louis, Mo., who was appointed as delegate to the National Irrigation Congress by the governor of Missouri, has returned from his trip to the Coast.

B. E. EDWARDS has resigned as president of the La Crosse City Railway Company, of La Crosse, Wis. Mr. Edwards was one of the original incorporators of the company and has held his office for almost thirty years. C.

HENRY C. PAGE, for four years general manager of the Springfield (Mass.) Street Railway, was transferred September 1 to the management of the lines in and around Worcester, Mass., controlled by the New England Investment and Security Company. He takes the place of E. G. Connette, who becomes the transportation engineer under the New York Public Service Commission, and is succeeded at Springfield by E. J. Dickson.

FRANK H. HILL, who has long been identified with the sales and engineering department of the New York office of the Sprague Electric Company, assumed the duties of manager of the branch office in Atlanta, Ga., on September 1, in place of F. V. L. Smith, who has resigned. Mr. Hill is a native of New York state and his natural energy, together with his experience in the various departments of the Sprague company, gives him special fitness for his new duties in the South, where his abilities will have greater opportunity.

THEODORE INSLEE JONES, manager of the sales department of the United Electric Light and Power Company, New York city, has resigned his position to take up the duties of general agent of the Edison Electrical Illuminating Company of Brooklyn. The change will take place September 15, 1909. Mr. Jones, who is a graduate of the Massachusetts Institute of Technology, was formerly connected with the American Telephone and Telegraph Company, and subsequently as illuminating engineer with the Nernst Lamp Company.

WILLIAM D. RAY has resigned the position of contract agent of the sanitary district of Chicago, and on September 1 took up new duties as general manager of the Northern Indiana Gas and Electric Company. Mr. Ray is well known to electrical men, having had wide experience in various branches of the industry. During the time from 1894 to 1897, while general manager of the Everett (Wash.) Railway and Lighting Company, Mr. Ray enjoyed the distinction of being the youngest manager of electric railway and lighting properties in the United States. Since then he has successfully managed various electrical properties, has directed the electrical department of several large steam roads and has also been the electrical engineer in the construction of several large electric railways now in operation. He was active in the pioneer electric lighting days in Chicago and later was connected with the electrical department of the Chicago World's Fair. He is the inventor of a number of electrical devices now in commercial use and is the patentee of an electric arc lamp. Among his technical writings is a popular book entitled "The Practical Application of Dynamo-Electric Machinery." As contract agent of the sanitary district, Mr. Ray accomplished the successful launching of its municipal lighting and industrial power project, and has placed the sale of its current on a profitable, and in every way successful, basis. He leaves the district with the confidence and good will of the trustees and all his associates. As manager of the Northern Indiana Gas and Electric Company, Mr. Ray will have headquarters at Hammond and will direct the affairs of the company at Hammond, Michigan City, Whiting, East Chicago and Indiana Harbor. Mr. Ray entered the American Institute of Electrical Engineers as an associate in 1892 and served a term as vice-president of the Chicago Electrical Association. He is thirty-eight years old, married and has two daughters. By reason of his integrity and pleasing personality, he enjoys the esteem and high regard of a large circle of friends, all of whom will be pleased to know that with his new connection he also acquires a stock interest in the prosperous Indiana company.

OBITUARY.

J. B. STETSON, president of the California Street Cable Railroad Company, died on August 21 at his home in San Francisco. He was prominent in commercial and railroad circles, organizer of the company which constructed the San Joaquin Valley Railroad, and the leading spirit in the California Traffic Association, which brought about a seventy-five per cent reduction in transcontinental freight rates.

HUGH ERAT HARRISON, principal of the Electrical Standardizing, Testing and Training Institution, Faraday House, London, England, died in London on August 12 last at the age of fifty years. Mr. Harrison has long been a familiar figure in the electrical world of Great Britain and his loss will be keenly felt. He will be remembered in this country as one of the delegates sent by the (London) Institution of Electrical Engineers (of which he was a member) to the International Electrical Congress at St. Louis in 1904. Mr. Harrison has contributed to electrical literature, and besides having written many articles for the electrical press of England was the author of several textbooks. He has twice been elected a member of the Council of the Institution of Electrical Engineers, was an honors *B. Sc.* of London University, a fellow of the Physical and Chemical Societies of London, and an associate member of the Institution of Civil Engineers.

NEW PUBLICATIONS.

DICTIONARY OF CHEMICAL AND METALLURGICAL MATERIAL—The first edition, dated 1909, of this handy little publication has been issued by "Electrochemical and Metallurgical Industry," 239 West Thirty-ninth Street, New York. The work is divided into three parts: (1) Machinery, Appliances and Material for Chemical and Metallurgical Industries (pages 1 to 132). (2) Measuring Instruments and Laboratory Supplies (pages 133 to 176). (3) Professional Directory (pages 177 to 182). When advisable a definition of an entry is given, and in all cases the firm or firms supplying the article; sometimes also a description of the article itself. The whole is alphabetically arranged under the three heads as above. The new work fills up a gap in chemical and metallurgical literature and will be found convenient, handy, and useful for reference purposes.

BULLETIN OF THE INTERNATIONAL UNION OF THE AMERICAN REPUBLICS—The July issue, which has recently appeared, is the "Annual Review" number of this publication, and contains a very carefully-prepared summarized statement of commercial, material, business and economic conditions in the twenty Latin-American Republics, from Cuba and Mexico south to Argentina and Chile. A careful perusal not only of the general introduction but of the data under each country will disclose interesting and instructive facts concerning the progress and development of these countries, which are attracting more than ever the attention of the world because of their immense material possibilities. This issue is a little delayed in delivery because the forms were held open up to the last moment, in order to receive the latest statistical reports from the different countries, some of which only arrived at the office of the International Bureau in the very last days of July.

NEW PROPOSALS.

COURT HOUSE AND CUSTOM HOUSE, RICHMOND, VA.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., September 20, 1909, for the reconstruction of the U. S. Post Office, Court House and Custom House at Richmond, Va., in accordance with the drawings and specifications, copies of which may be obtained from the custodian at Richmond, Va., or at the Supervising Architect's office.

POST OFFICE, LANCASTER, OHIO—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m. on October 6, 1909, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Lancaster, Ohio, in accordance with drawings and specification, copies of which may be obtained from the custodian of site at Lancaster, Ohio, or at the Supervising Architect's office.

POST OFFICE, DENISON, TEX.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., October 1, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Denison, Tex., in accordance with the drawings and specification, copies of which may be obtained from the custodian of site at Denison, Tex., or at the Supervising Architect's office.

POST OFFICE, WOONSOCKET, R. I.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., September 28, for the construction (including plumbing, gas piping, heating apparatus

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electric conduits and wiring) of the U. S. Post Office at Woonsocket, R. I., in accordance with the drawings and specification, copies of which may be obtained from the custodian of site at Woonsocket, R. I., or at the Supervising Architect's office.

POST OFFICE, FREDERICKSBURG, VA.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., October 4, for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Fredericksburg, Va., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Fredericksburg, Va., or at the Supervising Architect's office.

POST OFFICE, GREAT FALLS, MONTANA —The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., September 29, for the construction (including plumbing, gas piping, heating and ventilating apparatus, electric conduits and wiring, and standard clock system) of the U. S. Post Office and Court House at Great Falls, Mont., in accordance with the drawings and specification, copies of which may be had from the custodian of site at Great Falls, Mont., or at the Supervising Architect's office.

POST OFFICE AND COURT HOUSE, SAN ANGELO, TEX.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., September 16, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring and standard clock system) of the United States Post Office and Court House at San Angelo, Tex., in accordance with the drawings and specification, copies of which may be obtained from the custodian of site at San Angelo, Tex., or at the Supervising Architect's office.

INDUSTRIAL ITEMS.

THE PHILADELPHIA STORAGE BATTERY COMPANY has just moved into its new factory at Ontario and "C" streets, Philadelphia, Pa. A much larger floor space will enable the company to handle its rapidly increasing business with facility.

THE INDIANA RUBBER AND INSULATED WIRE COMPANY, of Jonesboro, Ind., is increasing its factory facilities by an addition to its plant, which will have a floor space of 10,000 square feet. This will give a total floor space of 100,000 square feet to the establishment.

THE SOUTHERN ILLINOIS ELECTRIC COMPANY, East St. Louis, Ill., dealer in electric lighting, railway and mine supplies, announces that it will soon issue a new and complete catalogue. This company is doing a constantly increasing business and is rapidly forging to the front.

THE KEUFFEL & ESSER COMPANY, Hoboken, N. J., is publishing a new leaflet concerning the blueprint papers that it deals with. They are of various widths and weight of paper and come in rolls of ten or fifty yards. The company also deals in Columbia blueprint cloth of both light and medium weight.

THE BENJAMIN MANUFACTURING COMPANY, in writing to its patrons and friends that its Chicago address has been changed in accordance with the new numbering system to 507 West Jackson Boulevard, has sent out a map of the city of Chicago showing in a very clear manner the general arrangement of the new numbers throughout the city.

THE PITTSBURGH TRANSFORMER COMPANY, Pittsburgh, Pa., is sending out a folder which calls attention to the large business on its transformers and the resulting advantages therefrom. Incidentally it has enclosed in this folder a very attractive calendar card for the month of September. Its patrons who are admirers of feminine beauty will be interested to receive this.

B. F. WASSON, president of the Wasson Reel Company, Clinton, Ill., has just returned from Winnipeg, Manitoba, where he established a factory for manufacturing the Wasson reel in the Dominion of Canada. The Wasson reel has met with great favor among electric light and telephone companies and other users of wire in the United States, and it is safe to say that it will become equally as popular in Canada.

THE HOYT ELECTRICAL INSTRUMENT WORKS, of Penacook, N. H., has bought a piece of land fronting 100 feet on Main Street, which forms a part of the Central Trunk Boulevard, being built through the White Mountains. Upon this plot the company will erect a modern fireproof garage and salesroom. The great demand for Hoyt meters has made it necessary to devote its entire Washington Street plant to their manufacture.

W. N. MATTHEWS & BROTHER, 219 North Second Street, St. Louis, Mo., have published a valuable book containing a reprint of an article on "Heavy Wire Terminations," by Anthony Gorham, which appeared in one of the electrical papers. This article describes very appropriately the adaptability of the well-known Matthews cable clamps. There are also given a number of good illustrations and many facts relating to the use of Matthews guy anchors, lamp guards, cable-splicing joints, lamp changers, etc. The book is concluded with a large number of valuable wire tables, tables of weights and measures, and a considerable amount of other data that are frequently referred to.

THE WESTERN POWER PLANT EQUIPMENT COMPANY, Chicago, Ill., as western representative of the Enterprise Machine Manufacturing Company, Pittsburg, Pa., is distributing Bulletin 100 on the Enterprise multiple strainer, and Bulletin 101 on Enterprise tube cleaners, both manufactured by the Enterprise company.

THE MOORE ELECTRICAL COMPANY, Newark, N. J., has issued an interesting booklet, entitled "Great Electricians," containing halftone illustrations of leaders in electrical science and application from Gilbert (A. D. 1600) to the present day. A short article on "Electricity, the Last of the Sciences," is prefixed, by W. Wirt Mills.

THE MASSACHUSETTS CHEMICAL COMPANY, Walpole, Mass., has prepared the second edition of its catalogue of liquid, plastic and solid insulating tapes and fabrics, as well as molded rubber goods. Most of these products are of interest to electrical men. The particular characteristics and advantages of each of these insulating materials are clearly stated. Copies of this catalogue are to be obtained upon application to the company.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a new booklet descriptive of its new Universal electric flatirons. These irons employ a new type of heating element for which a high efficiency is claimed. Special attention has been given in this new design to securing a uniform heat distribution on the ironing surface and yet maintain a very low temperature at the top of the iron. These circulars will be sent upon request.

THE H. W. JOHNS-MANVILLE COMPANY, New York, N. Y., has issued an attractive little book (catalogue 303) on J-M asbestos roofing. Other products listed here are J-M pointtite tinners' and slaters' roof cement, J-M Ajax asphalt cement, J-M Ajax asbestos waterproofing, "asbestoside" (an asbestos wall siding for factory plants, warehouses, barns, etc.), J-M Regal roofing, price lists, etc. A partial list is given of representative firms using J-M asbestos roofing.

THE OHIO BRASS COMPANY, Mansfield, Ohio, has published the August number of its "O-B Bulletin" of electric-railway and mine-haulage material. This contains, among other things, the articles: "Bonding Special Work," by W. H. Williams; "An Interesting Catenary Installation," by Clark T. Anderson; The Chicago Subway; an illustrated sketch, "Plant of the Ohio Brass Company;" Want advertisements, etc. Illustrated descriptions of some O-B trolley-wire hangers, etc., are also given.

THE YALE & TOWNE MANUFACTURING COMPANY'S shop courses have been referred to in a recent newspaper item as follows: "A student of Sibley College, Cornell University, inquiring as to how much credit he would obtain for shop work done during the vacation, was told that it was the practice to give one hour's credit for every two hours devoted to actual work in a shop or foundry, provided the latter were approved by the faculty as a proper place for gaining useful experience. Asking if the Yale & Towne works at Stamford, Conn., would fit this description, he was informed that double credit would be given for any time spent in this plant, as, in the opinion of the faculty, it was the full equivalent of the instruction given at the college, and that in this respect it ranked with a very few of the leading industries of the United States."

DATES AHEAD.

Northwest Electric Light and Power Association. Annual convention and joint session with Seattle branch, A. I. E. E., Seattle, September 7-9.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 8-10.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 14-16.

Kansas Gas, Water, Electric Light and Street Railway Association. Next meeting, Wichita, Kan., September 23-24.

Illuminating Engineering Society. Annual convention, New York, N. Y., September 27, 28 and 29.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Railway Signal Association. Annual meeting, Louisville, Ky., October 12-14.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 18.

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RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) August 24, 1909.

931,721. PLURAL LAMP-SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company. Filed October 17, 1904. The separate sockets are disposed in a hemispherical shell.

931,722. CLUSTER LAMP-SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company. Filed July 18, 1907. The housing for the socket is detachably connected to a supporting member.

931,743. ELECTRIC ENGINE. William Farrell, Philadelpria, Pa. Filed August 3, 1908. A motor mounted with a revoluble body has secured to it a gear wheel which engages with a circular stationary track. Power is transmitted from the revoluble body.

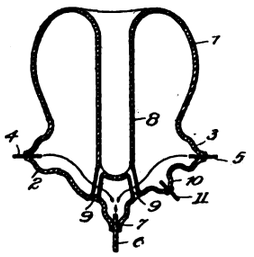
931,771. HANGER FOR TROLLEY-WIRES. Charles A. Kraynik, Racine,. Wis. Filed July 10, 1908. Comprises a flat non-conducting body having an arched lower end, a conducting plug extending through the body and beyond opposite faces thereof, non-alining brackets secured to opposite faces of the body and at opposite sides of the arch, contacts pivotally mounted within the brackets, etc.

931,775. SMELTING-FURNACE. Story B. Ladd, Washington, D. C. Filed June 7, 1907. A furnace for pyritic smelting comprises an elongated hearth adapted to retain a molten bath of matte, twyers disposed above the normal level of the bath, means for passing an electric current through the bath to maintain the temperature thereof, and means for effecting a continuous withdrawal of molten material from the bath.

931,806. RECTIFIER. Charles W. Sirch, Los Angeles, Cal. Filed November 2, 1907. Electrodes project from the walls of an inclosing glass bulb, and a chamber to permit a current of air to pass through to cool the electrodes extends through the interior of the bulb.

931,807. INCANDESCENT LAMP. Edward H. Smith, Aberdeen, Wash., assignor of two-thirds to Thomas Mitchell, Aberdeen, Wash. Filed August 21, 1908. Comprises a plug having a flange with an indented bridging portion forming a contact, a bulb, a head therefor rotatably mounted in the plug, spaced apart contacts carried by the head, and means for limiting the movement of the head relative to the plug.

931,835. ELEVATOR SIGNAL SYSTEM. James F. Baker and Arthur C. Moore, Kansas City, Mo. Filed October 22, 1907. Electric signaling devices, each connected with its separate contact part on a common switchboard, are provided at the several floors and are operated independently by the elevator operating mechanism.



931,806.—RECTIFIER.

931,854. RELAY MECHANISM. Samuel B. Fowler, La Fayette, Ind. Filed June 5, 1907. Two parallel electromagnets are devised so that attraction of one armature will cause the other armature to be bodily carried thereby.

931,904. TELEPHONE SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Filed July 27, 1906. A traveling switch for the line is operated by a motor magnet and a source of current, and a cut-off relay operates when energized to interrupt the normal circuit of the line limbs and of the line relay.

931,905. TELEPHONE SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Filed July 27, 1906. The insertion of a plug into the spring jack causes a movement of the switch to remove the normal battery connections of the line limbs.

931,906. TELEPHONE SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Milo G. Kellogg, Chicago, Ill. Filed August 13, 1906. A traveling switch having moving contacts is used to establish connection between a calling line and an idle link circuit, and means are provided for preventing electrical variations in the local circuit from producing disturbing currents in the line.

931,911. CONTACT DEVICE FOR SWITCHES. John A. York, Hartford, Conn., assignor, by mesne assignments, to The Arrow Electric Company. Filed May 18, 1908. A spring plate has two supports projecting from it at right angles, a pole plate with outwardly extending brush ends has an an elongated opening skewed at an angle of forty-five degrees to the pole-plate axis, and suitable insulation is provided on the supports and in the slot.

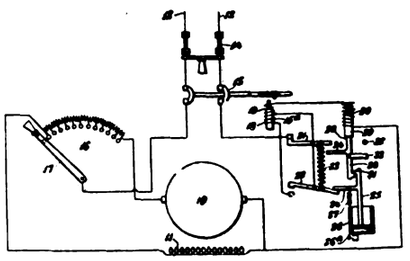
931,929. SECONDARY BATTERY. Henry F. Joel, Forest Gate, England. Filed April 13, 1908. The cylindrical negative electrode is spaced from the surrounding positive hollow cylindrical electrode by a separator having free vertical channels communicating with the electrolyte above and below the electrodes.

931,944. PROCESS FOR ELECTROLYTIC DEPOSITION OF METALS. Frank C. Mathers, Bloomington, Ind. Filed April 21, 1909. Consists in subjecting the metal or an alloy of the metal as anode to an electric current in a solution containing a salt of perchloric acid and in electrodepositing the metal upon the cathode.

931,947. RECHARGEABLE AND NON-INTERCHANGEABLE INCLOSED THERMAL CUT-OUT. Thomas A. Miller, South Hingham, Mass. Filed June 13, 1908. The fuse is inclosed in a case having removable sides, and separate fastenings co-operate with the fuse and the sides to maintain the latter in position to close the case.

931,994. TIME-LIMIT DEVICE FOR CONTROLLERS. Herbert W. Cheney, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed September 29, 1906. An electromagnetic circuit-breaker has means for rendering inoperative a portion of the actuating coil thereof for a predetermined time after the circuit is closed.

932,003. MEANS FOR PROTECTING OPERATORS' RINGING LEADS FROM SHORT-CIRCUITS. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company. Filed August 9, 1905. In combination with a line circuit, a source of ringing current, and a switch for connecting the source to the line, is a relay having its circuit completed and its operation continuously controlled through a back contact of its own armature, interposed in the circuit between the source and the switch.



931,994.—TIME-LIMIT DEVICE FOR CONTROLLERS.

932,013. ELECTRIC TRANSFORMER-FURNACE. Otto Frick, Stockholm, Sweden. Filed December 26, 1906. An electric induction furnace comprises a masonry base with an annular hearth for the material to be treated forming the secondary circuit of the furnace, a primary winding facing more than one side of the hearth, and a closed magnetic core, one limb of which is surrounded by the hearth and by the primary winding, and the other limbs of which are at such distance from the winding that a free space is left between the iron and the winding.

932,018. STEP-OPERATED CIRCUIT-BREAKER FOR ELECTRIC CARS. Benjamin B. Herron, Toledo, Ohio. Filed May 3, 1909. Describes a device for preventing the premature starting of an electric car.

932,019. TELEGRAPH-KEY. John A. Hulit, Topeka, Kan., assignor to J. A. Rosen, Topeka, Kan. Filed March 26, 1908. The device described comprises a telegraph key, a switch associated therewith, a clamp for securing the key, and

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switch to the typewriter frame adjacent to the typewriter keyboard, and a flexible cord for electrically connecting the key and switch with the telegraph circuit.

932,030. ELECTRICALLY-DRIVEN ELEVATING MECHANISM FOR BARREL-RECOIL GUNS. Johannes Krone, Essen-on-the-Ruhr, Gustav A. Schoeller, Mülheim-on-the-Ruhr, and Hermann Sundhaussen, Bredeney, Germany, assignors to Fried Krupp Aktiengesellschaft, Essen-on-the-Ruhr, Germany. Filed May 6, 1908. An electric motor moves the gun barrel between loading and firing positions; one of the controlling circuits for the motor is provided with means adapting it to be closed by the recoil movement of the gun barrel and another by the closure of the breech; and means operated by the gun barrel when it reaches firing position are provided for breaking the motor circuit.

932,031. ELECTRICALLY-DRIVEN ELEVATING MECHANISM FOR GUNS. Johannes Krone, Essen-on-the-Ruhr, Gustav A. Schoeller, Mülheim-on-the-Ruhr, and Hermann Sundhaussen, Bredeney, Germany, assignors to Fried Krupp Aktiengesellschaft, Essen-on-the-Ruhr, Germany. Filed May 12, 1908. An electric motor drives the mechanism for elevating and depressing the gun; a resistance is provided normally in circuit with the electric motor when the gun is approaching the firing position whereby the speed of the motor is reduced; and means are provided for automatically short-circuiting this resistance to cause the gun to travel faster during other portions of its travel.

932,042. SUPPORT FOR COMMUTATOR-LEADS. Emil Mattman, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed January 31, 1907. The armature of a dynamo-electric machine comprises a laminated core, end-heads at the ends of the core (one of these end-heads having an annular bracket), a winding on the core, a commutator, and commutator necks connecting the winding and commutator and having shoulders which bear against the inside of the bracket.

932,056. ELECTRIC SNAP-SWITCH MECHANISM. Charles G. Perkins, Hartford, Conn., assignor to the Arrow Electric Company. Filed October 25, 1907. Comprises an operating spindle, a pole plate rotarily movable about the spindle, mechanism for locking and releasing the pole plate, and a pair of studs, with two contact plates mounted on them, projecting from the pole plate. These contact plates have a central opening and stud perforations arranged diagonally with relation to their axes.

932,069. ELECTRIC FURNACE. Frank J. Tone, Niagara Falls, N. Y. Filed December 12, 1907. Has an arc reduction zone, a receiving space below this zone for the collection of the molten products and a hearth located between the reduction zone and the receiving space. The hearth supports and is substantially impervious to the charge but pervious to the molten products of reduction, and the arc has as a lower electrode a resistance column which is adapted to heat the reduced products after they leave the reduction zone.

932,072. SYSTEM OF DISTRIBUTION. Hermon L. Van Valkenburg, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed August 31, 1906. A switch or circuit-breaker is arranged to be tripped by a magnet coil having a circuit in shunt to it, and means are provided for opening and closing this circuit in a manner responsive to the direction in which energy is transmitted through the switch or circuit-breaker.

932,080. CYLINDRICAL INSULATION. Homer A. Woods, Indianapolis, Ind. Filed July 5, 1907. The process of manufacturing insulating cylinders consists in reducing a material which is a poor conductor of heat to a soft, pliable, pulpy condition, then subjecting a uniform layer of that material to heat with pressure to form a flat board of uniform density, then separating the board by cuts diagonally of its sides, into staves, and then bending the staves to a cylindrical shape to vary the density of the stave from inner maximum to outer minimum.

932,083. TURBO-ROTOR. Alfred H. Wouters, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company, jointly. Filed February 28, 1907. The rotor of a dynamo-electric machine comprises a core, coils carried by the core, and projecting beyond the end thereof, an annular coil retaining member surrounding the projecting portions of the coils, means for holding these portions of the coils to engagement with the annular member, which means being electrically connected to the coils and serving to carry current to and from the same.

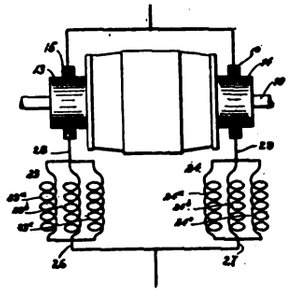
932,084. DYNAMO-ELECTRIC MACHINE WITH DISTRIBUTED BALANCING-WINDING. Edwin C. Wright, Newport, Ky., assignor to the Bullock Electric Manufacturing Company. Filed January 22, 1906. A double commutator dynamo-electric machine comprises a main field winding, means for reducing the tendency of unequal distribution of current between the two commutators, comprising sets of distributed auxiliary field windings, each set consisting of a number of windings in parallel with one another and connected to the brushes of one of the commutators.

932,087. GAS-CONTROLLING APPARATUS FOR BATTERY-CELLS. Oscar D. Apple, Miamisburg, Ohio. Filed February 13, 1908. A battery of cells has a fluid-containing reservoir common to all of the cells, and vent pipes independently connect the various cells with the reservoir, each pipe leading from a point above the level of the fluid in the corresponding cell to a point below the fluid level of the reservoir.

932,097. ROTOR CONSTRUCTION. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed December 1, 1905. The rotor comprises a shaft, a core having a number of rigid circular disks of definite thickness located on the shaft (these disks having radial slots and wedge-shaped pole pieces), and a coil of edgewise wound strap copper surrounding each of the wedge-shaped pole pieces.

932,105. MORSE TELEGRAPHIC APPARATUS. Giovanni Bogni, Sesto Calende, Italy. Filed August 28, 1905. Describes a form of transmitter.

932,111. PRODUCING HIGH-FREQUENCY OSCILLATIONS. Reginald A. Fessenden, Washington, D. C. Filed December 14, 1905. A capacity changer for electromagnetic electric circuits comprises a condenser and means to rapidly move its effective co-operating members relative to each other, to produce oscillations in the circuit.



932,084.—DYNAMO-ELECTRIC MACHINE WITH DISTRIBUTED BALANCING-WINDING.

932,112. LIGHTNING-ARRESTER. Reginald A. Fessenden, Brant Rock, Mass. Filed May 9, 1908. A lightning arrester comprises a rapidly self-restoring compressed air discharge gap and a circuit around the gap containing a capacity and inductive resistances on each side of the capacity, adjusted to absorb energy of discharge from the capacity, and make the circuit non-oscillatory.

932,114. CAR-LIGHTING SYSTEM. Edward C. Folsom, Saginaw, Mich. Filed April 16, 1908. An electrically propelled vehicle has a headlight at each end, a cylinder for reversing the direction of the current, and separate headlight circuits controlled by the movement of the reverse cylinder to forward or backward position to light the front or back headlight respectively.

932,132. AUTOMATIC SWITCHBOARD. Alexander Jambor and Paul Jambor, Bathbeach, N. Y. Filed March 31, 1909. Has fixed and movable contact pieces and means for setting the latter in position on the switchboard.

932,139. LAMP-SOCKET. Willard H. Kempton, Hartford, Conn., assignor to the Johns-Pratt Company. Filed February 13, 1909. A recessed body of insulating material has a conducting shell located therein and is closed at its upper end. A spring is provided to force a loosely connected conductor (connected with a central contact) against a conductor connected with the shell.

932,161. APPARATUS FOR GENERATING GASES BY ELECTRIC DISCHARGES IN AIR. John E. Mitchell, St. Louis, Mo. Filed May 14, 1909. Comprises two rotatable electrodes forming the terminals of an electric circuit and having circular contacting surfaces (one of the electrodes being mutilated), means for rotating the mutilated electrode, whereby the circuit will be alternately closed and opened with the intermediate production of arcs, and means for delivering a blast of air in proximity to the electrodes.

932,196. ELECTRIC-INSTALLATION OUTLET BOX. Wheeler H. Vibber. New London, Conn., assignor of one-half to the Gillette-Vibber Company. Filed January 22, 1909. Has an anchor for bodily insertion through an opening in the plaster smaller in size than the flatwise area of the anchor, a box inserted into the opening after the anchor has been posi-

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tioned back of the plaster, and screws passing through the box into the anchor for holding the box in place.

932,208. INSULATED SWITCH-BAR FOR RAILROADS. George W. Whiteman, Philadelphia, and Charles W. Reinoehl, Steelton, Pa. Filed February 29, 1908. Overlapped sections are bolted together through a separator of insulating material.

932,239. ELECTRICAL IGNITION FOR INTERNAL-COMBUSTION ENGINES. Victor Barreto, Marlow, England. Filed May 11, 1908. A rotary high-tension distributor comprises a box or casing of conducting material having in its circumference one or more stationary pole pieces or terminals insulated from the box, each forming the pole of an igniting circuit, a movable sparking gap arm connected with a high-tension circuit and adapted to turn on the axis of the box, so as to face the stationary pole or poles and thereby to lead high-tension current to the same once at every revolution, and a grounding device connected with the box.

932,242. ELECTRICAL PRODUCTION OF HEAT FOR COOKING AND OTHER PURPOSES. Arthur F. Berry, Ealing, England. Filed August 9, 1906. Electrical heating apparatus comprises a magnetic core having a closed magnetic circuit, and primary and secondary conductors arranged in close proximity to each other throughout their length and to surround a part of the core, the secondary conductor being permanently closed on itself and arranged to be exposed throughout its length to the body to be heated.

932,246. INCANDESCENT-LAMP SOCKET AND SWITCH. Ira L. Cash, Portland, Ore. Filed February 15, 1908. Comprises a shell having a slot, a block within the shell, a conductor plate within the block, a stem passing down into the block from above, a switch lever pivoted to the stem and projecting through the slot, contact plates within the block spaced apart from each other, and means adjustable transversely of the lever for moving between the plates to place them in electrical connection with each other when the lever is swung.

932,273. ELECTRICALLY LIGHTING UP GAS-LAMPS. Albert E. Hacking, West Bridgeford, Nottingham, England. Filed May 20, 1907. Describes a device having one fixed and one movable carbon electrode, for electrically lighting incandescent gas lights.

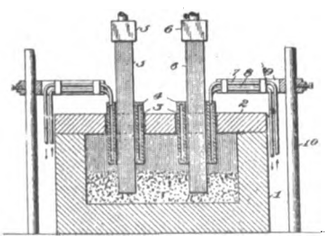
932,296. ELECTRIC FURNACE. Gilbert C. Landis, York, Pa., assignor to American Phosphorus Company. Filed April 8, 1907. Has a conducting lining in which is formed a working chamber, with a carbon terminal extending under the working chamber and laterally through the walls of the furnace and embedded in the conducting lining.

932,312. MOTOR VEHICLE. Lars G. Nilson, Philadelphia, Pa., assignor to William B. Strang, New York, N. Y. Filed February 23, 1906. In combination with an engine is a dynamo driven thereby, also a working circuit supplied by the dynamo, and an auxiliary circuit including a source of supply and a motor for starting the engine.

932,323. TELEPHONE MOUTHPIECE. George H. Reed, New York, N. Y. Filed January 16, 1909. Has a disinfecting device connected therein.

932,332. IGNITER. George W. Sage, Eureka, Cal. Filed October 6, 1908. Describes a contact and release igniter.

932,338. SPARK PLUG. William M. Sleaford, Brighton, Mich. Filed November 16, 1907. Has one fixed and one movable terminal.



932,368.—ELECTRIC FURNACE.

932,363. TROLLEY WHEEL. Frederick S. Yoder, Wernersville, Pa., assignor of one-half to Kenzie N. Yoder, Reading, Pa. Filed September 30, 1908. A rotatable electric conductor comprises a metallic trolley wheel having two integral annular flanges, a body having three annular surfaces, the central surface forming a groove and being of smaller diameter than the side surfaces.

932,368. ELECTRIC FURNACE. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Company. Original application filed January 8, 1908. Divided and this application filed June 6, 1908. Comprises a working chamber, metallic electrodes of opposite polarity extending into the same, and cooling jackets applied to the electrodes and longitudinally adjustable thereon.

932,401. INCLOSED PANEL. Hubert Krantz, Brooklyn, N. Y. Filed April 4, 1906. An inclosed chamber has a perforate fixed cover, an outer cover is arranged normally to conceal the perforate cover, this outer cover being provided with apertures in registry with those in the perforate cover and a switch within the chamber.

932,405. DOUBLE-FILAMENT INCANDESCENT LAMP. Henry E. Meyers, Denver, Colo., assignor of one-fourth to Gustav Schrage and one-fourth to W. E. Tallmadge, Sheboygan, Wis. Filed March 31, 1906. The globe has a tubular neck and a hollow body portion projecting from one end of and communicating with the tubular neck, and provided at its opposite end with a longitudinally extending chamber, and with a cylindrical hollow portion arranged within this chamber and communicating with the hollow body portion at one end and closed at its opposite end.

932,406. AUTOMATIC FLASH LAMP. Henry E. Meyers, Denver, Colo., assignor of one-fourth to Gustav Schrage and one-fourth to W. E. Tallmadge, Sheboygan, Wis. Filed April 30, 1906. In combination with an incandescent lamp is a thermostat having a spring-plate portion to spring outward as the thermostat becomes heated and inward as it cools respectively.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired August 30, 1909:

481,560. SECONDARY BATTERY. William W. Griscom, Haverford College, Philadelphia, Pa.

481,590. AUXILIARY FIRE-ALARM SYSTEM. Joseph Sachs, New York, N. Y.

481,617. LIGHTNING-ARRESTER CUT-OUT. James P. Freeman, Washington, D. C.

481,664. GALVANIC BATTERY. William H. Engledue, Byfleet, England.

481,665. SAFETY ATTACHMENT FOR ELECTRIC CONDUCTORS. Rudolph Furgang, Boston, Mass.

481,666. SAFETY ATTACHMENT FOR ELECTRIC CONDUCTING-WIRES. Rudolph Furgang, Boston, Mass.

481,677. DUPLEX ARC LAMP. Charles E. Scribner, Chicago, Ill.

481,678. MULTIPLE SWITCHBOARD TELEPHONE-EXCHANGE SYSTEM. Charles E. Scribner, Chicago, Ill.

481,679. TELEPHONE EXCHANGE. Charles E. Scribner, Chicago, Ill.

481,692. ELECTRIC CIGAR-LIGHTING LAMP. William J. Eastman, Waterville, N. Y.

481,701. ELECTRIC MOTOR OR DYNAMO-ELECTRIC MACHINE. Robert Lundell, Brooklyn, N. Y.

481,726. ELECTRICALLY-CONTROLLED STOP-MOTION FOR KNITTING MACHINES. Veeder S. Clute, Cohoes, N. Y.

481,739. ELECTRIC MOTOR AND REGULATING DEVICE THEREFOR. Frank J. Sprague, New York, N. Y.

481,781. RHEOSTAT. Charles E. Carpenter, Minneapolis, Minn.

481,785. ELECTRIC LIGHTING SYSTEM. Pitt Cravath, Whitewater, Wis.

481,833. DEVICE FOR REMOVING ARMATURES. Stephen H. Sharpsteen, Honesdale, Pa.

481,847. FIRE-ALARM TELEGRAPH. Andrew J. Coffee, Portland, Ore.

481,878. SYSTEM OF TELEPHONY. Elihu Thomson, Swampscott, Mass.

481,904. SYSTEM OF ELECTRIC LIGHTING. Ernest Huber, New York, N. Y.

481,905. ELECTRIC RAILWAY. Rudolph M. Hunter, Philadelphia, Pa.

481,912. CONDUIT FOR ELECTRIC CONDUCTORS. Augustus Noll, Mount Vernon, N. Y.

481,913. CONDUIT FOR ELECTRIC CONDUCTORS. Augustus Noll, Mount Vernon, N. Y.

481,914. ELECTRIC CIRCUIT CONNECTION. Augustus Noll, Mount Vernon, N. Y.

481,916. ELECTRIC CENTRAL CLOCK. Nicolaus Prokhoroff, Kiev, Russia.

481,919. ELECTRIC GUEST-CALL. Franklin Benner, Minneapolis, Minn.

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CONTENTS.

EDITORIAL:
Street Lighting as a Comprehensive Problem 455
The Electric Lighting and Illuminating Engineering Number 456
Popularizing Telephone Service 457
The Conservation of our Natural Resources Through the Use of High-Efficiency Lamps 457
Details of Watt-Hour Meter Manufacture.—V 458
Convention of the Illuminating Engineers 460
ELECTRICAL NOTES FROM GREAT BRITAIN 461-462
Third Annual New York Electrical Show 463
Meeting of the Central Electric Railway Association 464
CONVENTION OF THE ASSOCIATION OF EDISON ILLUMINATING COMPANIES —DINNER TO MR. AND MRS. EDISON 465
The American Mining Congress 469
Action Against Canadian Hydroelectric Commission 469
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
The Problem of Domestic Lighting 470
Commercial Tests on Systems of Illumination 472
Special Carnival Illumination at Poughkeepsie 475
Developments in Arc Lighting 477
The Illuminating Engineer 479
Tungsten Sign Lighting 479
Gift to Institute Library 479
Convention of the Municipal Electricians 481
CENTRAL STATION PRACTICE—TRANSMISSION—INTERIOR WIRING:
The Buying of Coal on a Heat-Unit Basis 482
Gas Engines for Small Central Stations 484
INDUSTRIAL POWER:
Power Used in the Re-Manufacture of Lumber, With Special Reference to Central-Station Energy for That Purpose 484
Electric Power in Breweries 486
Electric Pumping: How Not to Do It 486
TELEGRAPHY—TELEPHONY AND WIRELESS:
Effect of Phase of Harmonics Upon Acoustic Quality 487
Fighting Forest Fires with the Aid of the Telephone 489
ELECTRO-CHEMISTRY AND METALLURGY:
Recent Progress in Electric Steel Refining 490
ELECTRICAL ADVERTISING AND SELLING:
Getting Power Business 492
Central-Station Advertising Made Effective by Appealing to Children 493
The British Association Meeting 494
INDUSTRIAL SECTION:
The Hawthorn Flaming Arc Lamp 496
Aurola Flaming Arc Lamps for Alternating Current Equipped with Rapid Striker 497
Newest Types of Excello Flaming Arc Lamps 498
Subway Transformers 498
Wheeler Fluted Street Reflectors 499
Some Interesting Features About Tungsten Lamps 499
Dale Lighting Specialties 499
The "Tungsten" Life-Saver 502
The Illumination of Mills and Factories with Small Units 503
Transformers for Tungsten Street Lamps 505
Westinghouse Series Tungsten Lighting Systems 506
Progress in the Westinghouse-Nernst Lamp System 507
Intensified Arc Lamp 508
Progress with the "I-Comfort" System of Indirect Illumination 509
Co-Operation Based Upon Commercial Common Sense 510
CURRENT ELECTRICAL NEWS 511
DIRECTORY OF ELECTRICAL AND ALLIED ENGINEERING AND SCIENTIFIC SOCIETIES 517
RECORD OF ELECTRICAL PATENTS 519

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STREET LIGHTING AS A COMPREHENSIVE PROBLEM.

It is a singular fact that while street lighting is one of the oldest branches of central-station service, it appears to be no nearer standardized than many of the latest electrical applications. The advent of the tungsten filament, adapted to series operation on alternating-current circuits, and the recent development of luminous and flaming arc lamps of various designs, have changed the street-lighting situation in so many communities that the manager with an expiring contract on his desk often feels himself at a loss as to the equipment and prices desirable in new negotiations. Hence there is a natural tendency to attack the local problem by piecemeal methods, trying different illuminants in different sections of the city, going through long calculations of the cost of operating various systems, based largely upon the estimates of the sales engineer, presenting arguments for and against various pet schemes, and trying to back up the company's proposition by scattered tests of the candlepower of the units suggested, probably made with difficulty and perhaps with uncertain accuracy, on account of the unfamiliarity of the staff with measurements of this kind under service conditions on the street.

The amount of money which is expended by even the smaller cities yearly for street lighting is large enough to justify expert treatment of the problem in many instances. It will easily cost a city of 50,000 to 100,000 inhabitants from $1,000 to $2,000 a week to light its streets half decently, to use a Rooseveltian adverb. Offhand, the installation of a modern system of street illumination looks simple enough, but in reality the problem of adopting a system which shall give reliable service, permit advances in the art to be adopted later without excessive cost, produce first-class illumination, and prove to be highly efficient in its demands upon the station and its effect upon the power-factor, if the plant is of the alternating-current type, is one requiring for its solution a comprehensive knowledge of costs, installations and equipment under many different sets of conditions. Many managers doubtless possess such information in more or less satisfactory form, for such figures are often circulated privately in the central-station field while being kept from publication, because they usually represent operating costs only, and as such would be misinterpreted in the hands of the layman. Not a few managers, however, are unprovided with the results of street-lighting service in other comparable situations, and through no fault of their own are

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not in positions to judge with acute criticism and forecasting the applicability of unusual apparatus to their localities. It is a long and arduous process to determine a rate for street lighting which will give a reasonable return upon the investment after all fixed and operating charges are met, and here is certainly a chance for the engineering expert who has had special opportunities to observe conditions and workings in this field to be of the greatest service to the central stations and the cities which are far-sighted enough to command his judgment. There is a strong belief in certain quarters that street lighting ought to be made more profitable to the central station; that it is often unremunerative in proportion to the trouble it causes; that the apparatus is bulky in proportion to its capacity, in the station layout; and that altogether too little money is appropriated for a proper street-lighting service in the territory.

If the problem is treated in a broad way and handled by the expert having a close knowledge of the limitations of the case, both the city and the company will be the gainers. The interests of the two are singularly alike in relation to the present developments in equipment. The city authorities want as much light as possible without disproportionate expenditures, and the company desires, under good management, to provide the community with first-class service of the highest economy, which means a minimum expenditure of energy for a given quantity of illumination. What should never be forgotten is the fact that the city is interested in light, while the company is interested in energy. If the municipality can be furnished with more light for the same money, through an economy of energy at the lamp or elsewhere in the system, the result will be beneficial all around. Every effort should be made to discourage the purchase of the same light for less money, for there is need in most cities of a more liberal illumination of the streets, leaving out of the case the more or less uncertain aid provided by mercantile lighting. Here the specialist of wide experience can step in and convince the local authorities that an under-lighted town is thereby an economic sufferer, while the local central-station man might only be accused of trying to saddle the municipality with heavier bills. Whether the local central-station manager decides to handle all the details of the street-lighting problem or not, the line of successful treatment lies along the direction of complete comparisons with the work in other cities of similar size, including specifications as to the type and size of lamp, hours of use per year, relative cost of generation and distribution, influence of sign and window illumination, probable cost of handling and maintaining the system in toto and per lamp, character of light and magnitude of illumination at specified distances from the unit on the street, lamp-hours or candlepower-hours per dollar expended, lamp cost per kilowatt-hour delivered at the terminals, and the actual experience of other companies with similar apparatus. Economy and minimum investment call for the treatment of main and side streets together, when possible, and for the arrangement of circuits to reduce the cost of trimming to the lowest possible terms, which sometimes means the re-distributing of the trimming districts without attempting to trim circuits separately. The amount of energy required for the street lighting of a city may not be impressive, but the extreme length of the circuits and the scattered character of the lamp installations create conditions which deserve to be studied closely in the interest of all-around efficiency.

THE ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING NUMBER.

A considerable portion of this issue is devoted to the presentation of developments in electric lighting and illuminating engineering. At the risk of platitudinizing we venture to say again that in no other field of electrical development has there been such rapid growth and such conscientious assimilation of ideas looking toward the better utilization of electrical sources of illumination. In this number will be found several noteworthy contributions from those who have been particularly prominent in this field. In addition to these, the manufacturers have been generous in the extreme in assisting in the preparation of articles devoted to special lines of endeavor which come under a broad grouping of manufacturing, engineering, and application of electric lighting and illumination data.

Electric lighting and illumination, however, is but one department of effort in the great field of electrical engineering, and consequently, the other departments have in no wise been neglected. Coincident with the great activity which is now opening up extraordinary opportunities for new business and further applications of electrical engineering, there have been inaugurated in this issue certain changes in the make-up of the journal which will render it more than ever of value to its great circle of readers in concentrating in departmentalized sections all of that material which appertains to each division of work. This is the day of concentration, and the busy man must have every facility for easy access to that reading which essentially and primarily interests him. No effort will be spared to make these departments more complete and in future issues other lines will will be taken up which the large amount of material available for this issue has unavoidably crowded out.

One of the latest propositions which has as its basis a broad scheme of co-operation between central station operators, supply dealers and contractors is that recently worked out by one of the manufacturing companies whereby a complete plan is outlined and working material prepared for a thorough campaign on the part of the central station operator, and involving also a co-operative scheme by which the contractor or supply dealer is interested in taking care of the business developed through the central station campaign. With this plan the central station manager creates a desire for use of more current and makes the initial installation. The new business developed by reason of this pioneer work is then handled by the supply man or contractor. The plan has many features which makes it worthy of careful scrutiny.

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POPULARIZING TELEPHONE TOLL SERVICE.

In many communities the economic value of telephone toll service is but little appreciated by the public at large. There is a feeling that such service is too expensive except for use in important emergencies; that the expenditure of money for a "long-distance" talk is justified only by some extreme condition, perhaps one which could not be met by the sending of a telegram—an awesome undertaking in the minds of not a few good but conservative citizens. It is true that an enormous proportion of the telegraphic service in this country is purely commercial, largely centralized about the stock market, the railroads and the newspapers. This ought not to be so to such a great extent, and if the telegraph companies would adopt energetic campaigns of publicity, combined with further efforts to improve the speed of their service, it is probable that within a year or two the amount of personal traffic handled could be doubled or trebled. Probably less than five per cent of the present business is individual in character. If there is small excuse for the failure to save time and strength by the more general use of the telegraph in social and small business relations, there is less for the lack of appreciation found in many places of the usefulness and cheapness of toll telephone service.

Telephone managers need no instruction as to the value of their service to the public, but the people at large do. The manager must advertise his product, but he must present the subject from the standpoint of the hard-headed citizen of small affairs and from the point of view of the feminine customer whose natural instincts are to save considerable sums yearly by rigid economies in numerous small expenditures.

In order to reach this class of business, special attention must be drawn to a number of points, not necessarily all at a time, but in a definite and convincing way. In all live communities the value of time is coming to be appreciated as never before, and this is the chief theme to employ in advertising toll service. Let the manager compare the cost of a three-minute talk, in which two or three hundred words can be said on each side, with the cost of a personal trip to the distant point. Thus, it may cost twenty-five cents to talk to a city fifty miles away, or a net price of twenty-five-hundredths of a cent per mile for the round trip. Even at two cents per mile railroad fare the cost of the journey alone, exclusive of any value upon one's time in traveling, is thus eight times what the telephone bill amounts to. Adding a small sum like thirty cents per hour as a reasonable unit value of the time of many persons, we find that the trip in person costs probably from ten to fifteen times the trip by telephone. Again, let the manager emphasize the value of a positive appointment contrasted with a haphazard trip on the mere chance of meeting the desired person, and let him put down in black and white the time required for mail collection, transmission and delivery compared with the few moments required to connect up the distant city and party desired by the telephone. Each locality affords a field of special study and countless variations in instructive publicity.

THE CONSERVATION OF OUR NATURAL RESOURCES THROUGH THE USE OF HIGH-EFFICIENCY LAMPS.

At the recent Quebec meeting of the Canadian Electrical Association, Mr. S. E. Doane, Chief Engineer of the National Electric Lamp Association, read a paper entitled, "The Conservation of Our Natural Resources Through the Use of High-Efficiency Lamps." At a time when attention, far and near, is riveted upon the all-absorbing topic of the conservation of our natural resources, this is, indeed, an artful suggestion. Mr. Doane, however, adds to ingeniousness a sober analysis of conservation considerations, and he draws a convincing connection between wasteful methods of fuel consumption and the betterments which may be brought about by the universal use of the newer forms of high-efficiency units.

With the liberal replacement of other forms of illuminants by high-efficiency lamps, the rate at which fuel is being consumed could be reduced enormously. But, says Mr. Doane, "There has been a hesitancy upon the part of the central station men to place the tungsten lamp upon his circuits."

Mr. Doane points out that there is a necessity for a change in the methods of charging by central stations. Charging on a flat meter basis, which assumes to take into consideration both fixed and casual expenses, is inequitable to both consumer and central station man; and, in the long run, works the greater injury to the central station.

The development of the high-efficiency lamp with its reduction in energy consumption for the same amount of light has been viewed with alarm by the central station man, and, were it not for the energetic campaigns which have resulted in increasing either the illumination desired by the individual, or placing upon the circuit a larger number of consumers, considerable inroads would have been made into his revenue. The possibility of increasing the efficiency of incandescent or any other forms of electric lamps makes the analysis of Mr. Doane's suggestions of particular and timely importance.

Fixed charges to cover fixed expenses is the summation of all that Mr. Doane expresses. Once the proper relation of the consumer's responsibility for the equipment which he compels the central station to install in order to be at all times ready to give him service is established, there will be little difficulty in indicating to him the justice of the readiness to serve charge. It would seem to follow then, that, having established the justice of a readiness to serve charge, and this being the case, having collected it, there is a greater opportunity than ever for the central station to sell its current at a reasonable profit and increase this profit surely as the customer becomes better able to make his pocket keep pace with his desires.

It is highly improbable that there will be available a clean-cut proposition whereby a more accessible and logical system of charging can be worked out immediately; but there is apparently a necessity for close study of this matter, and Mr. Doane's suggestions are surely a good basis from which to start an investigation.

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DETAILS OF WATT-HOUR METER MANUFACTURE.—V.

BY JOSEPH B. BAKER.

FACTORY INSPECTION AND CALIBRATION OF INDUCTION METERS.

Following is an account of the final factory inspection and calibration of Westinghouse type C induction meters, constituting details of their manufacture:

Mechanical Inspection.—The so-called "mechanical inspection" takes place after the meters are tested, but before they receive the final checking. The meters to be inspected are hung in rows on specially constructed racks, and are connected in series with a standard. The dial hands on all of the meters are put at zero, and the positions of the dial hands of the standard are noted. The circuit is then closed, and the meters are run for a certain period of time, at the end of which the individual registrations of the meters under test are compared with the registration of the standard.

The final operation is a very severe application of a blast of compressed air to all interior parts of the meter, following which the covers are placed on the meters, wing-nuts tightened, and the meters turned over to the checkers for the final electrical tests before shipping.

General Calibration Method and Equipment.—A "master meter," hereafter termed simply a "master," is mounted on a special cast-iron rack, for convenience, and calibrated from a precision wattmeter on all loads from two per cent of full load up to full load. The master is equipped for having extraordinarily fine settings made of its adjustments, such as a screw for shifting the permanent magnet (full-load adjustment).

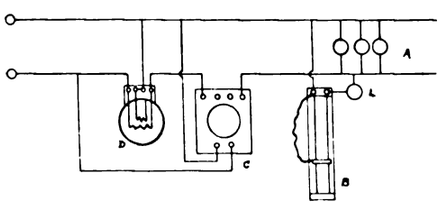

FIG. 35.—CONNECTIONS FOR CALIBRATION OF METERS.

The connections for adjusting the load by the use of the precision wattmeter are indicated in Fig. 35. In this A is the lamp bank, giving approximate load on the meters under test—full load, or any desired percentage of full load: B is a slide-wire rheostat in circuit with a single lamp (L), for giving the fine adjustment of the load; C is the precision wattmeter, and D is the (two-wire single-phase) meter under test. A form of slide-wire rheostat is used for this purpose.

It is a matter of considerable time to get a master calibrated; and it is constantly referred to the precision wattmeter as a precaution against any change of calibration. From this master other meters are calibrated (by synchronizing) for use as working "standards" on the different testing racks. These standards are never reset while in use on the testing racks. They are kept sealed while in use and under the exclusive supervision of the man in charge of the Standard Division, who checks them frequently with the master.

The integrity of the standard is insured by the fact that the checking of the product of meters at different stages—for example, by the testers who make full-load and light-load adjustments and the adjustments to unity power-factor, and later by the "checkers," who give the meter a final test before sealing and shipment—is by different individual standards of those which have been synchronized with the master. Therefore there is no chance for the standards themselves to get out of calibration without immediate discovery.

The accuracy and completeness of the tests made by the principal manufacturing companies, as a regular detail of the manufacture of meters, are perhaps not generally realized. For example, the following tests and adjustments are made on all Westinghouse induction meters, in the order given, before the meters are finally sealed for stock or shipment. The actual work of setting the adjustments of the product of meters is done by experienced operators. Several operatives work at each of a number of testing racks, on which is mounted one of the synchronized standards.

It may be stated here that the test department is instructed not only to test the finished meters, but to watch all the details of manufacture. By this organization the chance of imperfect material or workmanship, or incorrectly set adjustments, getting into the product is almost eliminated.

Full-Load Adjustment.—To make the full-load adjustment, the voltage is adjusted for the given testing rack by a specially designed potential regulator.

This potential regulator is made out of an induction-type fan motor, by securing what would ordinarily be its rotor (secondary) on a rod, with hand-holds at convenient intervals, running the length of the rack. By turning the rod, the secondary may be shifted into any desired angular position with relation to the primary, so as to control the voltage on the rack.

The operative then places the meter to be calibrated in series with the standard, and directly underneath it on the rack, and adjusts the load to make the standard run at the rate of twenty-five revolutions per minute.

Turning now to the meter under calibration:

As described elsewhere, the pair of meter magnets are carried in a "shoe" having a heavy brass back-plate or yoke, by means of which they are secured to the meter shield. The slotted ends of the yoke fit closely into machined grooves on either side of the shield, and are bound firmly to the latter by four heavy screws passing through the slots and tapped into the shield. This mounting gives a positive alinement of the magnet's air gap with the disk, and at the same time a wide range of adjustment of the magnetic system.

In making the adjustment on the meter under calibration, the binding screws are loosened and the shoe is shifted—backward or forward, so as to cause the magnets to enclose a greater or smaller portion of the disk and thereby to "damp" the latter more or less—till the disk is brought into true synchronism with the standard. As synchronism is approached, a fine adjustment of the magnetic system is obtained by loosening the screws on one side of the latter only, and "rapping" the shoe one way or the other.

As in commutator meters, the setting of the full-load adjustment affects the light-load accuracy equally.

Light-Load Adjustment.—The light-load adjustment is one of the most interesting features of this make of induction meter.

It is of great importance to have a long range of light-load adjustment. Deterioration of bearings has only slight effect on the accuracy of a meter at full load, but great effect on its accuracy at light load. A well-designed meter (irrespective of its practical construction) should not change much on full load with length of service; but on light load the damping magnets have practically no control. The magnets should always remain unchanged, so that there is no reason for change of full-load accuracy. On the other hand, the setting of the light-load adjustment of induction meters, like the shifting of the shunt-field coil in commutator meters, affects the light-load accuracy, mainly through a wide range of

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the movement of the strip; the full-load accuracy is only slightly affected. Variation of jewel friction counts for little on full load, inasmuch as, in the first place, friction is at most only a trifle greater, its increase being not at all proportional to increase of speed; and in the second place, the value of the friction at full load bears a very small proportion to the counter-torque of the damping magnet.

It should be noted at this point, in passing, that meter inspectors have a tendency to make use of the light-load adjustment too far up on the light-load scale. Thus, ten per cent of full load is a point outside the legitimate province of the light-load adjustment, since at the speeds corresponding to such load the damping magnets control; whereas, in the vicinity of two per cent of full load they do not control. Therefore, loads in

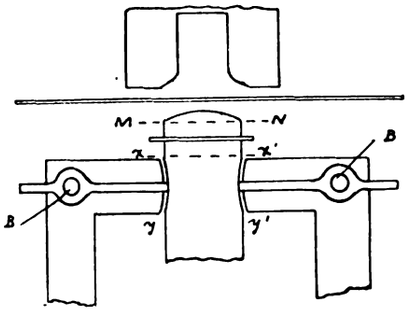

FIG. 36.—PARTIAL ELEVATION OF SHUNT AND SERIES FIELDS AND DISK.

the neighborhood of two per cent of full load are within the legitimate province of the light-load adjustment. It is important to bear in mind this principle of keeping the light-load adjustment within its own province. For example, if the inspector finds the meter abnormally slow on light load (over five per cent or six per cent) he should not at once proceed to set the light-load adjustment, but should look for and remove the cause of such a gross error. On the other hand, a setting of the light-load adjustment at loads exceeding fifteen per cent will cause abnormal inaccuracy of the meter at loads below that test load.

To summarize this important point; setting the light-load adjustment on loads above a genuine light load (five per cent for induction meters) is as illogical as would be the shifting of the damping magnets to effect light-load adjustment.

In the actual setting of the light-load adjustment, the procedure is to reduce the load on the testing rack till the standard makes one-half revolution per minute, indicating two per cent of full load. The tester then sets the adjustment till the meter under test synchronizes with the standard. The range of the light-load adjustment is so great that only a slight change of position of the shading strips is necessary to effect a considerable change in calibration. This adjustment, once set, should not vary. It ought, therefore, to be independent of the series field of the meter, which varies with the load on the meter. In the Westinghouse type C induction meter this adjustment is obtained by putting in each of the two leakage gaps of the shunt field a short-circuited loop, or "shading strip," the position of which may be adjusted in the gap at a greater or less distance from the exciting coil, as shown in Fig. 36, which is a partial elevation of the shunt and series fields and the disk, looking from the front of the meter (see also H, H, in Fig. 21, page 388 of the issue of August 28). These loops (Fig. 37) are made of a high-copper alloy having low temperature coefficient and not too high conductivity, *i. e.*, not too low a resistance for the amount of material necessary for mechanical strength.

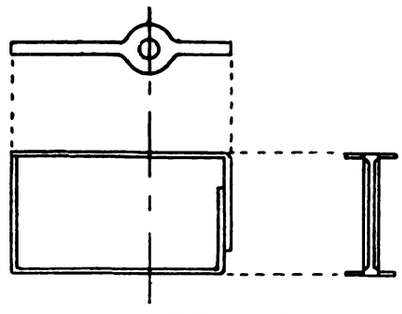

FIG. 37.—THE "SHADING" STRIP.

By loosening the screws B—which are tapped into the shield and serve also, with other screws passing through the shunt-field core, to secure the latter on the shield—the light-load adjustments may be tilted from the mid-position in which they are shown into any angular position between the limits indicated by the directions Bx and By and also Bx^1 and By^1, respectively. Since the screws B are at the centers of the circular arcs at the shunt-field air gaps in which the loops lie, the latter will clear the iron throughout their entire range of adjustment—an angle of about twenty-five degrees. The loops become the seat of weak eddy currents, of constant mean value, because generated wholly by the shunt-field flux; and the weak fluxes due to these currents, by reacting upon the disk currents, exert a constant slight additional torque upon the disk which serves to compensate for the retarding effect of mechanical friction. Varying the position of loops H, H, in their air gaps varies the compensating effect as may be necessary to correct for friction error.

The operation of this pair of angularly adjustable short-circuited loops constituting the light-load adjustment may be explained more at length, as follows:

The induced currents set up in one of the loops by the shunt-field flux would react on that flux, thus causing a local resultant field, which, reacting in turn upon the eddy currents set up in the disk, would cause rotation of the disk irrespective of and without interference with the principal reaction between the shunt and series fields of the meter. The placing of one loop on each of the two side poles of the shunt field thus gives two local fields, tending to rotate the disk in opposite directions and enables a balance to be obtained between them by setting the loops so that one of them traverses a stronger or weaker region of the field in its air gap than the other loop traverses in the other air gap. In the mid-position of the loops shown in Fig. 36 the two local torques will balance each other, giving zero resultant torque and friction compensation. But by moving one of the loops, thus unbalancing the pair of local fields, the resultant torque may be given any desired value, between maximum positive torque—*i. e.*, torque additive to the main torque of the meter—with the right-hand and left-hand loops in the positions Bx and By, respectively, and maximum negative torque—that would result in backward rotation of the disk on no load—with the loops in the position By and Bx^1, respectively.

[To be continued.]

Longest Telegraph Circuit.

Persia and its capital, Teheran, have been very much before the public lately, but probably few people are aware that the news which has come through to London has passed over the longest telegraphic circuit in the world.

The distance between London and Teheran by wire is 4,000 miles, and the operator in Teheran communicates direct with the operator at the London end, automatic repeaters taking the place of operators at ten places along the circuit. The first repeating station from London is at Lowestoft, where the wires enter the North Sea, beneath which they run for 200 miles, to Emden, Hanover, where the second automatic repeater continues the message. Thence it is flashed to Berlin, Warsaw, Rouno, Odessa, Kertch, Sukhum, Kaleh, Tiflis and Tauris, from each of which stations it is instantaneously forwarded without human intervention, the telegraphist at Teheran, who receives the message from Tauris, being the first operator to handle it since it left London. From Teheran the line then extends to India, but nowhere else is there a circuit so long as that between Teheran and London.

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Convention of the Illuminating Engineers.

As already announced several weeks ago, the Illuminating Engineering Society will hold its third annual convention in the Engineering Societies Building, 25 to 33 West Thirty-ninth Street, New York city, on September 27, 28 and 29.

The convention committee, composed of E. L. Elliott, chairman; Walter A. Addicks, Henry L. Doherty, Dr. A. H. Elliott, Dudley Farrand, Dr. A. C. Humphreys, J. H. Jourdan, J. W. Lieb, Jr., and W. C. Morris, is making rapid progress in all the final arrangements for this important gathering.

Convention sessions will be held as follows: Opening and routine business—Monday, 2 p. m.; technical papers and discussions—Tuesday, 8 p. m., and Wednesday, 10 a. m. Among the entertainment features will be a reception and musicale on Monday evening; review of the historical parade arranged for the Hudson-Fulton celebration on Tuesday morning; inspection of the special illumination in this connection on Wednesday evening. A number of special entertainment features for the ladies are being arranged.

An exhibition of gas and electric lighting devices of the latest commercial types, as well as a historical and educational exhibit showing the progress of the art of illumination, will be made in the building at No. 5 West Thirty-ninth Street, near the convention headquarters. This exhibition will be open to the public throughout the week of the convention and Hudson-Fulton celebration.

The spectacular illumination in connection with the latter event should alone prove of special interest to illuminating engineers, as it has been predicted that all efforts in decorative and display lighting ever attempted heretofore will be exceeded by the novelty and magnitude of the effects to be carried out on this occasion. Added to these attractions is an excellent programme of technical papers worthy of the most careful consideration. The titles and authors of the principal papers were given in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of August 21, page 339.

Members of the society and others expecting to attend this convention should notify the secretary of the Illuminating Engineering Society, Preston S. Millar, 33 West Thirty-ninth Street, New York city, so that advance copies of the papers may be sent to them. It is requested that these papers be studied in advance as much as possible, so that the time devoted to the technical sessions may be given up chiefly to the discussions of the various papers that will be presented in abstract only.

Rules for Service and Meter Wiring.

The Edison Illuminating Company, and its subsidiary concern, the Peninsular Electric Light Company, both of Detroit, Mich., have issued the following "Central-Station Rulings for Service and Meter Wiring." These should be of interest to other central stations throughout the country.

TO ELECTRIC-WIRING CONTRACTORS.

In wiring buildings to be connected to our mains, please conform to the following rules:

Service Wiring.—All service entrances should be on the rear wall of buildings. If, because of unusual conditions, this is not practicable, please confer with our sales department as to the placing of the entrance point. Service wires should be carried out of building in service pipes at least ten feet from the ground, and pipes should not in any case be wired with smaller than No. 10 wire. Two feet of wire must be left at the top of the pipe for the splicing of our wires. The service pipe for two apartment buildings should be wired three wire, the two apartments being balanced against each other at distributing point.

Meter Wiring.—Meter loops must be in a dry, accessible place, within four feet of the service entrance, and not more than seven feet from the floor. If it is necessary to place the meter a greater distance from the entrance point, the wires must be carried in conduit. Meters will not be placed on lattice partitions, or walls subject to vibration. Meters will not be installed in restaurant kitchens or similar places, when it is possible to put them elsewhere, but in any case where meters are so installed, a box to cover the meter, eighteen inches wide, twenty-eight inches high and twelve inches deep, must be provided by the customer. In no case will meters be installed over a stove or sink. Meters must be at least ten feet, and, where possible, fifteen feet, from all generators and motors. Meters must be separated by at least twenty inches between centers (both vertically and horizontally). Meters must not be located within three feet of conductors carrying heavy currents. Plans for large installations and special work, such as placing meters on switchboards, high-tension work, etc., should be submitted to the sales department of this company for approval before any work is done by the contractor. Specific instructions on service pipes and sizes for motor wiring have previously been issued to contractors. Copies of these instructions may be procured from our office.

Wireless in the Argentine.

It is reported that the Argentine Government has appropriated $75,000 gold to establish wireless telegraph stations between Buenos Aires and Ushuaia. The work, it is said, must be finished on or before May, 1910.

Instructors for Chicago Technical High Schools.

The Board of Education of the city of Chicago will hold a special examination on September 17 and 18 for teachers of electrical construction, mechanical drawing and foundry work. A number of these positions are open in both the day and evening technical high schools of the city. The examination will cover both general and technical subjects. Applicants should call upon or at least communicate without delay with the examiner's office, Board of Education, Room 829 Tribune Building, Chicago, where application blanks and statement of the detailed requirements may be obtained.

Chicago Electric Club.

At the meeting of the Chicago Electric Club, Wednesday, September 1, the regular plan of this club's meetings was resumed, the meetings during the month of August having been devoted to entertainment.

The speaker on this occasion was W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, and he chose for his subject, "Conservation of Natural Resources." Mr. Abbott's remarks, however, related principally to atmospheric conditions in the past and present. He also made some amusing suggestions regarding these conditions in the future.

British Cable Rates Reduced.

Dating from August 1 last, the rates for press telegrams between Great Britain and the countries mentioned have been reduced as follows, inasmuch as the British, Indian and Australasian governments have agreed to bear their ratable share of the reduction: India and Burma, nine pence (eighteen cents) per word; Ceylon, nine-and-a-half pence (nineteen cents); Australia, Tasmania and New Zealand, nine pence. The press rates to South Africa have also been reduced by about six cents a word.

Sierra and San Francisco Power Company.

Ladenburg, Thalman & Company announce that the transfer of the property of the Stanislaus Water Power Company to the Sierra & San Francisco Power Company has been completed. This is the source from which the United Railroads of San Francisco is to receive its waterpower, and negotiations have been under way for the past year.

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Electrical Notes From Great Britain.

By Our British Correspondent.

Last month I gave a few details regarding the past year's working of the municipal electric trolley system of Glasgow. I have now received the full report on the operation of the electric-light and power supply department of that city for the same period. Several causes combined to decrease the income by some $38,600—reduction charges for current, the extensive adoption of metal-filament lamps, and general trade depression—but as there was an all-round decrease in working expenses, there is actually an increase in the available profit balance, which is $704,000, as compared with $690,000. As, however, increased provision has been made for depreciation and sinking fund there is really a net deficit of $17,700 for the year. The provision for depreciation amounts to $266,000. The department added 1,232 new consumers, making a total of 18,158, and the motors on circuit numbered 4,292 and aggregated 29,508 horsepower, an increase of nearly 6,000 horsepower on the year. Out of nearly thirty-three millions of units sold, nearly eighteen millions were for power purposes, and of these, roughly, twelve millions produced one-and-one-half cents per unit.

Reference to the particulars of the various generating stations shows that at the Port Dundas station three marine water-tube boilers with economizers and fans have been erected, completing the present boiler house, but an extension is being built. A new grab transporter for lifting coal from barges has been rendering good service for some months. In the engine room a fifth turbine of 5,500 horsepower, with its alternator and condensing plant, has been added, bringing up the capacity of the station to 28,000 horsepower. Transforming plant of 2,000 horsepower erected at this station has assisted flexible and economical running of the Port Dundas and Pollokshaws Road generating stations at times of light load. Energy at extra high pressure is transmitted from Port Dundas to a number of substations, as well as to Pollokshaws Road, if necessary. The trunk main connections between Pinkston power station (tramways) and Port Dundas have been used frequently during the year. At Pollokshaws Road two new water-tube boilers and economizers have been added, the coal store has been covered in, and a third 5,500-horsepower turbo-generator has been erected, bringing up the total of this station to 21,700 horsepower. A new substation at Hoggs Road contains two 1,000-kilowatt sets, and this plant is satisfactorily meeting the needs of the southwestern district of the city. Six large consumers are economically supplied through transforming plant (aggregating 3,000 horsepower) placed in their premises.

The Institution of Mechanical Engineers held its annual summer meeting in Liverpool from July 27 to 30, with J. A. F. Aspinall, general manager of the Lancashire and Yorkshire Railway Company, as president. Three papers that came before the gathering call for mention here, namely, one by Prof. F. W. Burstall on the indicating of gas engines, giving the results of an investigation to ascertain what the error in the indication of such engines amounted to; this work was undertaken as the Institution of Civil Engineers Gas Engines Committee reported several years ago that the indicating of gas engines was open to very much greater errors than was the case with steam engines. The second was a paper by Arthur Maginnis on "Advance of Marine Engineering in the Early Twentieth Century," in the course of which he predicted an extensive application, before long, of electric drive for propeller shafts. He pointed out the advantages of electricity if applied to drive slower-going cargo tramps. The introduction of main driving would commence a new era of electric navigation. The other paper, "Electrical Operation of Textile Factories," by Herbert W. Wilson, has been abstracted in a previous issue.

The Madras (India) electric-light and power undertaking is, after delays, now making constructional progress. The concession, which was obtained by Crompton and Company, Limited, of London, was sold to the Madras Electric Supply Corporation, Limited, an English company, the purchase agreement stipulating that they should have the contract for the installation. In arranging the contract no penalty was attached to failure to complete within a given time. Two years was considered ample, but later it was thought that by accelerating the time current might be available by September, 1907. The great delay is stated to have raised a legal question between the two parties. At a meeting of the corporation just held in London it was stated that the station buildings were practically complete, these including the Mylapore substations. For the town supply there will be 2,000-kilowatt, direct-current plant for fans and lighting, and for tramways and workshop uses 1,500 kilowatts, alternating-current plant. The tramways will take a minimum of 1,000,000 units per annum. The Madras Port Trust is probably to take 40,000 units per annum. There appears, with these and other important consumers, to be every prospect of doing a satisfactory and progressive business when once the supply is fully available.

The firm of Crompton and Company, Limited, just named, is one of the oldest electrical manufacturing concerns in England, and India has been for some years among its chief markets. The past year has not been one of its rosiest on record, and the unsatisfactory net result called forth many remarks regarding trade depression in England and some of its causes, at the meeting recently held in London. The municipal electrical fever of several years ago led to such an increase in the manufacturing power of the country, so that when the excitement abated there was unhealthy competition, reducing prices to a profitless level. Other causes named were: Want of governmental support of industry; the lack of financial industrial institutions, such as supported enterprise in other countries; general want of confidence owing to the acts of the particular government in power; the lack of capital being invested in British industry, and the remarkable British investments in foreign and colonial undertakings. There is not believed to be any prospect of prices immediately improving, and the company is turning attention to certain special lines of manufacture, where a larger margin of profit is expected than is obtainable from the sale of standard lines, where there is so much competition.

International-exhibition arrangements are receiving a great deal of attention just now as a result of very special efforts that are being made to interest manufacturers and other possible exhibitors in two good shows that are being organized for next year and others following thereafter. As the outcome of frequently expressed desires, a new government policy of rendering the British exhibitor assist-

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ance of real value at international events of this kind is being introduced for the first time at Brussels next year. More inducements to, and facilities for exhibiting are being offered than on any previous occasion. This same progressive policy will enter into the organization of the British exhibits at the Rome and Turin displays, which follow. It may prove to be somewhat unfortunate that the Brussels exhibition will be held in the same year as the Anglo-Japanese show, which is planned for London, for manufacturers will probably regard both shows as calling for large and costly exhibits if any at all are resolved upon, and they may decide to do the thing properly at one rather than have two poor shows. In regard to the Anglo-Japanese exhibition, though this does not come under the government's new policy alluded to above, it is said to have the cordial support of the British government, and to be under the auspices of the imperial government of Japan, while it has the blessing of King Edward and the Emperor of Japan, the support of British chambers of commerce being also assured. The White City grounds and buildings at Shepherd's Bush will be utilized, and the Kiralfys are, of course, connected with it. Prince Arthur of Connaught, who is president, in an effort to stimulate interest in behalf of the event, says: "The unique character of the exhibition is sure to attract multitudes of people, not only from Japan, the United Kingdom, and the colonies and dependencies, but from every European country and from America, and cannot fail to increase the commerce of the two nations and to create new commercial channels between them and the rest of the world." The Imperial International Show, now running at the White City, from an industrial point of view, is more or less of a fiasco, and it will be interesting to see whether a number of firms do not prefer the Brussels exposition to that at Shepherds Bush in 1910.

The Metropolitan District Railway is certainly finding its feet again, for it has just completed a splendid half year both in regard to increased traffic and receipts and decreased working expenses. All over the system there has been a general increase of traffic, so that the passenger income has reached a record figure (£254,000 for the half year) exceeding by £10,900 the highest previous figure, which was obtained in the last half of 1908, when the Franco-British Exhibition was bringing large crowds to London. The thirty-three millions of passengers include an increase of 11.22 per cent over the first half of 1908, and there was an increased car-mileage run of about 6.5 per cent. Two of the half-year's economies are particularly worthy of mention, one being a saving of £8,545 in the cost of electric current, the other being a substantial saving as well as a general improvement in the method of working the middle doors of the coaches. At a cost of £5,600 the air-worked doors have been altered to doors with handles, and the latter are giving greater satisfaction. Sir George Gibb, in addressing the shareholders on this point, mentioned that to have run the car mileage of the last half year with the air-worked doors would have cost £4,000 per annum more than had actually been the case. The number of employes required on the trains was reduced, of course, but they were drafted into other departments of the service. The net result of all the foregoing was an increase of £25,419 in gross revenue and a reduction of £6,733 in the gross expenses.

A scheme is shortly to be laid before the shareholders of the District Railway for the purpose of capitalizing the accumulated dividend deficiency on the guaranteed stock. This deficiency is about £250,000, or about twenty per cent of the stock's nominal value. The improvement in the position of the undertaking is regarded as making the times propitious for handling this matter most expeditiously.

It is announced that the Central London (tube) Railway extension from the Bank Station to Liverpool Street (the terminus of the Great Eastern Railway), which has just been sanctioned by Parliament, is to be proceeded with almost immediately. This short addition to the city end of the line will be more important for traffic-catching purposes than any other section of the railway. Large numbers of north and east London residents using the Central London have at present to walk from five to ten minutes through congested city streets, or take a 'bus ride and then descend to the tube at the Bank. The close connection with the Great Eastern and North London lines, which this extension will provide, will be of much convenience to the public, and it is expected to have a very healthy effect upon the future business of the Central London Railway. The Greenock municipal electricity works are to be extended at a cost of $62,000 to meet a demand from the Admiralty for the new torpedo factory, and also for current required by Scott's Shipbuilding and Engineering Company, which is to build one of the new Dreadnoughts, in connection with which work the company is putting down additional power-using plant. The company will pay the municipality two cents per unit for the first 500,000 units, 1.8 cents for the second 500,000, and 1.6 cents for all in excess of a million. The contracting firm which is putting down the new naval dockyard works at Rosyth, on the Forth, has abandoned the idea of taking energy from the Fife Power Company, and instead will put down its own installation to serve for driving the numerous electric cranes required and for lighting purposes during the considerable night operations that are involved in the contract. From Greenock and Rosyth to Cape Colony is a far cry, but it is interesting to mention here that the Cape Town Corporation Electricity Department has recently installed a good deal of new plant from which to give a bulk supply to the Cape Government Railways and the Table Bay Harbor Board. Babcock and Wilcox water-tube boilers, 600 brake-horsepower Belliss and Morcom steam engines driving two-phase 2,200-volt Siemens alternators, a Phœnix booster for raising the pressure from 440 to 550 volts for dock purposes, a battery station with chloride cells at the docks, and a General Electric motor alternator, are comprised in the new work, which, including duplicate cables to the railway and docks switchboards, has cost altogether about $125,000.

ALBERT H. BRIDGE.

London, August, 1909.

Exhibits at Denver Conventions Returned Free.

It is announced that the Trans-Missouri Traffic Association, which governs freight shipments between Chicago, St. Louis, etc., and Denver, will return free of charge all material sent to Denver for the exhibit to be held there in connection with the conventions to be held during the week beginning October 4 next by the American Street and Interurban Railway Association and the Colorado Electric Light, Power and Railway Association.

Members of the Manufacturers' Association have also been notified by the exhibit committee, which makes the preceding announcement, to request roads which belong to the association and over which they are shippers, for special rates in accordance with the above-mentioned concession.

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The Third Annual New York Electrical Show.

The final details for the coming New York Electrical Show, to be held in Madison Square Garden, October 11 to 21, are rapidly nearing completion.

One of the special features of this year's show will be the great industrial exhibit representing manufacturing processes of all kinds utilizing electric drive. This exhibit will be of great interest to the hundreds of manufacturers in the vicinity of New York who are constantly on the lookout for every improvement that will increase production and promote the economy of operation.

The interior of the Garden will represent the highest attainment of the decorator's and illuminating engineer's skill and will present that distinctly uniform appearance which is so pleasing to the eye. More than 75,000 incandescent lamps will be used for illumination.

The number of exhibitors who have already taken space is far beyond expectations, and very little space remains unsold. The following list of exhibitors represents many of the leading manufacturing companies of the country, and their combined exhibits will make the greatest display of electrical and kindred appliances ever brought together under one roof:

The New York Edison Company, 55 Duane Street, New York; Goulds Manufacturing Company, 16 Murray Street, New York; Watson Stillman Company, 30 Church Street, New York; *Electrical World*, New York; United Shoe Repair Machine Company, 39 Warren Street, New York; Murphy Electricity Rectifier Company, Rochester, N. Y.; Fox Brothers and Company, 126 Lafayette Street, New York; Tucker Electric Construction Company, 110 West Thirtieth Street, New York; Shelton Electric Company, 105 West Forty-second Street, New York; Electric Suction Sweeper Company, 91 Wall Street, New York; The Heany Company, 25 Broad Street, New York; Manhattan Electric Supply Company, 17 Park Place, New York; Edison Electric Illuminating Company of Brooklyn, 360 Pearl Street, Brooklyn; The Crane Company, 519 South Canal Street, Chicago, Ill.; Electric Testing Laboratories, East End Avenue and Eightieth Street, New York; Duntley Manufacturing Company, Thirty-fourth Street and Broadway, New York; American Electric Lamp Company, 153-9 Jefferson Street, Chicago, Ill.; National Electric Lamp Association, 4411 Hough Avenue, Cleveland, O.; Harley Machine Company, 949 Broadway, New York; United Electric Light and Power Company, 1170 Broadway, New York; W. P. Pressinger Company, 1 West Thirty-fourth Street, New York; Keller Manufacturing Company, Philadelphia, Pa.; The Lansden Company, Newark, N. J.; Public Service Corporation of New Jersey, Newark, N. J.; Excello Arc Lamp Company, 30 East Twentieth Street, New York; ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Chicago; Otis Elevator Company, 17 Battery Place, New York; The Westinghouse Company, 165 Broadway, New York; American Metal Hose Company, 173-7 Lafayette Street, New York; Electric Home Supply Company, 45 West Thirty-fourth Street, New York; Electric Cleaner Company, Monadnock Building, Chicago, Ill.; C. L. Kleiwert Company, 39 Cortlandt Street, New York; Empire Vacuum Company, 110 West Thirtieth Street, New York; Consolidated Telegraph and Electric Subway Company, 66 Lafayette Street, New York; Pelouse Electric Heater Company, 403-13 Ohio Street, Chicago, Ill.; General Vehicle Company, Long Island City, N. Y.; General Compressed Air and Vacuum Cleaner Company, 315 Fifth Avenue, New York; Stanley & Patterson, 23 Murray Street, New York; General Electric Company, 30 Church Street, New York; Roger Williams (The Simplex Electric Heating Company), 25 West Forty-second Street, New York; Economical Electric Lamp Company, 25 West Broadway, New York; Collins Wireless Telegraph Company, 54 Clinton Street, Newark, N. J.; Southern Exchange Company, 97 Warren Street, New York; Radio Reflector Company, 1178 Broadway, New York; German-American Electric Company, 110 West Fourteenth Street, New York; H. Krantz Manufacturing Company, 160 Seventh Avenue, Brooklyn, N. Y.

Staten Island Subway.

It was learned that the engineers of the New York Public Service Commission are at work on detailed plans for an extension of the Fourth Avenue Brooklyn subway from the terminus of that line at One Hundred and First Street and Fourth Avenue, Fort Hamilton, to Rosebank, Staten Island, and when the Fourth Avenue line is constructed and bids are asked for the extension to Staten Island, the Commission will have everything complete and ready for quick action.

These plans will call for an extension under the Narrows, as submitted by George Von Kromer, chairman of the Citizens' Tunnel Committee of Staten Island, and filed with the Commission last May. This extension will be about three miles long, and the entire mileage of the route from Manhattan Bridge to Staten Island will be 9.97 miles. The cost of the Fourth Avenue Brooklyn route is between $15,000,000 and $16,000,000, and the proposed extension will approximate $10,000,000.

Chicago's Proposed Subway.

A proposal that the city of Chicago consider G. W. Jackson (Inc.) as possible builder of an extensive subway system costing $80,000,000 will be made to Mayor Busse and the City Council this fall. No tentative ordinance outlining the terms of a prospective agreement has been drawn, but George W. Jackson, president of the corporation bearing his name, states that he is ready to take the first steps leading toward the drafting of such a franchise and the presentation of a formal proposition to the city.

Makes Big Investment in Chicago Real Estate.

It seems almost incredible that a piece of land in Chicago which sold for $450,000 last week should have been purchased in 1836 for $231, having increased in value 18,622 times, but that is the history of the W. W. Cole (the former circus man) property, which was purchased by George A. McKinlock, president of the Central Electric Company, for $750,000. In 1833 the entire block in which this property is located, containing 2.9 acres, was purchased by Hiram Pearsons for $231. A few months thereafter Mr. Pearsons sold the block to William B. Eagan at a profit of $20. In 1835 Mr. Eagan conveyed the block to E. K. Hubbard for $750.

The land fronts eighty-seven-and-one-half feet on Fifth Avenue and 163 feet on Jackson Boulevard, with an eighteen-foot alley on the west, and it is improved with a ten-story fireproof building worth more probably now than it was when originally built.

The purchase was made by Mr. McKinlock as an investment, but it is likely that the Central Electric Company may occupy a part of the structure when the present lease expires. The consideration was based on a valuation of $450,000 for the land, equivalent to $5,142 a front foot for the Fifth Avenue frontage, $2,941 a front foot for the boulevard frontage and $33.61 a square foot.

Second Avenue Railroad.

In an order filed on August 30 in the United States Circuit Court, Judge Lacombe granted the application of Davies, Stone & Auerbach, solicitors for the Guaranty Trust Company, of New York, and Quigg, Baldwin & Pierce, solicitors for the Second Avenue Railroad Company, extending the time for the taking of testimony in the foreclosure proceedings instituted by the Guaranty Trust Company, until November 9 next. The complainant is allowed until September 9; defendants from that time to October 9 to take their testimony, and the complainant is then given until November 9 to take testimony in rebuttal. In this notice Judge Lacombe again expressed doubt of jurisdiction.

According to the State Railroad Commission, there were 551 fatal and 5,427 non-fatal railroad accidents in Pennsylvania during the six months ended June 30. Of the fatalities, seventy-nine were on electric roads.

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Meeting of the Central Electric Railway Association.

The first fall meeting of the Central Electric Railway Association, advanced from September, was held at the Cadillac Hotel, Detroit, Thursday, August 26. The meeting was notable for the large number of officials representing nearly every electric road in Ohio, Indiana and Michigan, who had made long-distance trolley trips to be in attendance at the first meeting of the association to be held in Michigan. The meeting was also noteworthy for the many entertainment features provided by the managers of the Detroit United Railway lines and city officials. It is understood that the September meeting was advanced to August in order to combine pleasure with the proceedings of the convention, and for this reason only one session was held to afford time for a pleasant excursion by boat on Lake St. Clair and an enjoyable luncheon at the Belle Isle Casino.

The convention was called to order by the president, A. A. Anderson, who immediately called for reports of officers and committees, and the preliminaries were soon out of the way. A resolution in condolence of the death of C. C. Reynolds, an active member of the association, who died at his home in Indianapolis June 26, was adopted with bowed heads.

Great interest was shown in the rapidly increasing development of the express business on electric railways as presented in a paper read by John H. Crall, general passenger and freight agent of the Terre Haute, Indianapolis & Eastern Traction Company.

Mr. Crall said, in part, that interurban express or dispatch freights is a feature of the traction business that has occasioned more or less controversy from the beginning, both as to the handling of the business and as to whether it could be made a revenue producer. He said the line with which he is connected has found that little additional capital or equipment is necessary to carry on the business by accepting shipments when delivered at its stations, transporting same and making station delivery only. That this plan has proven very satisfactory because of its quick delivery due to hourly service, is evidenced by the increasing amount of express matter carried by interurban roads adopting this plan. Mr. Crall described the manner in which the farmer or produce raiser communicated by telephone with the commission merchant or numerous customers relative to commodities. In consequence these were soon placed on board the cars, and in a short time delivered to the commission merchant at the city station. Likewise commodities are shipped to the towns, villages and even to crossroad stops in the country. The speaker suggested that the wasted space in the vestibule of the cars might be filled up with express shipments. He said that during the month of May the revenue from interurban express service on his lines was 6.14 per cent of the passenger earnings, and the space used in the cars for the express matter transported was 6.36 per cent of the total space in the cars. In other words, his lines earned as much from the space used in the cars for express as the corresponding space used for passenger traffic. Mr. Crall said it was a mistaken idea that interurban express or freight dispatch is of no importance other than a matter of accommodation. The business is not only a means of substantial revenue, but the possibilities for increasing it are more than flattering, and traction lines will, without question, be materially benefited by boosting the interurban express traffic.

In the discussion of Mr. Crall's paper C. N. Wilcox, general manager of the Cleveland, Southwestern & Columbus Railway, George Parker, general freight agent of the Detroit United Railway, E. F. Hyman, general manager of the Electric Package Agency, Cleveland, took the affirmative proposition and explained how and under what conditions straight express business was successfully conducted on their lines. J. H. Pardee, of Rochester, N. Y., and A. A. Anderson, general manager of the Indianapolis, Columbus & Southern Traction line, were inclined to believe there was little or no profit for the majority of roads; that it interfered with passenger service and they had found no inducement to encourage it. F. E. Hardie said that the Fort Wayne & Wabash Valley Traction Company was enjoying a satisfactory express business independent of a contract with the United States Express Company, which handles interline business over his road.

"The Development of Long-Distance Freight and Passenger Business" was the subject of a paper read by Frank D. Norviel, general passenger and freight agent of the Indiana Union Traction Company.

Mr. Norviel emphasized the ideal conditions under and by which the traction lines may enjoy a gradually increasing proportion of the passenger and freight traffic by describing in detail local conditions and situations. He stated that much of the interurban business was secured at rates equal to those of the steam lines because the service and accommodations are adequate for its needs. These conditions must be maintained and every comfort of the passengers looked after. He urged the necessity of encouraging factories to locate on the lines and building switches for their immediate accommodation. The leading feature of Mr. Noveil's paper was how to get long-distance passenger and freight business. He said this required something more and different from looking properly after local business. Among the requirements he cited the following: Tariffs for naming rates, clearly stating what an agent may do; a plan for a just division among roads; issuance of maps and time tables to passengers; arrangement for transfer of baggage at junction points; courtesy on the part of agents and train crews; and use of good, comfortable cars, well ventilated and thoroughly equipped for buffet meals and other necessities during a long-distance travel. The same rule applies to the securing of through freight. In conclusion, Mr. Norviel insisted that there is money in through business, and its future development is only waiting a more extended preparation for properly handling the traffic.

J. G. Forrester, of the Ohio Electric Company, Mr. Hardie, of the Fort Wayne & Wabash Valley, and F. W. Coen, of the Lake Shore Electric lines, discussed briefly some of the points brought out by Mr. Norviel and generally agreed with the proposition that there was much money in the through business.

Thomas H. Henkle, representing the Electric Service Supplies Company, with headquarters in Chicago, read an interesting paper on the subject of "Integrating Wattmeters and Their Application to Electric Cars." Mr. Henkle's paper was well received and brought out a number of questions which were answered by Mr. Henkle in a manner showing his familiarity with the subject.

The next bi-monthly meeting of the association will be held in Indianapolis November 18, 1909. S.

Long Island Electric Railway Company.

The New York Public Service Commission has approved the application of the Long Island Electric Railway Company for the reduction of its capital stock from $2,100,000 to $600,000. This company operates, by electric power, a street railway seventeen miles in length, extending from Brooklyn to Jamaica and Far Rockaway, with a branch running to Belmont Park.

It was brought out in the hearings that the company was originally organized with an authorized capital of $600,000, and in 1908 the road was consolidated with the New York & North Shore Railway Company. The authorized capital of this company was $2,100,000, but in the agreement it was stated that the capital stock of the Long Island company was $600,000 and the North Shore company $1,500,000. In addition, the property of the North Shore company was encumbered by mortgage bonds amounting to $1,261,000.

Interborough-Metropolitan Plan.

It is reported in Wall Street that the financial reorganization of Interborough-Metropolitan will be undertaken by J. P. Morgan & Company, Kuhn, Loeb & Company, and another leading international banking house. It is stated that the current fiscal year is certain to make results for the late year, surprisingly favorable though they were, look unfavorable by comparison.

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Convention of the Association of Edison Illuminating Companies.

Dinner to Mr. and Mrs. Edison.

The Association of Edison Illuminating Companies held its twenty-fifth annual convention at Briarcliff Lodge, N. Y., Tuesday, Wednesday and Thursday of last week. The attendance was thoroughly representative, and the following programme was carried out in executive session and discussed at length:

First Session.

Tuesday Morning, 9:30 O'Clock.

Roll call.

President's address, W. W. Freeman, Brooklyn.

Report of executive committee, D. L. Huntington, secretary, Spokane.

Report of treasurer, Louis A. Ferguson, Chicago.

Report of committee on meters, Joseph W. Cowles, chairman, Boston.

Paper, "Prepayment Meters," F. G. Vaughen, Schenectady.

Report of committee on storage batteries, Ernest Lunn, chairman, Chicago.

Symposium, "The Tungsten Lamp Situation in Various Cities" (prepared from reports received by the president), E. A. Baily, assistant secretary, Brooklyn.

Second Session.

Tuesday Evening, 8:30 O'Clock.

Address, "Combination Lighting and Railroad Loads," Samuel Insull, Chicago.

Report of committee on incandescent lamps, John W. Lieb, Jr., chairman, New York.

Third Session.

Wednesday Morning, 9:30 O'Clock.

Report of committee on National code, Wm. C. L. Eglin, chairman, Philadelphia.

Report of committee on high-potential disturbances, W. F. Wells, chairman, Brooklyn.

Report of committee on steam turbines, Alex. Dow, chairman, Detroit.

Paper, "New Low-Pressure Turbine Installations," W. L. R. Emmet, Schenectady.

Paper, "Gas Power," I. E. Moultrop, Boston.

Paper, "Standard Colors for Power-Station Piping," J. P. Sparrow, New York.

Fourth Session.

Wednesday Evening, 8:30 O'Clock.

Report of committee on electric heating and kindred uses of electricity, John F. Gilchrist, chairman, Chicago.

Paper, "Special Illumination Feature of the Hudson-Fulton Celebration," Arthur Williams, New York.

Paper, "The Central Station and the Electric Vehicle," F. M. Tait, Dayton.

Paper, "Commercial Problems," John F. Gilchrist, Chicago.

Paper, "Electro-Chemical Processes as Applied to Central-Station Service," C. J. Russell, Philadelphia.

Fifth Session.

Thursday Morning, 9:30 O'Clock.

Report on fire insurance, including claims for standard insurance, mutual insurance and individual insurance funds, presented by request of the executive committee from information obtained by the president.

Paper, "Notes on a Neglected Phase of the Insurance Question," Caryl D. Haskins, Schenectady.

Paper, "Rules for Employes from a Legal Viewpoint," James V. Oxtoby, Detroit.

Introduction to discussion, "The Present Condition of the Edison Tube System," W. F. Wells, Brooklyn.

Paper, "Rotaries vs. Motor-Generator Sets for Central-Station Service," C. W. Stone, Schenectady.

Election of officers and executive committee.

Adjournment.

OFFICERS ELECTED FOR 1909-10.

The following were selected as the officers for the ensuing year:

President—Thomas E. Murray, New York.

Vice-President—Charles R. Huntley, Buffalo.

Secretary—N. T. Wilcox, Lowell.

Treasurer—L. A. Ferguson, Chicago.

Executive Committee—Thomas E. Murray, New York; Samuel Insull, Chicago; C. L. Edgar, Boston; J. W. Lieb, Jr., New York; J. B. McCall, Philadelphia; W. W. Freeman, Brooklyn. Ex-Officio—Charles R. Huntley, Buffalo; N. T. Wilcox, Lowell; L. A. Ferguson, Chicago.

The entertainment was of a varied nature, including automobile rides, organ recitals, and golf and archery contests. The chief entertainment event was a trip Tuesday afternoon on the steamer *Glen*

THOMAS E. MURRAY,
President Association of Edison Illuminating Companies.

to West Point and return. This was a delightful affair in every way, a fine orchestra being on board, and luncheon served.

BANQUET TO MR. AND MRS. EDISON.

The dinner in honor of Mr. and Mrs. Thomas A. Edison occurred Thursday evening, September 2, and was a very notable event. The banquet committee, consisting of Samuel Insull, chairman; Charles L. Edgar, John W. Lieb and W. W. Freeman, planned and carried to successful issue one of the most enjoyable and impressive occasions in electrical convention history. The large dining room was most beautifully decorated with vines, flowers and tiny incandescent lamps to the number of many thousands. The table of honor was a great oval, at which seventy were seated, with Mr. and Mrs. Freeman and Mr. and Mrs. Edison at the head. Smaller side tables were arranged for the other diners, also decorated with tiny lamps and flowers.

After the conclusion of the excellent dinner, President Freeman said:

The programme of the evening does not include a formal array of speeches, although, as is well known, we have present this evening a large number of those whose talent in that direction is well understood. The committee, however, has felt that the presence of our guests of honor here in itself is sufficient to make the occasion truly memorable. All that is desired is to give adequate expression to the pleasure which we all feel in the honor of having with us tonight Mr. and Mrs. Edison.

In these times it seems true that we only appreciate the really great things or the really small things by comparison—the ten-story building in the smaller city is a greater wonder than our forty or fifty story skyscrapers in New York. The young lad born in the small country town on the banks of a tiny streamlet thinks he has a mighty river flowing through his town, until, perchance, he becomes familiar in later life with the wonderful Hudson, the beauties of which we have been enjoying for the past few days, and then he smiles at the comparison which he makes in his mind with the tiny stream at home. With reference to our guests of honor this evening, our particular guests, it is certainly true that time and perspective create no diminution of regard and wonderment.

We esteem it one of the greatest privileges that our association could enjoy to have Mr. Edison with us. While his genius has been too great to be circumscribed within the lines of our activities, and while in recent years his efforts have been put forth in somewhat other directions, still it will always be a source of particular pride to those engaged in the electrical industry, and still more particularly of the members of the association which bears his name, to learn of his accomplishments and to give praise for them; and it would seem that our feeling in respect to the special association of Mr. Edison with the members of this small company is somewhat shared, by the presence of Mr. Edison on an occasion of a character which he seldom honors with his company.

We are particularly proud to have with us not only Mr. Edison, but Mrs. Edison, whose presence gives us equal honor, and Miss Edison, and the other members of the family. I propose a standing toast to the guests of the evening:

To Mr. and Mrs. Edison—"May the years of health and enjoyment in store for them be as numerous as the benefits which Mr. Edison's genius has conferred upon mankind."

There is no one to whom quite so much credit for the success of the arrangement for our gathering this evening is due as to the chairman of our committee, to whom we are indebted for the presence of Mr. and Mrs. Edison, and for much of the arrangements of the evening. It gives me great pleasure to introduce for an address, and for such other formalities as he may see fit to inaugurate, Samuel Insull.

MR. INSULL'S ADDRESS.

I have the very pleasant duty to perform to thank you, on behalf of our two guests

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of honor this evening, Mr. and Mrs. Edison, for the very cordial way in which you have received them this evening, and for the very handsome entertainment that you have afforded them on this occasion.

It is a peculiar pleasure for me to be able to speak for them, as it is now upward of thirty-one years since I first entered the Edison service, and I am still, I hope, as enthusiastic in it as I was in 1879, two years before I met Mr. Edison.

It is a very great pleasure to us—I am now speaking as a member of the Association of Edison Illuminating Companies—to be honored by Mr. and Mrs. Edison's presence, and it is more particularly a pleasure to us when we hear from them, as we have during last night and today, that they consider that the attention we are paying them is a very great honor to them.

It is now upwards of twenty-five years since the first Edison station was started in New York, and if those around this table will look back to September, 1882, when that station was started on Pearl street, a little south of Fulton street, and remember the difficulties encountered in raising the capital to establish that business—difficulties which were almost insurmountable, apparently, to the capitalists who stood behind the enterprise—they will recognize that it would have been impossible to have started the station but for the personal credit extended to the institution by Mr. Edison through his manufacturing establishments which he owned at that time.

The money raised by one of the leading banking houses in America at that time was insufficient to finance the plant of the Edison Electric Illuminating Company of New York, and it was Mr. Edison's personal fortune that enabled the starting up of the Pearl street station, and it was Mr Edison's manufacturing establishments that had to wait for their pay until that station was a financial success. I think that fact is probably as great a tribute to the genius of the inventor as anything we can possibly imagine, because, I think, if you will search the annals of new industries you will fail to find a case where the original money invested paid a return on the investment to clear off the floating debts without the subscription of additional capital by those who had the courage to put their money in, in the first instance.

We have today, scarcely more than a quarter of a century since the first experiments were started at Menlo Park, business that employs in our branch of it not less than one thousand millions of dollars—a business that, whether it be the running of a small plant in a hotel like this, or the harnessing of the mighty natural forces of Niagara, or the enormous steam generating plants in all our large cities, in all systems of electrical distribution—these are impossible of operation unless the inventions made by our honored guest are used every day and every week by all of us, and it is a matter of common use for us to do so. I care not what you may have followed, whether it has been in the development of the power business, whether it has been in the development of the alternating current system, whether in the development of transportation, or whether in the development of the various forms of electric lighing—those are but matters of detail. The transcendent genius that gave us the great engineeering monument of a distribution system must be credited now and for all time to the illustrious inventor whose name our association bears.

Mr. Insull then read letters and telegrams of regret from C. A. Collin, Theo. N. Vail, Elihu Thomson, Charles Batchelor, S. Bergmann, John I. Beggs, R. R. Bowker, Capt. Wm. Brophy and others.

Mr. Insull called on E. H. Johnson to speak, saying that it was through Mr. Johnson that he came to this country.

MR. JOHNSON'S ADDRESS.

I have the honor to be the oldest associate of Mr. Edison in his work in this room. In the fall of 1870 I came to New York from Colorado at the summons of some friends to look into an enterprise in which they were interested, and, to make a long story short, they found themselves in considerable difficulties, and the question arose: Who is the man to lead us out of this difficulty? A young friend of mine, at that time associated with a big financial establishment in Wall Street, namely, Col. Josiah C. Reiss, who is present here this evening, got up and said: "I have heard of a young fellow over in Newark by the name of Edison; they tell me he is a great genius; he has wonderful inventive faculties, and I believe he is the man to get us out of this trouble." I said: "Yes, I have heard of that fellow; he was a telegraph operator originally, but has done some wonderful work in electrical matters." They proposed to send for him, and a resolution was passed at the meeting that afternoon to send for Mr. Edison and have him come over and meet me, and I was to pass on his qualifications and decide whether he knew anything.

We went up to the top floor of that building, this young man Edison and old man Johnson—I am a year older than he is—and we started to talk over the subject and talked all night long, away into the early hours of the morning, and then we separated and went home. I met my associates down the street the next morning and I said: "That chap knows what he is talking about, and he is your man, and he will get you out of the difficulty, and you had better make an arrangement with him," and they made an arrangement with Mr. Edison.

Mr. Edison turned the tables on me and said: "I will take the job if you will allow this fellow Johnson to stop over here a little while and assist me." We went at it. Mr. Edison immediately got to work on the difficulties which confronted the company, and he made improvements after improvements—you know them all—it is not worth while to take your time to tell you about them, but I want to ask you whether or not you are prepared here, as guests at this table, honoring this gentleman, to confirm my judgment that at that time he "knew something."

You have often heard it said that with great minds and great brains goes excessive modesty. I have to thank my young friend on the right here (Mr. Brady) for putting that thought in my mind. This man whom we are honoring tonight is the best exemplification of that statement I have ever seen, and I am sixty-three years of age, and have met a great many people, and I am able to speak of his modesty and its meaning by virtue of the fact that since 1870—can you count? It is a good many years ago—I have had a degree of intimacy with Mr. Edison that I think no man has ever enjoyed other than Charles Batchelor. I give first place to him, but in that intimacy I have learned a great many things about Mr. Edison that was not known to the public, and one is the direct attribute of his modesty, of his character, and that is the great, big, broad heart that he carries within him which he never lets anybody see. I have seen it time and time again, and I had a personal occasion once to feel it myself, and I knew it was there, and I am proud to admit it, and I know now, more than ever, that it was genuine.

Ladies and Gentlemen—I offer you a toast: "Here is to the brain, the greatest brain, in the judgment of great men in Europe" (with whom I have come in personal contact during the fifteen years I have sojourned on that side of the Atlantic, such men as John Lubbock, now Sir Avebury, Sir Richard Webster, the late Chief Justice of Great Britain—not your small inventor, envious of the credit this man receives, but the men without envy, and therefore competent to pass on the work this man has performed); I say, these men united with me in saying that no such brain ever was created in the mind of man as Mr. Edison has shown in the colossal work he has done and the diverse directions which his work has taken. Now, in addition to that brain, I offer you this toast: "Here's to the man with a heart as big as his brain."

F. P. Fish then was called upon and spoke at some length of Mr. Edison's work and his early acquaintance with him. Continuing, Mr. Fish said:

As some of you know, the older of you—for I have been much interested tonight to see twenty, thirty, forty or fifty men that I knew nearly thirty years ago and with whom I had intimate relations for many years—in the old days, beginning with 1882, I was in the rival camp of electric enterprise at a time when things were very small, the business was small, the aspirations were small, the expectations were small. I remember very well, just about that time, hearing one of the most intelligent men in the country, a man who was trained in mechanism, a man whose name was an authority, say: "That man Edison is wasting his time on that form of lamp that he has gotten up; now, there is some sense in the arc lamp that Brush has gotten up, but there is no future whatever for this dream of Edison's." The business in those days was not only small, materially, but it was small in some other ways. There were all kinds of jealousies, a good many of them on the side of some of my friends who were associated with Mr. Edison—never, in one single instance, as far as I ever heard, on the part of Mr. Elison himself; do not forget that, for from the very beginning he never showed one single particle of that small, petty meanness and jealousy which was in the business.

The time came when we got together, and there was no reason under the sun why it should have taken years for Mr. Edison and myself to have gotten into these relations which I wanted—which he could not have wanted, particularly, because there was no reason why he should—but I wanted them personally, and I wanted them in the interest of the business for which I was working, which was the General Electric Company, and to my surprise I had not seen Mr. Edison for one hour before I found out that he was one of the largest, broadest, clear-minded and fairest business men in the situation, which, as Mr. Insull says, was extremely delicate, as can be imagined by anyone with the most vivid imagination, and from almost our first interview down to the time when, to my very great regret, I began to see less and less of him, he was the same.

Mr. Insull then said: "I do not think this occasion would be complete unless we heard from Dr. Steinmetz."

DR. C. P. STEINMETZ'S ADDRESS.

It is a momentous occasion which has brought us together tonight to celebrate the existence of our association for one lifetime, and it is a lifetime ago that the grand master of our industry in-

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vented the incandescent lamp, whom we have the pleasure and honor of having with us tonight, as a member of our association. Mr. Edison thirty years ago invented the incandescent lamp and thereby created the possibility of our association's existence since that time.

Now, when Mr. Edison gave us the incandescent lamp, it was an invention more complete than any invention which ever has been made. It is interesting to realize that for a quarter of a century all the engineering and scientific talent and ability of the entire world has not been able to advance the incandescent lamp by one single radical feature, beyond the position where the inventor left it. All the advance has been made in methods of manufacture, and it took a quarter of a century for the electrical industry to develop new and unknown methods, electric furnaces, for the chemistry to advance, to make available to us materials non-existent in the early days, which were necessary to advance the incandescent light a single radical step, and even now, if we speak of the high efficiency of the tungsten lamp, do not forget that tungsten melts and boils at a temperature where carbon is still solid, and that the carbon filament lamp may still outrun the tungsten lamp in efficiency. There are the potent possibilities. The electrical industry has advanced since those days, in that lifetime, at an enormous rate, from the small dynamos of Edison's first station to the huge generating system of our friend from Chicago, Mr. Insull, where at least momentary power is available at the bus bars, measured by many millions of horsepower, an amount of power equal to the concentrated power of Niagara. That is, if you look at the advance of electrical industry from Edison's dynamo to the new dynamo station of the Commonwealth Edison Company of Chicago, or other large companies, what have we done? We have taken the commutator from the dynamo and put it two, ten or twenty or fifty miles away, and it still revolves with the armature of the dynamo synchronously, and we call it a rotary converter; that is, we have lengthened the commutating leads and connections between the commutator and armature from a few inches to many miles, but it is the same system and is not radically changed; it is a development of the old dynamo of Menlo Park, which still now generates and distributes the power of our huge modern systems.

It is not the great work of the creation of the incandescent lamp, or the creation of the generating system, which we desire to honor in our grand master—we do him honor because he created the electrical industry. There had been dynamos before his time, there had been scientific toys, apparatus suitable for physical demonstration, for exhibition purposes, for fancy, spectacular lighting, but it was Edison who insisted that the dynamo must be on the engine shaft, who has converted the physical apparatus into a machine, converted and changed electrical engineering from a branch of physical science into an industry, and all of these millions of dollars which are now invested in the electrical industry are invested in a thing which has been created by our grand master.

No theoretical man could have ever done that, no practical man could ever have done that. Only yesterday I heard the old stale joke sprung on theory and practice. Now, I do not recognize Mr. Edison as a theoretical man. I do not recognize him as a practical man. There are three ways of proceeding—the one is that of the practical man, who tries everything, and something else, and then fails, as a rule, because the number of possibilities is so unlimited that it is only luck that he may strike success once, and that never happens twice in a lifetime. The theoretical man proceeds still differently—he systematically starts from truths and premises, building up conclusions by mathematical formulas, and also scientifically proving methods, reaching conclusions which are correct scientifically, and in every other respect right, although numerically, if he does not happen to mistake a decimal point or two, his correct results apply to phantom phenomenon in a phantom world, but not to real things in a real world, except that a master mind directs in the selection of his premises, directs him in the use of his conclusions, so that after all the work of the theoretical man and the practical man are merely details of the master mind. Now, the third method is the method by which all the great advances of the world have been accomplished, by very few men, is being accomplished and will be accomplished—has been accomplished by men such as Faraday, Helmholtz, Edison—they proceed, not by the approved methods of science, but they pass beyond all these cumbersome mathematical and theoretical investigations, they lead the course by intuition, starting from the premises, leading to the results in a single step, in place of the numerous mechanical work across intermediate formulas and equations, which have no meaning by themselves. The theoretical man may then be called upon to calculate the second or third decimal. The result is there already.

Practically, also, investigations may be made, hundreds of experiments may be tried, more or less successfully, but it is not the blind trials of the practical man, but the reasoning direct, and that other quality which we may call common sense, because it is so extremely uncommon, which produces the result.

Now, it is true that all the advance of the world has taken place because of the efforts of those men who have been above theory and above practice, and therefore I say, I cannot recognize Mr. Edison as a theoretical man or as a practical man, but as one of those few for whom the differences between theory and practice have disappeared, just as the differences of the east and west cease to appear at the poles of the earth.

And, therefore, I ask you, gentlemen, and you, ladies, also, to drink to the health of Mr. Edison, the genius, and express our hope that for many years to come he may assist us with his help, and his advice, and with the stimulation of his work.

Mr. Insull said that before handing over the gavel to the president of the association and ending his part in these very pleasant exercises, he thought that the staff of the New York Edison Company was entitled to a vote of thanks for the very successful work which they had done in decorating the dining room. The transformation that had been effected here in less than twenty-four hours was marvelous, and he knew that all of those around the table who were engaged in practical electric-lighting work must be lost in admiration of the work which had been done, its finished and wonderfully artistic effect. Their work had been a work of love, they had taken as much interest in it as those present had taken in this occasion.

President Freeman then said that the only feature of the programme which was not entirely delightful to him was now due, and that was in the renunciation of all honors of this kind in future to a better man, who had been elected to the presidency of the association. We all recognize the necessity of frequent changes in office, if occasions of this kind are to be repeated, and he was certain that it would take the retiring president a considerable time to get down to a normal state of mind, and any danger of a repetition of the occasion would be altogether alarming. He called upon Thomas E. Murray, the newly elected president, and courteously asked him to accept a place at the head of the table and preside over the further functions of the occasion.

Mr. Murray expressed his hearty thanks for and sincere appreciation of the honor conferred upon him in electing him to the presidency of the association. It would be the object of his best endeavors to maintain the high standard of the Edison association, and in furthering the interests of the individual member companies. He expressed the cordial thanks of the association, and its guests, to Mr. and Mrs. Edison for honoring them with their presence.

THE GUESTS.

Among those seated at the great center table were:

Mr. and Mrs. Thomas A. Edison, Charles Edison, Madelaine Edison, Master Theodore Edison, Mr. and Mrs. W. W. Freeman, Mr. and Mrs. W. S. Andrews, S. Bergman, Jr., W. S. Howell, C. P. Dyer, P. J. Kreusi, J. W. Howell, W. J. Hammer, Charles W. Price, Gen. George H. Harries, C. R. Huntley, Mr. and Mrs. Alex Dow, Mr. and Mrs. Greenfield, Frank Frueauff, T. C. Martin, Mr. and Mrs. J. B. McCall, E. R. Weeks, S. S. Wheeler, R. T. Lozier, L. B. Stillwell, Arthur Williams, E. B. Gilmore, E. A. Baily, J. H. Vail, Dr. C. P. Steinmetz, Mr. and Mrs. Samuel Insull, Mr. and Mrs. J. W. Lieb, Mr. and Mrs. T. E. Murray, Mr. and Mrs. C. L. Edgar, N. F. Brady, Mr. and Mrs. E. H. Johnson, Mr. and Mrs. F. A. Vanderlip, F. P. Fish, Mr. and Mrs. J. T. Lovejoy, Mr. and Mrs. Louis Ferguson, B. E. Sunny, George B. Cortelyou, H. M. Byllesby, F. J. Sprague, Mr. and Mrs. E. W. Burdette, Mr. and Mrs. Walter R. Addicks, W. H. Meadowcroft.

At other tables were: Mr. and Mrs. C. D. Haskins, H. A. Wagner, Charles Blizard, W. S. Barstow, Fred C. Bates, E. H. Davis, W. L. R. Emmet, Frank H. Gale, John F. Gilchrist, Converse D. Marsh, A. D. Page, A. L. Rohrer, M. S. Seelman, Jr., Clayton H. Sharp, Francis W. Wilcox, John Wolff, William Yeager.

Among the presidents of prominent electrical associations, who were present to do honor to Mr. Edison, were the following-named gentlemen:

Thomas E. Murray, New York, of the Association of Edison Illuminating Companies.

Frank W. Frueauff, Denver, of the National Electric Light Association.

Lewis B. Stillwell, of the American Institute of Electrical Engineers.

Theodore Beran, of the New York Electrical Society.

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The Timber Supply of the United States.

The Forest Service of the United States Department of Agriculture has prepared, in the form of a twenty-four-page circular, a preliminary report on the timber supply of the United States.

The object of this circular is to answer, so far as present knowledge permits, many questions which are constantly arising concerning the extent of our forest resources, their ownership, the rate at which they are being cut, and the outlook for a future timber supply. The data given have been drawn from every available source.

The original forests of the United States exceeded in the quantity and variety of their timber the forests of any other region of similar size on the globe.

It is safe to estimate that the original forests of the United States covered 850 million acres and contained 5,200 billion board feet of saw timber according to present standards of utilization. In addition, there were probably 100 million acres of scrubby forest and brush land, chiefly in the West, which has been and still is a source of much post and fuel material.

The original forests of the United States have been reduced by cutting, clearing, and fire from an acreage of 850 million to one of not more than 550 million, with a total stand of some 2,500 billion board feet.

Of the total land area, the original forest area was forty-five per cent, and the present forest area is twenty-nine per cent. Of the original forest area the present forests cover sixty-five per cent. The present forest comprises about forty-eight per cent of the original stand of timber.

Most of the forests in the United States are privately owned. Approximately twenty per cent of the standing timber in the country is held by the Federal Government in national forests, Indian reservations, national parks, and on the unreserved public domain, and by the states in state reserves or other state lands. These public forests contain more than 100 million acres of saw timber.

The private forests are of two distinct classes, (1) farmers' woodlots and (2) large holdings, either individual or corporate. The farmers' woodlots are chiefly scattered and detached remnants of the original forests, which, as a rule, have been severely culled. They are mainly in the eastern half of the United States, and cover some 200 million acres, with a stand of perhaps 300 billion board feet of saw timber and one-and-one-half billion cords of wood. Aside from their protective and ornamental value, they furnish much firewood, many posts, poles, and cross-ties, and some lumber and cooperage stock.

The larger private holdings contain about 1,700 billion feet. These holdings generally include the best timber in the regions in which they occur, since private capital always seeks the best possible investment. They are the principal sources of the lumber which is used today, and upon the manner in which they are managed depends in a large degree the timber supply of the future.

So far, true forestry has been practiced to only a slight extent, or not at all, upon the forests in private hands, and, because of lack of funds, it has not yet been possible to apply right methods of forest management to all public forests, though such methods will eventually be used in handling them.

The value of the forest products of the United States in 1907, the last year for which detailed data are available, was approximately $1,280,000,000. The poles, posts and rails used for fences and overhead electrical circuits were valued at $100,000,000.

Some three-and-one-half million round poles exceeding twenty feet in length are used annually by telegraph, telephone, and other electric companies. Over three-fifths of these poles are cedar, and more than one-fourth of them chestnut. Relatively small amounts of pine, cypress, and redwood poles are also used.

The total yearly drain upon our forests, not counting losses from fire, storms, and insects, is some twenty billion cubic feet. Our present forest area of 550 million acres may be roughly estimated to consist of 200 million acres of mature forests, in which the annual growth is balanced by death and decay, of 250 million acres partially cut or burned over, on which, with reasonable care, there is sufficient young growth to produce in the course of time a merchantable, but not a full crop of timber, and 100 million acres of more severely cut and burned-over forests, on which there is not sufficient young growth to produce another crop of much value.

Taken as a whole, the annual growth of our forests under these conditions does not exceed twelve cubic feet per acre, a total of less than seven billion cubic feet. That is, we are cutting our forests three times as fast as they are growing. There is menace in the continuance of such conditions. While we might never reach absolute timber exhaustion, the unrestricted exploitation of our forests in the past has already had serious effects, and it will have much worse if it is allowed to continue unchecked. White pine, for instance, which was once considered inexhaustible, has fallen off seventy per cent in cut since 1890, and more than forty-five per cent since 1900. The cut of oak, our most valuable hardwood lumber, has decreased sixteen per cent since 1900, and that of yellow poplar twenty-two per cent. The same story will be told of other woods if they are not conserved.

The fact that timber has been cheap and abundant has made us careless of its production and reckless in its use. We take 250 cubic feet of wood per capita annually from our forests, while Germany uses only thirty-seven cubic feet, and France but twenty-five. On the other hand, Germany, who has learned her lesson, makes her state forests produce an average of forty-eight cubic feet of wood per acre. We have as fast-growing species as Germany, or faster, and as good or better forest soil, if we protect it.

The necessity for more farm land may eventually reduce our total forest area to 100 million acres less than it is at present. It is entirely possible, however, to produce on 450 million acres as much wood as a population much greater than we have now will really need if all the forest land is brought to its highest producing capacity and if the product is economically and completely utilized. But to reach the necessary condition of equilibrium between timber production and consumption will take many years of vigorous effort by individual forest owners, by the states, and by the national government. None of them can solve the problem alone; all must work together.

Pay-Within Cars.

A new type of trolley car will shortly be put into use in Bayonne, N. Y., by the Public Service Corporation of New Jersey. The cars are to be called pay-within cars. Both front and rear doors will be controlled by the motorman and platforms will be eliminated. The passenger will step from the street into the car proper. He can only leave by way of the front door, and there are no handles on the cars for persons to grasp in getting on or off. The doors will not open until the car comes to a full stop. It is believed that this design will reduce accidents to a minimum.

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The American Mining Congress.

The twelfth annual session of the American Mining Congress will be held at Goldfield, Nev., from September 27 to October 2 next, inclusive.

The meeting will be of particular interest to electrical men on account of one of the subjects to be taken up at this meeting being "The Standardization of Electrical Equipment in Mining Work."

This was proposed at the Pittsburg (Pa.) meeting last December by David B. Rushmore, of the General Electric Company, Schenectady, N. Y., and as a result of his recommendation the following gentlemen were appointed a committee to consider this important question: Dr. Edward B. Rosa, Bureau of Standards, Washington, D. C. (chairman); David B. Rushmore, General Electric Company, Schenectady, N. Y. (representing the electrical manufacturers); W. A. Thomas, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. (also representing the manufacturers); J. R. Bent, Oglesby Coal Company, Oglesby, Ill. (representing the mine operators); George R. Wood, Pittsburg Coal Company, Pittsburg, Pa. (also representing the mine operators); T. L. Lewis, president of the United Mine Workers of America (representing labor); and James O'Connell, vice-president of the American Federation of Labor, Washington, D. C. (also representing labor).

While the committee has been so recently organized that not a great deal of work has thus far been accomplished, it will render a preliminary report at the coming Goldfield congress announced above. It will then continue its work, and within the next few months it will doubtless be prepared to complete its recommendations in this timely and important matter.

The absence of uniformity in the installation of electrical equipment in coal and precious-metal mines has given rise to problems very annoying to operators and even to manufacturers, and the work of this committee will be watched with interest.

Those having any views to offer on this subject are invited to send them to Dr. Edward B. Rosa, Chairman of the Committee, care of the Bureau of Standards, Washington, D. C.

Consul-General Thomas Sammons, of Seoul, states that on March 31, 1909, there were 172 telegraph and eighty-five telephone offices in Korea.

Action Against Canadian Hydroelectric Commission.

Defeated in their attacks on contracts entered upon by the Hydro-Electric Commission of the province of Ontario with the various industrial municipalities of Ontario, the electrical interests have found another point which in their opinion offers better chances of success in their campaign to defeat the power policy of the Ontario Government.

According to a writ issued at Osgoode Hall last week their efforts are now concentrated upon annulling the contract entered into by the commission with the Ontario Power Company for the supply of electrical energy. The ground taken is that the company is assuming to take water from a navigable river forming part of the boundary between the United States and Canada, and under the authority of the Government of the Dominion of Canada, without the sanction of such Government.

The writ was issued by Messrs. Beatty, Blackstock, Fasken and Chadwick, for John A. Murray, on behalf of himself and all other ratepayers of Toronto, against the Hydro-Electric Commission.

In all previous cases the defendants have been the municipalities concerned, and efforts by the latter to have the commission joined as co-defendants were resisted.

In the present case the plaintiff asks the courts to restrain the Hydro-Electric Commission from erecting transmission lines and transformer houses and other electrical appliances for the transmission of electrical energy generated by the Ontario Power Company from the Niagara River, and from proceeding with the acquisition of real estate or easements for the location of such lines, and from proceeding to spend the money and pledge the credit of the Province of Ontario and the municipality of Toronto in carrying out the contract pretended to have been made by the defendants with the Ontario Power Company for the purchase of power generated from the Niagara River.

Suit Against United Railways.

J. Brooks Johnson has filed suit against the United Railways Company, of St. Louis, and the St. Louis Transit Company to recover about $35,000 in judgments against the St. Louis Transit Company, and asks for the appointment of a receiver, alleging fraud in the transfer of the Transit company's assets to the United Railways Company.

Receiver for Juniata Water and Power Company.

A bill in equity has been filed in Common Pleas Court No. 1, at Philadelphia, for a receiver for the Juniata Water and Power Company. The company defaulted on its first mortage five per cent bonds last May, and the present suit is the result of that and differences as to the management and reorganization of the company.

The capital stock outstanding is $7,500,000, and there is a debt of the same consisting of first mortgage five per cent bonds. A second mortgage of $500,000 is authorized but not issued.

Receiver Asked for Deschutes Irrigation and Power Company, of Oregon.

Application for the appointment of a receiver for the Deschutes Irrigation and Power Company was made September 1 in a suit filed by John G. Deshler, of Columbus, Ohio, against that company in the United States Court. Conspiracy, mismanagement and breach of trust are charged against the directors of the company, which is alleged to be in arrears for the last three semi-annual interest payments on a bonded indebtedness of $359,000. With the exception of 20,000 the entire bond issue is owned by capitalists of Columbus. The irrigation company has contracted to reclaim about 250,000 acres in eastern Oregon. About one-fourth of the area has been placed under irrigation up to the present.

Trolley Freight in Pennsylvania.

The Philadelphia Rapid Transit Company, taking advantage of the act passed by the recent Legislature relative to trolley companies carrying freight, has begun the running of cars between Doylestown and Philadelphia, a distance of about eighteen miles.

This company is erecting a station at Warrington, and a similar building is to be erected at Edison. The Transit Company proposes to haul any kind of freight that its cars will carry.

The movement for a union terminal for the three roads, the Rapid Transit, the Philadelphia & Easton and the Bucks County Electric Railway Companies, is again being agitated, and it is said that in a short time operations will be started for the building of the terminal. This building would be used for the housing of the cars of the three companies over night in order that all runs may be started direct from this point.

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ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

THE PROBLEM OF DOMESTIC LIGHTING.

BY DR. LOUIS BELL.

House lighting, despite its intimate relation to the life of people at large, is upon the whole the most neglected branch of artificial illumination. One would suppose that, considering the fact that a man has to pay lighting bills all his days, he would make every effort to get his money's worth and would go to some trouble to obtain the best possible results. In fact, however, the average man merely confines his efforts at betterment to kicking about the quality of the light and protesting at the amount of the bills, while the average woman, who is the more important factor of the domestic situation, adds to the grumbling chorus some items to the effect that any form of lighting specified by mere man is hopelessly inartistic. As a result house lighting is too often inefficient, expensive and garish.

To begin with, when a house is being planned the matter of lighting is commonly left to the very end of the chapter. The architect's draftsman crosses in a few outlets in conventional positions and no further attention is given to the matter until the building is so near completion that contracts for piping and wiring must be let at once. As a first suggestion for improvement, the architect's estimates and plans ought to cover all the provisions for lighting and heating the structure which are not of a strictly portable nature. It is absurd for a self-respecting architect to devote keen attention to decorative detail in his designs and estimates and then disclaim all responsibility for the lighting fixtures and permit the glib-tongued fixture salesman to unload upon his victim miscellaneous brasswork at two dollars the pound. Fixtures are as much a permanent part of the decorative scheme of a house as is the ornamentation around the mantels. The practical effect of leaving fixtures out of the architect's estimates is that they are dropped out of sight until it is too late to make a proper allotment of funds for them, and far too late to rearrange the outlets, which ought to be the subject of very close attention.

There is, too, an altogether bad tendency to provide outlets on the theory that combination fixtures are going to be used, with the result that the location and arrangements are those which are suitable for gas and all the advantage of facility which really characterizes electric lighting is lost. The expense is largely increased by combination systems and for all practical purposes the gain in reliability or in convenience is negligible. At the present time neither gas nor electricity is out of service enough to amount to anything, and if either does fail it is for so short a time that lamps, or, still better, candles, tide over the emergency very easily. And combination fixtures are peculiarly undesirable when purchased with undue economy, since, while cheap electric fixtures may be bad, cheap gas fixtures are positively dangerous, and cheap combinations still worse. In a modern house located in a territory where electric service is available, gas piping has no use beyond the kitchen. If only gas is available, a thoroughly good job of illumination can be done with it, and there is no use in wiring for combination fixtures even then, for when electric service is available the wiring scheme should not be confined to locations suitable for gas lights.

Very much mischief is done in house lighting by the lack of attention to which reference has been made, but even more is done by ignorance and prejudice on the part of the householder. The fear of electric wiring has not been altogether eliminated from womankind in particular, neither has the idea that electric light is "inartistic," "unbecoming," "bad for the eyes," etc., notions carefully fostered by the gas man, and due originally to the utter lack of knowledge of the first rudiments of proper illumination. And then comes the fixture salesman and gets busy at selling either for gas or electricity, anything that he can unload at sufficient price. For instance, the writer has in mind a popular style of chandelier and shade, that probably cuts off not less than three-fourths of the useful light without at all improving its quality or distribution; also a fixture designed for a piano lamp, which, from the standpoint of giving light, is altogether inferior to what one could extemporize from an old tomato-can. The result of such abominations is that an inordinate amount of light has to be used, the bills run up, and there rises the familiar complaint, that electric lighting costs outrageously much. Gas fixtures are sometimes bad enough, but the necessity for ventilation and avoidance of overheating combine to prevent results quite so bad as when the artistic temperament gets busy with an electric fixture.

Now, from a practical standpoint, the fundamental question in domestic lighting is how good results can be obtained at reasonable expense. It is altogether a fallacy to suppose that electric lighting is in itself particularly expensive, even at the relatively high rates commonly charged the small consumer. Some years ago the writer, living in a suburban house where neither gas nor electricity was available, took careful reckoning as to the cost of lighting by kerosene, the oil being purchased by the barrel and a locked faucet applied to check against waste. Without going into details, the result was that the house could have been lighted by electricity at practically the same cost, assuming the price of twenty cents per kilowatt-hour then charged on the nearest circuit. Of course, at such a price the cost per theoretical candlepower-hour was greatly in favor of the oil, but the total actual cost for the house is not measured by this figure, but depends on the relative waste of light by the two methods.

Electricity is the one artificial illuminant which can conveniently be used only when it is needed, and it is the proper appreciation of this fact that determines the economy of domestic lighting. The

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vital question is, how many candlepower-hours are needed for the proper service of the household? All light in excess of this is, from the economic standpoint, wasted. In using oil, candles or gas, it is not practically convenient to turn out the light in a room where temporarily unoccupied, and while gas may be easily turned down, it frequently is not, from the mere inconvenience of reaching for the fixture. Hence there is steady waste, often amounting to much more than the light actually utilized.

Of course, one can fall back upon electric gas-lighters, which can be operated like an electric switch at any convenient point, and in theory these can give to gas the same convenience in turning out possessed by electric lights. As a matter of practice, however (and the writer here speaks from considerable personal experience), the electric gas-lighting appliances as installed for house use are troublesome and frequently out of order. In addition, the full automatic form, which is the only one at all comparable with a switched electric lamp, may be and often is dangerous, both from accidental failure in operation and from being the source of small persistent leaks of which the final results may be grave, especially with gas rich in carbon monoxide.

The key to economical lighting is to control the lights by conveniently placed switches, so that they can be, and naturally will be, turned out when not in use. To this end it is wise to avoid key sockets as far as possible, save for table lamps and the like, to provide automatic door switches for closet lamps and in general to plan the lighting for the purposes of its use. Money spent in a thorough switching system is recouped very quickly in reduction of bills.

Another thing always to be borne in mind is the adjustment of lights to their requirements. In many places a four-candlepower lamp is just as good for practical purposes as a sixteen-candlepower, and a well-placed twenty-five-watt tungsten lamp is quite as effective as a badly placed 100-watt carbon lamp. The advent of the tungsten lamp enables domestic lighting to be done with a degree of economy hitherto quite impossible.

As to the placing of lamps, perhaps the commonest fault is the use of fixtures in which the axis of the lamp is at an angle. So far as the lamp itself is concerned such a position is unobjectionable, but bare high-efficiency lamps should never be used under ordinary circumstances, and there are no shades capable of giving first-class distribution in an angle fixture. A lamp should be placed tip down or tip up, and it can then be so shaded as to give almost any distribution required. The tip-down position is generally preferable, as suitable shading is thereby made easier. Only in the case of groups of lamps is good total distribution from an angle fixture really practicable, and groups are ordinarily less economical than well-placed single lamps of equivalent power.

The most economical general method of illumination for domestic purposes is a moderate diffused illumination reinforced where necessary by reading lamps or other localized light. As a rule the effect of this arrangeemnt is pleasanter and easier for the eyes than a purely general illumination, except in large rooms, which require to be brilliantly lighted. In fact, rooms in very dark finish are extremely hard to illuminate properly except by the device just noted, since proper diffusion is hard to obtain. A very light ceiling improves matters, but too often at the expense of a certain glaring effect that is better avoided.

With careful arrangement of lights and switches, domestic lighting can be done very economically. There are few rooms that cannot be given an adequate groundwork of illumination with tungsten lamps on a basis of a quarter watt per square foot of floor space. An equal amount in localized light is generally sufficient for additional lighting. At any moderate price for energy this means cheap illumination, considering the fact that very few rooms are used simultaneously in the ordinary house, and of these only a part require more than the groundwork lighting. Very often one would provide for double the amount of energy consumption just noted without using it save on rare occasions.

At the present time much is being done to exploit electric fans and electric heating and cooking appliances. Sufficient outlets should be provided in the house wiring to allow for these conveniences. It must be admitted, however, that save in some exceptional localities they run up the bills rather seriously. Central-station policy has usually been very unfavorable as regards the consumption of energy for domestic purposes. It is, of course, true that the householder is a small consumer with a rather large connected load, and on most schemes of charging he consequently gets bad rates, much worse than in the writer's opinion he ought to have. For the domestic load on the whole falls off the ordinary peak, and while an individual demand may occasionally be large, as when the house is lighted for a reception, such demand does not come simultaneously from any considerable number of consumers, and it practically always comes later than the peak. Experience shows that an absurdly large nominal house load can be taken care of by a very moderate transformer and feeder equipment. In fact, the domestic consumer is, from the nature and period of his load, entitled to much more consideration than he ordinarily gets. A recent English investigator, bearing this in mind, came to the conclusion that domestic lighting was in equity entitled to a better rate than the consumer in the small shop or office. Such has not been the common judgment here, yet the few plants that have conspicuously encouraged the domestic use of electricity have in effect endorsed the English opinion. Certainly the gas companies, who operate on a nearly flat rate, have found house lighting a profitable field—perhaps the most profitable left them—and have gone out of their way to occupy it. The gas range has helped them greatly in this campaign, while electric cooking has been much hindered in its development by the charging systems in vogue among electric companies.

There are signs of reform in this matter, however. A few electric companies, both here and abroad, have reverted to a flat charge per lamp or have taken similar steps to get domestic business. The flat charge is not to be commended in that it punishes that liberal installation of lamps that generally is desirable in a house. But certainly reasonable concessions to the householder, such as have been made in some places, will result in increased consumption on a profitable basis, and, what is equally important to public-service corporations, in an increase in the number of friends ready to stand by them.

Electric Meter Tests.

New York Public Service Commissioner Maltbie adjourned the electric-meter-test hearing that was scheduled for August 30 until September 13. At that date the Commission will determine whether, in order to insure the reporting of all tests of electric meters according to a standard form of report, every electric corporation operating within the First District shall be required to file a monthly report with the Commission stating the results of all such tests.

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COMMERCIAL TESTS ON SYSTEMS OF ILLUMINATION.

BY A. L. EUSTICE.

In modern illumination practice, when a lighting company or large individual consumer contemplates the installation of a lighting system which involves the expenditure of a large sum, the tendency of the present time is to make an investigation of the various systems of illumination now offered to the public in order to determine which system is best suited to the specific requirements.

The object of such an investigation is primarily the determination of comparative figures of total operating costs on the basis of equality of illumination, for it is important and essential to determine the relative actual working efficiencies of the various systems which will provide a fixed standard of mean illumination and not to arrive at conclusions as the result of comparisons of the recognized laboratory efficiencies of the individual sources of light, because the working efficiency of a system does not necessarily depend entirely upon the laboratory efficiency of the type of unit employed.[1]

In investigating the total cost of operating lighting systems, in order to determine which system has the lowest cost of operation, the following factors should be considered:

1. Commercial efficiency or cost of current consumed.
2. Cost of renewals or maintenance (labor and materials).
3. First cost or investment.

Investment is the least important of the items named, because any justified difference in the first cost of the various systems is based on the relative total cost of energy consumed and maintenance.

The ultimate decision, therefore, on the basis of equality of illumination, depends upon the observed value of mean illumination delivered by the systems in question, as determined by commercial tests on the systems when operating under actual service conditions of regulation, maintenance and surroundings under which the system is to be installed and operated, so that it is at once evident that the value and accuracy of the final comparative figures depend chiefly upon the test methods employed and the attention given to details and accuracy in the commercial illumination tests.

For a subject of such general interest and wide application, it is surprising to note the many erroneous test methods employed by some illuminating engineers and representatives of manufacturing companies for the determination of mean illumination. An examination of such methods will often show the resultant great number of unfair and inaccurate comparisons frequently given to the lamp buyer and technical public. A brief review of test methods is opened, therefore, in order that emphasis may be given, in the most forcible manner, to the importance of employing correct methods when conducting fundamental tests.

Tests on actual installations of various equipments should be carefully planned and executed after having firmly established the true meaning of the words "mean" and "average" illumination. The common errors often present in illumination tests are:

1. Improper selection of number as well as location of test stations.
2. Selection of test bays where the general nature and color of surroundings differ.
3. Disregard for actual operating voltage when other than normal.
4. The use of electrical measuring instruments whose calibration is not known.
5. Employment of units whose efficiency and energy consumption are not normal.

Perhaps the most common source of error in tests of this character is the general lack of judgment in the selection of both number and location of the test stations, so the following method of preparation for tests is recommended for giving a resultant true mean illumination.

In order to do entire justice to the various types of units under consideration, the location of the test area or bay should be chosen in every case without reference to the condition of the light sources except to note that every outlet within the effective range of the test bay contains no burnouts. To secure a typical result, the bay selected for test purposes should be entirely surrounded by other bays, so that the true effect of distant lights can be secured.

The test bay or area between the four columns should be divided into a great number of equal small areas, which are in turn considered as sub-test areas. At the center of each small test area there should be located a test station, where the illumination is determined by means of a carefully calibrated foot-candle photometer (illuminometer), as shown in Fig. 1. The illumination thus determined at each station represents the mean illumination of each sub-test area, and the arithmetical mean of the various values at the total number of test stations in the bay is a very close approximation to the mean illumination of the bay and of the system.

Where the surrounding reflecting surfaces, such as shelving, furniture and displays, are uniform in color and placement, and the ceiling is light in color, and when the lighting system has a uniform spacing and size of unit, the test area may be reduced to one-quarter of the total area of the bay. It is, however, better practice to increase the labor rather than to sacrifice accuracy in the results.

At each test station, no less than four separate observations of illumination should be made, and the mean of the readings taken as the illumination of that

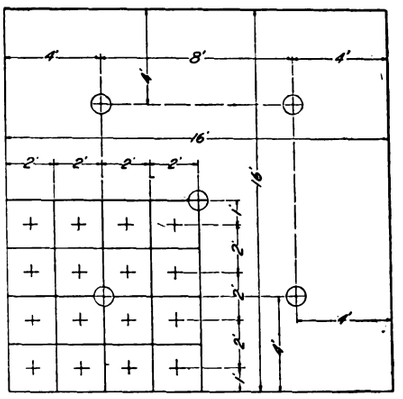

FIG. 1.—CORRECT LOCATION OF TEST STATIONS.

area. Simultaneous readings of voltage should be recorded with each observation of illumination and due corrections made according to the voltage-candlepower characteristics of the units in question, when the operating voltage is other than rated voltage.

The surprising differences in results which it is possible to secure can be appreciated only by contrasting the figures obtained by the above-outlined method, with the results of the erroneous methods sometimes used, of which the following review of some recently conducted commercial tests will serve as a practical illustration:

In the commercial test in question, the unit area, commonly termed the bay, or the area enclosed between the four columns, was approximately 256 square feet (sixteen by sixteen), in which the predetermined location of outlets provided for five light units of which four outlets per bay were arranged symmetrically in rows in either direction, with the fifth outlet located in the center of the bay. With

[1] See article by the writer in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, May 29, 1909, page 992.

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these restrictions regarding outlets, two systems of illumination were under consideration.

The one system (A) was based on a unit that actually had a very full or broad distribution curve, which tends to produce a very uniform distribution of illumination, while the other (B), though claimed to have a broad distribution, was equipped with a very concentrating type of prismatic reflector, with the resultant non-uniform intensity or "spotty" illumination.

The location of stations was absurd, as shown in Fig. 2. From this it is at once apparent that five of the eight stations were directly below a unit, and hence a unit with a concentrating curve should show a result—where the majority of stations are so situated—greater by far than that obtained from the unit having a broad curve; whereas, under proper methods, the result should be reversed.

ural broad distribution curve will show a superior illumination in both quantity and distribution over the entire bay.

An analysis of the foregoing evidence and of the following figures (Table 1), taken from the above-mentioned report, would doubtless prove to the satisfaction of anyone, the absolute necessity of care in planning the layout as well as executing all tests of this character; not only as a matter of justice and right to the manufacturer, but also as a matter of information to the purchaser of illuminating devices.

TABLE NO. 1.

System A.

Combination.	Mean Illumination.	Per Cent of Variation, Maximum.	Minimum.
No. 1.....	4.13	12.0	9.5
No. 2.....	3.11	6.3	8.1
No. 3.....	2.68	26.8	15.6

System B.

Combination.	Mean Illumination.	Per Cent of Variation, Maximum.	Minimum.
No. 1.....	3.64	26.0	12.0
No. 2.....	2.65	28.3	12.0
No. 3.....	2.94	39.1	28.0

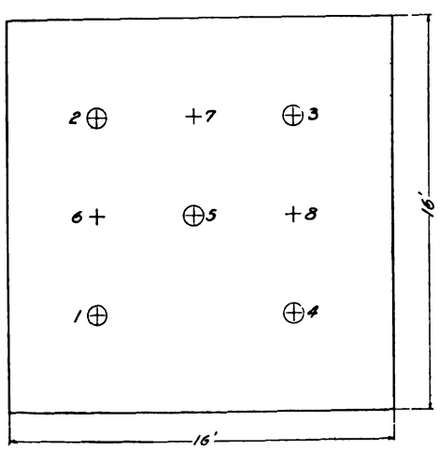

Fig. 2.

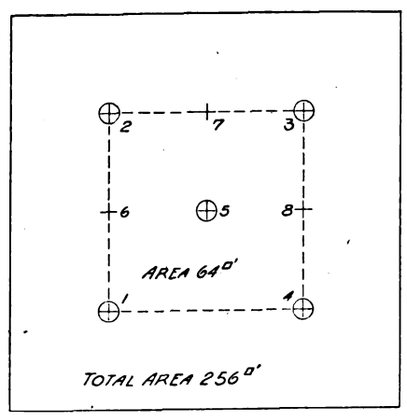

Fig. 3.

INCORRECT LOCATION OF TEST STATIONS.

The cause of such a reversal of figures is self-evident to anyone who is broad enough to see the evidence presented by a glance (Fig. 3) at the relation existing between the area covered by the test stations and the entire area of the bay. It will be seen that test stations were confined to approximately one-quarter of the area in question, yet in the report of the engineer in charge, the mere average of the values found at the eight stations was considered a true average for the entire area.

It is well recognized that an appreciable flux of light from each unit falls on the working plane in the area included between the limits of the bay and the area covered by the above-named selection of test stations, and it will require no lengthy argument to convince those who are anxious to do justice to the various forms of light, that the unit with a nat-

System A employed units whose distribution is broad.
System B employed units whose distribution is concentrated.
Combination 1—Entire room in operation—5 units per bay.
Combination 2—Entire room in operation—4 units per bay.
Combination 3—One bay only in operation—5 units per day.

In general, the prominent features of the above figures are shown by the percentage variation of the maximum and minimum intensities from the so-called mean value; the greater variation being from system B and the peculiar manner in change of value of the "mean" of the various combinations.

The increase in illumination or the accumulative effect of the surrounding and distant units, even under such an adverse selection of stations, will be observed in combinations 1 and 2 of system A, and it is interesting to note that combination 3 alone, due to the use of concentrating reflectors as well as to selection of stations, would lead one to believe erroneously that system B is the more desirable system, in so far as intensity is concerned.

Referring to this subject as discussed in the report, the extract given below will give further evidence of the effect of selection of stations, but it must be borne in mind that of the series of tests on eight combinations of each system (combinations of glassware) only two were such that the effect of distant lights was considered, and great stress was laid on the value secured when one bay only was in operation. In fact, the final figures were based on the result of one bay only.

In system A the report states: "The effect of lamps outside each bay is to increase the illumination about fifty-five per cent and to reduce the variation in illumination."

In system B—"The effect of distant lights is to increase the illumination about twenty-four per cent and to reduce the variation in illumination."

In order to arrive at some definite figures, a test installation was arranged to duplicate the conditions of the commercial installation (as shown in Fig. 2) and a series of tests was conducted under the direction of the writer, according to the above-advised location of test stations (Fig. 1), and, further, when the systems were operating with constant normal potential over the lamp terminals at all times, so that the errors due to voltage corrections were entirely eliminated.

TABLE NO. 2.

Mean Illumination.

System.	Entire Room in Operation, Units per Bay, Five.	Four.	One Bay Only in Operation, Units per Bay, Five.	Four.
A....	5.94	4.36	3.05	2.29
B....	5.16	4.01	3.48	2.69

The results of these tests (Table 2) show the true mean illumination delivered by the two systems in question in a large general office, where both four and five units were in service in each bay, as well as the mean illumination from one bay only, from which the true relative increase in illumination, or the accumulative effect from the surrounding bays, is apparent for both systems.

It will be noted that the increase in mean illumination by the addition of the center unit to the four-unit combination per bay, when the entire room is in operation, does not differ to any great extent for each system, and it is increased almost in proportion to the increased wattage, whereas the relative increase in illumination of a bay, when operated singly, and with the entire installation, is greater by far in the case of system A.

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The per cent increase in illumination for the various combination can be compared by a glance at the following data:

TABLE NO. 3.
Per Cent Increased Illumination.
One Bay Only to Entire Room.

System.	Correct Method (Fig. 1). Five Units.	Four Units.	Incorrect Method (Fig. 2). Four Units.
A.....	94.75	90.4	55.0
B.....	48.27	49.07	24.0

The peculiar reversal of the value of mean illumination is seen in the various combinations, where, when one bay only is in operation with either four or five units (Table 2), the apparent illumination of system B is of higher intensity than system A—and, it will be surprising to note that system A gives a higher mean illumination than system B, when the same energy per square foot is used but the entire room is in service, indicating that system B employs units which produce a highly concentrated distribution of light.

The contrast between the two methods of selection of test stations and the wrong conclusions set forth, where the units have a different character of distribution, may be noted by reviewing the above commercial figures, in which the increase in illumination from surrounding lamps was given as fifty-five per cent where the proper test station shows 90.4 per cent for system A and for system B a value of twenty-four per cent was given where the true value is 49.07 per cent.

Another interesting comparison of the two systems of illumination under consideration was secured by determining the illumination in various planes from the center of the bay, the results of which (Table 4) demonstrate the general character of distribution of the systems, and moreover show that the unit which has a natural broad curve delivers by far more useful light in the extreme limits of the bay, and therefore has a superior distribution over the entire bay.

TABLE NO. 4.
Illumination in Foot-Candles.

Stations.	—X— A.	B.	—Y— A.	B.	—Z— A.	B.
1.....	6.71	6.28	5.90	5.23	5.60	4.27
2.....	6.45	6.28	6.22	5.66	6.03	4.71
3.....	6.04	5.58	6.33	6.10	5.76	4.88
4.....	5.50	5.10	6.25	6.36	5.91	4.80
5.....	5.61	4.97	6.30	6.28	5.90	4.80
6.....	5.26	4.53	6.67	6.10	6.20	4.71
7.....	5.13	4.27	5.44	5.50	5.83	4.45
8.....	5.20	4.05	5.50	4.97	5.76	4.53
9.....	5.74	3.84	5.79	5.32	5.70	4.45
Mean.....	5.74	5.02	5.98	5.72	5.85	4.62

X—Every foot down center line of bay.
Y—Every foot down center line of lamps.
Z—Every foot down edge of bay.

A review of these results will prove that tests on lighting systems should not be based on results when one bay only is in operation, for, even in the case of relatively small rooms, the reflection from the walls is in many cases of almost equal importance to the direct light from distant units.

In proceeding with tests on illumination, after having first carefully laid out the test stations and observed the other necessary precautions preparatory to actual reading of results, as above mentioned, a voltmeter whose calibration is known should be arranged in the circuit so that the pressure impressed over the lamp terminals can be observed and recorded at each observation of illumination, for perfect conditions of regulation never exist on commercial circuits; but by observing the necessary precaution and making due corrections, where conditions on commercial circuits are other than normal, a true basis for comparative figures is established.

That a knowledge of the operating pressure is as essential as a knowledge of the illumination produced by a lamp operating at that pressure is evident, and a review of the following figures, secured by special investigation on voltage effects, will show the importance of the relation between voltage and illumination to those who are inclined to assume that the operating voltage of a system of illumination under test is about normal throughout the test.

Manufacturers of lamps provide, by label or otherwise, a permanent marking of the voltage at which every lamp is designed to operate, and at which voltage the lamp gives 100 per cent, or normal candlepower. When normal voltage is known, a voltage-candlepower characteristic, that is, a curve showing the per cent candlepower produced for various percentages of voltage above or below normal, as published by the manufacturers, may be used, for these curves represent the average performance for a type of lamp.

Since any increase in candlepower means a corresponding increase in illumination, when other conditions remain the same, it is obvious that it is only necessary to observe the operating voltage and the illumination simultaneously, and, knowing the normal and operating voltages, the illumination which would be obtained if the lamps were operating at normal voltage can be calculated by reducing the observed illumination to 100 per cent, according to the voltage-candlepower curve of the type of lamp used.

In order to determine what differences would be found by actually operating a system of illumination above and below normal, as well as at normal, and observing the operating voltage and reducing the observed illumination to normal, according to the above-outlined method, a test was conducted by holding the voltage constant over the lamps throughout the tests, at 95, 100 and 105 per cent of the normal rated voltage. Four lots of lamps of the same type and voltage were subjected to test, the results of which show the variations from the normal performance of the various lots (Table 5).

TABLE NO. 5.

	Per Cent Normal Voltage, 95	100	105
Mean illumination (foot-candles)—			
Lot A.....	4.06	4.86	6.04
Lot B.....	3.48	4.26	4.96
Lot C.....	3.35	4.02	4.76
Lot D.....	2.61	3.08	3.78
Theoretical per cent. normal illumination....	82.5	100.0	119.7
Observed per cent. normal illumination—			
Lot A.....	83.54	100.0	124.8
Lot B.....	81.7	100.0	116.43
Lot C.....	83.3	100.0	118.4
Lot D.....	84.7	100.0	122.7

The importance of voltage at once asserts itself when illumination tests of commercial installations are made, for on commercial circuits regulation may be such that, unless very carefully watched, entirely erroneous figures may result. It is common practice among some in this work to occasionally read the voltage, and assume it is constant, provided each reading observed shows approximately the same value.

An instance of how voltage and illumination may change for short periods during a test, and the effect of same on results secured under this assumption, is clearly shown in a test where the same voltage was read at the start and again at the finish, and was, therefore, assumed to be about normal throughout the test. Simultaneous observations of voltage and illumination for each observation, however, gave a mean illumination 11.9 per cent higher than the corrected or true value.

In general, the results of all investigations demonstrate that all illumination tests should be made with the greatest possible care, giving attention to the minutest details of test methods, and, when dealing with comparative figures, an effort should be made to avoid promiscuous visual tests when the operating and normal voltage are unknown; for the effect of ordinary visual tests is, in many cases, of even greater consequence than some test errors, when the lamp purchaser (the man who usually disregards voltage and considers only the intensity produced) views the systems in operation in order to finally select the most desirable system.

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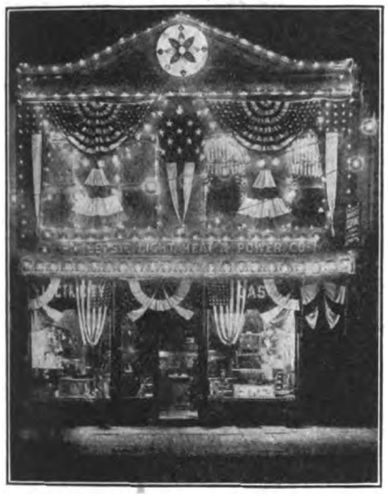
Special Carnival Illumination at Poughkeepsie.

During the week of August 18 there was held in Poughkeepsie, N. Y., the annual convention of the New York State Association of Volunteer Firemen, which was made the occasion for a general carnival celebration. A particular effort was made by the Poughkeepsie Light, Heat and Power Company to make an attractive display of electrical effects, and the accompanying illustrations give some suggestion of the manner in which these were carried out.

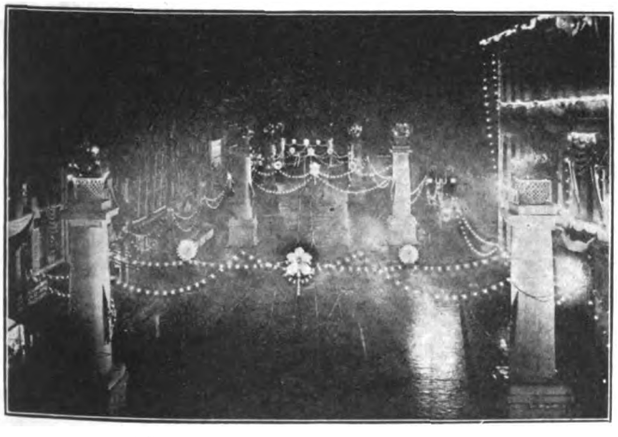


ILLUMINATION OF POUGHKEEPSIE LIGHT, HEAT AND POWER COMPANY'S BUILDING.

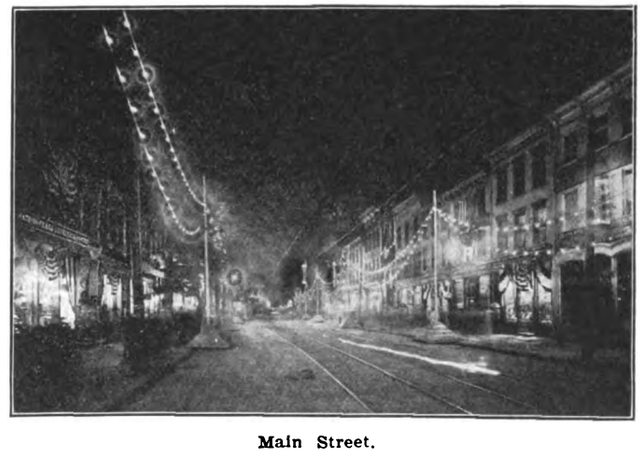
Special street illumination was made along Market Street and Main Street. In the former were mounted ornate white staff pillars, between which were hung chains of incandescent lamps and clusters of stars. The decoration of this street proved so attractive that it was termed the "Court of Honor." The illumination of Main Street, which, although not quite so pretentious, was also effective. The illumination of this "White Way," as it was termed, lasted for eight evenings. Nearly 20,000 incandescent lamps were in use. Besides special illumination of the streets proper, there were many buildings along these streets also illuminated in a most elaborate manner. The lighting and decoration of the building of the central-station company is shown herewith. Many of the merchants vied with each other to see who could produce the most attractive effect. The municipal building and fire-engine headquarters were also outlined with electric lights. It is proposed to keep these decorations intact until the Hudson-Fulton celebration in October. During President Taft's inauguration similar lighting effects were in use.

The city of Poughkeepsie, which has a population of some 30,000, prides itself upon the extent of these decorative and lighting efforts, and believes that this demonstration is but another example of the spirit which has resulted in its designation "Queen City of the Hudson."

The Poughkeepsie Light, Heat and Power Company deserves particular credit for its part in this display.



"Court of Honor" on Market Street.



Main Street.

DECORATIVE STREET ILLUMINATION IN POUGHKEEPSIE, N. Y.

Boston Consolidations Approved.

The Massachusetts State Board of Gas and Electric Light Commissioners have issued their approval in the case of the petition of the Edison Electric Illuminating Company, of Boston, Boston Consolidated Gas Company, Chelsea Gas Light Company, Newton & Watertown Gas Light Company, and the Waltham Gas Light Company, asking the approval of the board of the sale to the Edison Electric Illuminating Company, of Boston, of the electric locations and properties of the Boston Consolidated Gas Company and of the other companies named and also for the approval by the board of the purchase of the gas franchises and property of the Waltham Gas Light Company by the Newton & Watertown Gas Light Company, all operating in adjoining territory. The report says in part: "By the terms of the several contracts executed by these companies with each other the Edison company is to pay for the electric location and property of the Boston company $1,300,000; for those of the Chelsea company, $350,000; those of the Newton company, $500,000; those of the Waltham company, $600,000; and the Newton company is to pay $500,000 for the property of the Waltham company. The several companies also covenant that they will not further prosecute the business of furnishing electricity or gas as heretofore.

"The $1,300,000 to be paid for the electric property of the Boston company is to be used to cancel an equal amount of its floating debt. The Waltham company is to be liquidated. After its purchase of the Waltham company the capital and debt of the Newton company will be the same as they are now, as it is to receive the amount for its electric property. The outstanding bonds of the Chelsea company are to be cancelled. The direct result of the transaction will be to separate in these communities the gas business from the electric business. The facilities for furnishing and distributing light, heat and power will not in any event be diminished.

"It is clear that gas and electricity can be profitably supplied over far wider areas than was formerly thought feasible. Greater efficiency in operation and greater economies in costs are possible with a large lighting company serving a given territory than to several independent companies serving different sections of the same territory. There is a public advantage in having the gas and electric businesses separately conducted under independent control. The natural rivalry between the two should result in substantial benefits to the public."

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Destroying Insects with the Aid of the Electric Light.

In the ELECTRICAL REVIEW for August 15, 1908, there appeared a short account of the German experiments conducted at Zittau for the destruction of noxious forest insects by electricity. Some further details have lately come to hand from Consul Thomas H. Norton, of Chemnitz, and as the subject is of interest to the American agriculturist and others, the story is repeated with the additional information.

The foresters of Zittau found that the moths are most active between the hours of 10 p. m. and 1 a. m., and are most powerfully attracted toward the electric arc, of the several forms of light tried.

The next step was to allure the moths from the forests to points where the electric current was available. This was accomplished at Zittau by co-operation on the part of the municipal electrical works. The entire stock of arc lamps was linked together, after the globes had been removed, and set in activity after nightfall. Although the forests were some miles distant, the effect of the total illumination was sufficiently strong to attract vast swarms of the moths from their leafy shelter. They fluttered about the glowing carbons, and quantities fell to the earth with singed wings. Although great numbers were permanently disabled in this manner, it was evident that the destructive factor must be greatly multiplied in order to obtain an appreciable result. This was secured in the following manner:

At 11 p. m. the street lights were turned off. Electric searchlights, with a current of forty amperes, were suitably mounted, and their powerful rays were directed upon the neighboring forests. These searchlights exerted great attractive force, which was increased by linking each two arc lamps with globes. The latter served chiefly for the concentration of the fluttering moth swarms. Between these two lamps a powerful suction ventilator was stationed. A piece of wire netting (of about 0.4-inch mesh) was placed opposite the outlet of the ventilator, a few inches distant. The results secured by this combination when first tried were startling. The moths were allured from the forest in enormous numbers, and all so drawn to the brilliant source of light, sooner or later, were sucked into the ventilator and hurled by it against the wire netting with such force that the wings were broken, and the insects rendered helpless or killed outright. However, in the later improved and perfected device, as finally adopted, two searchlights are employed. They are adapted for currents from thirty to fifty amperes and are shielded in front by highly polished glass disks. In front of them and somewhat lower are the two arc lamps regulated for currents of ten amperes and protected by glass globes. Immediately below and between these two lamps is the opening of the ventilator. An electric motor attached to this produces 1,200 revolutions per minute, and sucks through about 2,800 cubic feet of air in the same time. The outgoing blast of air enters an open box alongside, three sides of which are composed of wire netting. In this the moths meet their fate, and it is emptied as fast as their bodies accumulate in such quantities as to obstruct the free passage of the air blast.

Four of these devices were installed in the town of Zittau upon the roofs of the electrical works, the town hall, a schoolhouse, and a factory.

Some few minutes after the searchlight is turned on, scattered moths appear. Then the number rapidly increases until thousands arrive simultaneously and flutter in and out of the great beam of light. Steadily they near its source until suddenly they are within the grasp of the suction of the ventilator; and, in a second, pass through it and fall crushed and helpless to the bottom of the wire cage.

The effectiveness of this new destructive agency seems to have been somewhat variable and dependent upon meteorological conditions. The maximum result attained in a single night by such an installation as above described was a total weight of 141 pounds, representing about 400,000 dead moths. Frequently, however, the weight would be less than seventy pounds.

Bright moonlight, a wind blowing from the town toward the forest, and a lowering of temperature, were all unfavorable factors. Sultry, stormy conditions were on the contrary decidedly favorable; while a slow, steady rainfall had no appreciable influence one way or another. The most favorable combination was a cloudy sky and a temperature ranging from fifty-three to fifty-nine degrees Fahrenheit. When the thermometer sank below fifty degrees Fahrenheit, the diminution in the attractive force of the electric light was very pronounced.

It has been asserted that the male moths are chiefly susceptible to this attraction, and that only in rare instances were females found among those collected about a source of light. The Zittau experiments show that this difference is by no means so marked. At times the females showed a slight numerical predominance and generally they composed at least forty per cent of the slaughtered insects. Similar experiments on a smaller scale, in which the electric arc was replaced by acetylene lamps, were instituted in the heart of the forests, and gave satisfactory results.

The outcome of the tentative campaign of 1908 against this destructive forest pest has been so convincing that it will be continued on a much more extended scale in Saxony during the present year, should the invasion of moths in devastating numbers be repeated.. Two illustrations of the apparatus for killing the insects by the use of the electric light are filed in the Bureau of Manufactures, Washington, D. C.

Electric Lighting for Constantinople.

The London *Times,* quoting the Vienna *Handels Museum,* the organ of the Austrian Ministry of Commerce, states that a commission has been appointed by the Turkish Ministry of Public Works to make investigations with a view to the establishment of electric lighting and power works in Constantinople. The Ministry of War and the municipality of Constantinople are also represented on this commission. After estimates have been prepared an invitation will be publicly made to those interested to make offers for the concession, which will be granted to the firm giving the best advantages.

A New Detector for Wireless Work.

A new detector consisting of a conducting point resting on natural iron pyrites is described in a recent number of *Comptes Rendus,* of Paris. This device works without a cell, and furthermore it is not impaired by heavy discharges or atmospheric disturbances. The pyrites is provided with micrometer adjustment for displacement in two directions at right angles, so that contact may be made at the points of maximum sensibility. The conducting point is positioned at one end of a lever, which has a movable counterpoise to regulate the contact. Efficient service has been given since last February with one of these detectors at the French Government wireless stations at Saintes-Maries-de-la-Mer and Alger, where they have been tried out.

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DEVELOPMENTS IN ARC LIGHTING.

BY A. J. MITCHELL.

Should an ordinary mortal, who has not followed the devious byways and tortuous paths of electrical progress, fall into a retrospective mood and attempt to review the achievements of those scientists and engineers whose lives have been devoted to the practical utilization of this mystic force since the day that Franklin drew the sparks from his key, the extensive applications and the magnitude of its functions, in adding to our daily comforts and lightening the burden of man's very existence, would probably transcend in his mental vision beyond the most vivid dreams of the most intense exponents of ultra romantic fiction. To the layman who is unfitted either by education or experience to grasp the intricacies of the problem, no demonstration of the electrical forces or their manifold uses appeals to his sense of the marvelous so strongly as that which calls for the exercise of his visual acuteness, namely, the production of light. The average buyer is "from Missouri," particularly when negotiating for a thing of mystery, and the fact that he can be shown has proven a beneficent blessing to the purveyor of artificial light or the means of producing it; the brighter the effect the more convincing the argument. The electric light, through its visible effects, commanded instant recognition and an immediate appreciation of its value to man, from the moment that Volta disclosed to the world the marvels of the carbon voltaic arc. This discovery, with subsequent improvements by Sir Humphrey Davy, was the progenitor of the carbon arc lamp of today and antedated by many years the invention of the incandescent lamp.

The first attempts to produce light by this means, however, were not successful from a commercial standpoint, on account of the expense involved; since the only known means of producing an electric current was with the voltaic battery, and the high cost of operation precluded its use for such purposes. Not until the perfection of magneto-electric machines did the carbon arc for uses of practical illumination receive its real impetus, and while the first machines were necessarily crude, in an incredibly short time open arc lamps, that were then considered commercial and of fairly satisfactory design, were coming into use, for both series and multiple operation. Strange as it might appear through all the evolutions of arc lamp design, up to the permanent introduction of the flaming arc about six years ago, there had been no material improvement in the efficiency of the light-producing agent, since the first use of carbon pencils for this purpose. This was used by the earliest investigators on account of its refractory nature and non-fusing qualities under intense heat. Light is incidental in the production of heat, with a ratio of something like two per cent of light secured, for every ninety-eight per cent of energy expended in heat, with the ordinary commercial carbon, and therefore the intrinsic brilliancy of a carbon arc is directly proportional to the temperature of the carbon tips or amount of electrical energy expended to produce this heat.

The standard unit of current consumption for the arc lamp is practically the same today as it was twenty-five years ago. The line of endeavor had therefore been, up to very recent times, in the direction of improved mechanisms to secure greater steadiness of the light, longer life and the perfection of suitable designs for the various fields of lighting, in which arc lamps seemed best suited. It has, in this sense, been a story of constant evolution from the old 9.6-ampere open arc to the 6.6-ampere direct-current series enclosed, and, with the adoption of high-potential alternators, the introduction of the multiple alternating type of lamp, followed shortly by the series alternating in response to a universal demand for an equivalent to the old series direct current that would make it possible to dispense with the use of constant-potential lamps for this purpose, securing increased efficiency and reducing the initial cost of street-lighting systems. This later form of lamp found immediate favor, especially with the smaller and newer lighting companies who were not burdened with an expensive equipment of old direct-current arc machines. But in many cases the older companies found it a profitable move to discard their old arc dynamos and install an alternating-current system from the fact that the use of series alternating lamps allowed greater flexibility in operating these from any available station apparatus, assuming that this consisted of more than one alternator and the certainty of uninterrupted street service was not dependent on the reliability of one machine or a certain group of machines.

Although the carbon arc in its various forms has ruled supreme so many years, as the most efficient as well as the most brilliant source of artificial light, when we stop to consider that its actual efficiency is less than one per cent, or, in other words, for every hundred heat units liberated by the coal under the station boilers, less than one of these is actually converted into useful light, it is not surprising that engineers have been active in their efforts to find a more economical substitute for pure carbon electrodes. The following comparison will be of interest to show the value of even a small gain in the efficiency of the arc: There were manufactured and sold in this country within the past ten years approximately one million carbon arc lamps. Assuming that two-thirds of these, or, say, seven hundred thousand, are in use at the present time, and each lamp is consuming while burning five hundred watts per hour, allotting four thousand hours each to street lamps and seven hundred hours each to all other arcs, would mean a consumption of at least seven hundred and fifty million kilowatt-hours a year, transformed into heat and incidentally into light, an economy of even one per cent would mean an annual saving to the generating plants of the country of seven million, five hundred thousand kilowatt-hours.

Resuming the subject of arc lamps and recent accomplishments in the line of higher efficiency units, it is gratifying to know that they have not only kept pace with the rapid strides of the incandescent, but are again leading it, in the race for supremacy, as an economical producer of light. This claim has for its foundation the performance of, first, the metallic electrode or luminous arc; second, the intensive or small carbon lamp, and, third, the impregnated or flaming arc, although these have a field of usefulness that is in the main really separate and apart from that of the tungsten. The three forms of lamps mentioned have a very much higher luminous efficiency than the ordinary carbon arc. Comparing these with the standard carbon lamps, shows the following relative light values: Series direct-current open arc, consuming 350 watts and producing 725 hemispherical candlepower, or 0.73 watt per candle. Series direct-current enclosed, with 530 watts, gives 540 hemispherical candlepower, or 0.91 watt per candle. The metallic, or luminous, arc, with a consumption of 300 watts, produces 650 hemispherical candlepower, or 0.46 watt per candle. The intensive or small carbon lamp, consuming 550 watts, shows an output of about 600 candlepower, or 0.83 watt per candle. The flaming

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arc, consuming 550 watts and producing 1,600 hemispherical candlepower, shows an efficiency equal to 0.34 watt per candle. In comparing these values with the well-known rating of 1.25 watts for the tungsten lamps, it must not be forgotten that this figure is based on mean horizontal and not on hemispherical candlepower. While these attainments in the production of more efficient arcs are extremely gratifying, there are considerations that govern the selection of a lighting unit, besides the simple question of light flux, regardless of whether it is for street or interior illumination; carbon life and distribution of light are two almost equally important factors.

The metallic electrode lamp, usually known as the magnetite, or as the product of another company, as the titanium lamp, is most admirably adapted for street-lighting purposes. These names are indicative of the material of which the lower pencil or electrode are formed. These pencils have an average life of 175 hours each and the maximum luminous intensity is at an angle of between fifteen and twenty degrees below the horizontal, giving an almost ideal distribution. The light is quite steady, very white and similar in appearance to the eye to the 9.6-ampere open arc, when operating at its best. The usual adjustment is for four amperes, but a few systems, notably in the City of Boston, have been installed to operate at 6.6 amperes, resulting in a vastly increased light. Electrodes made of metallic alloys produce only cathode rays, and for this reason the luminous arc is unsuited for use on alternating-current circuits, except in conjunction with a mercury-arc rectifier, in which the mercury vapor transforms or rectifies the alternating into continuous current.

The luminous arc is not suitable for indoor use on account of the fumes emitted, but is admirably adapted for street lighting and represents a substantial advance over the standard carbon arcs, in efficiency, maintenance and diffusion.

There is a field, however, in street lighting, now rapidly widening, in which even the luminous arc has been inadequate. This is the illumination of special streets and large buildings or areas, where striking effects are desired and a unit of high intensity is essential. But the ingenuity of man is usually equal to the call for improved methods, to meet new conditions, in any line of human endeavor, and in this case we perceive the evolution of the flaming arc, which is the fruit of many years of scientific effort to combine certain highly luminous salts in a commercial and efficient electrode. This lamp, with its value of 0.34 of a watt per mean hemispherical candle, even when fitted with a diffusing globe, which absorbs fully thirty per cent of the initial intensity, easily heads the list of electrical illuminants perfected to date.

Spectacular illumination has passed beyond the period of faddism and is fast becoming a permanent institution in many cities, not only as an advertising medium, but for utilitarian purposes. Despite the manifold advantages claimed for the tungsten by its hosts of disciples for street lighting on the theory of smaller units and more of them, with a consequent better distribution, the scope of their usefulness is more or less restricted, while the possibilities of high-intensity arcs are almost limitless, not only in street lighting, but for industrial installations as well. Foot-candles per watt per square foot is more often the chief desideratum, rather than perfect distribution. But a combination of both attributes is extremely advantageous and recent improvements have resulted in the development of a flaming arc, with vertically-arranged carbons, producing the characteristic curve of the luminous and ordinary carbon arc lamps, greatly intensified and with the equal advantage of comparatively long carbon life, thus removing a serious handicap that formerly existed to the general adoption of this type of lamp, on street-lighting circuits, to operate in conjunction with standard series alternating and direct-current lamps. While it is seldom possible in such installations and where lamps are used only at street intersections, to reduce the actual number used, by the substitution of flaming arcs, the illumination per square foot is, of course, greatly enhanced, with no increase in energy and a carbon cost per candle-foot of less than one-half for the latter over the former. After all, the basis of measurement for street lighting and the specific amount of light flux per square foot of surface to be illuminated is largely arbitrary and governed chiefly by what has been available under economic operation in the past; but if the standard can be raised through the medium of a more efficient unit, with no additional expenditure of energy, "it is a consummation most devoutly to be wished."

The intensive lamp previously referred to, sometimes known as the intensified lamp, is not adapted or intended for street lighting, but was developed primarily, in an effort to check the inroads of the tungsten on commercial arc lighting business, especially in that class of stores and limited areas requiring a brilliant steady light of high-unit intensity. This lamp is constructed to take carbons of very small diameter, usually about one-quarter inch in diameter, thus securing a very high current density and light of extreme whiteness, with an efficiency of about one watt per hemispherical candle and extremely good distribution. It bids fair ultimately to prove somewhat of a "thorn in the flesh" to the high-efficiency filament and possesses the added advantage peculiar to carbon arcs, of being better suited to color matching, on account of the near approach of its white rays to the solar spectrum. These lamps usually consume from four to six amperes and operate singly on 110-volt circuits. The life of carbons averages about sixty hours.

The very latest claimant for consideration in the arc-lamp field is probably the titanium carbide lamp; this is a form of lamp intended for series operation on alternating current, and therefore best suited for lighting streets and large open areas, such as railroad yards, amusement parks, etc. The electrode is composed principally of carbide of titanium, hence the name. This lamp might truly be considered in the nature of a supplement to the metallic electrode or luminous arc, in providing a highly efficient system capable of being operated direct from alternating-current machines and eliminating the necessity for current rectifiers. The efficiency is very high, being about 0.3 watt per candle-foot, but the power-factor is extremely low, being less than fifty-five per cent. It can scarcely be said to have passed the experimental stage, as its operation has not been entirely satisfactory to date, on account of unsteadiness of the arc and the tendency of the carbide vapors to condense and form slag on the electrode tips, as well as cost of the electrodes, being now about twenty cents a pair.

Such a form of lamp, however, as a more efficient substitute for the series alternating-current enclosed arc, would no doubt find immediate favor in the eyes of progressive central-station managers and municipalities, and it is to be sincerely hoped that the objectionable features may shortly be overcome and the titanium carbide lamp be numbered among the commercial possibilities in the field of illumination as a high-efficiency unit and a worthy compeer of that bugaboo of arc-light adherents, the tungsten lamp.

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THE ILLUMINATING ENGINEER.

BY S. E. DOANE.

The art of illumination would be on a much firmer basis if we knew more about the subject. Possibly no new branch of engineering was ever launched with a better foundation of fact, but we too often find that our foundation of knowledge is weak in spots.

Doubtless much that the illuminating engineer needs is to-day in existence, but never having been required for engineering work it is not available for quick reference. Science has laid down many laws and has jotted down much fact which is not in available form for the busy engineer. Much remains to be discovered and elaborated.

The illuminating engineer is in a somewhat different class from any other engineer. He should not only be an engineer in the broad sense, but he should have medical knowledge of the effect of light upon the human eye, and he should also know something at least of one of the fine arts.

The National Electric Lamp Association has founded and is equipping a laboratory for the public dissemination of such knowledge as may be determined therein on the medical and physical facts underlying illuminating engineering.

A thorough and systematic search is about to be made through technical publications of all kinds without regard to the language in which they may be written.

The data obtained will be verified, if such verification is deemed necessary, and on this foundation original work will be undertaken.

The intent is to accomplish something substantial in the increase of knowledge to the advancement of the art of illumination. The results of this work will be freely published.

The needs are very great and many such laboratories could work a long time without exhausting the subject. We hope this one laboratory will do much good, and that many other organizations will pattern after it and give to this most difficult field of engineering the added scientific data it so much needs.

Hudson-Fulton Celebration.

Upon the occasion of the Hudson-Fulton celebration in New York and vicinity at the end of this and the beginning of next month, there will probably be the greatest electrical display ever witnessed. The New York Edison Company is making a special rate for celebration lighting.

TUNGSTEN SIGN LIGHTING.

BY HENRY F. SCHROEDER.

A new field of lighting has been opened by the successful development of a low candlepower tungsten lamp, especially designed for sign lighting. After nearly a year of experiment, a four-candlepower lamp has been standardized, having a voltage of one-tenth that of standard lighting circuits, so that on alternating current, by using a transformer having a ten-to-one ratio, the lamps can be burned in multiple. The lamp consumes but five watts, one-quarter that required by the four-candlepower carbon lamp, and has a long life, averaging well above 1,500 hours.

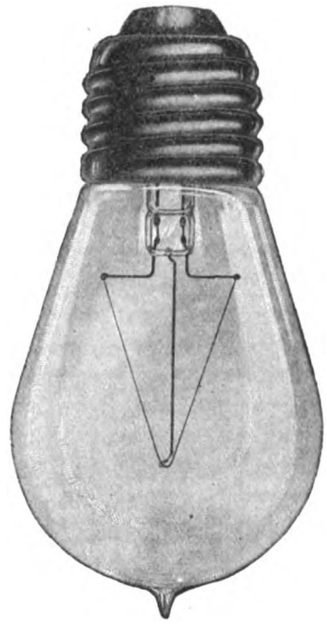

FIG. 1.—TUNGSTEN SIGN LAMP, FOUR CANDLEPOWER, TEN TO TWELVE VOLTS.

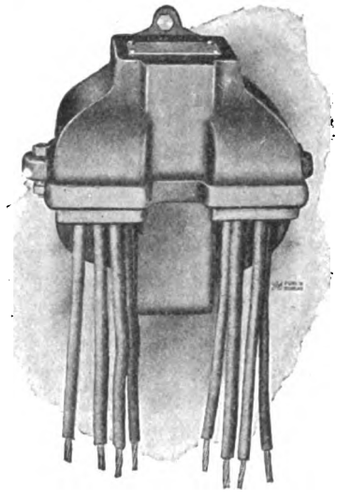

FIG. 2.—TUNGSTEN SIGN-LAMP TRANSFORMER.

The list price of the tungsten sign lamp is two-and-one-half times that of the carbon lamp, and on account of the extra ten per cent discount on standard package quantities of tungsten lamps, the actual cost of renewals is but slightly over twice that of carbon lamps. This is on the assumption that both lamps have the same average life, which is easily obtained in practice.

As is shown by the illustration, the filament is shaped like a wide "V," so as to give a large end-on candlepower without sacrificing the horizontal candlepower necessary for trough-letter signs. Four candles is the lowest obtainable with satisfactory life and high efficiency. Lower candlepower would necessitate a still lower voltage lamp, and on account of the shorter length of filament, the efficiency would not be as good, due to the relatively larger amount of heat conducted away from the filament by the leading-in wires.

On direct-current circuits the lamps are burned ten in series, and in signs containing 100 or more lamps, multiple series connection can be used. It is not advisable to use the latter in small signs, as if one or more lamps should burn out, the remaining lamps would have to carry an increase in current above that which they are designed to withstand.

Transformers are built with two primary and two secondary coils insulated from each other, just like a standard lighting transformer. Thus, any existing sign, wired up either two or three-wire, can be connected to any 100-120 or 200-240-volt alternating-current circuits without any change whatsoever. Flashing devices are not interfered with, but the transformer should be located on the service side of such devices. The transformers are built in capacities of fifty, 100, 200, and 400 lamps, the energy consumption being only one-fourth to two kilowatts.

The four-candlepower lamp can not only be used in signs, but can be used for decorative purposes. Higher candlepowers can be had, if desired, but it is not advisable to go above sixteen candlepower, on account of the higher current required, the sixteen-candlepower, ten or twelve-volt lamp taking four amperes. The lamps are supplied both clear and frosted. Superficially colored lamps can also be supplied with a new coloring which successfully withstands the weather.

Following is an example of the cost of running a fifty-lamp sign at a cost of ten cents per kilowatt-hour for current

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and the cost of lamp renewals, the sign burning from dusk until midnight every night:

CARBON-LAMP SIGN.

Cost of current per month—20 watts for 175 hours for 50 lamps	$17.50
Cost of renewals per month—50 lamps for 175 hours at 16 cents renewal per 1,500 hours' life	.93
Total monthly cost	$18.43

TUNGSTEN-LAMP SIGN.

Cost of current per month—5 watts for 175 hours for 50 lamps	$ 4.38
Cost of renewals per month—50 lamps for 175 hours at 36 cents renewal per 1,500 hours' life	2.10
Total monthly cost	$ 6.48

The above is shown graphically in Fig. 3 at different rates per kilowatt-hour for current and for various numbers of lamps in a sign. The cost of both carbon and tungsten-lamp renewals has been included. From the curves it will be seen that at a ten-cent rate per kilowatt-hour the total cost of burning a tungsten sign is one-third, and at a five-cent rate one-half, the cost of burning the same sign with carbon lamps.

It can easily be figured out how much longer a tungsten sign can be burned for the same total cost. This is diagrammatically shown in Fig. 4. Thus, at a cost of $5 a month, a fifty-lamp tungsten sign can burn, on the average, until 11 p. m. and the carbon sign until only 8 p. m. when current costs ten cents per kilowatt-hour.

Another way of showing the value of the tungsten sign lamp is to compute the number of hours' life the lamp must last to have the saving in current just offset the cost of the lamp. From the curves in Fig. 5, it will be seen that the total cost of the lamp has been saved if the lamp only lasts from 250 to 500 hours at ordinary rates for current. The increased cost over carbon renewals has been saved if the lamp lasts only 175 to 250 hours. There will, therefore, be a large net saving, as the average life is well above 1,500 hours.

Many thousands of these lamps have been sold, and it is expected that there will be a large demand for them during the next few months. Several large lighting companies are already offering the lamp on a flat-rate basis, one company quoting $1.25 per lamp-year, service given by a time switch from dusk until 11 p. m. This rate includes free renewals of the tungsten lamp, and nets the company over twelve cents per kilowatt-hour for current supplied, after the cost of renewals has been deducted. Another central station is inducing all its existing customers to put up border lights or signs on the fronts of their premises, and has installed over 10,000 lamps in the last three months. This is entirely new business, which could not have been obtained before, and is connected to the existing meter, thereby entailing no expense to the central station, except the cost of soliciting the business, the lamp being sold to the consumer at cost, and so the examples of instances where a profitable sign lighting business has been built up to benefit the central station company can be enumerated indefinitely.

Gift to Institute Library.

The Western Electric Company has presented to the library of the American Institute of Electrical Engineers a most valuable addition in the shape of a patent specification library. This gift constitutes the largest accession since the original creation of the library by Dr. S. S. Wheeler with the Latimer-Clark collection.

The patent library which the Institute thus acquires contains no fewer than 461 substantial leather-bound volumes containing approximately 100,000 specifications. These specifications begin with May 30, 1871, and run to December, 1908, thus covering the entire period of activity which includes the telephone, the electric light, electric railways and the electric motor. From May 30, 1871, up to the last day of 1887 the volumes are complete, containing all the specifications issued by the Patent Department, certified. From July, 1887, up to December 1, 1908, the volumes contain all the electrical specifications which are not certified.

The original set cost over $4,000, and duplicates of these specifications, if now purchased from the government and bound, would cost between $4,000 and $4,500. This library has been accumulated by the Western Electric Company in Chicago, from which city it is now being brought to New York to be added to the rich collection of technical literature housed in the Engineering Societies

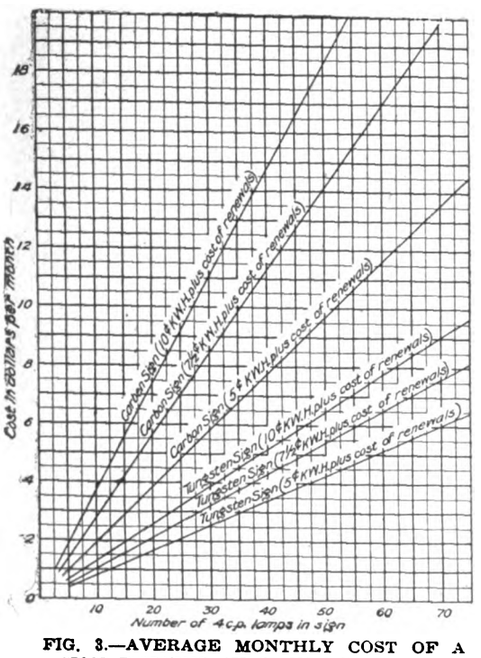

FIG. 3.—AVERAGE MONTHLY COST OF A SIGN BURNING 175 HOURS PER MONTH FOR VARIOUS NUMBERS OF LAMPS AND AT VARIOUS COSTS FOR CURRENT.

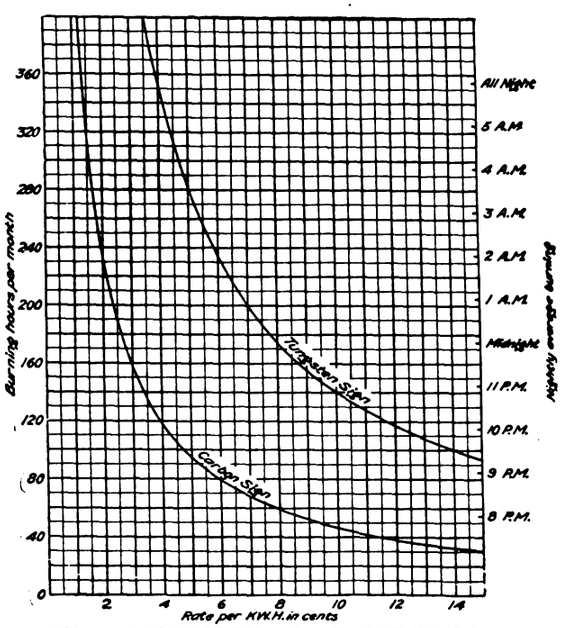

FIG. 4.—SHOWING THE NUMBER OF HOURS PER MONTH A SIGN CAN BE BURNED TO CONSUME TEN CANDLES IN CURRENT AND RENEWALS AT VARIOUS RATES FOR CURRENT.

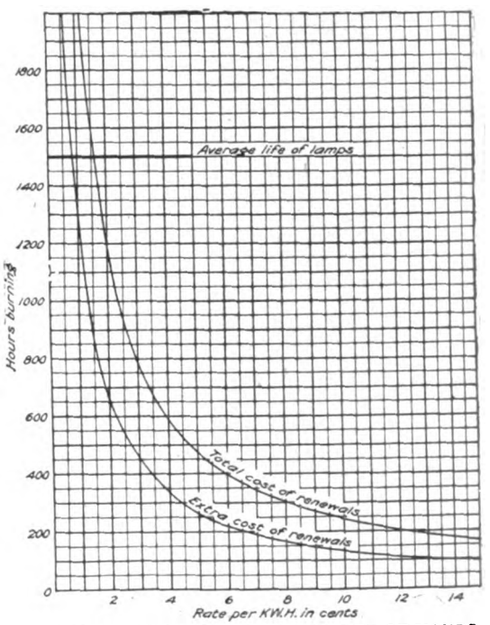

FIG. 5.—SHOWING THE NUMBER OF HOURS A LAMP MUST LAST TO HAVE THE TOTAL COST AND THE EXTRA COST OF RENEWALS JUST OFFSET THE SAVING IN CURRENT.

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Building. Mr. Edward Caldwell, chairman of the library committee of the Institute, has already taken the matter in hand as to proper care and installation of the library, so that the members may derive the greatest possible benefit from having such a collection at their disposal, and has also taken measures to complete the set to date.

It is generally believed that this splendid contribution from the Western Electric Company will prove one of the most valuable accessions that the library could possibly have from the standpoint of practical utility, and that it will be likely to stimulate further generosity of the same kind. It is a most fortunate coincidence that the Institute had already been presented with a set of specifications antedating the period prior to those included in this gift.

Melting Furnace Test.

Some interesting tests of a new Reyelbec furnace, built by the Hawley Down Draft Furnace Company, of Chicago, were recently made in Detroit, and are given in a recent number of *Electrochemical and Metallurgical Industry,* of New York. Two heats were made, one of 503 pounds and the other of 504 pounds, in one hour and fifteen minutes each, this time including the charging of the metal.

The metal consisted of a remelt of gates and valves and yellow ingot, the entire charge running eighteen per cent or twenty per cent zinc. The metal was poured into an iron ladle and the temperature of the first ladleful was 1,900 degrees. The temperature of the second ladleful (after the ladle had become more thoroughly warmed) was 1,990 degrees. The metal in the furnace had, no doubt, a temperature of over 2,150 degrees.

The fuel consumption was a little over eighteen pounds per 100 pounds of metal, but this could have been reduced by careful handling. In the tests no attempt was made to do anything extraordinary, but simply follow regular foundry practice. The Hawley Down Draft Furnace Company states that a melt can be completed within one hour, with a coke consumption not over fifteen pounds, or sixteen pounds of coke per 100 pounds of metal.

Copper Exports.

Exports of copper for the week ended September 2 were 4,745 tons. Since September 1 they were 1,459 tons, compared with 1,803 tons the same period last year.

Electric Development in the Klondike.

The machinery and other power-house equipment to the total value of $400,000, which was supplied in July to the Northern Light, Power and Coal Company, Limited, of Canada, is now on its way to Dawson City, and is expected to reach the Klondike in October, before frost occurs on the Yukon River. The company, which is financed chiefly by English capital, has acquired the existing power station at Dawson City, together with the local telephone system, the water company, and the only coal mine in the district. It is under contract to supply current from its new station from August 1, 1910. There is a certain amount of waterpower available during five months of the year, but during part of this period there is flood, and also a few weeks of drought. With the provision of ample electrical power all mining operations in the district will be facilitated. When the directors of the company went to allotment on June 12 last no definite plans or specifications whatever had been drawn up regarding the installation, but the managing director, E. H. Thurston, and the consulting engineer, C. J. Wharton, have been able, within five weeks, to complete arrangements for the dispatch of the material and equipment. With few exceptions, everything was supplied by British manufacturers, owing to the advantages offered by the Canadian preferential duties on British machinery and the disadvantages imposed by the high rates of freight on the American railways. The cargo of machinery is being taken to Mexico, where it will be transhipped across the Isthmus on the Tehuantepec Railway and put on board a specially chartered vessel for Skagway, Alaska. Thence it will go by the White Pass and Yukon Railway to White Horse, and finally by barge for 400 miles up the Yukon River. The plant, which has a total capacity of 10,000 horsepower, will be erected at the mouth of the company's coal mine, situated about forty miles from Dawson City. The existing power station is supplied with wood fuel, on account of the high price of coal, but the timber supply is becoming exhausted in the vicinity, and the new plant will be run mainly with the coal screenings which hitherto have been wasted. The transmission line from the mine to Dawson City will be in duplicate, one line being of copper and the other of aluminum, while the two lines are strung on independent sets of poles as a precaution against the risk of breakdown in bad weather. The company's purchases comprise all the steel framework for the concrete power house, boilers, automatic stokers, steel coal bunkers, ash-handling apparatus, steam piping, pumps, condensers, turbo-generators, transformers, and all electrical and mechanical accessories. The chief contracts were placed with J. M. Booth and Sons, Babcock & Wilcox (Limited), Willans & Robinson (Limited), the British Westinghouse Electric and Manufacturing Company (Limited), the Siemens Brothers' Dynamo Works (Limited), C. and J. Weir (Limited) (pumps), the British Aluminum Company (Limited), and Siemens Brothers and Company (Limited) (cables). An English clerk of works, two foremen erectors, and a representative of Babcock & Wilcox arenow on their way to Dawson City to Join Mr. Thurston, who is already on the spot. Mr. Wharton will start for the Yukon in the spring.—*Abstracted from The Times (London), Engineering Supplement, August 25.*

Convention of the Municipal Electricians.

The fourteenth annual convention of the International Association of Municipal Electricians will be held in the Convention Hall of Young's Hotel, in Atlantic City, N. J., September 14, 15 and 16. This hotel has been selected as the association headquarters and special rates have been made to the members. Special attention has been given to entertainment features to interest the ladies during the sessions of the convention. It is expected that there will be brought together a very comprehensive exhibition.

Among the papers that will be read and discussed at the meetings are the following: "The Construction of Underground Conduits," "Grounding of Alternating-Current Secondaries," "National Electric Code, and Its Proper Interpretation," "Locating Faults in Fire and Police Telegraph-Circuits Without Opening the Lines," "Progress of the Fire-Alarm Telegraph," and "The Storage Battery for Fire and Police Telegraph Systems."

Telephone, telegraph and express companies, according to Attorney-General U. G. Denman, will pay higher taxes under the Nichols law in Ohio this year than they have heretofore. The reports of the companies show, says Mr. Denman, that they have increased their business during the last year and that numerous extensions have been made to the telephone and telegraph lines.

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The Buying of Coal on a Heat-Unit Basis.

Since the cost of power is a small part of the operating expense the average manufacturer does not pay the attention to the buying of coal that he does to other raw material that goes into the manufacture of his product. The most common method of purchase is to take the tons per year for some time past with the names of the various kinds that have been used and the prices paid. With this information in hand prices are obtained from various mine operators or dealers and purchase made based upon the price, the percentage of fixed carbon, the percentage of ash, or upon the reputation of the coal.

Contracts cannot be made to advantage in this way. Because the price is frequently set by market conditions or the liability of the prospective purchaser to buy, the percentage of fixed carbon does not always determine the heat value of the coal, the percentage of ash affects the heat value of a coal in some ways, but not always the same, and the reputation of a coal is not to be relied upon, because the conditions under which coal is burned plays a large part in the economy that may be obtained. All coal should be purchased only after an analysis showing the percentage of moisture, fixed carbon, ash, sulphur, and volatile matter. The cost of handling the coal, unloading it and feeding it into the boiler, the cost of handling the ash (removing it from the furnace and disposing of it), the probable effect of burning coal on the grate bars, and in some instances the smoke that will be generated, must also be taken into consideration.

Since there is such a large variety of coal the above items will vary greatly and the prospective purchaser will have a wide field to select from. The analysis mentioned is what is called an approximate analysis, and while it shows to a certain extent the value of the coal as a heat producer, further information is needed, where close buying is desired, to show the exact value of a coal. The heat test determines the number of British thermal units that will be delivered to the boiler providing the coal is properly fired and the furnace setting properly arranged.

Moisture in coal is a source of expense as it adds weight to coal, must be unloaded with the coal, put into the boiler, and evaporated, thus absorbing heat that should come into contact with the boiler shell. Each one per cent of moisture in coal means the handling of one ton of water for each 100 tons of coal, and it is not uncommon for bituminous coal to contain from four to seven per cent of moisture!

Fixed carbon is that part of the coal which is not volatile and which will burn

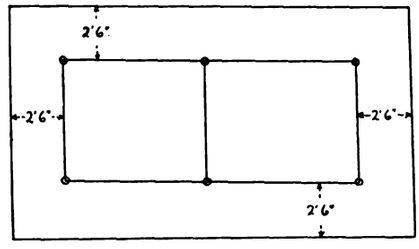

DIAGRAM SHOWING POSITIONS FROM WHICH COAL SAMPLES ARE TAKEN.

when the proper amount of air is provided. Usually in coal it is combined with the ash. The percentage of ash plays a large part in the economy with which coal may be used. It must be paid for the same as coal, must be handled to the furnace and removed, and large quantities make it necessary to be continually working with the fire. This is a disadvantage, as by having the doors open large quantities of cold air are admitted which cool the fire and the boiler, thereby having a detrimental effect upon the steaming capacity of the boiler. Bituminous coals seldom contain less than 4.5 per cent of ash.

Small quantities of sulphur are not objectionable, but large amounts will damage grate bars, cause clinkering, and corrode the boiler shell. Volatile matter is, for the large part, combustible, and every precaution should be taken to see that the boiler setting is such that it may be entirely burned. From this brief outline of the values of the various components of coal it will be seen that fixed carbon and volatile matter are the valuable properties and those that are to be desired. Of these two the volatile gases are the more important, and in those instances where the volatile matter is entirely consumed, as well as the fixed carbon, the coal may be called a smokeless coal. This condition many times depends upon the firing conditions and the boiler arrangements.

Coal is tested to determine the heat value (that is, to find the actual number of British thermal units given off by burning) by consuming a small quantity of the coal in a calorimeter. This is a device entirely surrounded by a known quantity of water at a known temperature. The coal is placed in a small vessel inside the calorimeter and completely burned. The rise in temperature of the water is carefully noted, and since the exact amount of water heated is known, as well as the rise in temperature, the number of British thermal units is easily calculated, one British thermal unit being the amount of heat required to raise one pound of water at sixty degrees Fahrenheit one degree in temperature. In order that a consumer may know exactly the quality of coal he is getting it is necessary that this test be made. Approximate analysis does not show the heat-producing value of a coal, although many dealers use it effectively in convincing prospective customers that the particular coal represented is the best, because of the large amount of fixed carbon and the small amount of ash.

Another feature in regard to the value of coal should be pointed out, and that is the sample that is taken for testing purposes. By selecting the sample carefully coal may be made to show an abnormally high value in British thermal units. There are few American coals that will, from a properly selected sample, show a heat value above 14,500 British thermal units. If the number given for any coal is higher than this it should be looked upon with suspicion until it is

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demonstrated that the sampling was done in a proper manner. It has become an axiom with many persons, when several examinations are to be made of a large quantity of coal, to select the highest moisture and ash values and the lowest British thermal units value when the method of sampling is not stated.

The calorific value of coal is affected by every constituent of the coal under examination. An increase of moisture and ash will decrease the British thermal units, and vice versa. The main features of an analysis are the calorific value, the percentage of moisture, and the percentage of ash. By having the various coals offered carefully analyzed for the calorific value, and the percentage of ash and moisture, the purchaser may calculate the cost of the ash, water, and British thermal units and the coal which will cost the least from this viewpoint of heat delivered, selected.

The consumer of coal must in some way protect himself from shut-downs on account of coal shortage. This is best done by purchasing from a reliable dealer or one who controls such a quantity of coal that if the kind desired is not to be had others may be obtained. Many of the coal contracts provide for a penalty when the coal falls below a certain limit which is set at the time of purchase and for a premium of the coal of a higher quality. There are numerous forms of contracts used when purchasing coal with the price based upon the British thermal unit, each one varying in minor details to suit either the peculiar desires of the purchaser or the conditions of the coal available or the reliability of the dealer. One of the best that has come to the writer's notice is given practically complete.

FORM OF CONTRACT.

The coal furnished is to be known as ..... mined from..... seam.....mines, located at ....., in the state of.....

The coal is to be of a size that will pass through a screen not larger than two-and-one-half inches, and not less than forty per cent of which will pass through a three-quarter-inch screen, and is to be free from dirt, slate and all other foreign substances.

Delivery Cars.—All shipments to be made in (here the kind of cars desired is specified).

Quantity.—The contractor is to ship regularly an average of.....tons per day, Sundays and holidays included, for the period beginning.....and ending.....

The failure to ship any coal for ten days or the failure to ship an average of .....tons per day for any period of .....days will be deemed sufficient grounds for the annulment of the contract by the purchaser.

The contractor will be obliged to ship the quality, size and quantity of coal specified, and in the event of failure to do so agrees to accept in full payment therefor the contract price, less the difference in cost to the purchaser to secure such delivery.

Notification of Shipment. — The purchaser will co-operate fully in getting the cars placed and will keep the contractor informed as to the approximate amount of coal required.

Weight.—The purchaser will accept mine weights, subject to a second checking, and reserves the right to reject any cars found short of more than two per cent of the amount billed; however, such cars may be accepted after weights have been mutually agreed upon; the contractor to bear any expense, such as demurrage, car rental, etc.

Reservation. — The purchaser reserves the right to purchase coal from other parties at any time for testing purposes; such purchases not to exceed five per cent of the total quantity required during the term of the contract.

Requirements. — In the failure on the part of the contractor to ship an average of.....tons per day, the purchaser reserves the right to purchase from other parties any amount of coal necessary to make up the deficit, and should the cost of such coal exceed the figures stipulated herein, the right is reserved to deduct such excess from any balance due the contractor.

Analysis.—The coal furnished is to conform to the analysis given herein, and samples will be analyzed as often as the purchaser deems necessary.

Monthly settlements will be made on the average results of such analysis.

The purchaser will have the right to have any number of analysis made by a reputable testing laboratory, and will assume the cost thereof.

Analysis.—Sulphur, one per cent; carbon, fifty-two per cent; volatile matter, thirty per cent; ash, thirteen per cent; moisture, four per cent; British thermal units per pound of dry coal, 13,000. [These values may be changed to suit.]

Samples.—The samples for analysis will be taken from each car; four such samples will be taken from any four of the points indicated in the accompanying sketch.

The above samples will be placed in a metal-lined, locked box, and the contents will be quartered and pulverized in the usual manner, and the samples obtained will be sent to the laboratory in sealed glass jars, duplicate samples being reserved for the contractor.

Terms.—Heat Units. All coal furnished under this contract is to be paid for at the rate of $..... per ton of 2,000 pounds at shipping point, based on a heat value of.....British thermal units per pound of coal.

If the average analysis for the month shows a heat value in excess of that specified, the price will be increased in proportion to the additional heat value. If the average of the monthly analysis shows less than the specified heat value, a deduction will be made directly in proportion to the heat value shown by the analysis; however, the figures so obtained may be subject to further deductions, as follows:

Sulphur.—If the analysis shows an average in excess of one per cent of sulphur, the price will be subject to a deduction of one per cent for each one-tenth of one per cent of sulphur in excess of that stipulated, one-and-one-half per cent being the maximum allowable.

Moisture.—If the analysis shows an average of more than four per cent moisture, a deduction of one per cent will be made for each one per cent or fraction thereof in excess of four per cent up to seven per cent, which will be the maximum allowable figure.

Ash.—The purchase price will be subject to a deduction of two per cent for each one per cent of ash in excess of fifteen per cent, the maximum allowable ash not to exceed eighteen per cent.

Date.—On or about the twentieth of each month, ninety-five per cent of the preceding month's deliveries will be paid for, the remaining five per cent to be retained, as for following guarantee:

Guaranteed Funds.—Five per cent of the monthly payment will be retained by the purchaser as a guarantee for the fulfillment and carrying out of contract in accordance with conditions outlined herein, and any expense incurred by purchaser owing to failure of contractor to make shipment and fulfill all contract obligations will be deducted from this fund before final payments are made at the end of the period of the contract.

Note that all calculations relating to bonuses and deductions are to be based on total costs of coal delivered at destination.

This contract may be canceled at the option of the purchaser, if the analysis for one month shows that the coal does not conform to specifications in any one or more of the following particulars: (1) If it averages below 12,000 British thermal units per pound; (2) if the ash exceeds eighteen per cent; (3) If the sulphur exceeds one-and-one-half per cent; (4) if moisture exceeds seven per cent; (5) if the contractor fails to ship coal for fifteen consecutive days, or if the contractor fails to ship the average stipulated quantity for a period of thirty days at any time.

Rejections of Fuel.—The purchaser reserves the right to refuse any fuel not conforming to these specifications, and assumes no obligation for demurrage or switching charges, therefore, unless such charges accrue through the direct fault of the purchaser.

Relations. — Under these specifications the .....Company..... is termed the purchaser, and the..... Coal Company of.....is termed the contractor.

The Zurich Hydroelectric Plant.

Details of the new municipal hydroelectric plant at present under construction near Sils for the city of Zurich, Switzerland, are given in a recent number of *L'Electricien*, of Paris. A barrage allowing a catchment area of 420,000 cubic metres of water has been built near Nisellas, from which water will be supplied by a number of large pipes to operate six 2,000-kilowatt hydroelectric sets generating current at 7,000 volts, from which pressure the current will be stepped up by transformers to 46,000 volts for transmission over the eighty-five-mile line. The latter will have two distinct conductors and armored concrete poles will be largely used to carry the wires.

The management of the Dolcoath mine, in Cornwall, Eng., has recently made a satisfactory contract with two local power companies to supply electricity to operate motor-driven pumps in the mine and for driving the new battery of twelve electro-pneumatic stamps.

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Gas Engines for Small Central Stations.

TO THE EDITORS:

I observe in your issue of July 24 that you have taken up fully Mr. James S. Knowlson's paper on "Central Stations in Towns of Less than 4,000 Inhabitants," read before the National Electric Light Association, at Atlantic City, and have given the paper prominence in your editorial columns.

It occurs to me that to have properly informed your readers, and to have corrected some points that create the wrong impression, it would have been desirable to have made some further comment on the paper—pointing out some of the features he did not cover properly, as well as those which he did.

I think the enclosed copy of my discussion at Atlantic City will explain this matter, and that after you have reviewed it, you will agree that Mr. Knowlson has failed to give proper consideration to a very important class of apparatus which will enable the small central station to derive higher economies, and perhaps place them on a better paying basis. I believe it would be well for your paper to prepare another editorial comment, bearing in mind the points that I have brought out. E. D. DREYFUS.

East Pittsburg, Pa., August 10.

[Following is the discussion by Mr. Dreyfus, referred to above.]

I believe the small central-station manager in very many cases experiences some difficulty in making his enterprise a favorable proposition owing to the low efficiency of both generating and distributing systems with which he has had to contend.

The intended scope of this paper evidently has been to point out the economic possibilities available for these small plants. In this sense, it seems the paper proves inadequate, as the gas engine, which appears to be the possible salvation of such a station, has been entirely overlooked. No longer can the plea be made that this type of prime mover does not merit full consideration on account of its present development. Your able Committee on Gas Power Generation, in this and last year's report, has well shown the position of the gas engine, and the recent progress of gas power plants is indicated in the appended tables.

It should be borne in mind that a gas plant of, say, 100 kilowatts can generate a kilowatt-hour at the switchboard with an expenditure of from two to three pounds of coal at a load factor of from fifty to seventy-five per cent, while in a simple steam-engine plant of equal capacity, under the same conditions, from eight to twelve pounds, and possibly more, will be required.

As regards labor, it might be considered equal in the two cases, with perhaps the advantage in favor of the gas plant, as there is less hardship, there being less coal to handle and less intensity of heat. I have observed that one man can handle a 125-kilowatt plant (both producer and gas engine) with ease and, it is safe to say, can readily take care of even more than this.

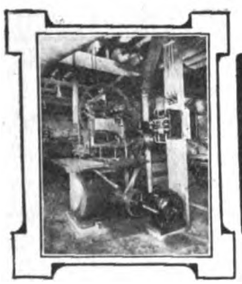
The first cost of a gas plant will, of course, exceed that of a steam equipment of the same capacity, especially in the small sizes, but considering the total cost of generating current, *i. e.*, including both operating expenses and fixed charges, the balance will be found largely in favor of the gas engine.

And also, it should here be remembered that a prominent feature of the gas engine lies in the fact that the economy of the small units closely approximates that of the larger sizes, which enables the small central-station manager to better line up his cost with the cost of the larger and more fortunate neighbor.

Some types of gas engines and producers possess extreme simplicity and are of such a nature that they respond automatically to variable load demands, necessitating minimum attention.

Extensive data on gas power have been published generally during the past decade, and the desirability of the gas engine is now fully appreciated by the greater number of power users.

That the cost of gas power apparatus is within the reach of small central stations, is quite evident by the large number of installations to be found in these plants.



Industrial Power

POWER USED IN THE RE-MANUFACTURE OF LUMBER, WITH SPECIAL REFERENCE TO CENTRAL-STATION ENERGY FOR THAT PURPOSE.

BY C. H. SCOTT.

PART II.

SELECTION OF MOTORS.

If only direct-current supply is available, motors should be compound-wound, or of the interpole variety, since it is absolutely essential that the motors be capable of resisting the inherently excessive "peaks" which are apt to occur during the all-day load of the great proportion of woodworking machinery. Direct-current motors should be totally enclosed, except in those special cases where the driving machines are ceiling-suspended away from shavings and sawdust or located in a separately partitioned room, in such a manner as to eliminate fire risk.

Large motors should be artificially ventilated and supplied with piping to and from outlet openings (1.5 cubic feet of air per minute per horsepower is usually sufficient). All controlling appliances of whatever nature, if exposed to sawdust and shavings, should be ordered totally enclosed, or properly boxed in after installation.

Where alternating-current supply is available, the polyphase induction motor with high-resistance squirrel-cage rotor should be specified, since the high-resistance rotor permits quick and frequent acceleration and provides the heavy starting torque requisite to overcome the inherently great inertia of woodworking machines.

The type of alternating-current polyphase motors with polar-wound rotor and internal starting resistance, while possessing admirable torque and starting-current characteristics, is not generally recommended for woodworking machines, since sawdust almost invariably may be expected to collect on the starting resistance. In a few cases, where variable speed for electrical control is desired, the well-known prototype of polar-wound internal-resistance rotor is used, *i. e.*, a motor similarly wound except that the rotor

[1] Abstract of a paper read before the sixth annual convention of the Michigan Electric Association at Detroit, August 18, 1909.

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is furnished with collector rings and external resistance for adjustable or variable-speed service. If this type of motor is desired, specifications should call for enclosed collector rings.

Induction motors should preferably be wound for moderate rather than slow speed, since, in addition to the decreased size and cost, the power-factor and efficiency of the moderate-speed motor is better than that of the slow-speed type. Also, three-phase motors have better power-factor than two-phase and the system is preferable, as less copper is required for the supply conductor.

In the use of alternating-current motors care should be taken not to go to extremes in over-motoring, since with belts on the loose pulleys or the machine under light load the power-factor of the motor may be exceedingly low.

In general, the use of alternating current for woodworking is to be recommended, since the requirements are ordinarily for constant speed and the three-phase type with high-resistance squirrel-cage rotor is admirably suited, due to the absence of commutator and the trouble and danger resultant therefrom where dust and inflammable material are present.

Since direct-current motors must be enclosed, their ratings for such operation must be sensibly diminished and larger machines are, therefore, demanded. In those few cases where variable speed is desired for operating the feed, alternating-current motors may be used, of either the adjustable or multi-speed type.

Woodworking plants are usually situated in the outskirts of the city, where the central station ordinarily supplies alternating current. The problem, therefore, of supplying breakdown service is much simplified.

Whether the requirements demand the use of alternating or direct-current motors, the central station should invariably recommend the use of those motors having the very highest efficiency and most rigid mechanical construction. It is regrettable that the customer's selection of a motor equipment should often be allowed to hinge upon what may be only a slight advance in cost between a thoroughly high-grade article and an inferior product, when the price differential may be wiped out in one year's operation by a very slight decrease in the efficiency of the cheaper motor. For example, a twenty-horsepower motor at eighty per cent efficiency will consume in 3,120 working hours at a five-cent rate $40 more per year than a motor of eighty-one per cent efficiency. It will be seen that close scrutiny is warranted between efficiency guarantees of different makes of motors, especially in those woodworking plants having large connected loads.

Owing to the high speed and light moving parts of woodworking machines and the frequent violent application of the load, it is desirable to use belt drive rather than gears or chains, especially as the speed of the driven pulley is usually too high to permit of other than direct or belted connection. The direct drive is coming into vogue in many up-to-date woodworking plants and is giving excellent results where the motor has sufficiently generous rating to accelerate rapidly and to withstand overloads. As we figure that the average depreciation of belting averages thirty-six per cent per year, it is important to reduce this waste and furthermore do away with any source of slippage between the driving unit and the working pulley.

In the installation of motors for woodworking machinery, if belts are used, it is strongly recommended that the same do not run vertically or have so decided a vertical component as to minimize the arc of contact on the driving pulley and at the same time prevent the use of the belt-tension adjustment on the motor base. Motors may often be conveniently located in an inverted position beneath the floor bearing the machine. If this method is adopted the belt between the motor and the machine should be boxed in and the drive arranged, as above stated, at a sufficient angle to be able to make use of the belt-tightener arrangement. There is a wide opportunity for the solicitor or power engineer to use his ingenuity in the layout and novel methods of drive for woodworking machinery.

One of the most difficult loads for the central station to handle is that of the large exhaust blowers which are used to exhaust the refuse material from the machines. Depending upon the size of the shop, one of these blowers may take from twenty to 150 horsepower, and the load is naturally constant throughout the working hours of the plant, therefore, the resultant bill, if central-station energy is used, is liable to be a serious impediment to the customer's adoption of motor drive.

In the plant of the Haffner Furniture Company an innovation was used which promises amelioration of the difficulty discussed.

In the installation in question only one small pipe is used, leading from each individual machine direct to a special cyclone dust and shaving separator, a small direct-driven blower being installed in the pipe of each machine. The important fact to be noted is that under ordinary conditions not more than two machines in any special group are in use at the same time. Hence abnormally large blowers, and ducts are not required and the economy of the blowing system is very marked.

WINTER HEATING.

Solicitors should be prepared with data which will allow them to estimate at least roughly the cost of the apparatus necessary and the fuel required to heat properly the building where the exhaust from the steam power plant is not used for this purpose. On this subject, as well as steam needed for kiln drying, I am also collecting data which I believe will ultimately be of considerable value to the central-station interests.

SALE OF WASTE PRODUCTS.

This information will be of great benefit, as the argument is frequently raised that waste material cannot be used, and therefore it would be poor economy to discard the existing isolated plant for central-station power. In one case of which we have knowledge arrangement has been made for utilizing the mill refuse in a small town where the local central station furnished electric power to a planing mill half a mile from the generating station, and also to a saw mill about one thousand feet away. In part payment the refuse from these two mills is taken by the central station for fuel. The electric company made a rate to each mill of $50 per horsepower per year and allowed the half of this charge as a rebate for fuel supplied. In the case at hand, which involved the use of forty horsepower in motors, it is calculated that the wage of one man is saved, aside from productive economies and other advantages. In the case of the saw mill, which used 100 horsepower, it is estimated that a saving of about $5 per day was made.

In the other case, a large box-making factory, taking power from the central station, there being forty motors installed totaling 470 horsepower. This company disposes of about 2,500 cords of kindling wood per year, retailing at about $5 per cord, and in addition about 70,000 bales of shavings per year, retailing at about forty cents per bale. While local conditions will have to be taken into account, the above would serve to refute the arguments so frequently presented, viz., that

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it is impossible to dispose of waste wood, shavings, etc., which may best be burned under the boilers of the isolated plant.

COST OF OPERATING BY CENTRAL-STATION SERVICE.

While undoubtedly there will be cases where the arguments of the central station may not irrefutably prove that the use of metered power will be more economical or advantageous than owned power, I do believe that a very great chance exists to add immeasurably to the central-station load for this class of service if all the salient talking points are properly marshaled to the front and the solicitor prepares himself to handle understandingly all phases of the situation. Records from a large number of central stations where woodworking plants form a goodly portion of the load indicate that the load factor of such establishments make the use of metered power decidedly feasible. For instance, one of the largest central stations in the West, with 3,522 connected horsepower, employing 234 motors (most of these group drives), found that the load factor was thirty-three per cent. With individual drives I should expect an average in many cases as low as eight or ten per cent and seldom to exceed twenty per cent.

Electric Power in Breweries.

Electric power is largely used in breweries abroad for driving malt mills, hoists, barrel hoists, grain conveyors, pumps, centrifugal pumps, portable pumps, mash tuns, mash rakes and refrigerators. Only enclosed types of motors are recommended for breweries because of the amount of steam and dust present in the atmosphere. The condensation of moisture on the walls and machinery will sometimes lower the insulation resistance of a motor to a dangerous degree. The efficient earthing of motor frames, starters, cable coverings, etc., is of the utmost importance in breweries. The floors are usually wet, and the workmen often wear iron-shod clogs on that account, so that a shock under such conditions is attended with considerable danger. Although it is an expensive method, the installation is recommended of a complete earthing system, to which all motor frames, starter cases, switch covers and metallic cable sheathing should be connected. To merely bond a motor frame on to the lead covering of a cable is inviting damage to the cable if the motor sparks over to frame or the insulation breaks down, besides introducing an element of danger of shock. Instances of the lead covering of cables being melted away at the point of contact of an earth wire, and thus leaving the faulty apparatus "alive" to shock any unwary persons, are not uncommon. The earthing system, in its turn, should be connected at several points to a water-supply pipe that always contains water, and contact with any apparatus used for heating or in conjunction with the covers should be avoided.—*Abstracted from Insurance Engineering (New York), August.*

Electric Pumping; How Not to Do It.

From time to time, says *The Mining and Scientific Press,* reference has been made to the difficulties experienced by the historic mines of Cornwall, Eng., in connection with electric pumping. The old Cornish pump has the advantage of running automatically with little attendance. It is not subject to breakdowns, nor is it expensive in power and repairs. But it has its limits of usefulness, and when unwatering operations, or sinking to great depths, are contemplated, it has become necessary for Cornish managers to investigate the claims of modern electric pumps. Unfortunately, owing to mining men not understanding the intricacies of electric machinery, and the electrical engineers not being in touch with the requirements of a mine, many of the plants so far erected in Cornwall have been failures, and mutual recriminations have been plentiful.

One of the most recent cases is that of Great Wheal Busy, at Chacewater. This mine was acquired a couple of years ago by a French syndicate of chemical manufacturers who were desirous of obtaining an independent supply of arsenic. The syndicate arranged with a prominent firm of manufacturers of electrical machinery in London for the supply of a pump. As is usual in contracts of this sort, there was a penalty clause providing for damages in case the pump was not delivered in working order by a certain date. The case was complicated by the contracting firm not supplying the pump itself, but sub-contracting to other firms. It is not surprising, therefore, that with all the ins and outs of contracts and sub-contracts, the efficiency of the pump and its applicability to the work in hand was obscured. In the end, there was great delay in the delivery of the pump, and when it was erected it could not be made to do its work. Consequently, the mine owners discarded it, and are now putting a Cornish pump in its place. They also brought an action for damages against the firm that supplied the pump, and judgment has been given in their favor. A sum of $13,500 has been awarded to the mine owners for the delay and the failure to work.

The moral to be drawn from this story is twofold. To begin with, in new ventures of this sort, the presence of intermediaries involved in contracts and subcontracts is highly disadvantageous to the actual contracting parties. It is a pity that the people who want a pump, and the people who design and make it, cannot get together and discuss requirements and capacities. The second consideration is that the mining engineers and the electricians ought to meet and learn each other's experience. A mining engineer accustomed to a Cornish pump imagines that all pumps, even electric pumps, should work efficiently with just as little attention and study. On the other hand, the electrician designs a pump with little or no knowledge of the rough conditions existing in a mine, and expecting the mining engineers and miners to be qualified to take care of the delicate anatomy of an electrical machine.

The Price of Rubber.

Although rubber has lately been somewhat reduced in price, the reduction will be only temporary, according to Spencer Brett, of the firm of Gow, Wilson & Stanton, Ltd., of London, England, who is quoted on the subject as follows:

"Prices for the best Para rubber have dropped from 8s. 5d. to 8s. a pound, but the reduction is quite a temporary one. It is possible that the price will not only go up again to the 8s. 5d. rate, but even higher. The state of the market is very uncertain, and one cannot say what the conditions will be in the near future. Supplies are not coming in any faster, despite the fact that so many new companies have been floated since the boom commenced. Nine new companies have been formed, representing a capital of £750,000. They are, of course, getting to work to produce rubber as fast as they can, but it will be some considerable time before the effect of their enterprise is felt on the market. The first month of this year's crop is only 100 tons in excess of the corresponding month last year, which is, of course, quite inadequate to deal with the great demand from motor tire manufacturers and makers of electrical goods, which require a large amount of rubber in their construction."

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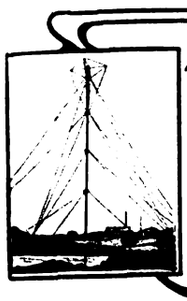
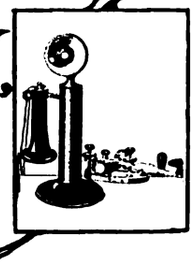


TELEGRAPHY—TELEPHONY, and WIRELESS.



EFFECT OF PHASE OF HARMONICS UPON ACOUSTIC QUALITY.

BY M. G. LLOYD AND P. G. AGNEW.

Introduction.—Ever since the celebrated controversy between Helmholtz and König concerning the influence of the phase of harmonics, this question has remained a point of dispute between the supporters of these two great experimenters. Each of them had conducted experiments which apparently supported his case, König finding that the quality was affected by phase displacement of a harmonic, while Helmholtz found no effect.

The method used by Helmholtz[1] to produce a change in phase was elegant, but open to objection. He shaded the aperture of the resonator used to reinforce the sound. This changed the amplitude as well as the phase of the vibration, and necessitated a compensating correction by altering the distance between fork and resonator. It is thus evident that the change from one condition to another could not be made with much rapidity. König's[2] experiments were made with the wave siren, which has since been shown[3] to give small quantities of extraneous harmonics. His results are therefore of doubtful significance.

The experiments to be described made use of electrical currents whose wave form could be controlled, a telephone receiver being used to transform these into sound waves.

Apparatus.—Definite composition of the electrical wave was made possible by the use of a special set of generators at the Bureau of Standards, known as the Harmonic Set. This set consists of two driving motors and eight three-phase generators, which, at normal speed, give frequencies of 60, 180, 300, 420, 540, 660, 780 and 900 cycles per second. They are assembled in two sections, the generators with the three lower frequencies being mounted on the shaft of one motor, while the others are mounted with the second motor. The two sections can be coupled rigidly together when desired. Each generator has rotating poles and stationary unslotted armature, and the position of the armature can be shifted by means of a worm gearing and hand wheel. By connecting the generators in series, and properly exciting the fields and setting the armatures, any odd harmonic up to the fifteenth can be superposed upon the fundamental frequency in any amplitude and phase relation, thus permitting the synthesis of an endless variety of wave forms. The individual generators give waves which are approximately sinusoidal, although containing a few per cent of harmonics.

Another generating set which has been used consists of two two-phase generators of sixty and 180 cycles, respectively, connected to a driving motor. These machines give nearly pure sine waves. A third generator set, furnishing three-phase and sixty cycles, was also used.

Several telephone receivers were used, but most of the experiments were carried out with a Siemens & Halske instrument of 10.5 ohms resistance. The telephone was sometimes used with a high resistance in series; at other times it was placed in parallel with an adjustable carbon resistance of low value, and the whole put in series with an incandescent lamp. Variation of the carbon resistance altered the current through the telephone. In a few of the experiments separate telephones were connected to the generators, and the sound waves combined.

Experiments.—At first the simple method of armature shift was used. Several combinations gave changes in the note sounded. But the method was neither convenient nor very sensitive, several observers and precautions to avoid suggestion being deemed necessary to firmly establish the change as taking place. The changes could be detected only with particular percentages of harmonic.

To shift the phase more quickly, a phase-shifting transformer was tried, but was found unsuitable, as slight changes in voltage and wave form accompanied the rotation of the secondary.

Finally, use was made of a second motor-generator set. By taking the fundamental from one and the harmonics from the other, and then running the machines just out of synchronism, we have one wave train slowly drifting relatively to the other, thus producing a slowly and periodically recurring change of phase.

The effect is much the same as in the arrangement used by Lord Kelvin,[4] who took two tuning forks, one of which was an exact harmonic of the other, and changed its period very slightly by adding a small weight to it, thus giving a continuous cyclic change of phase.

This method was found to be very much more sensitive than either of the others. In fact, with the armatures connected single-phase, every combination of harmonics tried showed distinct cyclic changes in the note sounded. By controlling the speed of one of the generators, the change in phase may be made rapid or slow, the rate being observed by means of a synchronizing lamp connected in series with the sixty-cycle generator of each set. Relative intensities of the electromotive-forces of the generators connected to the telephone could be adjusted by resistance in the field circuits. This method proved very convenient, the control being easy and flexible.

TABLE I.

Cycles.	Changes per lamp cycle.
60	3
	15
300	15
420	21
540	9
660	33
780	39
900	15

Table I shows the results of using each frequency of the harmonic set with the 180-cycle two-phase generator. Changes in quality were evident in every case, and the number of cyclic changes occurring during a complete cycle of the synchronizing lamp were counted. This is the number of changes taking place while one

[1] H. L. F. Helmholtz, "Sensations of Tone," third edition, page 124.
[2] R. König, "Quelques Expériences d'Acoustique," page 222.
[3] R. König; Wiedemann's Annalen; volume 57, page 339; 1896. C. Stumpf; Wiedemann's Annalen; volume 57, page 677; 1896.
[4] W. Thomson; Proceedings Royal Society of Edinburgh; volume 9, page 602; 1878.

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sixty-cycle generator gains a cycle upon the other. The significance of these numbers is seen when we consider the impurities present in the waves from the two generators. Thus, with 300 cycles, the possible overtones have frequencies of 900, 1,500, 2,100, etc. The frequency of 900 cycles is common to both, and with shifting phase these components will at times oppose, at other times reinforce, each other, thus changing the amplitude of this component of the combination. As the wave of this frequency shifts in phase by a complete cycle for one-fifteenth of a cycle of the sixty-cycle generator, a shift of an entire cycle of the latter corresponds to a shift of fifteen entire cycles of the higher frequency, and consequently fifteen cycles of amplitude change. In each of the other cases it will be found similarly that the number of changes counted corresponds to some common harmonic of the two frequencies used. In one case (sixty cycles) two distinct and recurring changes could be distinguished, each one depending upon a separate frequency, common to the two generators, namely, 180 and 900 cycles. No doubt other frequencies are common to the two generators in every case, but are not prominent enough to be heard.

It is evident that the changes in quality observed are simply beats due to the interference of frequencies common to the two sources. For an experiment to be decisive, it is necessary that the two sources should have no harmonic common to them. Lindig,[5] in 1902, found similarly that changes in quality always resulted when the two sources furnished the same harmonic. He used a telephone in conjunction with a telephone-siren, and found no change in quality except when this condition was fulfilled.

Alternators giving rigorously sinusoidal waves are not obtainable. Yet it is well known that in star-connected three-phase generators, the third, ninth, fifteenth, twenty-first, etc., harmonics are eliminated automatically. It is to be noticed that with two machines so connected, if only frequencies having ratios of three to one and nine to one are used, then there will be no common impurity, even though they are not necessarily sinusoidal. Again, in most generators the even-numbered harmonics are entirely lacking, so that if generators with frequencies in the ratio of two to one can be used, there will again be no common impurity. The first condition was attained by using the two sections of the harmonic sets separately, or by using one of them with a second three-phase generator. The second arrangement was carried out by running one generator at half speed, which also allowed other combinations to be used, which should, theoretically, give no common harmonics.

It will be seen that we were thus enabled to test under the three distinct conditions, in which the phase of an overtone was constantly changing in respect to the fundamental, the overtone and the fundamental containing no common impurity, viz., an odd harmonic, an even harmonic, and an overtone, which was not harmonic, that is, an overtone having a pitch ratio of three to two, four to three, or the like.

When the harmonic set was run in separate parts, an oscillograph was used as a synchronizing apparatus.

It should be said that a direct synthesis of sound waves by this method does not seem to be possible without introducing distortion.

When a separate telephone was excited from each source, and the two placed inside the body of a mandolin to act as a sounding board and combine the sounds, very distinct changes were observed, often of more than one period. They could not be made to disappear by any arrangement of intensities, nor even to decrease materially. Evidently these changes of tone were chiefly due to the harmonics introduced by the sounding board, just as we should expect.

Accordingly, in the final experiments the electromotive-force waves were directly combined and applied to the telephone. This method assumes that the diaphragm gives out a sound wave having the same form as the electrical wave impressed upon the telephone. To test this assumption, the telephone was excited from a star-connected generator, and the sound analyzed by a set of Helmholtz resonators,[6] in order to determine whether the sound wave given out by the telephone contained harmonics not present in the electrical wave.

The generator was run at such a speed that one of the resonators reinforced the fundamental, and the sound was then examined by means of resonators whose natural frequencies were two, three, four and five times as great. Four different telephones were thus examined, the results being shown in Table II. The fifth harmonic was no doubt present in the electrical wave, whereas the second, third and fourth may reasonably be assumed to be absent. It is to be noticed that the third was always present in the sound wave, whereas the second and fourth were sometimes absent, or too weak to be heard. They are less prominent in the shunt than in the series connection, and are never strong in the Siemens & Halske and Bell receivers.

TABLE II.

Experiments with Resonators.

Harmonic Set, star-connected, and run slow, so that the 300-cycle generator gave about 256 cycles. With small current in the telephone, such as to require pressing against ear, no harmonics discernible.

Phone Connection.	Receiver.	
Shunt	S. & H.	3, 4, 5 with heavy current 3, 5 with weaker current
Shunt	Elephant	2, 3, 4 (very faint), 5
Shunt	Bell	2 (very faint), 3, 4, 5
Shunt	Lambert & Schmidt	3, 4, 5 or 2, 3, 5, according to current
Series	S. & H.	2 (very weak), 3, 4, 5
Series	Elephant	2, 3, 4, 5
Series	Bell	2 (very weak), 3, 4, 5 (weak)
Series	Lambert & Schmidt	2, 3, 4, 5 (3d strong)

Summary: 3d and 5th always noticeable, and 3d as strong as 5th; 2d and 4th sometimes absent, or too weak to be heard, and less prominent in shunt than in series connection. The 2d is never strong in the Siemens & Halske, nor in the Bell.

It might seem that the distortion found by the resonators was introduced, not by the diaphragm, but by the armature reaction in passing a current from one machine through the armature of a second; but only a very small current was used, and the harmonic set is rated at 34.5 amperes. Moreover, if it were due to armature reaction, the distortion should be greater for the shunt connection, where a few tenths of an ampere were drawn, than in the series connection, where only micro-amperes were drawn; but the reverse was found.

It is thus evident that the receiver may introduce harmonics not present in the electrical wave, and thus lead to false inferences in regard to the question being studied. The best conditions are evidently obtained by using a sensitive receiver in shunt connection, excited as slightly as possible, and star-connected generators whose ratio of frequencies is an even integer. The frequencies should, moreover, be as high as possible, since the ear is more sensitive at higher frequencies, and less current is necessary.

In the final experiments, at least one of the machines used was star-connected, three-phase. Even under the most favorable conditions of connection, every combination tried could, by using sufficient current in the telephone, be made to show a periodic change of quality which gave the same sensation to the ear as occurred

[5] F. Lindig; Annalen der Physick; volume 10, page 242; 1903.

[6] These were very kindly loaned to us from the University of Pennsylvania by Prof. A. W. Goodspeed, to whom we are greatly indebted.

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in the case of the single-phase connection described above. This could be done with the telephone, either in series or in shunt, and with five different types of telephone. Lindig does not mention this effect with strong tones. Perhaps the greater sensitiveness of the continuous slip-phase method accounts for it being noticed in our experiments and not in his.

Yet in nine different cases it was found that with less current in the telephone, no change could be detected by either observer. These are shown in Table III.

TABLE III.

Pitches of components.	Intensity of sound possible without beats.
60 - 180	Less than normal
60 - 540	Less than normal
60 - 900	Less than normal
180 - 270	Normal
180 - 390	Normal
180 - 450	Normal
180 - 590	Normal
300 - 450	Normal
300 - 900	Above normal

By "normal" is here meant an intensity that would allow spoken words to be easily and distinctly understood, but not great enough to make the sound unpleasant, that is, about the intensity of ordinary conversation over the telephone.

In these cases it is probable that a change in quality as great as would be caused by the interference of harmonics common to the two sources, when present to the amount of even less than one per cent, could have been easily detected.

But in several cases beats were obtained which could not be made to disappear by decreasing the intensity of the sound, and this when, theoretically, there should have been no common harmonics present, and, as far as could be told, the machines were running smoothly. For example, using the two-phase machine with the harmonic set, beats were obtained with the following combinations: 90-180; 180-270; 180-450. Yet, it will be noticed that, as indicated in the previous table, the last two combinations gave no beats when the two parts of the harmonic set were used as source. A little light may be thrown upon the discrepancy by a consideration of the second case. The 180-cycle electromotive-force from the two-phase machine is known to contain four per cent of its third harmonic, corresponding to a pitch of 540. Now, if the telephone diaphragm introduced this tone independently, its amplitude would be likely to be altered by the addition of this harmonic to the electrical wave, or by a change in its phase relation to the fundamental. In other words, the distortion of the wave during its conversion from the electrical to the mechanical form would naturally vary with the form of the electrical wave, and particularly with any alteration in those components which are independently introduced during the conversion. Evidently, these results should be discarded in favor of those obtained under the more favorable conditions of taking both the components from star-connected machines. When so connected, and when both machines were running smoothly under best conditions, no change in quality was found that could not be traced to extraneous causes.

Very great care had to be observed to exclude such extraneous interference and in many cases it was found to be impossible to do so. Several times during the course of the work, results were obtained that seemed to indicate a real dependence of quality upon phase, but in each case investigation showed that the results were vitiated by bad conditions. For example, the throbs of the engine supplying power to the dynamo, which in turn supplied the direct current to the driving motor, could occasionally be heard in the telephone, and for this reason nearly all the observations were made while the energy was being taken from a storage battery. Noises in the dynamo room were sometimes transmitted through the telephone, and slip rings and commutators had to be in perfect condition or the sound became unsteady. Mechanical beats were sometimes transmitted to the telephone, as, for example, when it was attempted to obtain the combination 300-600 by running the halves of the harmonic set at slightly different speeds, the note given out by the telephone when connected to the 300-cycle machine alone contained beats which ceased when the machine of higher frequency was stopped. Unfortunately, this condition prevented us from getting results with nearly all of the combinations involving even harmonics.

Thus, while the method is very sensitive, positive results should be accepted only after care has been taken to insure that no disturbing factors are present. The ideal condition for its use would be to have the machines in separate buildings, and the observer in a third.

Summary.—The experiments clearly support Helmholtz's view that quality is independent of phase relations, as was found by Lord Kelvin with his analogous mechanical drifting phase method, and also show that the telephone introduces both the odd and even harmonics which are not present in the electromotive-force wave at its terminals, or in the current wave through it.

Fighting Forest Fires with the Aid of the Telephone.

The telephone is playing a very important part in a determined campaign which is being waged in the state of Maine against forest fires. The land agent and forest commissioner at Augusta recently had installed a number of telephone sets on lookout stations in the northern part of the state. Men are posted at these commanding spots with telescopes and keep a vigilant lookout for trouble. At the least sign of blaze or smoke they telephone to the nearest fire-fighting station for help.

Eight watch-towers have been erected, each with its telescope and telephone connection. The watch-towers are located on the highest points of land in Hancock, Washington, Somerset, Piscataquis, Aroostook, Penobscot, Franklin and Oxford counties.

The watchmen in their towers this year are able to sweep the entire forest section, and at the least sign of smoke their telephones bring them into immediate communication with the nearest settlement and aid is at once dispatched.

Foresters are eagerly awaiting a real test of the usefulness of the new system. According to Commissioner E. E. Ring forest fires in Maine last year caused a damage of $618,816.

Cable Laid in 1881-82 in Perfect State.

The cable steamer Mexican has returned after a cruise of thirty-one days, during which she repaired two of the European cables which were laid by the cable steamer Faraday in 1881-82. Captain Bond said:

"Northeast of Sable Island one of these cables was found to have been buried several feet in the sand bottom, and when finally brought to the vessel's bow by the grappling gear, it was in a perfect state of preservation. This cable has been buried twenty-seven years.

"Ordinarily when a cable has rested upon the ocean's bed for a couple of years it becomes covered with marine growth, and generally the steel wire armor is rusty and worn away by constant grinding on the bottom. But twelve miles of this cable was picked up for examination, and when it was found to be as good as the day it was laid, the cable was replaced, and the ends joined together. This cable was picked up, relaid, and spliced in thirty-six hours, which was a quick job considering that four splices were made."

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ELECTRO-CHEMISTRY and METALLURGY

RECENT PROGRESS IN ELECTRIC STEEL REFINING.

BY JOHN B. C. KERSHAW.

The article upon "The Problem of Waste Heat Utilization in Iron Works," which appeared in *The Iron Trade Review* for February 18, included some particulars relating to the progress of the electric-furnace methods of steel refining. Those who control British and American iron and steel works were urged to apply some portion of the power now wasted in their blast-furnace gases, to the production of structural and rail steel in the electric furnace.

It is the writer's purpose in the present article to amplify the information contained in the above-mentioned article and to give the latest details available relating to the electric-furnace methods of steel production.

As regards the number of furnaces in operation, the issue of the *Electrochemical and Metallurgical Industry* (New York) for January of this year, gives the following summary of the position:

	No.	Aggregate Charging Capacity in Kilogrammes.
Héroult furnaces in operation or in course of erection....	19	63,300
Héroult furnaces planned but capacity not decided.....	5	.....
Stassano furnaces in operation or in course of erection.....	11	16,900
Kjellin furnaces in operation or in course of erection....	10	21,500
Röchling-Rodenhauser furnaces in operation or in course of erection.....	10	29,200
Girod furnaces in operation or in course of erection....	9	34,000

This gives a total of fifty-eight furnaces, having an aggregate capacity of 165,000 kilogrammes, or 165 metric tons—equal to an average capacity of nearly three tons per furnace charge.

It is useful and instructive to compare with these figures the still more recent summary of progress published by the Gröndal-Kjellin Company, of London, from which the following figures are taken:

	No.	Aggregate Charging Capacity in Kilogrammes.
Héroult furnaces in operation or in course of erection....	19	74,300
Kjellin furnaces in operation or in course of erection....	14	34,950
Röchling-Rodenhauser furnaces in operation or in course of erection.....	10	30,200
Stassano furnaces in operation or in course of erection.....	11	16,900
Girod furnaces in operation or in course of erection....	10	32,800

This list gives a total of sixty-four furnaces, with an aggregate capacity of 189,150 kilogrammes (equal to 189 metric tons), either in operation or in course of erection—rather larger totals both in furnaces and in aggregate capacity, than those given by the independent inquiries and estimate of the New York paper.

In addition, there are between fifteen and twenty electric furnaces for steel production operating upon other systems than those named above, in Europe and America.

One may safely assert, therefore, that at the present moment, there are between sixty and seventy electric steel refining furnaces at work, with an aggregate capacity of over 200 tons steel per charge. Since the average number of charges worked per day in electric furnaces is two, this gives a daily production of 400 tons of electric steel, a total large enough to show that on the Continent of Europe electric steel refining has now become an important feature of the iron and steel industry.

As regards the size of the individual furnaces, the largest Héroult furnace in operation is that of the Aceries du Saut du Tarn, at St. Juery, France, this having a capacity of 5,000 kilogrammes (five tons) per charge, while a furnace of equal capacity is at work at the Halcomb Steel Company's Works at Syracuse, N. Y. The Societa Tubi Mannesmann, at its works at Dalmine, in Italy, is just completing, however, two 6,000-kilogramme furnaces, and it will be of some interest to note whether the Héroult type of crucible furnace can be successfully worked in these larger units, most of the refining so far having been carried out in furnaces of three tons capacity. The chief difficulty with the Héroult furnace is the regulation of the current during the melting of the charge, when both arc and resistance heating are employed, great variations in the electrical resistance of the charge occurring during this stage of the heating process. As the size of the furnace increases, and larger currents are employed, this difficulty is likely to become intensified, and on this account a limit to the practical capacity of the furnace is certain to be found The other special difficulty found in the operation of the Héroult furnace, namely, the overheating and rapid consumption of the carbon electrodes, has been overcome by the use of water-cooled stuffing boxes for these, packed with a special conducting mixture of graphite and carbon grains, which enables a large surface of

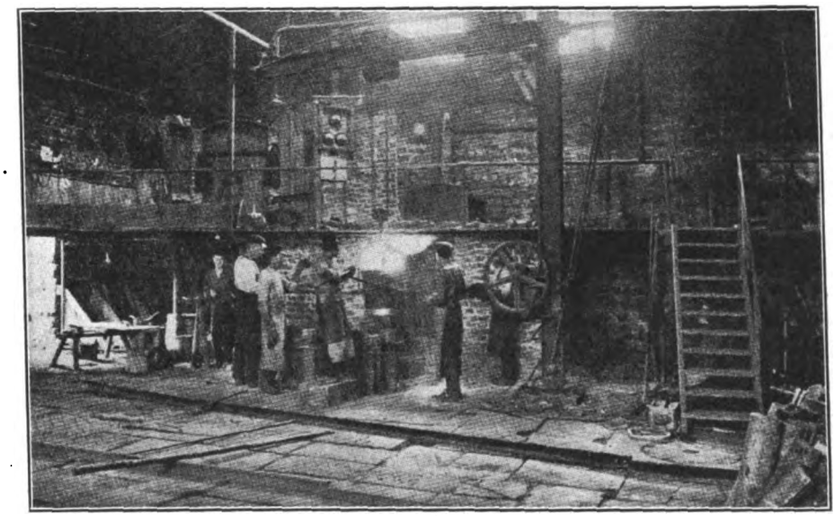

FIG. 1.—THE KJELLIN FURNACE (DISCHARGING).

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the electrode to be employed for electrical connection to the cables conveying the current. Having studied completely the problem of manufacturing the higher classes of motor-car and tool-steel, Héroult is now turning his attention to the production of structural and rail steel in his furnace, and in a letter to the writer, dated January 13 of the present year, he states that he is now working at this branch of the subject with some hope of success.

The largest Stassano furnaces are to be found at the works of the "Forni Termo-elletrici Stassano" at Turin, Italy, where two 5,000-kilogramme furnaces of this type have been erected. In the case of the Stassano furnace, the heat effect is obtained entirely by radiation from two or more arcs formed above the charge, and the difficulties connected with the regulation of the current, met with in the operation of the Héroult furnace, do not occur. On the other hand, the electrical efficiency is lower, the most reliable figures showing a power consumption of 1,164 kilowatt-hours per 2,000 pounds of steel, as compared with 864 kilowatt-hours for the Héroult type of furnace.

The "Bonner Fraserfabrik," at Bonn, has erected and is working two 1,000-kilogramme Stassano furnaces, and the Italian government has two 700-kilogramme furnaces of this type at the Royal Arsenal, Turin.

As regards the Kjellin induction type of furnace, the largest in operation is that at the Krupp works, at Essen, this furnace being of 8,500 kilogrammes capacity.

A furnace of similar size, until quite recently was in operation at the Röchling Iron and Steel Works, at Volklingen; but this has now been converted into the modified Röchling-Rodenhauser type of furnace, and the remaining Kjellin furnaces are of 4,000 kilogrammes, 2,000 kilogrammes, and 1,500 kilogrammes capacity. Owing to the inability to attain a high temperature in the original Kjellin type of furnace, it can only be used as a melting furnace, and on this account its field of usefulness is limited.

Coming now to the Röchling-Rodenhauser furnace, the type which is at present attracting most attention, it may be explained that this furnace utilizes a combination of induction and resistance methods of heating, and that by this combination the difficulties due to the low temperature of the metal and slag in the original Kjellin type of furnace, are overcome. The experimental work connected with the development of this furnace was carried out at the Röchlingsche Iron and Steel Works at Volklingen, by M. Rodenhauser and Dr. Schonawa, and there are now two furnaces of the new type in operation, and one in course of erection, at the Volklingen Works, while others are operating at Remscheid and Dommeldingen, in Germany, at Bressoux, in Belgium, and at Walzenhausen, in Switzerland. The largest furnace of this type is the 8,500-kilogramme furnace now under construction at Volklingen, while the largest yet operated is one of 3,500 kilogrammes capacity at the same works.

No detailed figures for the power consumption of these large furnaces have been given, but Harden in a recent paper, read before the Faraday Society, stated that when using molten metal from the converter for charging the furnace, the power varied from 125 to 150 kilowatt-hours per ton of finished material. The corresponding figure for the Héroult furnace is 329 kilowatt-hours per ton of 2,000 pounds. No doubt under exactly similar conditions as regards the purification effected in the furnace, the power consumption of these two types of furnace would be more nearly equal.

Finally, as regards the Girod furnace; the largest in operation is one of 2,000 kilogrammes at the works of Oehler and Company, at Aarau, in Switzerland, but two furnaces of 10,000 kilogrammes capacity are now under construction at the new steel works which Girod is erecting at Ugine, in Savoy, and these were expected to be in operation in March of the present year. This works will have 22,000 horsepower available, and will be the first steelworks operated entirely by electric power. The furnace and casting house is a building measuring seventy feet wide by 350 feet long, and is at present equipped with two two-ton furnaces and with two ten-ton furnaces. The latter, according to Richards, will be operated with a current of 32,000 amperes at sixty volts, equivalent to 1,920 kilowatts, or 2,000 horsepower, and will produce eight to twelve tons of steel per charge.

The only reliable detailed figures yet published show that the Girod furnace consumes 1,136 kilowatt-hours to produce one ton of steel from scrap steel and pig-iron charged cold, but it is probable that these results will be much improved upon in the furnaces recently erected at Ugine. When molten metal is charged into the furnaces, the power consumption is reduced to 358 kilowatt-hours per ton. As pointed out above, however, the comparative figures for power consumption are of little value, without some measure for the purification effected by the electric-heating process.

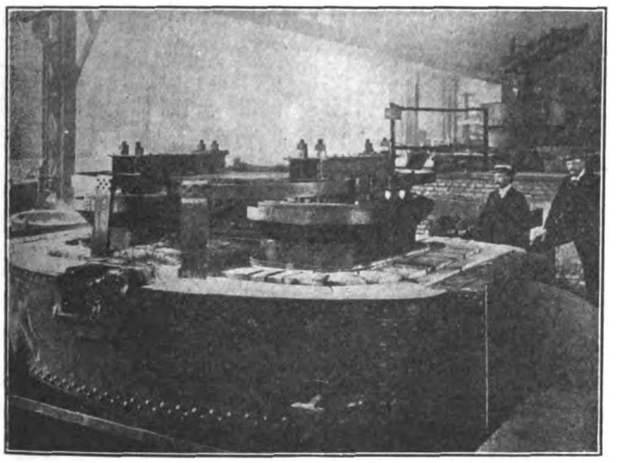

FIG. 2.—THE LARGE RÖCHLING-RODENHAUSER FURNACE AT VOLKLINGEN.

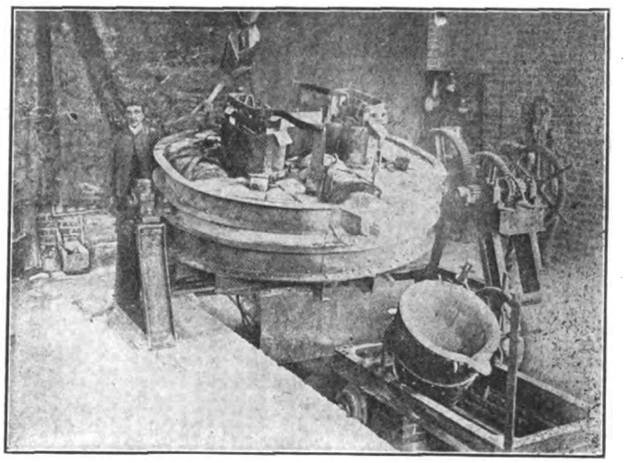

FIG. 3.—THE 140-KILOWATT RÖCHLING-RODENHAUSER FURNACE AT VOLKLINGEN.

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ELECTRICAL Advertising *and* Selling

GETTING POWER BUSINESS.

BY JOHN A. CLEVELAND.[1]

The aim of every progressive central station is, in general, to increase its output. Increase in output means increase in revenue and, under proper management, increase in profits to the company. Electric power is the most profitable class of business which can be secured by any central station. It possesses several characteristics which render it especially attractive to the central-station manager. It is essentially a day-load and therefore tends to broaden out the peak-load of the station and to increase the output during those hours of the day when the load on the station is light. It is also a long-hour load and, therefore, increases the load-factor of the station. Moreover, power accounts are, in general, large each month and the distribution expense incident to each of these accounts is comparatively small, as there is but one account to keep and collect, one meter to read and keep in repair, and one service to maintain.

Electric power, therefore, being the most desirable adjunct to the central-station load, it is the object of this article to point out briefly the general methods which should be pursued for obtaining an increase in this class of business.

It is, in the first place, desirable and important that the commercial manager should have at his hand a complete file of all the users of power in his city. This file should contain individual records of each power user, showing as nearly as possible the equipment, operating conditions, probable amount of power used, and if possible the approximate monthly or yearly cost of power. The following headings will illustrate the manner in which this information may be classified upon individual cards:

Name.....
Address.....
Business.....
Boilers, horsepower and kind.....
Engines, horsepower and kind.....
Estimated maximum load in horsepower.....
Estimated average load in horsepower.....
Kind of coal used.....
Cost or quantity of coal used.....
Use of exhaust steam.....
Use of live steam.....
Number of engineers and firemen.....
Hours plant is operated daily.....

[1] Superintendent of new business departments of Bartlett Illuminating Company, Saginaw, Mich., and Bay City Traction and Electric Company, Bay City, Mich.

When a card has been compiled for each user of power in the city these cards will form a file which will enable the commercial manager to ascertain at a glance the general conditions existing at any manufacturing plant within his territory.

It is needless to say that the value of these cards depends absolutely upon the care and accuracy with which this information is secured. The solicitor who obtains this data must use not only care, but also good judgment and tact. He should explain to the manufacturer that the central station is desirous of securing whatever information it can from the various manufacturers in town to the end that the central station may, if possible, offer to the manufacturer a more efficient and economical form of power. The solicitor should, however, avoid any tendency to enter into any argument or discussion concerning electric power versus other forms of power, except in a general way. The object of his first visit should be to form the acquaintance of the manufacturer and secure all the information which he can concerning this particular plant. Without this information the solicitor is at a disadvantage, as the manufacturer will argue from a complete knowledge of his own conditions of which the solicitor knows nothing. Moreover, an attempt at argument may tend to antagonize the manufacturer at the start, a condition which must be carefully guarded against. The solicitor should point out to the manufacturer the fact that, if at any time there should occur a breakdown, or an accident to the prime-mover of the factory, and the manufacturer should need power at once to keep his machinery in operation, this information in the hands of the central station would enable the central station to ascertain at a glance the conditions at this factory, and it could then quickly arrange to furnish enough power to keep the factory in operation until the necessary repairs were made. Many times a break-down of this kind offers the opportunity to the central station of temporarily installing electric power which results in the permanent use of this power and the abandonment of the old equipment. It may happen that the manufacturer himself will be unable to furnish the solicitor with all the information which he may desire. In that case the solicitor should, with the manufacturer's permission, talk with the engineer or foreman of the shop, from whom accurate information may usually be obtained upon all these points.

The commercial manager having, then, secured a complete record of all the manufacturing establishments, his next step should be to go over this file carefully and pick out from the list those manufacturing plants which in his judgment offer the best field for the introduction of electric power.

The solicitor then starting out to secure some individual power business should, first of all, study the record of this manufacturer as outlined upon the card record. He should then call upon the manufacturer, state the object of his visit, and secure permission to present an estimate upon the cost of electric power. If the manufacturer is approached in the proper way there is no reason why the solicitor should not be granted an opportunity to present his case. Having then aroused the interest of the manufacturer, the solicitor should proceed to make a careful and detailed study of this individual plant. He should supplement and add to the information already secured and study carefully and exhaustively all the conditions under which the plant is operated. He should confer with the engineer and from the engineer's knowledge and from his own observations he should arrive at an estimate of the maximum load of the plant, the average load, and the daily hours' use of the maximum load. It is sometimes advisable to conduct an indicator test of the engine, thus determining the actual running load, the load of the various parts of the plant and the friction load of engine and shafting. The solicitor should inspect carefully all parts of the factory, proceeding from the prime-mover outward, and should note all inefficient methods of power transmission, the various losses which exist in belt drives and long

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lengths of shafting and countershafting. He should ascertain from the engineer the approximate amount of fuel used per day, and from the foreman the hours per day that each machine or group of machines is operated, and should note carefully and accurately all items which will have any bearing upon the information which he is to secure.

The solicitor is then ready to prepare an estimate upon the cost of electric power and the greatest care and accuracy should be used in preparing this report. The report should show clearly the probable monthly power consumption in kilowatt-hours, which at the stated rate would amount to a definite amount of dollars and cents per month. It should show the complete cost of the proposed electric installation and the number and size of the various motors to be used. A comparison should then be drawn between the present operating costs and the cost of electric power. In the cost of operating by steam power care must be exercised to include all the various items incident to the use of such power. This cost will, in general, include labor of engineer and fireman, cost of coal, water, oil and waste, the removal of ashes, repairs to engine and boiler, and repairs to shafting and belts. The rental value of the space occupied by the plant, and the damage from heat and vibration, as well as poor sanitary conditions, should also be noted and remarked upon.

The solicitor is now prepared to present his case. He has studied the conditions of this plant until he knows them as well as the manufacturer himself, and he is therefore prepared to meet the manufacturer upon even ground. The solicitor has been fair and just in his estimates, has studied the conditions carefully, and has gained the confidence of the manufacturer. It now remains for him to convince the manufacturer that electric power is the best form of power for him to use. To do this he must point out the many advantages of electric power, its reliability, convenience, flexibility and finally its economy in operation. He must be sincere in his statements, logical in his deductions, and convincing in his arguments. He must avoid generalities and make specific statements and support them with facts and figures. He must recognize the fact that in attempting to secure business of such importance that mere persuasion and eloquence will not avail. The manufacturer is going to look upon a proposition of so much importance to himself calmly and judicially, and is not going to spend what he may consider a large sum of money and throw out his old system of power until he is convinced that he will be a gainer in the end. The solicitor, therefore, must base his arguments upon logic and reason to the end that the manufacturer shall be convinced, and these arguments must be driven in so deep that there shall be no room for after-doubts.

It is not only toward the large manufacturers, however, that the commercial manager should direct his energies and the work of his solicitors. For every manufacturer operating a plant of any size there are probably ten or more smaller ones. These small manufacturers do not use much power individually, but collectively they form a power load of no mean importance. These small manufacturers use either gasoline or small inefficient steam engines, and it is among these people that the solicitor will find a quick appreciation of the advantages of electric power. It may be desirable and necessary for the central station to offer some of these prospective customers a motor for, say, one month's trial. If this is done it will be found that only in extremely rare cases will the customer return to his old engine. The convenience, reliability, ease of operation and the uniform power furnished by the electric motor power will easily win in the end.

The commercial manager should always bear in mind that every addition to his power load, however small it may be, is worthy of his consideration and careful attention. A great deal depends upon the cultivation of a sentiment favorable to the use of electric power and every customer becomes in himself in many ways an advertiser of electric power.

Central-Station Advertising Made Effective by Appealing to Children.

The large amount of advertising literature that is being sent through the mails would give one the impression that this form of advertising is being overdone, especially, considering that a large share of it finds its way to the waste-basket. However, given a good mailing list and the proper kind of literature, very successful results are obtained.

Proper kind of literature carries a suggestion that is indeed a vital one. Advertising is distributed to be read, and to accomplish this it must first be attractive. It should have a striking opening sentence, or a bold dash of color, or a picture full of life and action, or, better still, all of these combined.

A style of literature that has become very popular for advertising purpose is one using nursery rhymes for conveying a message. These are not only attractive to the individuals to whom sent, but frequently become the property of the children, and are held constantly up to one's attention. For a residence-lighting campaign they are particularly adaptable.

DETROIT EDISON COMPANY'S BOOKLET FOR RESIDENCE CAMPAIGN.

An example of this form of advertising is shown in the accompanying illustration of a booklet distributed by the Edison Illuminating Company, of Detroit, Mich., entitled "Alice in Switchland."

The quality of paper used is of the best, the colors are bright and distinctive, the illustrations are amusing and the verses short and to the point.

It is of the class to attract attention and undoubtedly will serve its purpose very satisfactorily.

The verses are composed to show the many electric devices that add to the comfort and luxury of the home and lessen the labor of housekeeping.

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The British Association Meeting.

The recent meeting of the British Association for the Advancement of Science, which was held at Winnipeg, Manitoba, Canada, commencing August 25 last, produced much that was of electrical interest, not the least remarkable being a fine address by the president of the association, Prof. Sir J. J. Thomson, of Canbridge University, England, a fuller abstract of which will be given in an early issue of THE ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

PRESIDENT'S ADDRESS.

Professor Thomson, in dealing with the wonderful developments in Canada during the past twenty-five years, pointed out that even the "enterprise and energy of your people and the richness of your country would have been powerless to effect this change without the resources placed at their disposal by the labors of men of science." Later he compared the university training of Canada with that of Cambridge in the mother country, pointing out that Canada had avoided the scholarship extravagances of Cambridge. He pleaded in the interests of physics for a greater study of mathematics by physicists and of physics by mathematicians in the interest of pure mathematics. He thought that of late years there had been some tendency for mathematical and physical sciences to drift apart, and the workers in applied mathematics are relatively fewer than they were some years ago. This was no doubt due to some extent to the remarkable developments made in the last few years in experimental physics on the one hand and in the more abstract and metaphysical parts of pure mathematics on the other. The fascination of these had drawn workers to the frontiers of these regions, who would otherwise have worked nearer the junction of the two. In accordance with the usual practice of presidents of the British Association, Professor Thomson then proceeded to give a short account of some of the more recent developments in the branch of science which he more particularly represented — physics — with some remarks on the new conceptions of physical processes to which they have led.

ENGINEERING SECTION TOPICS.

In the Engineering Section, the presidential address was delivered by Sir W. H. White, and among the matters of electrical or allied interest to come before this section were "International Electrical Standardization," by Ormond Higham; "The Distribution of Dielectric Stress in Three-Phase Cables," by W. M. Thornton and O. J. Williams; "The Engineering Works of the Panama Canal," by Colonel Goethals; "Losses from High-Tension Overhead Lines Due to Brush Discharge," by E. A. Watson; "On the Calculation of the Charging Currents in Three-Core Cables and Overhead Transmission Lines Supplied with Three-Phase Currents," by Prof. E. W. Marchant; "The Work of the British Association Committee on Gaseous Explosions," by Dugald Clerk—the second report of this committee was submitted; the first gave rise to an important debate at last year's gathering at Dublin.

OTHER ELECTRICAL TOPICS.

Among the subjects coming before other Sections were the following: "Mercurous Sulphate for Standard Cells," by Charles Fox, and "The Constancy of the Hydrogen Gas Electrode," by the same author.

A paper on Clark and Weston standard cells, contributed by H. L. Bronson and A. N. Shaw, dealt mainly with the accuracy and reproducibility of Clark and Weston cells, the authors' hope being to throw further light on the value of the cell as one of the two legal electrical standards. The work was greatly facilitated by the courtesy of the Bureau of Standards at Washington, where one of the authors spent some time in 1908 in studying the construction of modern standard cells. The authors had actively co-operated with the Bureau in the work it had been doing along these lines. In the four main sections of their paper they dealt with: (1) The reproducibility of the cells when prepared according to the specifications of Wolff and Waters; (2) the effect of introducing slight simplifications into the preparation of materials; (3) the relative value of cells set up according to the Board of Trade specifications, and those set up according to the specifications of Wolff and Waters; (4) the ratio of the electromotive-force of the Weston cell to that of the Clark.

Abstracts of some other papers presented at this meeting follow:

THE ELECTRICAL CONDUCTIVITY OF SOLUTIONS OF IODIDE AND OF PLATINUM TETRA-IODIDE IN ETHYL ALCOHOL.

BY E. H. ARCHIBALD AND W. A. PATRICK.

When solutions of iodine in ethyl alcohol were examined as to their power of conducting the electric current, it was found that the conductivity increased rapidly with the time. This change appeared to be due to the progress of a reaction, the speed of which was greatly accelerated, at low temperatures, by the platinum block of the electrodes. At twenty-five degrees centigrade the conductivity reaches a maximum in about twenty-five hours. The reaction goes on extremely slowly if platinum block is not present. As a result of this reaction the color of the solution becomes lighter. The initial conductivity of the iodine-alcohol solution was very small. No evidence could be found of the formation of an addition compound between the iodine and alcohol at as low a temperature as minus eighty degrees. Platinum tetra-iodide forms good conducting solutions with alcohol. The molecular conductivity soon reaches a constant value.

THE EFFECT OF TEMPERATURE VARIATIONS ON THE LUMINOUS DISCHARGE IN CASES FOR LOW PRESSURES.

BY R. F. EARHART.

For this investigation a small glass bulb was used, in which two parallel electrodes were sealed. These electrodes were five millimetres apart. Suitable tubes permitted the bulb to be evacuated, the pressures being measured with a McLeod gauge. The bulb was contained in an electric furnace, which could also be used as a container for carbon dioxide snow when measurements for discharges occurring at low temperatures were taken. Potentials required to produce a luminous discharge for pressures varying from 0.2 millimetre to five millimetres were made, and for temperatures varying from minus seventy-five to plus 325 degrees centigrade. The gases operated upon were air, hydrogen and carbon dioxide. Potentials required to maintain the luminous discharge under similar conditions were also measured. Curves showing the effects of temperature and pressure for potentials required both to produce and to maintain luminous discharge were given. They indicate that Paschen's law holds approximately for the discharge in air until temperatures in the neighborhood of 300 degrees centigrade are attained. Here Paschen's law does not hold even approximately.

NEW METHOD OF PRODUCING A CADMIUM ARC.

BY DR. T. MARTIN LOWRY.

In order to produce a cadmium spectrum of sufficient intensity for polarimetric work advantage is taken of the favorable properties of the silver-cadmium alloys. On account of their isomorphism the two metals form an excellent series of alloys, which are characterized by good mechanical properties and very high melting points. (An alloy with sixty per cent cadmium melts at a temperature as high as 700 degrees centigrade.) In striking contrast to the behavior of the pure metal, the alloy gives a steady arc which can be kept true to center by rotating the electrodes in opposite directions. The spectrum shows the silver as well as the cadmium lines, but these are so far separated that even with a low resolving power the slit of a spectroscope can be opened to its full width without any overlapping of the brilliant "blocks" of light which take the place of the usual "lines."

Japanese Visit Power Plant.

Japan's party of eighty representative business and professional men left Tacoma on September 6 in its special train for a ride over the Tacoma Eastern Railroad to Mount Rainier and Rainier National Park, accompanied by committees of the Tacoma Commercial Club and Chamber of Commerce. The party took a side trip to the power plant at Electron.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

YONKERS RAILROAD.

The report of the Yonkers (N. Y.) Railroad Company, Leslie Sutherland, receiver, for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$132,881	$140,996
Total railway operating expense.	116,877	124,400
Net railway operating revenue.	$ 16,003	$ 16,595
Taxes accrued	5,110	7,808
Operating income	$ 10,893	$ 8,787
Other income	180	214
Gross income	$ 11,074	$ 9,001
Total deductions from gross inc.	13,441	12,500
Net corporate deficit	$ 2,367	$ 3,498

WESTCHESTER ELECTRIC COMPANY.

The report of the Westchester (N. Y.) Electric Railroad Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$107,843	$ 97,747
Total railway operating expense.	99,535	104,102
Net railway operating revenue.	$ 8,308	*$ 6,355
Taxes accrued	3,996	3,569
Operating income	$ 4,311	*$ 9,924
Other income	198	137
Gross income	$ 4,510	*$ 9,787
Total deductions from gross inc.	7,375	6,250
Net corporate deficit	$ 2,864	$ 16,037

*Deficit.

LAKE SHORE ELECTRIC.

The report of the Lake Shore Electric Railway Company for the month of July, 1909, compares as follows:

	1909.	1908.
Gross earnings	$121,184	$110,427
Operating and taxes	55,650	55,732
Net	$ 65,534	$ 54,695
Interest	33,786	33,389
Surplus	$ 31,747	$ 21,305

FONDA, JOHNSTOWN & GLOVERSVILLE.

The report of the Fonda, Johnstown & Gloversville (N. Y.) Railroad Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$211,396	$191,947
Total railway operating expense.	92,187	89,775
Net railway operating revenue.	$119,208	$102,172
Net revenue from outside operating, debit	4,702	2,768
Total net from operating	$114,506	$ 99,403
Taxes accrued	10,482	9,599
Operating income	$104,023	$ 89,803
Other income	4,201	4,693
Gross income	$108,225	$ 94,497
Total deductions from gross inc.	82,962	84,371
Net corporate income	$ 25,263	$ 10,125

OGDENSBURG STREET RAILWAY.

The report of the Ogdensburg (N. Y.) Street Railway Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue	$9,787	$8,821
Total railway operating expense	5,564	6,982
Net railway operating revenue	$4,222	$1,839
Taxes accrued	327	.....
Operating income	$3,895	$1,839
Total deductions from gross income	3,468	3,468
Net corporate income	$ 426	*$1,628

*Deficit.

ROCHESTER RAILWAY.

The report of the Rochester Railway Company for the quarter ended March 22, 1909, compares as follows:

	1909.	1908.
Total railway operating revenue.	$536,200	$597,216
Total railway operating expense.	338,486	404,589
Net railway operating revenue.	$197,714	$192,627
Taxes accrued	38,087	44,831
Operating income	$159,626	$147,796
Other income	816	1,034
Gross income	$160,442	$148,830
Total deductions from gross inc.	75,486	81,378
Net corporate income	$ 84,956	$ 67,452

NEW YORK TRACTION COMPANIES TO ISSUE ADDITIONAL SECURITIES.

The Up-State Public Service Commission, of New York state, has authorized the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Company to execute to the West End Trust Company, of Philadelphia, a mortgage for $2,500,000. The corporation is authorized to issue at present $500,000 five per cent thirty-year bonds, to be sold at not less than ninety. Of the proceeds, $400,000 is to be used for the discharge of the outstanding bonds of the corporation and $100,000 for the acquisition of property and extension and improvement of facilities of the corporation.

The commission has authorized Leslie Sutherland, receiver of the Yonkers Railroad Company, to issue receivers' certificates to the amount of $65,000, payable two years from date and bearing interest not to exceed six per cent, the proceeds to be used for the purpose of discharging or refunding certificates falling due on September 10.

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of July and seven months ended July 31 compares as follows:

	1909.	1908.
July gross	$ 640,094	$ 606,373
Expenses	277,571	278,138
July net	$ 362,523	$ 328,235
Charges, taxes and pfd. divs.	140,251	128,361
July surplus	$ 222,272	$ 199,874
Seven months gross	3,890,160	3,589,222
Expenses	1,900,053	1,813,728
Seven months net	$1,990,107	$1,775,494
Charges, taxes and pfd. divs.	968,009	877,788
Seven months surplus	$1,022,098	$ 897,706

The directors have presented the audited statement of account for the year ending June 30, 1909, as follows:

BALANCE SHEET, JUNE 30, 1909.

Assets.

Real estate, buildings, plant, machinery, etc., less reserves for depreciation and accrued renewals. (Appraised at $1,533,984.74)	$1,266,482.71
Stocks of raw materials, supplies, work in progress and finished product, as per physical inventories of June 30, 1909 (less reserve)	1,014,784.93
Investments in telephone companies (less reserve)	324,823.47
Notes receivable of telephone companies (less reserve)	890,546.77
Accounts receivable (less reserve)	428,395.77
Cash on hand and in banks	105,632.40
Unexpired insurance and taxes	4,227.07
	$4,034,893.12

Liabilities.

Capital stock—		
Preferred (authorized and issued)		$1,500,000.00
Common (authorized and issued)	$4,500,000.00	
Held in company's treasury	3,000,000.00	1,500,000.00
Total stock outstanding		$3,000,000.00
Mortgage on Chicago real estate, due January 1, 1911		80,000.00
Notes payable		775,000.00
Accounts payable (including accrued wages)		42,994.97
Surplus, as per annexed accounts		136,898.15
		$4,034,893.12

PROFIT AND LOSS AND SURPLUS ACCOUNT—JUNE 30, 1909.

Balance at June 30, 1908		$108,869.30
Net income for year ending June 30, 1909, after deducting expenditures for ordinary repairs and maintenance, amounting to $40,658.19	$144,688.21	
Deduct provision for depreciation and accrued renewals	61,860.82	
Net earnings for the year.	$ 82,827.39	
Less interest on loans	54,798.54	
Net profits for year ending June 30, 1909		28,028.85
Surplus at June 30, 1909, as per balance sheet		$136,898.15

Metropolitan Street-Railway's Affairs.

A new light has been thrown on the future of the proposed reorganization of the Metropolitan Street Railway by one of the members of the joint committee of the bondholders of the Metropolitan Company. The committee represents the general collateral trust five per cent first-mortgage bonds, amounting to $12,500,000, and the refunding four per cent second-mortgage bonds, amounting to $16,604,000, leaving $1,175,000 miscellaneous underlying bonds, the grand total of all being $40,854,000.

This committee has employed the services of Stone & Webster to make a physical valuation of the Metropolitan system. As a result of this appraisal they have recommended that the only alternative to total alienation is the formation of a partnership with the city and joint operation of the system as is done in Chicago. This agreement between the Chicago City Railway Company and the city of Chicago was instituted through the efforts of L. C. Krauthoff, who is counsel for the point bondholders' committee, and Attorney-General Wickersham. So far the management has proved profitable to the municipality, and the system is being brought to the highest efficiency.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Hawthorn Flaming Arc Lamp.

After several years of extensive practical use, the flaming arc, by reason of its great brilliancy and power, its high efficiency and the pleasing effect of the light given, has demonstrated that in certain fields of usefulness it is without a peer in effectiveness and economy of operation.

The tendency of representative American manufacturers to adopt the gravity feed in preference to the clock feed found in most foreign lamps, is emphasized in the strictly gravity-feed flaming arc lamp which has recently been placed on the market by the Western Electric Company.

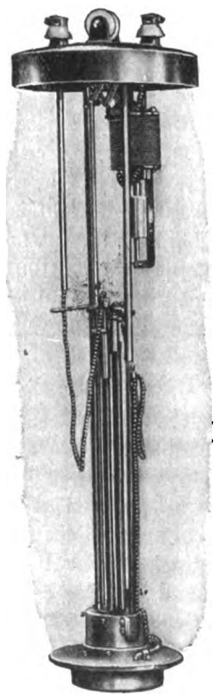
The lamp is a result of carefully conducted tests and intelligent development by competent and trained experts, and its simplicity, efficiency and general effectiveness well illustrates the skill and care exercised in the work. Beginning with more or less crude models found in certain imported lamps, and advancing largely by the process of elimination of unnecessary and undesirable parts, the lamp in its present form, both by reason of its performance and appearance, stands for all that is most advanced in the art.

The Hawthorn lamp embodies several features not found in any other American lamp, but makes use of the fundamental ideas worked out by the Deutsche Beck-Bogenlampen Gesellschaft, whose output is upward of 30,000 lamps per year, and whose lamp has been adopted as standard by the German Navy.

The new lamp maintains the carbons parallel while burning. The distance between the carbons must, therefore, remain the same, and as they are consumed there is no rise in voltage, so that shunt coils can be entirely eliminated. The lamp is simple, as may be seen from the illustration.

One carbon is provided with a longitudinal rib, which is made to rest on a metal shoe at the bottom, and in this respect is similar to the German lamp above mentioned. The other is round and is suspended from the arm attached to the ribbed carbon holder. The shoe is made a live part and is connected in parallel with the ribbed carbon. As current is fed to the shoe it generates heat, and this, plus the heat from the arc, disintegrates the rib, always keeping the carbon points below the copper shoe. This prevents the arc disintegrating or burning the metal support, which is a vital point in the successful operation of a gravity feed lamp.

The Hawthorn lamp can be supplied for either alternating-current or direct-current circuits, and for any frequency. When four or more lamps are used in series an automatic cut-out and substitutional resistance is supplied in each lamp so that one or more lamps of the series may cut without affecting the operation of the rest.



MECHANICAL CONSTRUCTION OF HAWTHORN FLAMING ARC LAMP.

It is especially well developed for illuminating main thoroughfares and business blocks, and can readily be adapted to the wiring system in use, whether multiple or series.

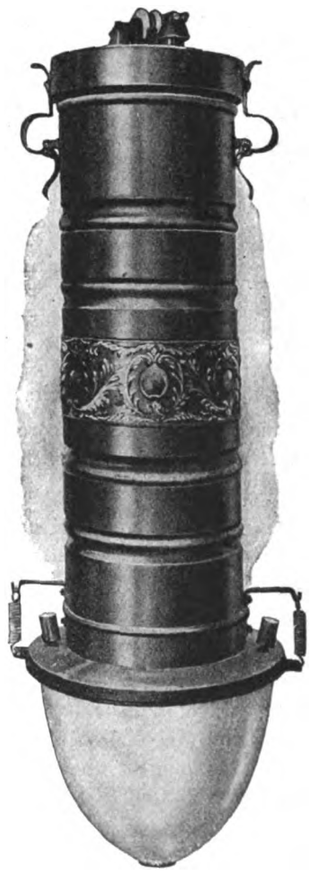
The following comparison of the relative cost of gas arcs, ordinary enclosed arcs and the Hawthorn flaming arc is given, based on practically the same cost per kilowatt-hour for the energy required and counting in all supplies and attendance necessary for the maintenance of the different lamps is given by the makers:

Gas arcs, 250 candlepower, four cents per hour.

Ordinary arcs, 600 candlepower, five-and-one-half cents per hour.

Hawthorn flaming arcs, 3,000 candlepower, five-and-one-half cents per hour.

Recently the German originators of the gravity feed lamps have simplified and improved their lamps by feeding the current into the carbon through the copper shoe in a very similar manner to the Hawthorn arrangement. This new type of gravity feed lamp has been very successful, being used to a large extent by the German government and by numerous municipalities for street lighting, as well as by all kinds of commercial enterprises, including railroads, factories, etc.



EXTERIOR VIEW, HAWTHORN FLAMING ARC LAMP.

Electric Tunnel System Extended.

Great Northern officials announce plans to extend the electric system so as to run trains from Wenatchee on the east side of the Cascades to Gold Bar on the west.

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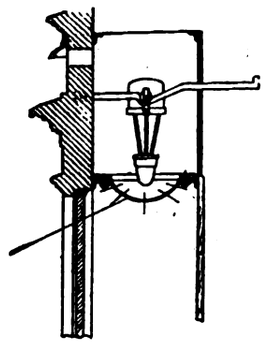
Brilliant Store-Front Illumination.

A modern business street is distinguished by its brilliant illumination. Merchants are realizing more and more the strong attractive power which plentiful illumination exerts, and therefore are giving careful attention to their light equipments.

An illustration of progressive light equipment is shown herewith by a photo-



ILLUMINATION OF STORE WINDOW IN MILWAUKEE.

graph of the new store owned by G. M. Barrett & Company, Milwaukee, Wis., which was opened for business recently.

The white tile front, which is fifty feet wide, is illuminated with two "Aurola" flaming arc lamps, using carbons giving white light. They light up the section of the street adjacent to the store, and because of their great power and brilliancy, are noticed from four to five blocks away, and consequently draw the people in crowds to the store.

ILLUMINATION OF STORE FRONT IN MILWAUKEE.

The show-window lighting is done in a very novel way, the principle of which is shown by the accompanying diagram. The Holophane hemisphere diffuses the strong pure white stream of light of the "Trucolor" arc lamp, which is suspended above it.

The noteworthy features of the construction and arrangement of these lamps is that the different colors of fabrics are distinguished so correctly that there is no doubt as to their shades. Besides this, the people are not confused by glaring light.

These arc lamps were supplied by the Chas. L. Kiewert Company, 39 Cortlandt Street, New York, and 114-116 Huron Street, Milwaukee, Wis.

Aurola Flaming Arc Lamps for Alternating Current Equipped with Rapid Striker.

The alternating-current arc is more sensitive to voltage fluctuations and strong draft or small inhomogeneity of the carbon than the direct-current arc lamp. The induction-motor feeding mechanism is very satisfactory in regard to gradual and exact regulation. Should, however, the arc extinguish, it takes nearly a half minute to strike the arc anew and put it in normal condition.

The device shown in Fig. 1 is a material improvement in alternating-current arc-lamp design. It is called the "Rapid Striker" and operates as follows:

An iron core moving inside of the coil sinks down by its own weight in case the lamp is not switched on or the arc not yet established. By this downward sliding of the core, the plate which guides one of the carbons is moved in such a direction that it brings the two carbons nearly together. As soon as the lamp is put in circuit, a few revolutions of the aluminum disk are sufficient to make the carbons touch, thus striking the arc. As soon as this happens, the coil operating the rapid striker is energized, attracts the core upward and causes the guide plate to separate the carbons. A few revolutions of the motor will then establish the proper arc length.

It is clear that the operations described follow one another very rapidly, and are instrumental in starting the lamp with a minimum of current. Should the arc be interrupted for any reason, the rapid striker will immediately establish it again. In Fig. 2 is shown a photograph of the Aurola type Rw 17 flaming arc lamp with the rapid-striker attachment, marketed by Chas. L. Kiewert Company, 39 Cortlandt Street, New York, and 114-116 Huron Street, Milwaukee, Wis.

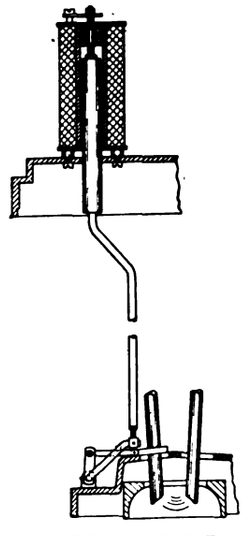


FIG. 1.—"RAPID STRIKER."

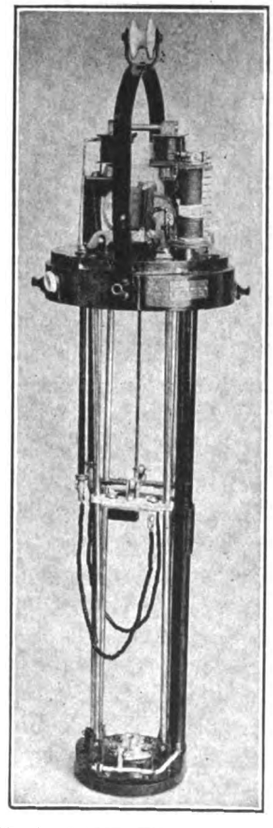


FIG. 2.—LAMP WITH "RAPID STRIKER" ATTACHMENT.

Lamps with this attachment are operating successfully on twenty-five-cycle circuits, so that Aurola lamps are available for this now much-used frequency.

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Newest Types of Excello Flaming Arc Lamps.

The Excello Arc Lamp Company, of New York, N. Y., is placing on the market new models of flaming arc lamps which are distinguished by the addition of an inner enclosing globe. All of the new Excello flaming arc lamps will be equipped with this new inner globe, which offers many advantages over its predecessor, among which may be named the elimination of the deposit of ash on the outer globe; the improved ventilation of the arc, thereby facilitating the removal of ash by increased draft; and the ease with which the ash deposited in the inner globe may be removed, owing to the small surface to be cleaned.

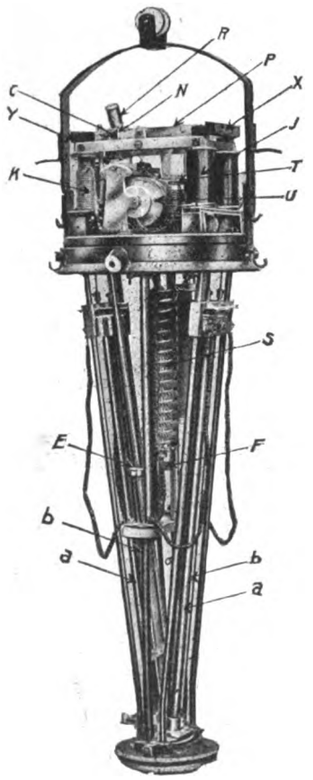

FIG. 1.—VIEW OF MECHANISM OF DUPLEX FLAMING ARC LAMP.

Another new type of lamp that this company is marketing is the Duplex flaming arc lamp. This lamp is a logical development of its standard type of lamp, especially adapted to meeting the commercial requirements which emphasize the desirability of longer trimming interval and lower carbon costs than are possible with the latter type.

Longer burning periods per trim are obtained in this lamp, in which it is desirable to trim only at those periods when the lamp extinguishes itself by the complete consumption of the carbons. To accomplish this it is necessary that more than one pair of carbons be placed in the lamp at each trimming, and that suitable means be provided to insure the consumption of both pairs automatically.

Another result which has been obtained in this lamp is the avoidance of waste of carbons which is incurred whenever the standard lamp is trimmed at other periods than those due to the burning out of the carbons.

To accomplish this, necessitates the feeding of the carbons in such a manner that one pair shall be completely consumed before the other is brought into service, and that it be convenient to remove the stub of the completely burned pair, and substitute a fresh pair, without affecting in any way the adjustment of the operating pair. It is necessary that the mechanism should automatically transfer the arc from the burned-out carbons to the incoming pair, and disconnect the operating mechanism of the former from the feeding and regulating mechanism, in order that they may be replaced by a new pair which shall be cut into service as soon as the burning pair is consumed.

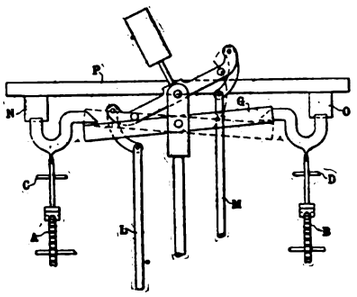

FIG. 2.—SECTION OF ESCAPEMENT AND DETENT MECHANISM.

The Duplex flaming arc lamp has been designed so as to obtain both of the results already mentioned in a satisfactory manner.

Figs. 1 and 2 illustrate the mechanical features upon which the operation of the lamp depends, Fig. 2 being a simplified representation of the escapement and detent mechanism shown by a cross-section through the walking beam P (Fig. 1), parallel to its turning axis, and viewed from the shunt magnet end.

Subway Transformers.

The transformer on top of a pole or buried under the ground, renders the same service as a generator in direct-current transmission and makes possible the distribution of energy by alternating current for commercial purposes, and therefore should be given the same amount of attention in the selection of central-station equipment as boilers, engines, generators, etc.

Many cities have abandoned pole-line construction and now require all electrical conductors to be placed underground. This necessitates the installation of transformers in manholes below the street level with an opening to the street, covered with a cast-iron cover.

In the accompanying illustration is shown a subway transformer manufactured by the Moloney Electric Company, St. Louis, Mo., which is designed to meet the exacting conditions of the underground system. It is of water-tight construction and is not affected by the damp air or surface water, which often leaks into the conduit. The size and proportions of this transformer are adapted to the limited space of the manholes and the efficiency is high, as this class of transformer is usually connected to the mains and operates twenty-four hours per day. The design also provides for operation with low temperature rise as the heat radiation is very low in a closed manhole.

GENERAL VIEW OF MOLONEY SUBWAY TYPE TRANSFORMER.

Most of the details of construction of this transformer are similar to those of the well-known Moloney type H E transformers.

They are manufactured for standard voltages in sizes which range from five to fifty kilowatts.

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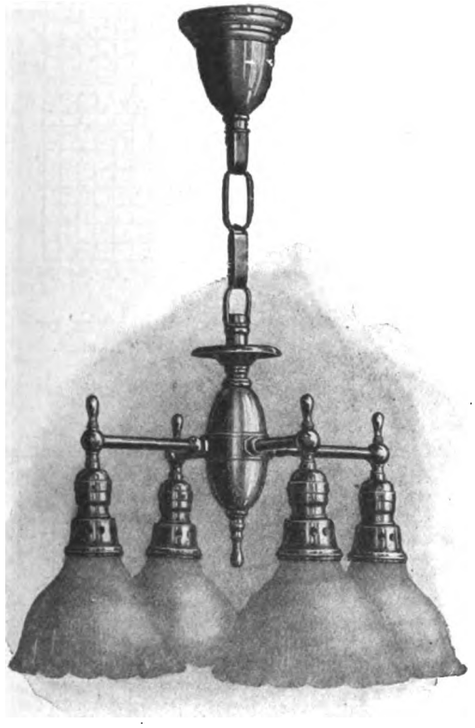
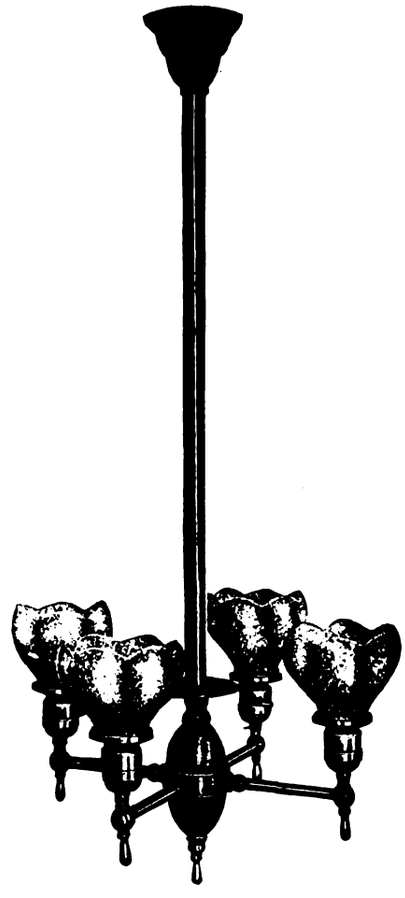
Wakefield Brass Company Fixtures.

The accompanying illustrations show two styles of electric lamp fixtures being placed on the market by the F. W. Wakefield Brass Company, Vermilion, Ohio.

These fixtures are made with from two to four arms and will hold from one to five lamps, as desired.

The fixture arranged for the lamps in the downward position is twenty-four inches in length and has a spread of twelve inches. The other one shown is thirty-six inches long and has a spread of eleven inches.





TWO TYPES OF WAKEFIELD BRASS COMPANY'S FIXTURES.

In addition to the ones shown, this company manufactures several lines of both elaborate and inexpensive fixtures adaptable for various purposes. The glassware can be furnished to suit any type of incandescent lamp.

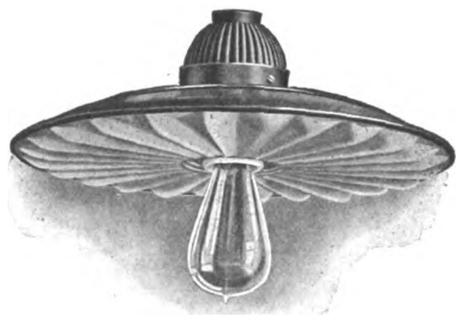
Wheeler Fluted Street Reflectors.

The Wheeler Reflector Company has specialized on lighting reflectors for nearly thirty years, and has, moreover, the only enameling plant in the United States whose product is devoted exclusively to porcelain enameled reflecting surfaces.

With this experience it is readily understood how the Wheeler fluted street reflector has achieved such distinction as it has from prominent authorities in street illumination, insuring not only a wide light distribution but a low absorption factor and light below the horizontal with a tungsten series lamp at an efficiency claimed to be 1.1 watts per candlepower.

The importance of this can be realized best from a comparison of the following:

The mean spherical candlepower of a bare tungsten series lamp is forty-eight. Now, the purpose of any reflector is to divert as much light as possible to a useful direction which in street lighting can only be below the horizontal. Photometric measurements of this lamp under a standard fourteen-inch convex deflector and under a Wheeler fluted reflector are, respectively:

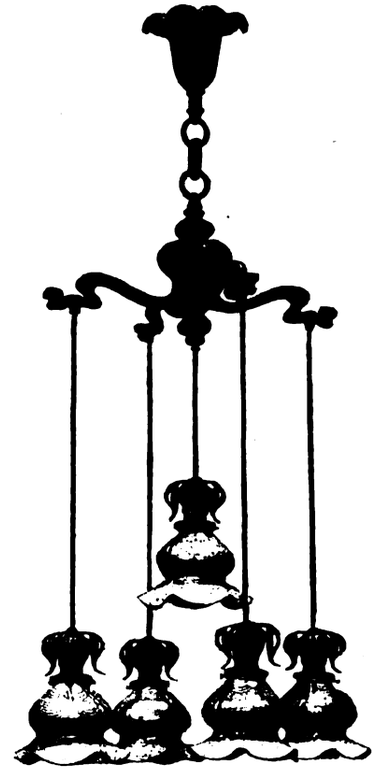


WHEELER FLUTED STREET REFLECTOR.

Fourteen-inch convex reflector, 56.0 mean lower hemispherical candlepower.

Wheeler fluted reflector, 68.7 mean lower hemispherical candlepower, or an increase in useful light with the Wheeler reflector of twenty-three per cent over that with any fourteen-inch convex reflector, either plain or fluted.

The Wheeler Reflector Company, of Boston, Mass., makes also a large variety of lighting fixtures for various purposes that embody applications of the Wheeler reflectors.



TYPE OF BEARDSLEE CHANDELIER.

New Type of Beardslee Chandeliers.

That an effort is being made to digress from the conventional dome-type of fixture for use in dining rooms, libraries, halls, etc., is shown by the number of electric-lighting fixtures manufactured to suspend from the ceiling by ornamental chains or bars.

The Beardslee Chandelier Manufacturing Company, of Chicago, Ill., is placing on the market some very artistic fixtures of this type, an example of which is shown in the accompanying illustration. Husks, of floral design, completely hide the sockets in this fixture, which tends to improve the general appearance.

The metal work, trimmings and glassware can be finished in any color to harmonize with the decorations in the rooms where they are to be used.

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Some Interesting Features About Tungsten Lamps.

The following are some interesting facts about tungsten lamps, in comparison with other types of incandescents.

The table below gives the lengths and diameters and filament surface of the various lamps:

TABLE I.

Filament.	Length in Inches.	Diameter.	Projected Areas Square Inches.	C. P. per Sq. In. of Projected Area.
Carbon 25 c. p.....	9.4	.0060	.0564	443
Metallized 20 c. p..	9.5	.0037	.03515	570
Tantalum 20 c. p...	23.4	.0018	.04212	474
Tungsten 80 c. p...	28	.0029	.0812	985

The resistance characteristics of metal filaments, such as tungsten, are the reverse of those of carbon. Fig. 1 shows the curves of resistance and the manner in which this changes with increasing temperature (or voltage) in the different types of filaments.

As a result of this characteristic, there is a very interesting difference in current flow in the different lamps at the moment the current is turned on. This is shown in Fig. 2, which is a reproduction of the oscillograms of the initial current of carbon, Gem and tantalum lamps, as given by Amrine, of the University of Illinois. The curve for tungsten is very similar to that of tantalum.

Table II shows the changes in candlepower and efficiency due to change in voltage on the carbon, tantalum and tungsten lamps, and these results are also given in Fig. 3.

The relative life and candlepower performance of the different lamps, that is,

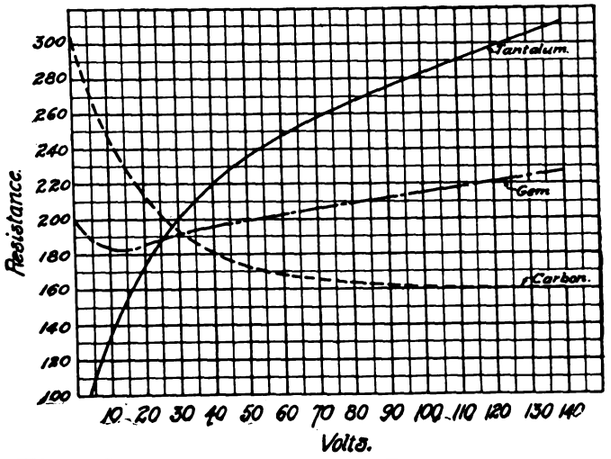

FIG. 1.—CHANGE OF RESISTANCE WITH VARIATION OF VOLTAGE OF TANTALUM, GEM AND CARBON LAMPS.

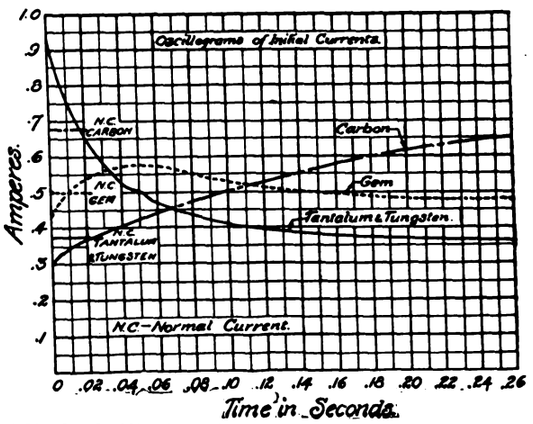

FIG. 2.—OSCILLOGRAMS OF INITIAL CURRENTS OF CARBON, GEM AND METAL-FILAMENT LAMPS.

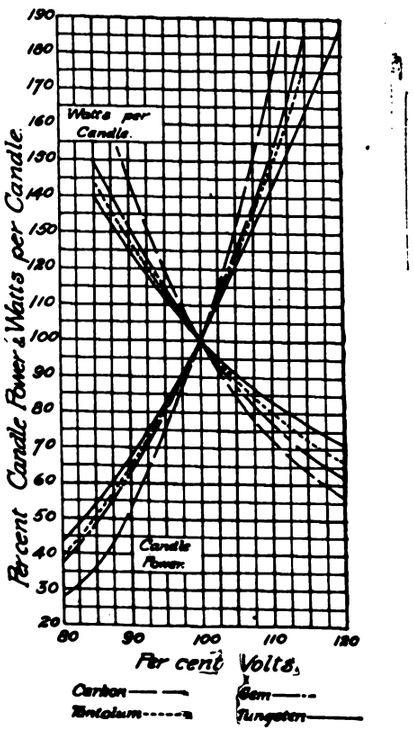

FIG. 3.—VARIATION OF CANDLEPOWER AND WATTS PER CANDLE FOR VARIOUS LAMPS WITH VARIATION OF VOLTAGE.

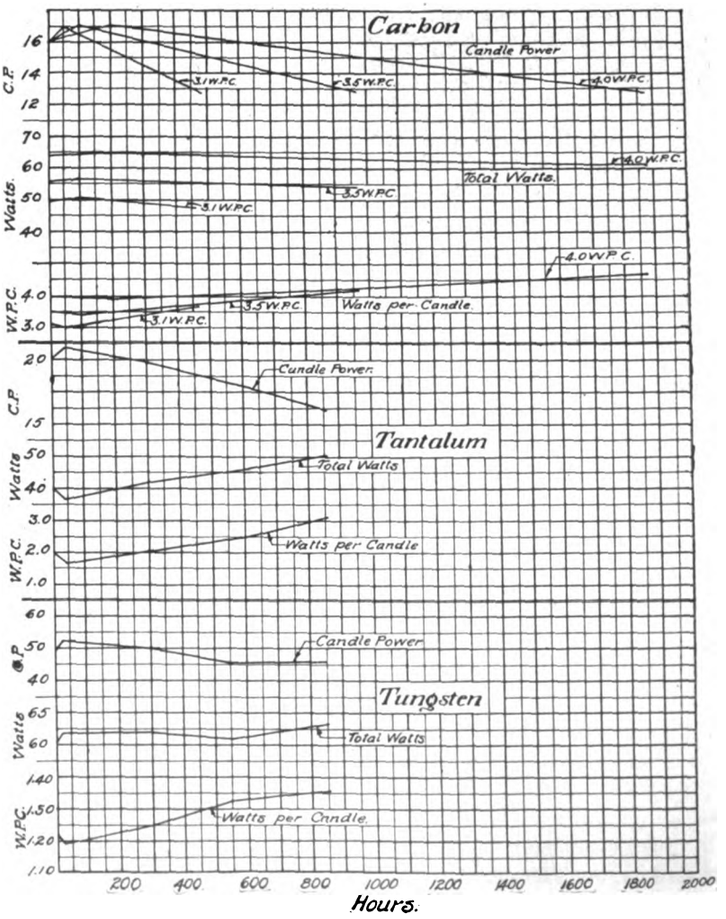

FIG. 4.—VARIATION OF CANDLEPOWER, TOTAL WATTS AND WATTS PER CANDLE DURING LIFE FOR CARBON, TANTALUM AND TUNGSTEN LAMPS.

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the change in candlepower during life and also the change in total watts and efficiency (watts per candlepower) are given in Fig. 4. These curves show the remarkably long life obtained with tungsten lamps, exceeding all but that of the low-efficiency types of carbon lamps.

As is well known, the absolute efficiency of the ordinary lamp as a producer of light is very low; but this is also true of all other forms of artificial light. Excepting the arc light, the ordinary carbon incandescent lamp had a better efficiency than other lamps, averaging about 3.5 per cent of light-giving efficiency. This means that 96.5 per cent of the energy is wasted in heat and non-luminous vibrations, and only 3.5 per cent given out as light or luminous vibrations.

TABLE II.

Change of Candlepower and Efficiency Due to Change of Voltage, for Carbon, Gem, Tantalum and Tungsten Lamps.

		Carbon.		Gem.	
	Per Cent	Per Cent		Per Cent	
	Volts.	C.P.	W.P.C.	C.P.	W.C.P.
Under voltage..	80	28		36	
	85	36		47.3	
	90	52.3	145	62	131.8
	92.5	62.6	132	70.2	123.7
	95	76	120	79.6	115.5
	97.5	87.1	109.6	89.1	107.5
	100	100	100	100	100
Over voltage...	102.5	115	91.8	112	93.5
	105	130.5	84.3	124.1	87.5
	107.5	149	77.2	138	82.3
	110	169.2	71.5	152.7	77.3
	115		63	185.5	68.2
	120		56.4		61.6

		Tantalum.		Tungsten.	
		Per Cent		Per Cent	
		C. P.	W.P.C.	C.P.	W.P.C.
Under voltage..	80	39		43	
	85	49.3	144.5	53.1	140.3
	90	64	128	67	126
	92.5	72	120.5	75	118.9
	95	80.7	113.4	82.9	112
	97.5	89.7	107	91.2	106.5
	100	100	100	100	100
Over voltage...	102.5	111.3	94	110	95.4
	105	122.8	89.2	120	91.7
	107.5	135	84.6	130.4	86.8
	110	148	80.1	141.6	82.9
	115	177.7	74.3	164	76.2
	120		66	188	71

This absolute efficiency has been increased in the case of the new tungsten lamp to about eight per cent. This is quite a material gain, considering the efficiency of the lamp as placed at the peak of a pyramid, the base of which represents the original source of energy—the coal pile. As an illustration of this Fig. 5 has been prepared by a lamp expert and shows, in a relative way, the loss from the coal pile to the lamp and the material reduction in the base of the pyramid, that is, the reduced amount of coal required for a given amount of light from the tungsten lamp, as compared with the ordinary carbon lamp.

Tungsten series lamps have been a marked success and are widely used. Practically ninety per cent of the series incandescent street lamps now being supplied are of the tungsten type, and it is expected that the manufacture of all other types of series incandescent lamps, such as the carbon and Gem, will be discontinued, and such lamps rendered obsolete.

The breakage record of tungsten lamps has shown a materially improved result, and at present compares very favorably with the carbon lamps, not exceeding one to one-and-one-half per cent. A large part of the tungsten shipments are made by freight, and it has been found that the lamps carry better in many cases this way than by express. In ordinary cases this would be the preferred method of shipment for tungsten lamps.

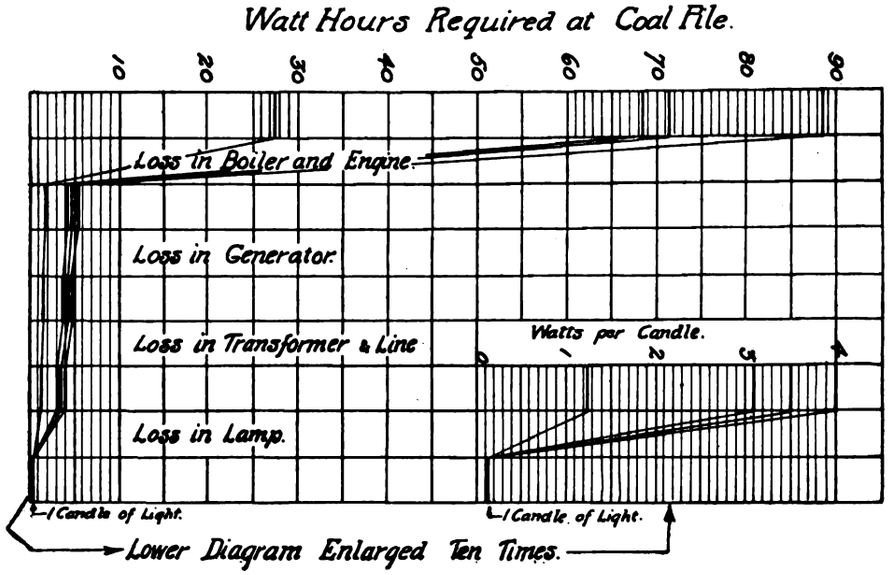

FIG. 5.—DIAGRAM OF RELATIVE LOSSES BETWEEN COAL PILE AND LAMP. GIVES THE ENERGY AT COAL PILE REQUISITE FOR ONE CANDLE OF LIGHT FROM LAMP AND SHOWS THE LARGE SAVING EFFECTED BY TUNGSTEN LAMPS OVER CARBON.

TABLE III.

Tungsten Lamp Breakage Record of a Leading Eastern Central Station Company.

Size of Lamp.....100-Watt			60-Watt		40-Watt		25-Watt		Total	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Lamps used.....	14691		9888		11392		24218		59106	
Breakage	595	4	507	5.1	941	8.3	426	1.8	2469	4.2
Early burnout.....	390	2.6	111	1.1	242	2.1	416	1.7	1159	2
Total breakage.....	985	6.6	618	6.2	1183	10.4	842	3.5	3628	6.2

handling, and in service in central stations and by consumers, has also been greatly reduced as the result of greater care. Table III gives some interesting information obtained from one of the large eastern illuminating companies, showing that the total breakage, including shipping, handling and early burnouts, amounts to about six per cent.

The tungsten lamp is also creating a revolution in the field of small lamps for battery service, for flashlights, automobile lights, etc.

Canada Has New Rubber and Insulation Plant.

The development of the manufacturing industries of Canada is going on apace. The latest announcement in this line is the incorporation of the Walpole Rubber Company, Limited, with a capital of $250,000.

The factory of the company at Granby, Quebec, is nearing completion. The main building is 120 by sixty feet and will have a basement and four stories. In addition there is being constructed a paint factory thirty by forty feet and a boiler and engine house twenty by thirty feet.

The general sales offices are in the Eastern Township Bank Building, in Montreal. The officers and directors of this new company are for the most part officers and directors of the Massachusetts Chemical Company, operating the Walpole Rubber Works, the Walpole Varnish Works, and the Walpole Shoe Supply Works at Walpole, Mass.

The Walpole Rubber Company, Limited, of Canada, will operate upon similar lines to the parent company, producing all kinds of rubber splicing, insulating and friction tapes and miscellaneous rubber sundries, together with the well-known varnishes and insulating compounds, such as Armalac, Insulac, etc.

The remarkable growth of the business of the Massachusetts Chemical Company, and the ever-increasing demand from all parts of Canada for the products named, necessitated the establishment of a manufacturing equipment in the Dominion to properly care for and encourage it. This the Granby plant is designed to do.

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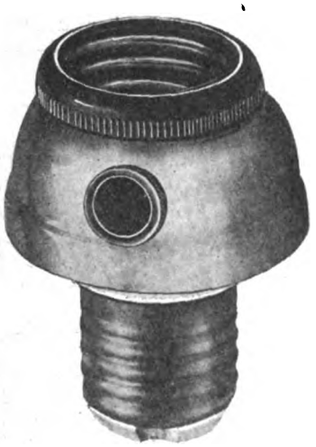
Dale Lighting Specialties.

The accompanying illustrations show several specialties which have been placed on the market by the Dale Company, Ninth Avenue and Thirteenth Street, New York city, especially adapted for use in the lighting field.

The Dale detachable wireless cluster is a recent product which, by reason of its



DALE CURRENT TAP.

practical labor-saving features, has established for itself a growing demand.

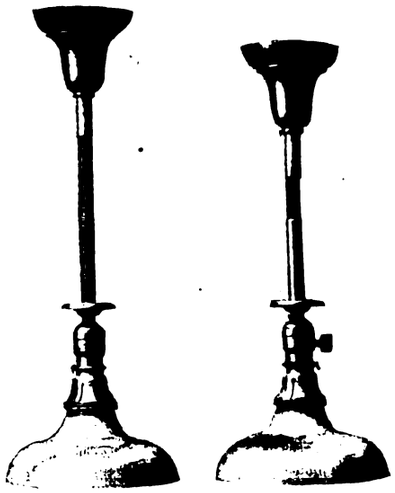
The cluster is made in two parts, the detachable base and the cluster body. A simple pull detaches and a push and twist securely locks it. It cannot unscrew from the stem and has all porcelain insulation. The body of cluster and shade may be quickly removed without disturbing the wire connections. A great advantage of the detachable cluster is that the bases may be wired and installed, and when mechanics are out of the building the bodies, shades and lamps may be quickly attached.

TUNGSTEN LAMP HOLDER.

The Dale spring tungsten pendant is a new arrangement for taking up vibration, insuring long lamp life.

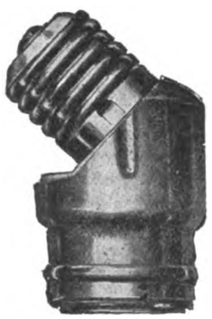
The new Dale canopy insulator thoroughly insulates the canopy from the stem, and does away with the riveting of the fiber to the canopy. It eliminates insulating rings, canopy collars and set screws. The clean-cut, artistic appearance of the fixture is preserved, as the insulation is practically invisible and the general appearance of the fixture is improved. The insulator is securely fastened to the stem by means of a screw-locking collar with tapering thread.

The Dale current tap is a brass-covered current tap made in both multiple and series. It allows two lights to be taken from one socket, and is especially valuable in connection with fan motors, portables, curling-irons, sadirons, etc., allowing these devices to be used and still have the use of the lamp.



DALE SPRING TUNGSTEN PENDANT.

The Dale tungsten adapter is a simple practical device with no moving or hinged parts, insuring stability and avoiding any repairs. Simply screwing the adapter into any standard socket, where at an angle, allows the lamp to point directly downward, making it unnecessary to reconstruct or rewire the fixture.



DALE TUNGSTEN ADAPTER.

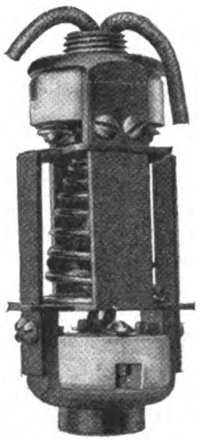
The new Dale tungsten holder is in one piece, two-and-one-fourth inches high. There are no screws, and it can be quickly and firmly attached to both socket and shade.

The company also makes a number of other lighting specialties.

The "Tungsten Life-Saver."

The American Arc Lamp Company, Kalamazoo, Mich., is marketing a new device, named the "Tungsten Life-Saver," for preventing injurious shocks from vibration to the delicate filament of tungsten lamps.

It is composed of a sensitive, helically-coiled spring, arranged between the inner ends of oppositely-disposed stirrup-like hangers. This admits of a free lateral or oscillating motion in a limited area.



TUNGSTEN LIFE-SAVER.

The device, shown herewith, may be used with any standard fixture or cluster, and when installed in stores or offices it may be entirely covered by a ceiling canopy. It is attached to the ceiling by using an ordinary crow-foot. When installed in a steel building an insulating joint is used. The tungsten "life-savers" are made in four different sizes, supporting fixtures weighing from four to fifteen pounds.

This company has also placed on the market an inexpensive, four-light tungsten shop cluster, made entirely of steel and of very few parts. It is equipped with an eighteen-inch steel porcelain-enameled shade and a light-distributing cone which extends down from the center of the receptacle plate to a point about midway of the lamps. This serves to deflect the light downward and outward into the light zone most needed, and also prevents the light of one lamp from being absorbed by the others.

The Lepel System in Jamaica.

A wireless station using a 190-foot mast and having a radius of 300 miles is being installed by the Lepel Wireless Telegraph Company in Kingston, Jamaica. There are certain difficulties in the way, it is said, which may cause the station to be removed ultimately to Bowden.

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THE ILLUMINATION OF MILLS AND FACTORIES WITH SMALL UNITS.

BY E. B. ROWE AND FRANK B. RAE, JR.

To anyone who investigates industrial lighting, the most striking aspect of the subject is the indifference of hard-headed factory managers to the practical advantages of correct lighting methods. Even in plants where cost accountants and production engineers are employed to lop off every penny of useless expense and devise short-cut methods for expediting work, the economics of scientific artificial illumination are still virtually unknown. Careful analysis of conditions in a number of mills and shops shows that the average increase in efficiency (as measured by the output of machines and men and disregarding the item of spoilage which is considerably less where good illumination prevails) is between one and three per cent. This means, briefly, that a plant having a pay-roll of $1,000 per week will effect a saving of from $500 to $1,500 annually, measured either in less wages or increased output. That an item of such magnitude should escape the attention of any manufacturer seems incomprehensible, yet the blame probably can be traced to the makers of lamps and lighting equipment who so far have dealt in industrial plant *lighting* rather than industrial plant *illumination*. The distinction is not one of terms but of methods. So long as mill and factory managers are importuned to buy light they will hesitate, because in their minds light is an expense. But when they are educated to understand the economic value of good illumination as a source of increased production, the standard of industrial plant lighting will at once be raised.

That the standard must rise, and speedily, is inevitable. If factory owners will not see the practical advantages of better methods, the workmen and those who busy themselves with the workmen's welfare will. The subject has been agitated abroad with astonishing results; notably in Holland, where an imperial edict setting forth certain definite minimum intensities for various industrial requirements was issued so long ago as 1897. In France, Belgium, Austria, Switzerland and Australia the matter has had the attention of the state, and regulations covering illumination as well as heating and ventilation, are rigidly enforced. While the subject has received little official recognition in this country, there are several striking incidents to show the workmen's attitude. In a Pennsylvania textile mill tungsten lamps were introduced into one department to test their color value, and were later removed; immediately the management was approached by a committee of employes, who said that the men would buy their own tungsten lamps rather than continue to work under a lamp giving a nearly monochromatic light which proved extremely annoying. Again, in a southern city, one mill was persuaded to install tungsten lamps. Within a week this mill was overrun with applications for employment by the best operatives in the district. The other mills in that locality were compelled to install tungsten lamps to keep their hands. Nor is the lamp alone of importance. A New Jersey factory made an experimental installation of reflectors over the individual lights supplied to each machine. The experiments were presumably not satisfactory to the owners and the reflectors were removed, yet when they were taken away, each workman substituted a paper bag over the lamp to protect his eyes, and within a fortnight the factory management found itself supplying current to hundreds of thirty-two-candlepower lamps in the paper bags which the men substituted for bare sixteen-candlepower lamps.

The problems of industrial illumination and industrial power are very closely analogous, general illumination, group lighting and individual lighting being comparable to shaft drive, group drive and individual motor drive. It is quite useless and foolish to advocate one system for all conditions, either in light or power, and the man with a hobby defeats himself by endeavoring to make conditions conform to a system instead

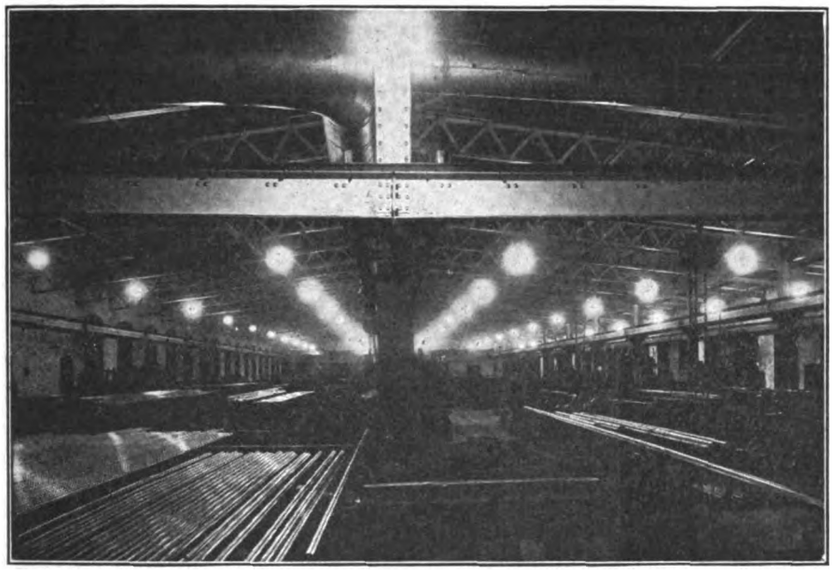

FIG. 1.—STEEL MILL LIGHTED BY 250-WATT TUNGSTEN LAMPS AND HOLOPHANE GLASS REFLECTORS.

FIG. 2.—KNITTING MACHINES, CONDITIONS TO BE MET IN GROUP LIGHTING.

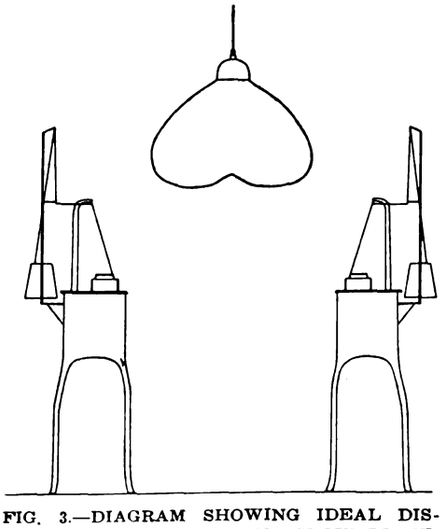

FIG. 3.—DIAGRAM SHOWING IDEAL DISTRIBUTION OF LIGHT FOR GROUP LIGHTING. (SEE FIG. 2).

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of flexibly applying one or several systems to conditions as they are found. Speaking broadly, the small-unit group or individual system is preferable to the large-unit general illumination scheme, just as small motors near or at the machines are preferable to large motors and much line shaft. The problem is always one of proportions; to determine how much of each system will best serve the requirements.

Some general illumination is necessary in all industrial lighting, but in many cases a low general illumination satisfies all needs. This applies to those classes of manufacturing where general oversight of a machine or working floor must be maintained, yet where the actual mechanical operations require individual lights. Where the work does not demand close application, general illumination of moderate or high intensity serves all purposes. This latter can be supplied by almost any type of lamp, color value and efficiency being the ruling considerations. For a low general illumination, small incandescents with proper reflectors, either of glass or metal, are the only available equipment if we are to secure satisfactory uniformity; for the higher intensity, the incandescents still remain, since they are available in units of high candlepower. The advisability of using tungsten lamps is often questioned where the building is subject to any considerable vibration. However, there are a number of coiled-spring devices on the market that overcome to a large extent the breakage due to vibration, and similar devices to meet local conditions can easily be worked up by any competent plant engineer or electrician.

A unique example of tungsten lighting under conditions of excessive vibration is a steel mill illustrated in Fig. 1. In this case, we have a space 260 by 84 feet illuminated by five rows each of eleven 250-watt tungsten lamps equipped with Holophane extensive-type glass reflectors hung twelve feet six inches high and giving an even illumination of approximately two-and-one-half-foot candles at the plane thirty inches from the floor. The vibration in this case was taken care of by the use of flexible metallic cordage, the weight of lamp and reflector being just sufficient to take the kink out of the cordage while leaving sufficient spring to absorb all shock of vibration. It will be seen from this case, that the vibration can readily be taken care of, the only real obstacle to tungsten units for general illumination, where local conditions make their use advisable, being the selection of reflectors which will properly distribute the light.

This is equally true of that class of illumination which might be termed group lighting. In textile mills especially, group lighting has many decided advantages when the lamps are equipped with properly designed reflectors. Such machines as winders, spinners, twisters and spoolers are usually placed back to back with an aisle for the operatives between each double row, and these operatives are called upon to attend from two to twenty machines. These conditions (Fig. 2) call for a system of lighting which will give uniform and adequate illumination on both sides of the aisle extending over a plane having a width equal to the thread travel between rolls and spindles, or spindles and bobbins, and a length equal to that of the machine. In the past these conditions have been met with indifferent success by the installation of a system of general illumination, which is wasteful because high intensity is required upon the working plane, or by individual carbon lamps either glaringly bare or with flat tin reflectors giving practically no re-direction of the light to the useful plane or with tin cone reflectors having an equally inefficient concentrating distribution. The ideal method, however, is group lighting with forty, or sixty, or even 100-watt tungsten lamps equipped with metal reflectors giving a bowl-type or extensive-type distribution (Fig. 3).

The lighting of warping machines and looms having no overhead harness, though quite different problems from those just cited, falls naturally under the heading of group lighting. Fig. 4 shows graphically the difference between old methods and new. The warper to the right is supplied with two thirty-two-candlepower carbon lamps equipped with flat tin reflectors; that on the left has two forty-watt tungsten lamps in Holophane-D'Olier steel reflectors. In such a case, the benefit gained by protecting the operatives' eyes from the glare of the bare lamp is of almost as great practical advantage as the sixty per cent saving in current or the 100 per cent increase in useful illumination, for every mistake, whether caused by eye strain or inadequate illumination, means serious loss to both operative and mill.

While both general illumination and group lighting take care of most mill and factory requirements, there are in every industry certain operations which

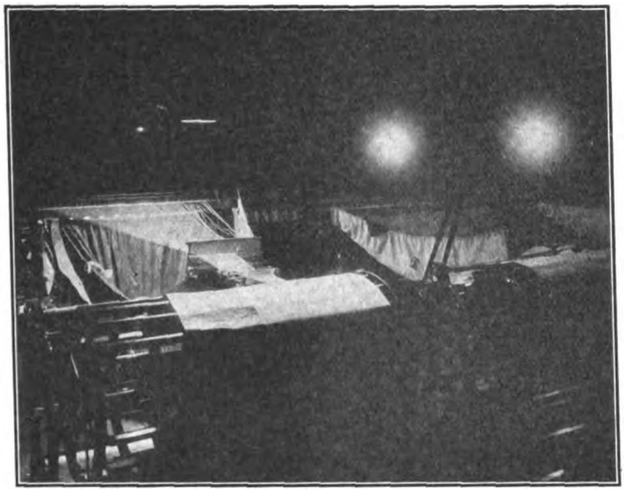

FIG. 4.—TWO FORTY-WATT TUNGSTEN LAMPS IN PROPER REFLECTORS COMPARED WITH TWO THIRTY-TWO-CANDLEPOWER CARBON LAMPS IN OLD-STYLE FLAT SHADES.

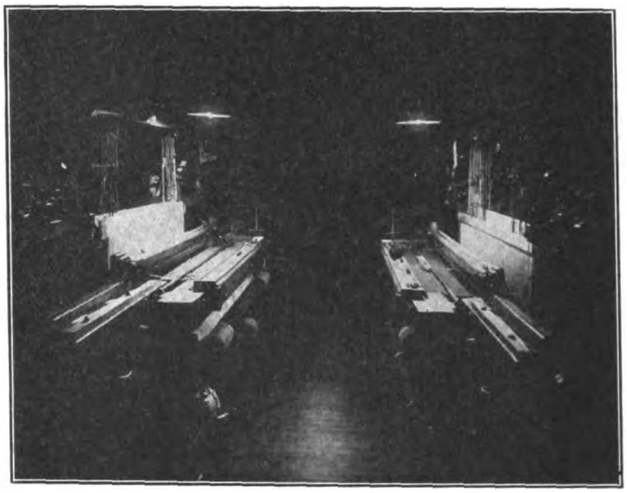

FIG. 5.—HOW THE REQUIREMENTS OF LOOM LIGHTING ARE MET BY ONE SMALL LAMP PROPERLY EQUIPPED.

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demand a strong light upon a comparatively small surface. Such lighting is classed as individual lighting. Loom lighting is, in reality, in this class, though the conditions call for peculiar treatment as will be seen in the illustration (Fig. 5). Weave hands attend from two to twenty looms, the latter capacity, however, being attainable only with the modern looms having various automatic devices. Should a warp thread break on one of the older style looms and, because of poor illumination, the weaver fail to notice it immediately, there would result the formation of a "float" or "overshot." When the break is finally noticed, a "pickout" is necessary; the temples must be pulled back, all the filling threads that have been laid since the

FIG. 6.—SOCKET EQUIPPED WITH SIXTEEN CANDLEPOWER BARE LAMP.

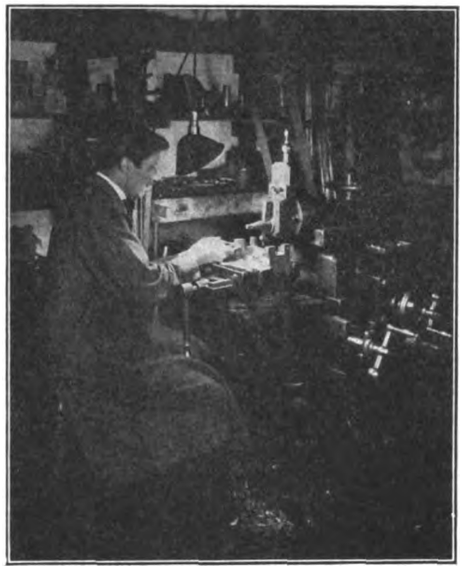


FIG. 7.—SAME SOCKET WITH TEN-CANDLEPOWER LAMP AND PROPER REFLECTOR.

tangle commenced must be removed by a tedious combing operation, the warp beam must be turned back, and the tension of the cloth properly adjusted before the loom can again be set in operation. Meanwhile, the weaver has been forced perhaps to stop all looms under his charge, otherwise, warp threads might break on other machines, thereby causing an accumulation of stoppages. It will be seen how essential good lighting is in reducing to a minimum these occurrences and the time required for the removal of defects. Adequate and proper illumination is a further necessity in the textile industry in order that each operation may be at the same time an inspection, reducing thereby the number of pieces thrown out or classed as seconds in the final inspection.

Machine shops give the most common examples of individual lighting as this term is generally understood. Drills, lathes, shapers, grinding and polishing wheels, as well as most bench work, require not only good light, but light from the right direction.

The question of the direction of the light is of prime importance, but unfortunately is often lost sight of. The ordinary makeshift method is to provide each machine with a lamp and perhaps a flat or cone reflector. This equipment the operative ties to the machine with a string, getting the proper direction by hanging it at an angle or by cutting away one side of the cone. The more economical method—both from the standpoint of the workman's output and the current consumption of lamps—is to provide rigid or flexible arms or drop lights with angle-set reflectors so that the light shall be secured with the least delay at exactly the point it is wanted. If this is done smaller lamps may be used. In choosing reflectors, those in which the lamps set well up into the reflectors generally give the greater efficiency, while those having a roughened or matt surface avoid objectionable streaks or striations which are so wearing upon the operative's eyes.

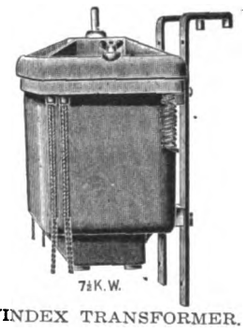
The "before and after" pictures here published are ample evidence of the importance of proper equipment for individual lights. In the one case we have as much light going into the workman's eye as is thrown upon the work; in the other, a lamp of smaller candlepower throws twice as much illumination over the work as before and the man is entirely protected. Can any factory or mill owner doubt that a man working thus comfortably will produce twenty-five per cent more work during the dark hours of the day than a man subjected to the glare and discomfort of the bare lamp?

Problems of industrial illumination are almost always problems of local conditions. Whether general illumination, group lighting or individual lights are used, depends not upon what the lighting man desires to sell, but upon what the conditions demand. To airily dismiss individual lighting as beneath consideration—as has been done by some who have only the welfare of large units at heart—is as great an error as to condemn the large units and depend wholly upon small lamps. Large units have their place, especially in the coarser sorts of manufacturing plants, but small units solve many problems and their selection and equipment are of the utmost importance.

Transformers for Tungsten Street Lamps.

When tungsten lamps are used for street lighting they are generally placed on iron poles at the curb lines. Therefore, in all such cases it is desirable that a low-voltage system of distribution be used, for, were high voltage transmitted to the lamps, a breakdown of the insulation might charge the iron poles, and thus endanger the lives of people in the street.

Transformers are being used to step down the high voltage to 110 or 220 volts, and the ordinary tungsten lamps operate in multiple, successfully, for this class of work. The multiple system requires a little more copper than the series system, but on the other hand it is claimed that the cost of maintaining lamps operating in multiple is considerably less than the cost of operating similar lamps operating in series.



VINDEX TRANSFORMER.

The Vindex Electric Company, of Aurora, Ill., is giving special attention to the manufacture of transformers for such work, the accompanying illustration being a view of one of them.

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Westinghouse Series Tungsten Lighting System.

In addition to its standard constant-current regulating-transformer system, using film-gap receptacles to insure a continuity of circuits, the Westinghouse Electric and Manufacturing Company has developed to a high state of efficiency and is marketing for use with its series tungsten lamp a system of series street lighting which employs "adjuster" sockets to maintain a current of constant value in the series circuit. Contrasted with the "regulator" system, which requires a constant-current regulating transformer to supply each series circuit, and film gaps at the individual lamps, the adjuster-socket system enables the series of lamp units to be connected directly across the constant-potential distribution mains (usually 1,100 or 2,200 volts), each lamp socket being equipped with a specially designed impedance coil arranged in shunt with the lamp. If the filament breaks or the lamp is removed from the socket, the line current is forced through the coil, saturating the magnetic circuit and setting up a reactive voltage at the coil equivalent to the drop in the lamp. The current in the line and voltage at the remaining lamps thus remain practically unaffected. When connected in parallel with the lamps, the losses in the adjuster coils are very small, the efficiency of the adjuster-socket system measuring about ninety-six per cent. At the same time, the adjuster-socket system displays the extremely high power-factor of ninety-nine per cent. Contrasted with the low power-factor of the regulator system, which diminishes rapidly for partial loads, this feature will especially recommend the adjuster-socket system to the central-station manager who realizes the losses incident to low power-factor load.

For use with short lines, where the sum of the lamp voltages is not equal to that of the constant-potential mains, a special auto-transformer is supplied, having taps brought out from the winding, making available any voltage from zero to the maximum, in fourteen equal steps. The auto-transformer is designed to supply continuously two separate circuits of its rated current capacity.

The auto-transformer is assembled in a weatherproof case for outside or pole mounting. It may also be furnished with a suitable control panel having plug switches for conveniently changing taps, and an oil switch in the primary circuit, the auto-transformer and panel being then enclosed in a station or weatherproof building.

Besides the high efficiency and very high power-factor of the adjuster-socket system, its flexibility in application to circuits of any length, and the self-contained character of each lamp unit, are prominent advantages. Thus it becomes especially useful for small installations, such as for lighting factory yards, parks, drives, etc., where, with only ten or twenty lamps, it is desired to take advantage of the copper economy of the series tungsten system and the superiority of of the series tungsten lamps. With the long life of the tungsten lamp, the attention required by a series incandescent lighting system is reduced to the minimum, no other supervision being required than that of occasionally renewing the lamps which become broken or burned out.

The Westinghouse adjuster-socket series tungsten street-lighting system employs line currents of 1.75, 3.5 or 4.0 amperes, and utilizes thirty-one, forty, fifty, seventy-five and 100-watt lamps. Adapting them for any installation, street hoods for the adjuster-socket system are provided for bracket or center-span suspension with radially fluted porcelain enameled reflectors, and for bracket suspension with the street Holophane glass reflector. The impedance coil is sealed against entrance of moisture, in the cast-iron bell of the street hood. The adjuster socket is furnished with all connections completed, so that installation of the system becomes very simple, since, except on short lines, there is no regulating apparatus extraneous to the sockets themselves. Insulation has been given careful attention in the design of the street hoods while the light and distribution efficiency of the reflectors is in accordance with the best illuminating-engineering practice.

Electric Tower Wagons.

An electrically driven tower wagon has been designed in Germany by the Siemens-Schuckert Works and has proved very successful in effecting trolley repairs. The movable frame is controlled by a side lever and is adjustable between heights of 3.17 and 4.87 metres above the ground. The platform is accessible by a convenient ladder and the interior of the frame provides room for the tool case, etc. The single-motor system is used, with geared drive, and at eighty volts the motor will stand a 300 per cent overload for a short time.

An Electrical Barometer.

A unique electrical device for enabling the indications of the mercury barometer to be read with extreme accuracy has been invented by one P. B. Goldschmidt and is described in a recent issue of *The Electrical Engineer,* of London.

In this improved barometer a V-shaped carbon filament passes through the Torricellian vacuum, the bend dipping into the mercury. The two ends of the filament pass through the glass of the barometer tube at different points and are connected, one with the cathode, the other with the anode of a battery, a galvanometer being in the circuit. It is obvious that if the barometer rises the current has a less length of carbon filament to traverse than before, and the galvanometer shows an increased current, the reverse effect occurring if the barometer falls, the bend of the filament being so placed, of course, that the mercury never falls out of contact with it.

To eliminate the effect of changes of temperature on the height of the mercury column, a thermometer, provided with a carbon filament in exactly the same way as the barometer, is included in the circuit. At each reading a known resistance is added to the circuit sufficient to bring the galvanometer to the null point. From this resistance the height of the barometer can be determined within the tenth of a millimetre.

Goldschmidt's barometer has revealed a long-suspected phenomenon which the ordinary barometer cannot detect, viz., that the atmospheric pressure is continually varying, and is hardly ever the same for five minutes at a time.

Tracks Laid in Pennsylvania's Tube.

Tracks and roadbed have already been laid in the first completed tube of the Pennsylvania Railroad Company, and it is understood that the road will be finished in about two weeks, when it is proposed to install an experimental train.

Work on the mammoth bulwarks of concrete which are being erected at different points in the Pennsylvania's yards in Long Island City, some to carry the superstructure to the various viaducts on which streets and avenues will cross the tracks, and others for carrying elevated tracks, and work on the big storage building for the Pullman cars and the general supply house and the yard superintendent's office, is also being rushed in order to make available the system as speedily as possible.

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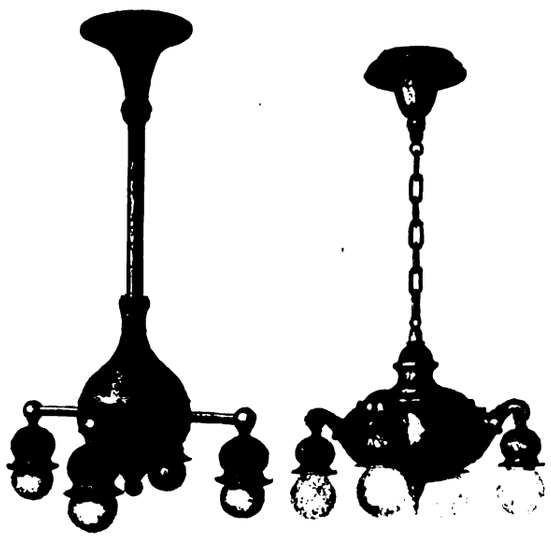
PROGRESS IN THE WESTINGHOUSE-NERNST LAMP SYSTEM.

BY MAX HARRIS.

The introduction of Westinghouse-Nernst units, twelve months ago, marked the highest development in incandescent-lamp efficiency. The past year's record of progress in glower lamps has covered the perfecting of additional units, new heaters, ornamental lamps and chandeliers, and mechanical improvements to bring about further reduction in maintenance cost and ease in trimming.

Two new single-glower units were recently placed on the market, the 176 and 220-watt units. With the addition of these lamps, both of which employ screw burners for renewals, there are now five

ORNAMENTAL HOUSING.



CHANDELIERS.

sizes of single-glower units available, as follows:

At 220 volts, 0.4 ampere, or eighty-eight watts.
At 220 volts, 0.5 ampere, or 110 watts.
At 220 volts, 0.6 ampere, or 132 watts.
At 220 volts, 0.8 ampere, or 176 watts.
At 220 volts, 1.0 ampere, or 220 watts.

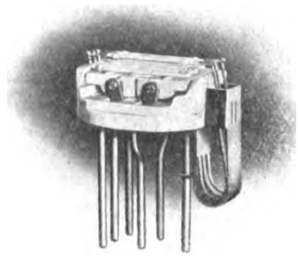
All of these units fit any standard Edison screw socket, and the two new units, on account of their low first cost, and particularly low maintenance cost, are rapidly being adopted.

The new Westinghouse-Nernst cluster is made for three sizes of burners, viz., 88, 110 and 132 watts, and is interchangeable for use with Nernst burners or other forms of incandescent lamps. The accompanying illustrations show some of the latest chandeliers, of which the Nernst Lamp Company is now manufacturing a large line in various ornate as well as plain designs. Others show two of the new ornamental forms of multiple-glower pendent and ceiling lamps, suggesting the possibilities and adaptability of these units to artistic treatment. An important feature is the new spring-type holder for multiple-glower lamps. The development of this device has made the maintenance of multiple-glower lamps so simple that anyone without the slightest electrical knowledge can replace burned-out glowers and heaters. Longer glower life is another feature resulting from the use of this holder, with resulting lower maintenance cost for material and labor. The labor item is naturally considerably reduced, since it is no longer necessary to bring holders to the station to be replaced by the inside attendant, the glower and the heater being at once renewed on the premises where the lamp is in service.

The design of the holder makes incorrect mounting impossible, the glowers automatically assuming their proper position. The new holders are also available for the old Nernst lamps in service.

An objection offered against the older Nernst system was the slow lighting of the lamp, and while the objection was not serious, in some cases, even when large units are employed, instantaneous lighting is desirable.

This advantageous feature has now been secured by replacing the old platinum form of heater with the new mineral heater, which itself becomes instantaneously incandescent, meanwhile lighting the glowers in from ten to fifteen seconds. The new heater is strong and durable, and its use will result in a reduction in maintenance costs. It will be made for use in all sizes of lamps of both



WESTINGHOUSE-NERNST SPRING HOLDER FOR MULTIPLE GLOWER LAMP.

the Nernst and Westinghouse-Nernst types.

Past objections to the glower system, urged by its competitors, though never considered serious by its manufacturers, have thus been gradually eliminated, until even the old contention of high first cost no longer obtains. This objection was always offered on the plea that later developments in incandescent-lamp efficiency would result in writing off large investments without having earned the cost of installation by the savings effected. Not only has this failed to occur in any single instance of which the writer knows or has heard, but the objection no longer holds in view of the marketing of a complete line of universal or inter-

REFLECTOR-TYPE CLUSTER.

CEILING BOWL.

changeable clusters and chandeliers by the Nernst Lamp Company, and the recent mechanical improvements and lower prices at which multiple-glower lamps are being marketed.

The development of the screw-burner units in sizes up to the one-ampere unit (220 watts on 220 volts) makes the first cost of the screw-burner system dependent only on the elaborateness of the fixture which the user desires to employ.

For example, if the purchaser prefers one of the inexpensive clusters now avail-

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able, this investment would be the same, in case either the Nernst or some other incandescent unit were employed, so that the question of renewal costs is all that is left for consideration. For the relative renewal costs of the two high-efficiency systems, the following table of list prices may be quoted:

Westinghouse-Nernst.

88-watt	$0.65
110-watt	.75
132-watt	.85
176-watt	1.05
220-watt	1.25

Tungsten.

100-watt	$1.60
150-watt	2.25
250-watt	3.25

The ruling discounts are about the same for both types of lamps. Rebates for Nernst burners are allowed upon their return.

A New White Cedar Pole Firm.

As some of the trade is probably aware, Raber & Watson, who have for years conducted a large cedar business at Chicago, Ill., Menominee, Mich., and other points, are retiring from business and have sold their business to the Crawford Cedar Company, who will be located at Menominee, Mich.

The Crawford Cedar Company will handle the cedar productions from the large output obtained from the timber holdings of Crawford and Sons, Cedar River, Mich., who have for years past been large producers of cedar in the Northern Peninsula.

William S. Patch, who has been in charge of Raber & Watson's Chicago office during their career, and prior to that with Edward E. Ayer, whom Raber & Watson succeeded, has taken the management of the Crawford Cedar Company's affairs.

Another Enemy to Wooden Poles.

It is reported that woodpeckers have been doing much damage of late to peeled cedar poles, for supporting telegraph lines, etc., in various parts of the country. These birds seem to have formed a preference for the poles to bore in for their nests rather than in decayed tree stumps, as was hitherto their usual custom. A casual inspection of the poles showed that those treated with creosote were not attacked, and an investigation is under way to prove whether creosote is always a deterrent to the attacks of the birds. If this is so, the creosote will serve the twofold purpose of protecting the poles from both birds and insects.

Intensified Arc Lamp.

The "intensified" enclosed arc lamp marks a distinct advance in the field of interior illumination, incorporating as it does all the advantages of the enclosed arc lamp, together with numerous improvements. For years the enclosed arc lamp has been greatly in favor for general mercantile lighting, in virtue of the whiteness of its light, low maintenance cost, and high efficiency. By a radical change of design, the "Intensified" arc lamp maintains these special points of superiority even, it is said, over the other improved artificial illuminants.

In the construction of the new lamp two upper or positive carbons, six millimetres in diameter and 305 millimetres in length, are placed in converging tubes, so that the ends of the carbons are in contact. A self-acting weight bearing down on the top prevents one carbon from being consumed faster than the other.

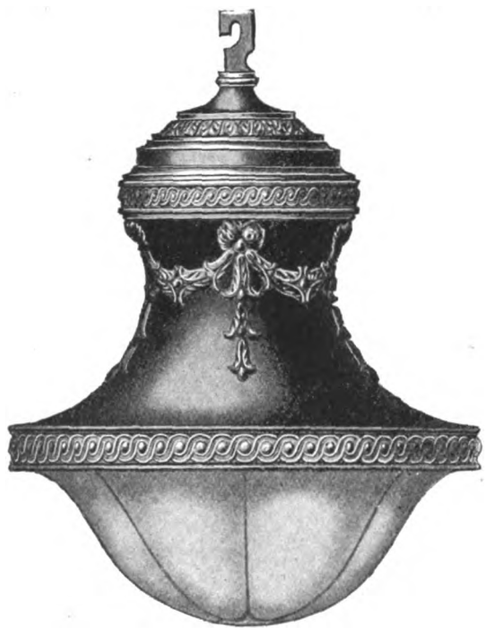

FIG. 1.—INTENSIFIED ARC LAMP.

One lower or negative carbon is used, nine-and-one-half millimetres in diameter and 100 millimetres in length. The lower carbon holder is movable in a vertical direction, being attached to a counter-weight mechanism through which the action of gravity tends to hold it in contact with the upper carbons. The magnets, acting through a clutch on the rod of the counter-weight mechanism, draw the lower carbon downward away from the upper ones. In this way the magnets cause the carbons to strike and maintain the arc, keeping the lower carbon floating at the point of electrical equilibrium.

When an arc is formed, the current density is much greater at the carbon tips than in the case of the standard enclosed lamp and, as the resultant heat cannot be readily dissipated, the carbon tips pass beyond the usual red-hot poker stage to the incandescent or white-hot state.

In order to obtain the highest efficiency possible, a small diffuser is used, located directly above the arc. In this way a greater percentage of the light is distributed in the lower hemisphere. The resultant efficiency, therefore, is equal to about one-and-one-fourth watts per mean lower hemispherical candlepower at five amperes and 110 volts direct current.

The distribution of light, as shown in Fig. 3, is ideal for interior illumination, since maximum intensity is obtained on the working plane where most needed. Perhaps one of the most noticeable features of the lamp is the daylight effect created when in use. The light is of a soft, almost perfect white, tone, and is steadily and evenly distributed. So pleasant and restful is the lighting produced, one is hardly conscious of the illumination.

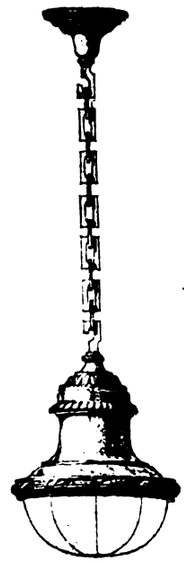

FIG. 2.—LINK SUSPENDED INTENSIFIED ARC LAMP.

At five amperes and 110 volts direct current, a carbon life of seventy-five to one hundred hours is obtained. This long life, together with the high efficiency, reduces the maintenance cost to a minimum. The lamp, as manufactured by the General Electric Company, can be furnished for either direct-current or alternating-current multiple circuits.

Figs. 1 and 2 represent the "Intensified," equipped with ornamental casing.

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It will be noticed that this lamp differs materially from conventional designs and has very pleasing lines. The outer globe

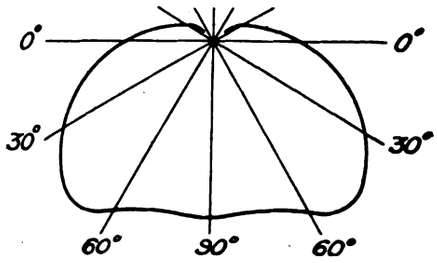

FIG. 3.—DISTRIBUTION CURVE OF INTENSIFIED ARC LAMP.

is made of leaded glass to correspond in effect with the casing. The lamp will therefore appeal particularly to dry goods, clothing and department stores, as it fills a long-felt want for an illuminant which is attractive by day as well as by night, and at the same time which meets the requirements of high-grade illumination and minimum cost.

Progress with the "I-Comfort" System of Indirect Illumination.

The "I-Comfort" system of indirect illumination, while only presented to the public a year ago, has made great strides in public favor since that time. Architects and illuminating engineers have long looked for some practical system of indirect illumination, and now that tungsten lamps are coming into such general use, this system is considered opportune. It is particularly interesting to central stations, as sixty and 100-watt lamps are used, and while it is acknowledged that there is approximately a twenty-five per cent absorption of light by indirect use, the consumer is well protected, as it is contended by medical authorities that the human eye can see twenty-five per cent better when there is no brilliant light source in range of vision.

This system is, of course, more generally known in Chicago and the middle West, but its introduction in all parts of the country is becoming general. Since the ballroom shown here, which was first opened two weeks ago, it has been decided to illuminate several large auditoriums in this way, one being the new First National Bank of Denver. Marshall & Fox, architects of the Maxine Elliott Theatre, New York, are planning to install this system quite generally in the new Blackstone Hotel, now in process of erection on Michigan Avenue, Chicago.

THE MAIN BALL ROOM, TWENTY-EIGHT-FOOT CEILING, SHOWING THE THREE LARGE CHANDELIERS, EACH CONTAINING TWENTY-THREE "I-COMFORT" INDIRECT LIGHTING UNITS USING 100-WATT TUNGSTEN LAMPS.

Among other installations of indirect illumination recently made using the "I-Comfort" system might be mentioned an interesting one in the Art Institute, Chicago, by D. H. Burnham & Company, for the Commercial Club. Here are shown (on the four walls of a large gallery) the plans and water-color sketches of "Chicago Beautiful." The four walls of the gallery are completely covered with these, each framed and covered with glass. To illuminate this room so as not to have any annoying reflections from the pictures was a problem solved, apparently, by indirect illumination.

The Hamilton National Bank, occupying the ground-floor corner of the Home Insurance Building, corner Monroe and La Salle streets, Chicago, also has a notable example of this indirect lighting scheme. The ceilings are but ten feet high. Without exception every employe speaks with enthusiasm of the comfort of working under the indirect system. Every direct light has been eliminated, even over the paying and receiving tellers' windows, where it has heretofore been supposed nothing but a strong direct light could be used.

The Chicago Beach Hotel, where the first installation of the "I-Comfort" system for hotel use was made, has had such pleasing results that the manager has recently installed the system in a second dining room and also in the card rooms.

The United States Government, after having tried out the system in New York, is now specifying it in various places.

A Practical Man's Opinion on the Electrification Problem.

A practical man who has served on both steam and electric power railways gives some practical opinions as to the future of electrification. He says: "The electrification of all traffic lines is certain to come some day. Of course the operators on the steam roads do not believe that, but it is coming. It simply is a question of time. Also it is simply a question of time when the electric lines all will be double-tracked. Perhaps that will come first. The owners of the steam lines, no doubt, understand the value of the traffic handled by the electric lines, but I am quite certain that the men in the operating departments of the steam lines are lacking in appreciation of the extent of that business. The cost of handling business on the electric lines is small, indeed, as compared with the expense of the steam lines. Those fellows, if shown the figures, would say that while figures do not lie, tell the truth. Per ton of freight handled the difference in cost is so great that it seems incredible."

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Co-Operation Based Upon Commercial Common Sense.

"Sound commercial common sense and correct business principles, applied to electrical interests, must inevitably destroy the attitude of unrest too often existent between the electrical dealer and contractor and the central-station management."

The Tungstolier Company, of Cleveland, Ohio, in its booklet entitled "Simple Solution of a Central-Station Problem," has worked out and put into effect a plan of co-operation, the fundamentals of which are the elements above quoted.

This plan recognizes fully the very obvious fact that upon the central-station manager devolves the obligation of increasing his load, and points out as clearly that there are methods that he (the manager) may successfully employ which would spell financial ruin to the dealer and contractor.

Rentals, long-time payments, maintenance of equipments, etc., in cases where prospects can be secured in no other way must be assumed by the central-station manager, but it does not follow that he must sacrifice a profit upon the articles sold under these necessarily generous conditions; indeed, there is every reason why he should ask and maintain a price commensurate with the liberal terms allowed.

Electricity is not in its experimental stage. No one (it is quite reasonable to assume) would be without it, if it could be secured and employed on a basis of price even approaching that of other illuminants. It is a most desirable adjunct to any business house or home; it has been on the defensive in competition with other forms of light, only in the one item of cost, which the advent of the tungsten lamp has entirely removed.

Dealers and contractors are as fully alive to the advantages to them of new business campaigns, conducted along sane and aggressive lines, as the progressive business manager is to the value and importance of their friendly co-operation; every additional connection secured by the central station is one more customer added to the field of the local craftsman.

The tungsten lamp has wrought a complete revolution in the public mind, which is keenly alive to its many advantages and possibilities. It has caused attention to be drawn to the difference between glare and effective illumination. All this means revenue to the central station, additional profit to the contractor and an understanding of illumination which must result in mutual benefit to all concerned.

At no time in the history of electric lighting have there been offered so many opportunities to increase the use of electricity as now. Never has the necessity for intelligent co-operation been so urgent. The Tungstolier Company, in this connection, seems to offer a simple and most logical plan.

The central station is furnished with campaign material in the form of folders, form letters and booklets, which, with slight changes to meet local conditions, covers the advertising requirements and special time arrangements under which—only—can be secured the class of business that up to the present it was impossible to secure at all.

This advertising matter is confined to the exploitation by the central-station manager of but three units, viz., one-light, two-light and four-light folding tungstoliers, which are delivered wired complete, ready to hang, thus relieving the central-station manager of the need of maintaining a fixture department, or special wiremen, or of the necessity of investing in more than the immediate demand for units created by his own energy in securing new business. Special appeal in this advertising is made for artistic and scientific lighting; every effort is brought to bear upon the advertising value of modern illumination, properly distributed and softly diffused.

The high standard thus established by the central station as an index of what may be secured by users of old-fashioned methods will induce others to bring their places of business up to the level of their neighbor, or competitor, in illumination; the central station having but three units to offer, must necessarily refer these seekers after more and better light to the local contractor, to whom the entire line of tungstoliers is offered under a dealers' and contractors' agreement that is both unique and original and contains the essence of the co-operative idea. The several clauses in the agreement which entitle dealers and contractors to the maximum discount earned by their joint purchases and those of the central station are as follows:

"The company agrees in further consideration of the character and object of this agreement to permit one or more individuals, firms or corporations to purchase such quantities of tungstolier units as will secure for them jointly with the purchaser the maximum discount which the total amount purchased by them and the purchaser within one year would entitle them, provided that the several parties entering into individual agreements with the purchaser are acceptable to the company.

"It is expressly understood and agreed that neither of the parties participating in this joint purchase of the company's several lines of 'central-station tungstolier units' and fixtures shall in any way be responsible for the acts or indebtedness of any of the other participating parties, and that the co-operative feature of this part of the agreement is designed solely and only to enable the several parties participating to secure the maximum discount on their individual purchases, that the joint sales of the several parties will earn for all.

"The company will furnish the several purchasers a statement showing the total purchases made by all of the participating parties so as to show the discounts that each of the said participating parties is entitled to.

"The company agrees to rebate to the purchaser and to the participating parties the maximum discount provided as soon as the joint sales of the purchaser and the participating parties shall have reached the amount to which the maximum discount applies as per schedule 'A,' after which and until the termination of this agreement the maximum discount will apply to all sales."

This is co-operation in letter and spirit. But the co-operative idea does not stop here.

Realizing what scientific illumination means as an advertising asset and that the public is demanding the best, an illuminating engineering department is at the service of the dealers and contractors (without charge). The company issues a blank, arranged in simple form, upon which may be indicated the dimension of the place to be illuminated, with spaces in which counters, cases, columns and all other necessary data may be shown. This may be forwarded to Cleveland and a full set of plans and specifications will be properly and scientifically worked out and returned, showing all details, with prices, thus enabling the dealer to submit to his customer exactly what he will receive.

The entire scheme is worked out to enable the manager to increase his business and that of the dealer and contractor without either encroaching upon the domain of the other, with the object in view always that the day of scientific illumination is here permanently to stay, and that co-operation will materially benefit all concerned.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, AUGUST 28.—The event of the week has been the total elimination, by the House of Commons, of the clause in the Electric Lighting Acts (amendment) Bill relating to electric wiring, fitting, etc., by municipalities. The bill came up for third reading on Saturday morning toward the end of an all-night sitting and, contrary to general expectation, the clause in question, over which there would undoubtedly have been a conflict with the House of Lords had it been passed, was withdrawn as the only means of securing the passing of the rest of the bill this session, in which there are admittedly some good points. As it is, both the Electrical Contractors' Association and the municipalities prefer the present position to be maintained, as they both now have a possible chance when the matter is raised before private bill committees, whereas a clause in a general act of Parliament would have unduly favored one party or the other once and for all. The varying fortunes of the contending parties in this matter make interesting reading. The Board of Trade, in introducing the clause, wished to give local authorities unrestricted powers, and consequently unrestricted powers to compete with local electric-light contractors, i. e., their ratepayers. The Contractors' Association took the matter up vigorously and succeeded in getting a proviso added to the clause, when the bill was in the House of Lords, to the effect that wiring work could be carried out by municipalities, but only through a contractor. When the bill left the Lords, and came to the House of Commons—which is strongly municipal—this proviso was deleted. Then followed a period of "lobbying" in order to secure the support of members on either side. Further, the Contractors' Association had enlisted the support of a noble lord to move the reinsertion of the proviso when the Commons amendments were sent back to the upper House. This proved the turning point, as, late in the session as it is, a conflict with the Lords would have ended in the bill having to be dropped in its entirety. Rather than do this, the government deleted the clause. The result is that municipalities may only carry out wiring work, etc., where they have special powers from Parliament, and the contractors may be said to have scored.

For the rest, the bill clears up certain inconsistencies and anomalies which have arisen by reason of the antiquation of the Electric Lighting Acts of 1882 and 1888, owing to the progress of the industry. Such a bill was asked for in 1902, but social reforms have occupied the attention of successive governments to such an extent that no time could be found to pass a measure. As it was, the present bill was rushed through at about 4 o'clock in the morning, in the midst of a budget, the like of which has never been known.

One of the two remaining examples of cable traction in England was discontinued this week, viz., the cable cars on Highgate Hill, London. The service has been taken over by the London County Council and will be converted to electric traction on the conduit system. The gradient is very severe, about 1 in 4, and a special type of brake has been designed in connection with the electrical working of the line.

The service of electric tramcars over Blackfriars Bridge, London, will be opened on September 15. It took the London County Council about ten years to break down the prejudice of Parliament and the City Corporation against this line, the House of Lords perpetually throwing out the bill on the opposition of the City Corporation. Eventually, the proposal was passed, and the City Corporation agreed to the widening of Blackfriars Bridge to avoid too great a congestion of traffic. Both sets of rails are laid close to the footpath on one side of the roadway. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, AUGUST 30.—One of the most recent of the French electric plants to use steam turbines is the station now running at Marseilles and owned by the Gas and Electric Company. Curtis turbines are used in the present plant, and these were built at the Paris factory of the Thomson-Houston firm. Three-phase current at 5,500 volts and twenty-five cycles is produced by three turbine-alternators, each unit giving 1,000 kilowatts. There is installed a third turbine-alternator group of the same size, which works together with two rotary converters in order to change the frequency from twenty-five to fifty cycles. A fourth group is formed by a Curtis turbine and a 13,500-volt alternator, which is of larger size than the preceding, and gives 13,500 volts, working at twenty-five cycles. The current at 5,500 volts is used in substations or transformer posts within the city or in the suburbs for lighting circuits, while the 13,500-volt current is used on a separate power circuit, which gives a power supply. The boiler plant comprises twelve boilers, which are heated with coke, this latter coming upon small cars from the adjoining gas works. In the station there are two large switchboards, one for the 5,500-volt circuit and a second for the 13,500-volt current. Exciting current for the alternators is given by three motor-generator sets, whose motors are supplied by transformers from the machine circuits. A fourth steam-engine set is also installed. It is proposed to increase the present plant in the near future so as to give a total capacity of 14,000 kilowatts.

Among the new companies formed at Paris I note the St. Germain Electric Company, the Omnium Electric Installation Company and the Marche and Limousin Electric Company. At Mendon there is formed the Charet Brothers Company, and at Levallois-Perret the storage battery firm of Caillard and D'Hanens. The Schussel and Dumarthenay firm is located at Collonges. The Ezbekieh electric garage at Cairo is occupied with electric automobiles and supplies.

In France there is an electric tramway project on foot in the Jura region for a line running from the locality of Morez to the Swiss frontier. In the region of Haute-Vienne it is proposed to install a system of tramway lines which will include several different sections, and the current will be furnished by a turbine plant located on the Vienne stream.

As regards electric lighting, the town of Arpajon is taking measures to erect a station of some size. A light and power distribution network, having Lisieux as a center, is now under consideration by the municipality. A hydraulic plant is likely to be erected in the neighborhood of Couterne, which will use the power of the Mayenne River in order to supply a number of communes. It is proposed to erect a steam plant at Epinac in order to supply an extensive power network for that region. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, SEPTEMBER 4.—The promoters of the big electric belt line scheme to run a railway from Ottawa through Bell's Corners, Arnprior, Perth, Brockville, Morrisburg, Metcalfe and back to Ottawa, are preparing to turn over to the English capitalists, who have an option on the charter, their interests in the road. The line embraces a run of 251 miles.

The promoters of the development of the Long Sault Rapids, by damming the St. Lawrence River at the head of Barnhart's Island, have been very busy of late buying the property, until they now own the whole of Barnhart's, as well as the south shore of Sheik Island. The project offers cheap power, and will put Eastern Ontario on an equality with those parts of the west of the province served by the power from Niagara Falls.

Development of the hydroelectric power proposition at Indian Chute, on a horseshoe bend of the Montreal River, some eight miles north of Elk City, in the silver mining district of Gowganda, Ont., will be actively proceeded with this season, with the intention of laying down 4,000 horsepower for use at the silver mines, early next summer. Plans call for the erection of a dam at the head of the chute, giving a working head of 42 feet.

The Canadian Light and Power Company, of Montreal, has arranged with J. G. White & Company, of New York, for the engineering, design and supervision involved in the construction of a hydro-electric plant on the St. Lawrence River, near St. Timothee, Quebec. The old Beauharnois Canal passes around the rapids at Grand Island, and the Canadian Light and Power Company has acquired from the Dominion government the right to enlarge, modify and use the canal for power purposes. The present initial development provides for 21,600 shaft horsepower, with such further developments as may be required in the near future. It is estimated that the present initial development will cost about $4,000,000. The Canadian Light and Power Company proposes to do this work by contract on the basis of unit prices. The work of deepening the canal will be begun immediately, and it is expected that the excavation will be pushed ahead as rapidly as possible.

The city of Winnipeg, Man., is demonstrating its venture in the direction of a 60,000-horsepower electric plant by an exhibit at the big fair in Toronto, Ont. There is a tank, 16 feet by 12 feet, with a miniature river and power plant modeled upon what it is expected to look like when completed, next year, at a cost of $3,250,000. The Winnipeg plant is being established on the Winnipeg River, at Point du Bois, seventy-seven miles from the city. When in operation it will be a formidable rival of the Mackenzie-Mann Power Company, which has a present monopoly and sells power at around $35 per horsepower per annum. The

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civic plant will, it is figured out, be able to cut charges in two. The Mackenzie-Mann Company offered to sell out to the city, but the company's terms were considered unreasonable. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, SEPTEMBER 4.—For the first time in her history, Winnipeg, Manitoba, was honored by being the meeting place of the British Association for the Advancement of Science. It was the seventy-ninth annual meeting of the organization and was attended by scientists, savants and learned men from practically every civilized country. The United States, Canada and the British Isles were largely represented, while a number of European and Asiatic countries sent their representatives and one came from far-off Ceylon purposely to watch the reports of the chemistry section, expecting an announcement to the effect the experiments toward the manufacture of an artificial india-rubber had been successful. However, the rubber planters will be happy for at least another year, the chemists announcing their experiments had been a failure so far, and natural rubber will continue to supply the demand.

In addition to the many papers read and discussed, the visitors made several trips to points of interest to them. The agriculturalists visited the wheat fields and experimental farms; the engineering section inspected the locks at St. Andrews, Man., the railroad shops, bridges and buildings of interest; the educationalists inspected the schools and colleges, while the electricians and a number of others looked over the sub-station of the Winnipeg Electric Company and also the $3,500,000 power plant being built by the city of Winnipeg at Point du Bois.

Under the leadership of G. W. Bissell, of Michigan Agricultural College, a number looked over the sub-station of the Winnipeg Electric Company on August 31. This principal sub-station receives the high potential of 60,000 volts from the Lac du Bonnet power plant, on the Winnipeg River, at a point sixty-four miles from Winnipeg. This power is transmitted for distribution to various purposes, including seven sub-stations recently erected, the machinery in one of which was turned over for the first time on the day the visit by the scientists was made.

The visitors included a number of members from the general physics section, which has been dealing with the abstruse electrical problems during the Winnipeg meeting, and included a number of men from the United States, England and Scotland whose names are household words in advanced electrical science. All expressed their astonishment and delight at the perfect and up-to-date nature of the plant, hardly expecting to find anything so complete in the far Canadian West. They were interested particularly in the charts showing the lead and were surprised to learn that the peak load the day previous was only 7,500 horsepower out of a total capacity of 27,000 horsepower, and that the heaviest momentary peak had never exceeded 17,000 horsepower.

The potential of 60,000 volts carries banks of fifteen transformers, with a total capacity of 30,000 horsepower, equipped with a secondary side of 2,300 volts. It is then carried to the 2,300-volt busbars, where the taps are taken off which supply Winnipeg's lighting, the capacity being 150,000 incandescent lights. The current is also used to operate the motor generators, which are used for street-railway purposes at a voltage of 575.

The visitors again and again expressed their pleasure at the completeness of the use of electricity in Winnipeg. Professor Dixon, of the Manchester (Eng.) University, was surprised to find in his arrangements for a lecture on the Chemistry of Flame at the Walker Theatre that he had to have gas specially laid into the theatre, which had nothing but electric light.

Another visit of interest was to the site where Winnipeg is constructing a municipal power plant, at an estimated cost of $3,500,000. The work was started a little over a year ago and, it is expected, will be completed within two years. The site is in the immediate vicinity of the Winnipeg Electric Company's generating station, but it was pointed out to the scientists that neither power will be lessened. A visitor from London, Eng., asked what the charge for the power would be when the plant is completed and was informed, "Eighteen dollars per horsepower per annum." The Britisher thereupon took out his notebook and pencil and began to figure. In a minute he said, "Why, a horsepower a year yields as much heat as a ton of anthracite. Your current will be quite cheap enough for a good deal of cooking and heating. Its cleanliness and convenience will offset its extra cost, you'll see." It was further explained to him that the charge of $18 per horsepower allows for all operating expenses, sinking fund and a profit for contingencies.

In the engineering section several papers devoted to electricity were given by men at the head of their profession. Prof. W. M. Thornton and O. J. Williams presented a valuable contribution on the distribution of dielectric stress in three-phase cables. They explained that the problem was to find the voltage gradient at any point in the cross-section of a three-core cable, as used for three-phase currents at any time during the cycle of electrification. The subject was taken up very fully, a number of diagrams and tables being shown, and then the matter was discussed by members of the section.

International electrical standardization was explained by Ormond Higman, chief electrical engineer at the electrical standards laboratory, Ottawa. He said the United States led the way in studying the problem, and in 1899 the American Institute of Electrical Engineers issued their first report. France, Germany and Great Britain followed with their respective rules, in the order named, which, though dealing with practically the same subject, contained certain differences. He mentioned that a somewhat similar paper was read by Sir John Wolfe Barry, K. C. B., at the meeting of the association, held in York, England, three years ago.

In the section devoted to physics, electricity was also discussed from a physical standpoint, the papers being highly technical. R.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

WALLA WALLA VALLEY LINE—Gilbert Hunt, of Walla Walla, Wash., president of the Washington Traction Company, announces that English bankers in London will back the organization in the construction of an electric railway system in the Walla Walla Valley to Kennewick and Pasco, Wash.; also that the company has increased its capital stock from $3,500,000 to $5,000,000. The line projected is from Dayton to Pasco by way of Waitsburg, Walla Walla and Wallula. It is expected that construction work will begin on the valley line the latter part of September. The company has arranged contracts with companies operating boats on the Columbia and Snake rivers for the transportation of freight.

NEW "L" ROAD FOR PHILADELPHIA—The Philadelphia & Suburban Elevated Railroad Company, which has applied for a charter at Harrisburg, Pa., plans to construct an elevated system running north and south in the city of Philadelphia, with spurs into important sections east and west. The company claims to have ample capital to finance the undertaking. So far as perfected, the plans call for twenty miles of main line track, in addition to a number of loops. By a spur to Wayne Junction physical connection is to be made with the tracks of both the Pennsylvania and Reading Chestnut Hill branches. Another spur will connect with the Baltimore & Ohio and Philadelphia, Baltimore & Washington railroads. The incorporators are S. S. Neff, Caspar Wistar Haines, John H. Hawkins, Coates Coleman and A. H. Phillips. The board has organized by electing Mr. Neff, president; Mr. Haines, vice-president; F. T. Finch, secretary; Coates Coleman, treasurer, and Edwin O. Lewis, counsel. An office has been opened at No. 416 Franklin Bank Building, and though the capital announced in the application for the charter is only $1,000,000, it is declared that all the money needed is available and that it will be subscribed in this city exclusively. Mr. Neff has had an extensive experience in steam and electric railway work.

MICHIGAN POWER, GAS AND ELECTRIC LIGHT INTERESTS—The announcement from the secretary of state for Michigan's office that articles of incorporation have been filed by eighteen power companies, with a total paid-in capitalization of $3,200,000, is believed to mean that practically all of the available power sites in Northeastern Michigan have been acquired by eastern interests, which now control gas and electric properties in many cities of the state. While there is nothing in any of the incorporation papers to connect either firm with the companies, it has been reported that Hodenpyl, Walbridge & Co., of New York, and E. W. Clark & Co., of Philadelphia, are interested in Michigan power sites. Fourteen of the new concerns are waterpower companies. Their incorporators are: E. F. Loud and H. K. Loud, of Au Sable, Mich., each of whom holds one share of stock, and L. A. Wood, of New York, to whom are credited the other 998 shares. In the second group of three companies George E. Hardy, of Englewood, N. J., is the heavy stockholder, with W. M. Eaton and J. C. Weadock, of New York, as small holders. These companies and their capitalization are as follows: Saginaw Power Company, $1,000,000; Bay City Power Company, $500,000, and Pontiac Power Company, $200,000. The Charlotte Power Company, with a capitalization of $50,000, is incorporated by George H. Clark, E. Clark and George A. Crawford, of Detroit.

CONSOLIDATION OF MARYLAND ELECTRIC RAILWAYS—With a capitalization of over $100,000,000, having as its object the consolidation under one management of the United Railways and Electric Company of Baltimore, the Annapolis Short Line and the Maryland and Pennsylvania Railway, a proposed big railroad deal is stirring financial districts of Baltimore. The opinion prevails that the Maryland Electric Railways probably will become the holding company for the other properties. Alexander Brown, senior member of the banking firm of Alexander Brown and Sons, who engineered the deal whereby all the trolley systems of Baltimore were united, is said to be the moving spirit in the latest plan for a bigger trolley combination. He is on his way from Europe, and is expected in Baltimore about September 20. The Maryland Electric Railways was organized after the great fire for the purpose of financing the needs of the United, and since has bought equipment, built barns, etc., which it leases to the latter at an annual rental equal to six per cent on actual cost. The United is bound under the terms of the lease to purchase the property of the Maryland Electric Railways subject to a first mortgage for $2,727,000 at an amount sufficient

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to pay the principal of the bonds. The Maryland Electric Railways also controls the Annapolis Short Line, having acquired it from Alexander Brown and Sons, who are also the dominant factors in the Maryland and Pennsylvania Railroad, and, in conjunction with Michael Jenkins, George C. Jenkins and John B. Ramsay, absolutely control the United Railways and Electric Company.

LIGHTING AND POWER.

(Special Correspondence.)

ANTLERS, OKLA.—Fort Smith capitalists will put in an electric-light plant at Antlers, Okla.

CEDARVILLE, CAL.—The voters here have decided to organize an electric-lighting district.

IPSWICH, S. D.—Citizens have subscribed $10,000 in stock for an electric-light and power plant. C.

MINOT, N. D.—Nick Hendrickson, owner of Spring Lake Park, is installing a new electric plant. C.

ALAMOSA, COLO.—The Conejos Flouring Mill Company is to install about $15,000 worth of machinery. U.

CANTON, ILL.—The electric-lighting plant at Abingdon has been sold to a new company, and it has been incorporated at $30,000.

DEMING, N. M.—A central-station power plant is wanted at this point and mass meetings have been held with that object in view.

HAWLEY, MINN.—Fairbanks, Morse & Company has secured the contract for the installation of the electric-light and water works system for $13,750. C.

SANDPOINT, IDAHO—The Idaho Power and Concentrating Company has under consideration the building of a concentrating plant on the lake shore. U.

GREENE, IOWA—The Greene Electric Light and Power Company is erecting a new building for the machinery to furnish the town with a day circuit. C.

LODI, CAL.—The municipality has sold bonds to the amount of $126,000 for the purpose of constructing a lighting plant, water system, and sewer system.

GILBERT, MINN—The Home Electric Company, of Eveleth, and the Virginia Light and Water Company, of Virginia, will ask for franchises for electric lighting. C.

RENO, NEV.—The Masonic Mountain Gold Mining Company has been taken over by F. E. Garrett and W. H. Paul, of Denver, who will erect a mill on the ground. U.

BAUDETTE, MINN.—J. G. Robertson, of St. Paul, Minn., has secured the contract for the installation of the electric-light plant and pumping station here for $15,240. C.

BOISE, IDAHO—A thirty-stamp mill is to be erected by the Victory Mining Company fourteen miles up the Boise River. W. A. Hepburn is superintendent of the mine. U.

IDAHO CITY, IDAHO—Fire recently destroyed the supply house at the Boston & Idaho dredge, six miles below this place. A large amount of electrical apparatus and supplies was destroyed. U.

OAKLAND, CAL.—The Central Oakland Light and Power Company, of this place, has given a trust deed to the First Federal Trust Company, of San Francisco, to secure a bond issue of $800,000.

DEADWOOD, S. D.—The controlling interest of the Consolidated Power and Light Company has secured control of the plant and business of the Black Hills Traction Company. About $500,000 is involved in the deal. C.

CARTERVILLE, ILL.—The Interurban Electric Company has been incorporated to operate an electric-light, heat and power plant, with $150,000 capital stock. The incorporators are F. W. Richart, E. E. Denison and H. B. Cassel.

GALESBURG, ILL.—The Abingdon Light and Power Company has been incorporated with a capital of $30,000 to operate an electric-light plant. The incorporators are: J. J. Welsh, A. K. Hardy and Judd Hartzell, of Galesburg.

YREKA, CAL.—The Siskiyou Electric Power and Light Company, which has just completed its nine-mile transmission line from the power house at Fall Creek, is now enlarging the latter to make room for an additional 1,250-kilowatt generator.

BUTTE, MONT.—At a meeting of the Butte and Superior Copper Company at its offices in the Wolvin Building, Duluth, Minn., recently, it was decided to build in Butte, Mont., at once a zinc concentrating plant of 300 tons capacity per day. U.

GRAND FORKS, N. D.—The contract for the installation of the new street-lighting system, comprising 132 lamp posts and accessories, was awarded to the Electric Construction Company, of St. Paul, Minn., at $29,651. The Minneapolis Steel and Machinery Company, Minneapolis, Minn., will furnish the lamp posts. C.

KIRKSVILLE, MO.—W. B. Kinnik and B. C. Davidson have traded the light and heat plant to H. G. Hanson for 960 acres of land in Polk County, Iowa, valued at $72,000. C.

LEAD, S. D.—The Homestake Mining Company is erecting a 5,000-horsepower plant to cost $1,000,000 on Spearfish Creek. It is expected to have it ready by the fall of 1910. C.

COLUMBUS, OHIO—The Mt. Healthy Light and Power Company has increased its capital stock from $10,000 to $45,000. Paul M. Hooven, of Hamilton, is the president of the company.

GREAT FALLS, MONT.—The Great Falls Water Power and Townsite Company has started construction on its big transmission line, which will carry electricity from the power house to the mines and smelters of Butte, a distance of 129 miles. U.

EVANSVILLE, IND.—It is reported that a merger of interests has been effected by the Evansville, Gas and Electric Light Company and the Evansville and Southern Indiana Traction Company. The merger will involve several million dollars. S.

PONDERAY, IDAHO—The Panhandle Smelting and Refining Company, now in the receiver's hands, will resume operations in the near future under new ownership. The capacity of the plant is to be doubled. J. Herbert Anderson is president of the company. U.

FORT WAYNE, IND.—Steps have been taken for the beautification of the central portion of the city by installation of ornamental posts with clusters of lights around the entire court house square. The city will furnish the current from the municipal plant. S.

CHARLOTTE, N. C.—J. W. Menefee, of Saxapahaw, N. C., is understood to be planning the organization of a company to develop a waterpower near Saxapahaw and build a large cotton factory, to be operated by electricity transmitted from the waterpower plant.

MODESTO, CAL.—The La Grange Light and Power Company has finished its substation outside of this city and has completed its transmission line from La Grange to the Modesto substation. A force is now at work connecting up with the Modesto system.

DE PERE, WIS.—The De Pere Electric Light and Power Company has agreed to get 300 horsepower from the Green Bay Light and Power Company, of Green Bay, Wis., and has let the contracts for the necessary transformers and other machinery to be used in taking it. C.

SALT LAKE, UTAH—The Prince of Wales Mining and Development Company, organized as a leading company on the old Prince of Wales mine at Alta, is figuring on the erection of a mill. Fred Schrott is president and E. A. Ulrey is secretary of the company, with headquarters in Salt Lake. U.

GORHAM, N. H.—The power house of the Cascade Light and Power Company, a large, low wooden building situated near the eddy in the Androscoggin River half a mile from the center of this village, was burned Sunday evening, August 8. Loss estimated at $50,000. The plant was built in 1894.

HICKORY, N. C.—G. H. Geitner, A. A. Shuford and others of Hickory are planning the organization of a cotton-mill company. They intend to capitalize the enterprise at $80,000 to begin with, and to operate the plant by electricity transmitted from the Southern Power Company lines to Hickory.

EAU CLAIRE, WIS.—The Wind Electric Power Company has been incorporated by Frank S. Culver, of Madison, and H. T. Lange and F. A. Lange, of Eau Claire, with a capital of $30,000, to manufacture an invention which, through wind power, will generate electricity for lighting purposes on farms. C.

PORTLAND, IND.—The people will be given the privilege of voting on the question of building and equipping an electric-light plant in this city. Much interest has been aroused and this is deemed the best plan to determine the sentiment for municipal lighting. The Biniel Company is now lighting the city. S.

KALAMAZOO, MICH.—The Kalamazoo Valley Hydraulic Power Company, with a capital stock of $300,000, has been organized to do business in this city and other places in this section of Michigan. The headquarters will be in Kalamazoo. The incorporators are E. W. Stone, C. H. Wilkes and H. J. Aldsworth.

BRAZIL, IND.—The Brazil Electric Company and the Terre Haute, Indianapolis and Eastern Traction Company were competitive bidders for the lighting of the city buildings, fire department and the viaduct, in the city. Both bids were the same—6 cents per 1,000 kilowatts—and in consequence both were rejected. S.

CARTHAGE, MO.—The hydroelectric development of High Falls, on the Deer River, a short distance from the village of Copenhagen, is progressing rapidly. The power plant is being erected by S. R. Cleveland, of Watertown, who has been granted

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a franchise from Copenhagen to furnish electric street-lighting service.

GUADALAJARA, MEXICO—A meeting of stockholders of the recently organized Chapala Hydroelectric and Irrigation Company has arranged with the Banco Central in the City of Mexico to contract a loan from the Caja de Prestamos of the City of Mexico in connection with the company's proposed irrigation system.

RUTLAND, VT.—The work of raising the dam at East Pittsford by the Rutland Railway, Light and Power Company has been started. The company has bought about twenty-five acres of land bordering on what they already owned around the pond and the dam will be raised about six feet, which will about double the capacity of the reservoir.

GEORGETOWN, COLO.—William H. Goldrick, an electrician and gas engineer of Mineral Wells, Tex., is going over the property of the Golden Glory Tunnel Mining Company, on Saxon Mountain, and will report concerning the construction of the 600-horsepower electric plant which the company purposes erecting on Clear Creek, three miles below Georgetown. U.

DULUTH, MINN.—The contract for the electric light and power wiring in the new Holland hotel has been let to the Duluth Electrical Company. The contract includes a three-panel switchboard with necessary switches and instruments for controlling all lights and motors. The Richardson Electric Company secured the contract for the engines and generators. C.

EDGAR, NEB.—At a special election held here bonds to the amount of $5,000, to purchase an electric-light plant for the town, were carried by a majority of nineteen. Only 125 votes were cast. The town holds an option of $4,000 on the Edgar Light and Power Company. This amount will be paid from the bonds voted and the remaining $1,000 will be used to equip the plant with modern machinery.

CHILLICOTHE, MO., will soon hold an election to vote on the proposition of issuing bonds for the purchasing and improving of the present water works and electric plants, or for the building of a new combined plant. The bond issue will be about $150,000. The Fuller-Coult Company, Chemical Building, St. Louis, Mo., successors to the W. A. Fuller Company, have been retained as consulting engineers.

REDDING, CAL.—An industrial event of great importance to this locality was the receipt here of a carload of pig iron from the electric process iron smelter, at Heroult. It is said to be the first carload of iron ever smelted by electricity on the Pacific Coast. The iron was delivered to a local foundry at $25 a ton, or less than it could be bought for at tidewater. It is pronounced of the finest quality for casting purposes.

ROCHESTER, N. Y.—The Livingstone Niagara Power Company, capitalized at $100,000 to furnish electricity for light, heat and power at Avon, Caledonia, Geneseo, Lima, Livonia, Mendon, Rush and Honeoye Falls, has been incorporated and the papers filed with the secretary of state. The directors are: Charles J. Brown, William S. Riley, W. W. Dake, William L. Likly, Henry G. Strong, William E. Dugan and George Dietrich, all of Rochester.

MONTREAL, CANADA—The Montreal Light, Heat and Power Company has announced the reductions it will make as from October 1 next in the charges for the supply of electric light. This is being done, on five-year contracts only, by increasing the rate of discount to thirty-three and one-third per cent on every account, irrespective of the amount of the bill. Thus the confusion caused under the "primary" and "secondary usage" schedules is done away with.

ALBANY, N. Y.—The public service commission has consented to the consolidation of the Plattsburg Light, Heat and Power Company and the Lozier Light and Power Company under the corporate name of Plattsburg Gas and Electric Company and given its permission that the companies may, pursuant to the terms of the agreement of consolidation, transfer all their property, franchises, etc., to the new corporation formed by such agreement of consolidation.

WORCESTER, MASS.—The Connecticut River Power Company has petitioned the Massachusetts Gas and Electric Light Commission for authority to supply electricity for lighting and power in the city of Worcester, having already secured franchises in some of the towns to the west of the city. On September 9 the Board will give a hearing on the petition and it is expected there will be opposition from the lighting companies which are already supplying the city.

RENO, NEV.—The United Gold Corporation, recently incorporated, has purchased the rights and title of the Sunny Jim Gold Mining and Milling Company and the Tyler Gold Mining Company. Plans are being prepared for the first unit of a mill, which will eventually have a capacity of 1,000 tons a day. G. W. Ebner, assistant cashier of the Crocker National Bank, San Francisco; E. E. Wade, chief clerk of the general passenger department of the Southern Pacific, and other prominent men are interested in the company. U.

ELECTRIC RAILWAYS.

(Special Correspondence.)

BOONE, IOWA—A franchise has been voted to the Iowa Railroad Company. C.

SAN FRANCISCO, CAL.—The United Railroads of San Francisco have bought a four-acre power plant site in this city.

LONG BEACH, CAL.—An ordinance has been adopted granting a franchise in this place to the Pacific Electric Company of Los Angeles.

SAN BERNARDINO, CAL.—Fred Durham, of Redlands, has applied to the city council for additional electric railway franchises in this city.

NORTH YAKIMA, WASH.—The Yakima Transportation Company will extend its line through Fruitvale. The franchise is for about two miles. U.

ADEL, IOWA—The indications are that the route of the proposed Des Moines, Council Bluffs & Western Electric Railway will pass through this town. C.

SAN DIEGO, CAL.—The South Park and East Side Railway Company states that its line has been sold to the San Diego Electric Railway Company.

PACIFIC GROVE, CAL.—E. H. Kramer, president of the Monterey County Gas and Electric Company, owners of the Monterey-Pacific Grove Electric Railway line, states that the company will double-track and standardize the line.

LA CROSSE, WIS.—William Edmunds, expert electrician, of Boston, Mass., has been inspecting the plant of the La Crosse City Railway Company with a view to its purchase by eastern capitalists. C.

MINNEAPOLIS, MINN.—Construction on the Arrow line, an electric railroad between the Twin Cities and the head of the lakes, is being pushed. It now has nearly forty miles of grading completed. C.

RED OAK, IOWA—W. L. Sontag, of Evansville, Ind., builder of the Evansville interurban railway system, has been employed, with offices in this city, to build the Des Moines & Red Oak interurban. C.

CHARLESTON, S. C.—A commission has been issued to the Greenwood and Augusta road with a capital of $1,200,000. The incorporators are Henry Briggs, Frank Hammond, J. P. Charles and two New Yorkers.

HAMILTON, IOWA—Work has been commenced on the construction of a coal road to Hamilton, Iowa, which is expected to ultimately form the main line of the interurban between Ottumwa and Des Moines. C.

PEORIA, ILL.—The ordinance before the city council for the franchise of the Peoria & Galesburg interurban railway is being redrafted by the corporation counsel and will shortly be again presented to the council for action. V.

WENATCHEE, WASH.—A move is on foot to build an electric railway from here to Waterville and from here to Leavenworth. George H. Ellis, E. M. Tipper and W. R. Powell compose the committee in charge of the matter. U.

DEADWOOD, S. D.—The Consolidated Electric Light Company has purchased the lighting plant on Redwater and the auxiliary plant here of the Black Hills Traction Company, the consideration being in the neighborhood of half a million dollars. C.

TOLEDO, OHIO—According to announcements given out by the officials of the company, the Lake Shore Electric is fitting up repair shops at Sandusky, where after October 1 all "bad order" cars will be sent for proper attention. The shops at Fremont, Ohio, will be discontinued. H.

BOISE, IDAHO—James Adams, a capitalist of Boston, is the chief promoter of an enterprise for the building of an electric line from the business center of Boise across the Eighth Street bridge and running out on the bench for several miles and then in a westerly direction to the town of Kuna. U.

LOS ANGELES, CAL.—The Los Angeles-Pacific Company has arranged with the Southern Pacific Railway Company to lease eight miles of the latter company's steam railway track between Los Angeles and Sentous station. The leased track will be converted into a trolley line for the use of the beach passenger cars of the Los Angeles-Pacific Company's system.

OTTAWA, CAN.—A new electric railway is to be built from Morrisburg, Ont., to Ottawa, Ont. The power plants will be at Morrisburg and Billings Bridge, Ottawa. The company has $1,000,000 corporate capital. Another line contemplated, called the Belt Line Electric Railway, covers practically the same route, and whichever line begins work first will get the right-of-way.

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TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

CRAB ORCHARD, NEB.—The Crab Orchard Telephone Company has been incorporated with a capital of $20,000.

BROKEN BOW, NEB.—The Broken Bow Electric Light Company has been incorporated with a capital of $25,000.

GREELEY, COLO.—The Colorado Telephone Company intends installing an exchange here with a capacity of 9,000 lines.

DES MOINES, IOWA—The Iowa Telephone Company has purchased the business of the Mutual Telephone Company for $600,000.

HOQUIAM, WASH.—The Pacific States Telephone and Telegraph Company will expend about $12,000 this year in improvements here. U.

MINNEAPOLIS, MINN.—The chief of police has recommended the levy of $8,500 to pay for the installation of a new police signal service. C.

CRAB ORCHARD, NEB.—The railway commission has authorized the Crab Orchard Telephone Company to issue capital stock to the amount of $20,000. C.

VALLEJO, CAL.—The Pacific States Telephone and Telegraph Company has appropriated $27,000 for the renewal of the company's toll lines in the Napa and Vaca valleys.

BRIDGEPORT, CAL.—A. S. Bryant, owner of the Bridgeport telephone line, has bought out the Copper Mountain and Mono Lake line and is now repairing and rebuilding it.

WEBSTER CITY, IOWA—It is said that the Martin Telephone Company will secure a controlling interest in the Hamilton County Telephone Company and the Iowa Telephone Company, in this vicinity. C.

ONTARIO, ORE.—The Ontario Independent Telephone Company has just elected permanent officers. H. B. Grauel is president and J. Prinzing, secretary. The company expects to have its line built and in operation within three weeks. U.

MONTICELLO, IND.—Articles of association have been filed in the state auditor's office by the Home Telephone Company, of Jasper, Newton, Pulaski and White counties. Capital stock, $50,000. Incorporators, Frank Welsh, F. E. Babcock and George W. Casey.

DETROIT, MICH.—It is announced that the Michigan State Telephone Company, which is to list its securities on the Chicago Stock Exchange, has named the Harris Trust and Savings Bank as its Chicago agent. The Farwell Trust Company was selected as registrar.

PITTSBURG, PA.—The West Virginia Western Telephone Company, with headquarters at Parkersburg, W. Va., has been purchased by the National Telephone Company, of Wheeling, which recently acquired control of the Pittsburg & Allegheny Telephone Company, of Pittsburg.

BOZEMAN, MONT.—The Rocky Mountain Bell Telephone Company has closed contracts with the Montana Eastern Telephone Company, of Glendive, and Paul Van Cleve, of Glendive, by which all the territory in the Yellowstone Valley, east of Billings, will be in the Bell long-distance system. C.

DES MOINES, IOWA—The Iowa Telephone Company has bought the majority of the stock of the Mutual Telephone Company, of Des Moines, held by Charles and Clyde E. Brenton, bankers, of Dallas Center, Iowa, for $600,000. The value of the property owned by the Mutual company is valued at $1,100,000. C.

SAN FRANCISCO, CAL.—Judge Seawell, of the Superior Court of San Francisco, has decided in favor of the Western Union Telegraph Company in its suit against the Postal Telegraph Company and the Commercial Pacific Cable Company to enjoin the latter companies from making an extra charge of $5 on all cablegrams handed in by the Western Union Telegraph Company for transmission over the cables of the Commercial Pacific Cable Company.

MEMPHIS, TENN.—The Cumberland Telephone and Telegraph Company is planning to expend more than $100,000 in Memphis territory before the beginning of the new year. The district extends for about two hundred miles in either direction from Memphis, Tenn. Work has already begun on several new lines which will give Memphis business connections with considerable new territory, which has not before been reached from that office. A part of the line between Memphis and Jackson, Miss., is to be reconstructed. The last link is now under construction between Tutwiler and Lake Cormorant, Miss. A new line is also being built in Mississippi, between Winona and Starkville, a distance of about seventy-five miles. A new line will also be built from Union City to Jordan, Ky., and another from Selmer to Savannah, Tenn., by way of Stanton and Adamsville.

ELECTRICAL SECURITIES.

There has been quite the usual to-and-fro movement of prices, with little animation in either direction. All over the country there is a strange mixture of confidence and apprehension, with business improving every minute in many lines, but overshadowed by a fear that the return of activity is too good to be true. This is but the natural reflection of a dearly purchased conservatism, and as improving conditions continue, doubt and fear will give way to general optimism. Among the interesting things noted in tractions last week was the announcement of an increase of 4.46 per cent in the daily average passenger traffic on the Northwestern Elevated, Chicago, during August. In the same month the gross earnings of the Brooklyn Rapid Transit Company increased $186,000, an increase of $6,000 per day. This makes the increase in earnings for the first two months of the new fiscal year $375,520.

On July 1 last Pacific Telephone Company had a total of 311,418 subscribers' stations, an increase of 21,747, or 7½ per cent, since the first of the year.

The Northwestern Elevated Company of Chicago's annual meeting will be held September 20. Books close September 9 and reopen September 21.

DIVIDENDS.

Brockton & Plymouth Street Railway Company; semiannual dividend of $3 per share on the preferred stock, payable September 15 to stockholders of record September 7. Chicago Telephone Company; regular quarterly dividend of two per cent, payable September 30 to stock of record September 25. Interborough Rapid Transit Company; regular quarterly dividend of two-and-one-fourth per cent, payable October 1 to stock of record September 18. Oklahoma Gas and Electric Company; regular quarterly dividend of one-and-one-fourth per cent on the common stock of the company, payable September 15 to stockholders of record September 15. Philadelphia Traction Company; regular semiannual dividend of $2, payable October 1 to stock of record September 8. Railways Company General; dividend of ten per cent, payable September 15 to stock of record August 31. This is the initial dividend on the stock of the company. San Diego Consolidated Gas and Electric Company; regular quarterly dividend of one-and-one-fourth per cent on the common stock of the company, payable September 15 to stockholders of record September 15.

NEW YORK.

	Sept. 6.	Aug. 30.
Allis-Chalmers common	15⅜	15
Allis-Chalmers preferred	52½	50½
Amalgamated Copper	84	83
American Tel. & Cable	*80	*80
American Tel. & Tel.	141¾	139
Brooklyn Rapid Transit	78⅞	78⅝
General Electric (ex-dividend)	166	165¾
Interborough-Metropolitan common	14¼	14
Interborough-Metropolitan preferred	46½	46½
Kings County Electric	130	131
Mackay Companies (Postal Telegraph and Cables) common	82½	81
Mackay Companies (Postal Telegraph and Cables) preferred	74½	74½
Manhattan Elevated	141	141½
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	138	137½
U. S. Steel common	80	75¼
U. S. Steel preferred	127¼	124
Western Union	75⅜	73
Westinghouse common	85½	84¾
Westinghouse preferred	130	120

*Last price quoted.

BOSTON.

	Sept. 6.	Aug. 30.
American Tel. & Tel.	141¾	139
Edison Elec. Illuminating	256	253
General Electric (ex-dividend)	166	165¾
Massachusetts Electric common	17	15
Massachusetts Electric preferred	78	74
New England Telephone	136½	...
Western Tel. & Tel. common	11½	11
Western Tel. & Tel. preferred	90	89

PHILADELPHIA.

	Sept. 6.	Aug. 30.
American Railways	46	46¾
Electric Company of America	12¼	12⅛
Electric Storage Battery common	63	68½
Electric Storage Battery preferred	63	68½
Philadelphia Electric	12⅝	12
Philadelphia Rapid Transit	30	30
Philadelphia Traction	90¾	90½
Union Traction	53	53¼

CHICAGO.

	Sept. 6.	Aug. 30.
Chicago Railways, Series 1	110	108
Chicago Railways, Series 2	37¼	37¼
Chicago Subway	17¾	19½
Chicago Telephone	135	135
Commonwealth Edison	120	120½
Metropolitan Elevated common	15⅛	15⅛
Metropolitan Elevated preferred	49	49
National Carbon common	95	95
National Carbon preferred	119	119

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PERSONAL MENTION.

CLAIRE F. BEAMS has severed his connections with J. G. White & Company, New York, to accept the position of general manager of the Cobalt Power Company, Cobalt, Ont., Can.

JOSEPH F. BECKER, of the Edison Illuminating Company of Brooklyn, N. Y., has resigned to become superintendent of the sales department of the United Electric Light and Power Company, of New York city. Mr. Becker enters on his new duties on September 15.

GLENN MARSTON sailed for Glasgow, Saturday, September 4, on the steamship Columbia, for the purpose of investigating the relations of public service companies to the public, their practical restrictions, and regulation through commission and otherwise, in England and on the continent.

H. M. BYLLESBY, of Chicago, was one of the old-time friends of Mr. Edison to attend the banquet in his honor given by the Association of Edison Illuminating Companies, at Briarcliff Lodge, N. Y., last week. Mr. Byllesby renewed acquaintance with a host of electrical friends on that occasion.

HUGH J. McGOWAN, president of the Indianapolis Traction and Terminal Company and the Terre Haute, Indianapolis and Eastern Traction Company, has returned to this city after a year's sojourn in the old country. Mr. McGowan went abroad for his health and returns almost completely restored to his usual good health. S.

JAMES B. WALKER, assistant secretary to the New York Public Service Commission, left last week on his first vacation since the organization of the commission. Mr. Walker will spend three weeks at Lake Skaneateles and at the end of that period will go to Syracuse for one week to assume charge of an exhibit the Public Service Commission will have at the state fair.

HAROLD K. WELD, of the engineering department of the Chicago Telephone Company, has resigned his position to become a member of the sales department of the McRoy Clay Works, manufacturers of underground conduits, Rookery Building, Chicago. Mr. Weld's work has been along the engineering side of underground conduit construction for some time past, and his new work will therefore be along congenial lines.

CHARLES BAKER, who for many years was one of the erecting engineers with the Goodman Manufacturing Company of Chicago, has formed a partnership with Grant Ford and opened an office in Room 701, Chicago Opera House Building, 112 Clark Street, Chicago. The firm of Ford & Baker will do general consulting engineering work, specializing on power plant design, erection and testing. Mr. Baker has had extensive experience in the electrical equipment of coal mines and particularly in the installation of their power plants.

DR. LOUIS COHEN has resigned his position as physicist and librarian of the Bureau of Standards, Washington, D. C., and has received an appointment as mathematician and experimental engineer for the National Electrical Signaling Company. This is the company that controls the Fessenden wireless telegraph system and is designing a 3,000-mile station for the government at Washington, D. C. Doctor Cohen is a graduate of Armour Institute of Technology, Chicago, in the class of 1901. He spent one year subsequently at the University of Chicago and two years at Columbia University, New York, in graduate work. At the latter institution he was engaged in special research work with Doctor Pupin. After leaving Columbia Doctor Cohen took the position with the Bureau of Standards that he has just left. During most of the four years that he was in Washington he was also assistant professor at George Washington University. Doctor Cohen is the author of a large number of technical papers that have appeared in the Bulletin of the Bureau of Standards, in the Proceedings of the American Institute of Electrical Engineers and in several technical journals.

PROPOSALS.

POST OFFICE, JACKSON, MICH.—Sealed proposals will be received at this office until October 7, 1909, and then opened, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of an extension, remodeling, etc., to the United States Post Office, Jackson, Mich., in accordance with the drawings and specification, copies of which may be obtained from the custodian of site at Jackson, Mich., or at the Supervising Architect's office.

POST OFFICE AND CUSTOM HOUSE, BELFAST, ME.—The Supervising Architect will receive sealed proposals on October 14, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the U. S. Post Office and Custom House, Belfast, Me., in accordance with drawings and specification, copies of which may be obtained from the custodian, at Belfast, Me., or at the Supervising Architect's office.

INDUSTRIAL ITEMS.

THE ROCHESTER MACHINE TOOL WORKS, Rochester, N. Y., is issuing a catalogue descriptive of their Acme engine.

THE LIBERTY ELECTRIC MANUFACTURING COMPANY, Pittsburg, Pa., is distributing a pamphlet describing its cellulose and non-cellulose filament lamps.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., announces that it will open an office in the Ford Building, Detroit, Mich., on or about September 10. Charles W. Cross will be the manager of this branch.

THE GARWOOD ELECTRIC COMPANY, Garwood, N. J., announces that it has appointed the Atlanta Brokerage Company, Atlanta, Ga., as its sales agents for the state of Georgia, also that it has appointed as its agents for the states of Oregon and Washington the Montilius Price Company, Seattle, Wash.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has published an illustrated folder (Bulletin 115) describing the battery of "Chloride Accumulator" cells, etc., as installed in the Hudson Terminal Building, New York. This is one of an interesting series of bulletins on the application of storage batteries to isolated lighting and power plants.

THE TUNGSTOLIER COMPANY, Cleveland, Ohio, announces the incorporation of the Tungstolier Company of Canada, Limited. The officers of the company are E. J. Kulas, president; R. B. Basham, vice-president and general manager; W. H. Wissing, secretary, and C. F. Koepge, treasurer. R. B. Basham was formerly general western manager of the parent company in Chicago.

THE FORT WAYNE ELECTRIC WORKS COMPANY, Fort Wayne, Ind., has plans under way for the construction and equipment of a four-story addition to its electric-lamp factory. The improvement and extension will involve the expenditure of a half million dollars. When completed the company will manufacture on an extensive scale the Wood new style magnetic arc lamp, which is said to have successfully withstood every test. S.

MATHIAS KLEIN & SONS, Chicago, the well-known manufacturers of electricians', linemen's and contractors' tools, announce that, owing to the revision in the Chicago house numbers, all mail should hereafter be addressed to numbers 562 and 564 West Van Buren Street. The company is doing an excellent business, and has recently appointed Harmon S. Salt, 114 Liberty Street, New York, as its eastern agent, and Otis & Squires, 155 New Montgomery Street, San Francisco, as its Pacific Coast agents.

THE EXCELLO ARC LAMP COMPANY, New York, N. Y., announces that it has received an order for forty-four lamps from the Minnesota State Agricultural Society. These lamps are to be used in extending the outdoor lighting arrangement which this society began last year, when it purchased forty-two lamps from the Excello company for the illumination of the live-stock yards, and the lighting of the field upon which was enacted the spectacular reproduction of the Fort Ridgely massacre.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, has issued Bulletin 351 (superseding Bulletin 321) on Triumph induction motors. This describes, with the aid of several illustrations, the twenty-five horsepower three-phase induction motor, both the mechanical details and the efficiency, speed regulation, temperature, power-factor, and other considerations. Special types of motor, as the slip-ring, back-geared, and vertical motor are described; also the applications of all the types. A chapter on starting devices is also given.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has entered suit in the United States Circuit Court at Buffalo, N. Y., under date of July 14, against the United States Lighting and Heating Company and the National Battery Company, alleging infringement of a patent owned by the Electric Storage Battery Company for the manufacture of storage battery plates. The Electric Storage Battery Company announces the purchase of a large number of its car-lighting equipments by the Atchison, Topeka & Santa Fe Railroad.

THE MECHANICAL AND ELECTRICAL MANUFACTURING COMPANY, 54 North Desplaines Street, Chicago, has published a complete price list of its electrical specialties. These comprise weatherproof pendant and wall sockets, outlet-box and sign or festoon sockets, combined outlet box covers and open or weatherproof sockets, as well as various outlet-box covers, brushings, receptacles, etc. The combination outlet-box covers and sockets are made in a great variety of forms and materials, the weatherproof types being particularly in great demand.

THE HEMINGRAY GLASS COMPANY advertises in this journal, giving its office address as Covington, Ky., and factory address at Muncie, Indiana. An English reader of this journal sent for prices and catalogue on Hemingray insulators, addressing the letter as follows: Hemingray Glass Company, Covington, Ky., Muncie, India. The letter was mailed from Birming-

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ham, Eng., on June 10, and finally reached its destination in Covington, Ky., on August 5, after a circuitous trip through the Orient. The envelope is literally covered with foreign postmarks.

THE CRESCENT COMPANY, Chicago, Ill., announces that it has taken the agency for the American Conduit Manufacturing Company, Pittsburg, Pa., makers of American rigid iron conduit and "wireduct" non-metallic flexible conduit; also the agency for the Lowell Insulated Wire Company, Lowell, Mass., makers of lamp cords, telephone wire and all kinds of rubber-insulated wire. The Crescent Company will carry at 106 South Clinton Street, Chicago, a complete stock in each of the above lines so as to insure prompt delivery of rush orders.

THE WESTERN ELECTRIC COMPANY, New York and Chicago, is distributing a bulletin illustrating and exploiting the Sunbeam tungsten miniature lamp for use on voltages between one-and-one-half and twenty. These lamps vary in efficiency from 0.9 watt per candlepower to 1.33 watts per candlepower, and are particularly desirable for use in automobiles, flashlights, signs, dental, optical and surgical instruments, and, in fact, any place where battery or low-voltage power circuit lamps are used. A copy of this bulletin No. 8-A may be obtained from the Western Electric Company's nearest house.

THE RATHBONE & PANIGOT COMPANY, 54 Clyde Park Avenue, Grand Rapids, Mich., reports rapidly increasing popularity of its electric open fireplaces and electric radiators. A large number of central stations have found that they are an effective weapon in fighting gas competition. The electric radiators, particularly, have met with much favor, as they are not only a very cheerful heating medium, but absolutely eliminate the vitiation of the air and the positive danger and discomfort from leaky gas radiators. Electric fireplace designs of very tasteful character have been made and have added materially to the line of electric heating appliances this company handles.

THE HOPPES MANUFACTURING COMPANY, Springfield, Ohio, has secured an order for two 30,000 horsepower open heaters for the Transit Development Company, of Brooklyn, N. Y., and one 25,000 horsepower heater for the Metropolitan Street Railway Company, New York, N. Y. Both of these heaters will take the place of closed heaters, and the latter will take the place of the secondary heater, about which there was so much discussion at the time of its installation. It is stated by the company that there will be a saving of one dollar an hour in water alone in the Metropolitan plant. These heaters are made in smaller sizes for plants of smaller capacity. Full information may be secured upon request.

M. O. PAYNE, vice-president of the Schott Engineering Company, Chicago, is receiving the congratulations of his many friends for securing the contract from the Yakima Central Heating Company, North Yakima, Wash., for a central-station steam-heating system, which is to be built in connection with the Yakima artificial-ice and cold-storage plant. The contract amounts to about $100,000, and includes the power house equipment, as well as about 10,000 feet of street mains. Immediate construction will be begun, and the plant is expected to be in operation about November 1.

THE MOORE ELECTRICAL COMPANY, Newark, N. J., has closed a contract for installing the Moore light in the new building of the Emigrant Industrial Savings Bank at 43-51 Chambers Street, New York, of which Raymond F. Almirall is the architect. This installation is to consist of forty-two tubes of the Moore light and approximately 4,500 feet of glass tubing. The lighting is designed to produce useful illumination at a low-current consumption and to make extremely pleasing lighting effects. The building is to be sixteen stories high, and will be built in two sections, the first half to be completed within six months. It is probable that several other banking houses will adopt the Moore light in the near future.

THE KIMBLE ELECTRIC COMPANY, 1121 Washington Boulevard, Chicago, Ill., is distributing a new catalogue devoted to its variable-speed, single-phase, alternating-current motors. This company has ready for the market a fine line of motors for ventilating fans, printing presses, static machines, forge-blowers, church organs, air compressors, and, in fact, any standard or special application. One of the latest things this enterprising company has done is the sending of a strong letter to the central-station industry calling attention to the valuable features of variable-speed, single-phase, alternating-current motors in increasing the day load of central stations. This literature should be secured by everyone interested in this subject.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the second issue of each month.)

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary, Lloyd Lyon, secretary and auditor Mobile Light and Railway Company, 158 Government Street, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis Avenue, New York city.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York city.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West One Hundred and Sixteenth Street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, Flatiron Building, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, secretary and treasurer Tri-City Railway Company, Davenport, Iowa.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

AMERICAN STREET AND INTERURBAN RAILWAY TRANSPORTATION AND TRAFFIC ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, superintendent of lighting Hot Springs Light and Railway Company, Hot Springs, Ark.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF CAR-LIGHTING ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Chicago, Ill.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, D. L. Huntington, second vice-president and manager Washington Water Power Company, Spokane, Wash.

ASSOCIATION OF EDISON PURCHASING AGENTS. Secretary, J. W. Brennan, Edison Illuminating Company, Detroit, Mich.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass.

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ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, Frick Building Annex, Pittsburg, Pa.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Minnesota, St. Paul & Sault Ste. Marie Railroad, Chicago, Ill.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Pioda, Oak and Broderick streets, San Francisco.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 33 Melinda Street, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Traction Terminal Building, Indianapolis.

CENTRAL ELECTRIC TRAFFIC ASSOCIATION. Secretary, J. T. Brittson, assistant claim agent Chicago, South Bend & Northern Indiana Railway Company, South Bend, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Colo.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Conn.

ELECTRIC CLUB OF CHICAGO. Secretary, Wm. S. Taussig, 115 Adams Street, Chicago, Ill.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CLUB OF CALIFORNIA. Secretary, Russell D. Holabird, Argonaut Hotel, San Francisco, Cal.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, George William Russell, Jr., 500 Fifth Avenue, New York city.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine Street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, San Francisco, Cal.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York city.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau Street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt Street, New York city.

ENGINEERS' CLUB OF PHILADELPHIA. Secretary, H. G. Perring, 1317 Spruce Street, Philadelphia, Pa.

ENGINEERS' SOCIETY OF MILWAUKEE. Secretary, W. Fay Martin, Milwaukee, Wis.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, G. F. Doig, Gainesville, Fla.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Ottawa, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Preston S. Millar, Engineering Societies Building, 33 West Thirty-ninth Street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Frederic Leslie, Muncie, Ind.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Allen J. Paylow, Rockport, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Annual convention, Atlantic City, N. J., September 14-16.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis, Parkersburg, W. Va.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, Des Moines, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary and treasurer, A. P. Biggs, Detroit, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, B. W. Copperthwait, Faribault, Minn.

MISSISSIPPI ELECTRICAL ASSOCIATION. Secretary, J. Abbott, manager Jackson Electric Railway, Light and Power Company, Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATERWORKS ASSOCIATION. Secretary Claude L. Clary, Sikeston Electric Light and Power Company, Sikeston, Mo.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George W. Schwerer, Windsor, Mo.

MUNICIPAL LIGHTING ASSOCIATION OF MASSACHUSETTS. Secretary, J. C. Norcross, Reading, Mass.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago, Ill.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, Frank M. Tait, Dayton, Ohio.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 60 State Street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass. Meetings held on fourth Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

NEW YORK RAILROAD CLUB. Secretary, H. D. Vote, 95 Liberty Street, New York, N. Y.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD-TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, Frank J. Scherrer, 195 Broadway, New York city.

ORDER OF THE REJUVENATED SONS OF JOVE. Mercury, C. B. Roulet, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

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PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, E. L. Smith, Towanda, Pa.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary C. C. Rosenberg, Bethlehem, Pa. Next annual meeting, Louisville, Ky., October 12-14, 1909.

SOCIETY OF AUTOMOBILE ENGINEERS. Secretary, Alexander Churchward, 30 Church Street, New York city.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York city.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. A. Gould, Ennis, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Addison County, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Chairman, William B. Jackson, 115 Adams Street, Chicago, Ill.; secretary, J. H. Warder, Monadnock Block, Chicago, Ill.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 382 Ohio Street, Chicago, Ill. Annual convention, Detroit, Mich., October 26-28, 1909.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

DATES AHEAD.

International Association of Municipal Electricians. Annual convention, Atlantic City, N. J., September 14-16.

Kansas Gas, Water, Electric Light and Street Railway Association. Next meeting, Wichita, Kan., September 23-24.

Illuminating Engineering Society. Annual convention, New York, N. Y., September 27, 28 and 29.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Railway Signal Association. Annual meeting, Louisville, Ky., October 12-14.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 18.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) August 24, 1909.

932,426. TROLLEY-REPLACER. Walter M. Austin, Swissvale, Pa., and Samuel C. Cooper, Johnstown, N. Y., assignors of one-third to said Cooper, one-third to Philip Keck, and one-third to Sidney E. Trumbull, Johnstown, N. Y. Filed May 3, 1907. Renewed September 3, 1908. Has means for automatically projecting replacer into operative position, and fluid pressure means for resetting the replacer.

932,433. CONVERTLET. Cecil R. Bold, Charleston, S. C. Filed April 10, 1909. Openings through the end sections form outlets for wires, and a detachable cover affords access to the interior.

932,441. ELECTRIC-WELDING MACHINE. Alvin E. Buchenberg, Toledo, Ohio, assignor to the Toledo Electric Welding Company. Filed August 19, 1908. Describes a form of electric transformer welding machine.

932,459. METHOD OF REDUCING AND MELTING OXIDES AND THE LIKE. Otto Frick, Sheffield, England. Filed April 19, 1907. The material forms a continuous conductor of high-resistant material between electrodes connected to a source of alternating current. The reduced metal sinks into an annular crucible and is melted by an induced current therein.

932,469. ELECTRIC FURNACE. John A. Hay, London, England, assignor to American Electric Furnace Company. Filed June 19, 1909. Has a passage through the crucible or hearth for limbs of the core and a winding, and a metallic shield for the passage has a radiation surface of greater area than that of the passage.

932,481. CURRENT-INTERRUPTER FOR ELECTRIC CIRCUITS. Frederic W. Lord and Frederic W. Erickson, New York, N. Y. Filed April 27, 1907. As a means for dissipating a "following-arc," there are: a circuit including spaced opposing terminals, a rotor extending into the arc-gap between the terminals and having conducting segments adapted to be rapidly and successively brought within the arc-gap, and means for varying the position of the terminals relative to the rotor during the movement of the latter.

932,505. ELECTRICAL SIGNALING SYSTEM. Frank M. Slough, Elyria, Ohio, assignor to The Dean Electric Company. Filed July 10, 1906. Includes means for producing a periodic signaling current, a separate synchronizer therefor, a common source of electric energy and means whereby the operation of such synchronizer tends to maintain constant the frequency of such signaling current.

932,511. TROLLEY. Norman W. Storer and Theodore Varney, Pittsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed October 18, 1905. Describes a form of side-rail trolley.

932,519. TROLLEY FOR ELECTRIC VEHICLES. Theodore Varney and Norman W. Storer, Pittsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed May 23, 1908. Comprises a pantograph or lazy-tongs structure, a main bow contact shoe supported at the upper end of the structure, auxiliary contact shoes, and means dependent upon the speed of the vehicle for forcing an auxiliary contact shoe into engagement with the conductor.

932,523. INSULATOR FOR THIRD RAILS. Eugene M. Weaver, Ozone Park, N. Y. Filed September 10, 1908. A metallic standard supports an inverted cup-shaped insulating support for the rail.

932,537. DYNAMO-ELECTRIC MACHINE. Abe L. Cushman, Concord, N. H., assignor of one-half to Benjamin A. Kimball, Concord, N. H. Filed February 15, 1908. Comprises a frame for field and commutating magnets including a main core projecting from the yoke of the frame having an extended pole shoe, and a commutating magnet core beside the main core and projecting from the yoke to the outer side of the extended pole shoe, a commutating winding on the commutating core in series with the armature circuit, and a main field magnet winding in shunt with the armature circuit and inclosing both the main magnet core and the commutating magnet core and winding.

932,538. TROLLEY. Harry P. Davis and Theodore Varney, Pittsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. Filed November 8, 1907. Comprises a supporting frame having a number of cross-rods, end castings in which the rods are mounted, side bars rotatably mounted near the extremities of two of these rods and provided with gear segments which mesh with each

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other, and twin contact shoes rotatably mounted upon a third rod.

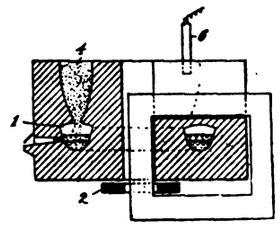
932,539. CURLING-IRON HEATER. Harry W. Denhard, San Francisco, Cal., assignor to George B. Katzenstein, Jr. Filed August 10, 1908. Comprises a heating chamber, a resistance coil in connection therewith, a metallic part within the chamber having electrical connections, a space between adapted to be occupied by the iron or like device to make the electrical connection, and a spring for holding the iron in place.

932,541. ABNORMAL POTENTIAL-DISCHARGING AND ARC-DISRUPTING DEVICE. Frederic W. Erickson and Frederic W. Lord, New York, N. Y. Filed April 27, 1907. In an abnormal-potential discharging current path having spaced terminals therein, and also having intervening current-conducting means intermediate the terminals and spaced therefrom, an arc-dissipating device has a number of disks extending within the current path intermediate the terminals and the intervening current-conducting means, and a motor is provided for imparting simultaneous movement to each of the disks.

932,545. TELEPHONE ANTISEPTIC MOUTHPIECE. Jacob M. Haff, Los Angeles, Cal. Filed April 24, 1907. An antiseptic disk of fibrous material is included in a lining for the mouthpiece.

932,554. TROLLEY. Ray P. Jackson and Christian Aalborg, Wilkinsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed April 28, 1906. Describes a fluid-controlled pantograph trolley.

932,557. SWITCH-HOOK-CONTROLLING DEVICE. Mose M. Kahn, Louisville, Ky. Filed October 29, 1908. Comprises a bracket for attachment to a transmitter support, an arm pivoted by one end to the end of the bracket, a cylindrical weight connected with the other end of the arm, a grip on the weight, and means for fixing the arm with respect to the bracket.



932,459.—METHOD OF REDUCING AND MELTING ORES AND THE LIKE.

932,582. RAILWAY BLOCK SYSTEM. William L. Rummel, Sioux City, Iowa. Filed April 11, 1908. Plates extending from the engine engage contacts to close the circuit.

932,613. ARC-LAMP CUT-OUT. Laban E. Jones, Anaconda, Mont. Filed January 28, 1909. Describes a contact system in connection with an arc-lamp hanger and lifting mechanicsm.

932,616. BRUSH FOR DYNAMO-ELECTRIC MACHINES. Earle R. Knight, Norwood, Ohio, assignor to The Bullock Electric Manufacturing Company. Filed February 7, 1906. The brush holder guide plate is riveted only to one side of the brush, the plate being bent over the end of the brush.

932,621. ELECTRIC LAMP. David D. Lockwood, Bridgeport, Conn. Filed January 7, 1909. Describes an adjustable bracket, etc., for an electric lamp.

932,625. INDUCTION-MOTOR. Emil Mattman, Norwood, Ohio, assignor to The Bullock Electric Manufacturing Company. Filed September 5, 1905. Comprises a shaft slotted at one end, a number of collector rings carried by the shaft, lugs extending inwardly from said rings through said slots, winding terminals connected to the lugs, and an axially movable short-circuiting sleeve mounted on the slotted portion of the shaft and having openings which receive the lugs and permit axial movement of the sleeve relative to the same.

932,637. CONTAINER FOR SECONDARY BATTERIES. Emil L. Oppermann, London, England. Filed August 22, 1908. A sheet-metal tank is lined with insulating material which extends also over the outwardly protruding lip around the tank top, and a rubber washer is interposed between the lip and a lid for the tank.

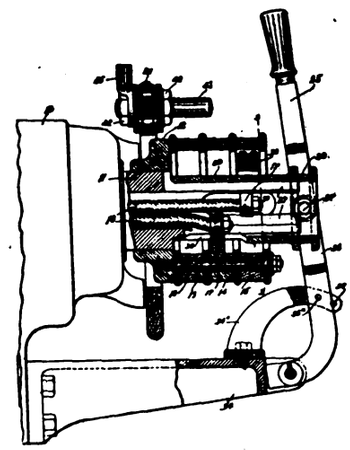
932,641. DYNAMO-ELECTRIC MACHINE. William D. Pomeroy, Norwood, Ohio, assignor to Allis-Chalmers Company and The Bullock Electric Manufacturing Company. Filed June 16, 1906. Comprises a stator consisting of a frame with integral bearing-housings, a rotor, a shaft on which the rotor is mounted, bearings for the shaft, wedges carried by the housings for supporting the bearings, means for adjusting the wedges to adjust the shaft vertically, and means for adjusting the bearings laterally.

932,651. TROLLEY. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 16, 1906. Describes a form of double pantograph trolley with pneumatically controlled contact shoe, etc.

932,652. TROLLEY FOR ELECTRICAL VEHICLES. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 5, 1907. A bow frame has end castings and side strips, and a number of contact plates mounted thereon in end-to-end engagement along diagonal lines.

932,653. TROLLEY. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 5, 1907. A trolley for electric railways comprises a supporting frame and a galvanized steel contact plate having an upward curvature from end to end and a longitudinal groove or recess.

932,654. TROLLEY. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed November 8, 1907. Comprises a supporting frame having a resilient outer extremity the ends of which are bent inwardly into alinement with each other, bearing blocks rotatively adjustable on the alining ends of the frame, and a pair of oppositely disposed resilient bow contact shoes secured to the bearing blocks.



932,625.—INDUCTION MOTOR.

932,655. TROLLEY FOR ELECTRIC VEHICLES. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed April 22, 1908. Comprises a double pantograph supporting structure and a contact member secured thereto, means for expanding the supporting structure, and wind-vanes pivotally suspended from the ends of the structure.

932,656. TROLLEY FOR ELECTRIC VEHICLES. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed October 7, 1908. Comprises a supporting structure and a number of resilient contact strips disposed parallel to each other and in the same horizontal plane under tension.

932,661. DIRECT-CURRENT TURBO-GENERATOR. Alfred H. Wouters, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed November 3, 1906. Describes details of the armature and commutator.

932,662. ROTOR CONSTRUCTION. Alfred H. Wouters, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed January 31, 1907. The rotor of a dynamo-electric machine comprises a shaft, a core mounted on the shaft, a winding carried thereby, a collector ring, and means for connecting the winding and collector ring comprising a plurality of straight rods or bars electrically connected in series and extending parallel to the rotor axis.

932,707. ELECTRIC LOCOMOTIVE. William F. Hunt, New York, N. Y., assignor to C. W. Hunt Company. Filed November 21, 1907. In combination with an electric locomotive and its motors is a storage battery carried by the locomotive, also plural conductors external to the locomotive, a three-armed trolley carried by the locomotive, a contact on the trolley connected to one side of the battery and motors, two contacts carried by the trolley and connected in parallel to the other side of the battery and motor, and connections between the battery and the motors.

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932,714. AUTOMATIC CONTROL DEVICE FOR ELEVATORS. Louis J. Milke, Baltimore, Md. Filed August 11, 1908. Levers connected with valve and cylinder devices are provided with armatures co-operating with electrical coils so that one piston ascends as the other descends, thereby closing a gate valve in the main supply pipe which connects with a storage tank.

932,753. CALL-BOX. Henry S. Bullock, Jr., New York, N. Y., assignor to American District Telegraph Company. Filed January 17, 1907. A signal transmitter comprises transmitting means for transmitting successively and in alternation two different signals, mechanism arranged to operate said transmitting means a greater or less number of times at will, and contact means for closing a shunt connection around the transmitting means, arranged to close the shunt connection during the last transmission, by the transmitting means, of the first of the signals.

932,773. ELECTRIC-ARC LAMP. Joseph B. Fournier, Paris, France. Filed November 21, 1903. Renewed June 7, 1909. Describes an arc-lamp regulator.

932,775. ELECTRIC THERAPEUTIC INSTRUMENT. Charles W. Gaston, Fresno, Cal. Filed June 5, 1909. Comprises a tubular body open at its ends and exteriorly grooved, wires of opposite metals arranged alternately in the grooves of the body and having end portions extending within the body, and end closure plugs removably arranged in the ends of the body and retaining the wires in position.

932,792. SWITCH FOR ELECTRIC LAMPS. Edward A. Lefebre, Jr., and William I. Miller, Brooklyn, N. Y. Filed January 13, 1909. A lamp socket has a rotatable contact maker actuated by a cord.

932,799. COHERER. Walter W. Massie, Providence, R. I., assignor to Massie Wireless Telegraph Company. Filed August 16, 1905. Describes the details of a device comprising a coherer and tapper.

932,819. OSCILLIAMETER. Harry Shoemaker, Jersey City, N. J., assignor to International Telegraph Construction Company. Filed December 11, 1906. A combined wavemeter and wave producer comprises a variable condenser, an inductance element, a scale for indicating the natural period of the combined condenser and inductance, and an incandescent lamp in series with the condenser and inductance as an indicating means.

932,820. TRANSMITTING APPARATUS. Harry Shoemaker, Jersey City, N. J., assignor to International Telegraph Construction Company. Filed August 19, 1907. Comprises an oscillating circuit containing pairs of inductance and capacity, said pairs connected in parallel, means for charging the capacities, and means for discharging the capacities through a closed circuit containing only the capacities and inductances.

932,821. TELEPHONE AND TELEGRAPH TRANSMITTING APPARATUS. Harry Shoemaker, Jersey City, N. J., assignor to International Telegraph Construction Company. Filed July 25, 1908. A substantially continuously oscillating circuit has a relatively low natural period, and a high-frequency oscillation circuit is associated with the first-mentioned circuit and derives energy therefrom, and radiating conductor is associated with these.

932,834. SHADE-HOLDER FOR ELECTROLIERS. Henry A. Torrey, Waterbury, Conn., assignor to the Plume & Atwood Manufacturing Company. Filed March 25, 1909. A holder for a shade or globe comprises two members, one of which is adapted for connection with the socket and the other of which is adapted together with the shade or globe for an axial and telescoping movement upon and with reference to the first aforesaid part.

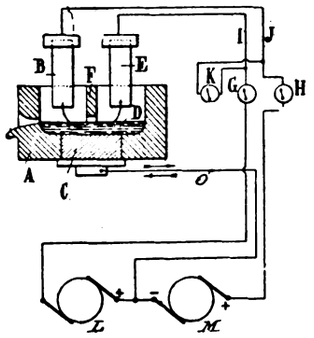
932,835. ELECTRIC FURNACE. Jean B. Trillon, St. Jeoire, France, assignor to himself and La Societe Electrochimique du Giffre, St. Jeoire, France. Filed July 6, 1907. Comprises at least two independently adjustable electrodes of opposite polarity, in which the sole and conducting bath form a part of the generating circuit and at least two hearths are formed, and a third conductor between this sole and a selected point of the generating circuit to allow of the return of the electric current wholly or partly through this third conductor.

932,841. BATTERY-COVERING. George E. Andrews, Providence, R. I. Filed May 21, 1909. A bag-like member of rubber is provided with thickened portions, and with holes extending through these thickened portions for the purpose of receiving wires, the bag-like member being thickened at one of its edges for the purpose of excluding the entrance of water.

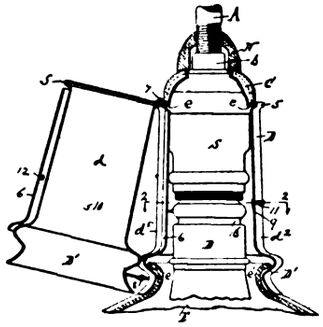
932,863. CIRCUIT-BREAKER. John B. Howe and Harvey E. Howe, Windber, Pa. Filed March 19, 1909. In combination with coupling members and an insulated piece connecting the members and having a lower edge V-shaped in cross-section, is a movable conductor piece substantially V-shaped in cross-section normally supported out of engagement with the coupling members by the insulated piece.

932,877. AUTOMATIC SYNCHRONIZER. Howard Marshall, Vance, Colo. Filed October 6, 1906. In combination with an alternating-current machine, connected with an external circuit and an incoming machine, to be coupled in parallel therewith, are a secondary circuit, means controlled by the incoming machine for completing the secondary circuit, a closing switch for completing the coupling of the incoming machine with the external circuit, a resistance in the secondary circuit, and a vibrating means controlled by the secondary circuit for automatically operating the resistance and controlling the coupling switch.

932,883. PUSH-BUTTON ELECTRIC SWITCH. Lembert H. Moulthrop, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company. Filed November 12, 1908. Comprises an oscillating contact-carrying member and a detent, moving therewith, which comprises a spring which itself acts directly as the retaining member, in combination with means for freeing the detent.



932,835.—ELECTRIC FURNACE.



932,893.—SHADE-HOLDER FOR ELECTRIC LAMPS.

932,893. SHADE-HOLDER FOR ELECTRIC LAMPS. Granville E. Palmer, Boston, Mass., assignor to the Price-McKinlock Company. Filed March 19, 1909. A lamp socket shade holder comprises a casing to be supported from the cap of the socket and to inclose the latter and made in three vertical sections, two of which are permanently secured together, the third section being hinged at one side to one section, and means to latch it on the other side to the other section, the several sections having flanged lower ends to engage the shade.

932,896. ELECTRIC MOTOR. Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. Filed June 21, 1909. A motor or generator comprises a casing having a retaining device at one end, a field formed of disks fitted in the casing and held at one side by the retaining device, and a retaining ring co-operating with the opposite side of the field.

932,897. DYNAMO-ELECTRIC MACHINE. Alvin A. Pifer, Cleveland, Ohio, assignor to the Cleveland Armature Works, Cleveland, Ohio, a partnership. Filed April 1, 1909. Has a number of poles, each with two separate pole-shoe sections adapted to be moved toward and from each other circumferentially about the armature, the forward surface of each shoe section being tapered inward so as to coincide substantially with an extension of a radius drawn from the center of the armature.

932,898. ART OR PROCESS OF PRODUCING OZONE. James F. Place, Glen Ridge, N. J. Filed February 26, 1909. The process comprises evaporating liquid oxygen by heat drawn from a column of air in a pipe submerged therein, and subjecting

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the cold vapor and oxygen gases from the evaporating liquid to an electric current in an ozonizer.

932,913. RECEIVING APPARATUS. Harry Shoemaker, Jersey City, N. J., assignor to International Telegraph Construction Company. Filed April 28, 1905. Includes a looped aerial conductor, a wave-responsive device connected in one leg of the loop, an adjustable inductance bridging the legs of the loop, a condenser connected with the wave-responsive device and the inductance in a closed local circuit, and a signal-reproducing means controlled by the wave-responsive device.

932,923. TRAIN-STOPPING SYSTEM. Jean F. Webb, Jr., New York, N. Y., assignor to the Electric Signagraph and Semaphore Company. Filed August 15, 1908. A contact member on the train completes a local circuit and operates a relay which actuates a valve-opening motor to control the air brakes.

932,924. CONTACT-MAKER. Jean F. Webb, Jr., New York, N. Y., assignor to the Electric Signagraph and Semaphore Company. Original application filed August 15, 1908. Divided and this application filed August 26, 1908. A contact-maker for train signaling and stopping mechanisms and the like comprises a plate, a switch mounted thereon, contact bristles pendent from the plate, and means carried by the plate for actuating the switch.

932,925. CLOSED-CIRCUIT WIRING FOR AUTOMATIC TRAIN-STOPPING SYSTEMS. Jean F. Webb, Jr., New York, N. Y., assignor to the Electric Signagraph and Semaphore Company. Filed September 1, 1908. Describes in detail the connections for a sectionalized block system.

932,926. TRAIN-STOPPING SYSTEM. Jean F. Webb, Jr., New York, N. Y., assignor to the Electric Signagraph and Semaphore Company. Original application filed September 1, 1908. Divided and this application filed February 3, 1909. Describes electrical connections for a block system at a point where a line crosses a main line.

932,928. APPARATUS FOR THE CONTROL OF RAILWAY TRAINS. Robert J. White, Wilkinsburg, Pa. Filed January 15, 1908. Apparatus for the control of railway trains comprises indicating mechanism on each train for indicating at any time the actual distance traveled by that train, other indicating mechanism on each train for indicating the actual distance traveled by another train, connection for establishing an electric circuit between successive trains, and means on each train for affecting the electrical circuits to thereby actuate indicating mechanism on another train or trains.

932,966. ELECTROTHERMOSTATIC HEAT-REGULATOR. Lloyd G. Copeman, Berkeley, Cal. Filed October 1, 1908. Comprises a movable electrical heater, with interior resistances and a main heat circuit, a hood in fixed relation with the heater, a thermostat located within the hood and the heat zone of the heater, a shunt circuit controlling the main heat circuit, and connections between the thermostat and the shunt circuit.

932,970. ELECTRIC-LIGHT-CORD ADJUSTER. Owen Dodge, Colorado Springs, Colo. Filed October 12, 1908. A spring-actuated drum rotates within a stationary supporting frame for an electric-light hanger, and a suspension cord is attached to the drum.

932,984. TROLLEY-POLE BASE. Charles C. Hale, Wapakoneta, Ohio. Filed February 17, 1909. The vertical standard rotates on ball bearings above and below its enlarged disk-like end.

932,986. TRANSFORMING SMELTING-FURNACE. Hugo Helberger, Munich, Germany. Filed September 11, 1908. A transformer furnace embodies a transformer having terminal electrodes of its secondary windings located in proximity to and directly connected with the windings, whereby current losses are reduced, the electrodes having oppositely disposed contact faces for clamping a melting crucible between them and clamping means separate from but engaging the electrodes to clamp a crucible between them.

933,012. CIRCUIT MAKING AND BREAKING DEVICE. Henry S. Baker, Wilkinsburg, Pa. Filed March 23, 1906. Has a stationary contact terminal, a flexible switch arm to engage therewith, and a retarding device attached to the free end of the switch arm.

933,018. TELEPHONE SYSTEM. Edward R. Brodton, Mobile, Ala., assignor of one-third to George H. Fonde and one-third to Ernest E. Wagar, Mobile, Ala. Original application filed November 19, 1907. Divided and this application filed June 29, 1908. The system comprises means for propagating trains of waves, including an induction coil, means for receiving trains of waves, and including signals actuated by the effect of these waves, and a telephone transmitting and receiving system, including the induction coil, and means for grounding two sides of the same at two points spaced apart.

933,027. ABNORMAL POTENTIAL-DISCHARGING AND ARC-DISRUPTING DEVICE. Frederic W. Erickson and Frederic W. Lord, New York, N. Y. Original application filed April 27, 1907. Divided and this application filed July 11, 1907. Spaced terminals are located within the current path, and a rotor has an insulating disk permanently extending between the terminals. The axis of the disk extends in a direction parallel with and spaced from the line of shortest distance between the terminals, and the disk has a larger area than a cross-sectional area of the current path to provide an extended dissipating path, portions of which are successively positionable within the current path, the disk completing a revolution between successive passages of any given point thereof between the terminals.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired September 6, 1909:

481,959. CONDUIT SYSTEM FOR ELECTRIC RAILWAYS. Reuben Lawrence, St. Joseph, Mo.

481,975. METER FOR ALTERNATING ELECTRIC CURRENTS. Oliver B. Shallenberger, Rochester, N. Y.

481,979. APPARATUS FOR ELECTRICALLY PURIFYING WATER. Lucius T. Stanley, Brooklyn, N. Y.

481,989. ELECTRIC FIRE AND BURGLAR ALARM CONNECTION. Homer T. Wilson, Louisville, Ky.

481,999. ELECTRIC FURNACE GENERATOR. Emile Berliner, Washington, D. C.

482,012. BATTERY CONNECTOR. Edward R. Knowles, Brooklyn, N. Y.

482,015. PRINTING OR RECORDING TELEGRAPH. Zachary T. Lillard and Ursinus Erhard, Kansas City, Mo.

482,031. TROLLEY FOR ELECTRIC RAILWAYS. Clarence A. Adams and Thomas J. Thorp, Lincoln, Neb.

482,032. ELECTROSTATIC SWITCH AND PHASE INDICATOR. Alfred U. Alcock, Melbourne, Victoria.

482,043. STORAGE BATTERY. Patrick Kennedy and Charles J. Diss, Brooklyn, N. Y.

482,074. ELECTRICAL HEATER. John V. Capek, New York, N. Y.

482,104. CEILING BLOCK FOR INCANDESCENT LAMPS. Luther Stieringer, New York, N. Y.

482,126. TRAIN-SIGNALING APPARATUS. James M. Henry, Wilmerding, and Robert B. Wilson, Altoona, Pa.

482,129. COMBINED TELEGRAPH KEY AND SOUNDER. Dan J. Ludwig, New York, N. Y.

482,133. ELECTRIC ALARM CLOCK. John McMillan and George H. Taylor, Philadelphia, Pa.

482,136. AUTOMATIC BATTERY CUT-OFF. Walter S. Richards, Natick, Mass.

482,137. ELECTRICALLY-ADJUSTING RELAY. Walter S. Richards, Natick, Mass.

482,139. ELECTRIC VALVE CONTROLLER. Edward F. Roberts, Columbus, Ohio.

482,148. TELL-TALE FOR ELECTROLYTIC REFINERIES. Francis B. Badt, Chicago, Ill.

482,149. ELECTRICAL CIRCUIT AND CABLE. John A. Barrett, Brooklyn, N. Y.

482,150 and 482,151. ELECTRIC CONDUCTOR. John A. Barrett, Brooklyn, N. Y.

482,152. ELECTRIC CIRCUIT AND CABLE. John A. Barrett, Brooklyn, N. Y.

482,157. ELECTRIC ARC LAMP. John T. Birch, Pittsburg, Pa.

482,172. ELECTRICAL GAS LIGHTER. James E. Hamilton, Chicago, Ill.

482,174. TELEPHONE-EXCHANGE APPARATUS. Angus S. Hibbard, New York, N. Y.

482,181. ELECTRIC CONNECTOR FOR HOSE. Charles F. Kellom, Delair, N. J.

482,209. INDUCTION COIL FOR ELECTRIC METERS. Elihu Thomson, Lynn, Mass.

482,240. ELECTRIC ARC LAMP. James E. Gaston, Sparta, Ill.

482,251. WATCHMAN'S ELECTRIC TIME-RECORDER. Emanuel R. Heyser, Leon, Mex.

482,253. ELECTRIC ARC LAMP. Jesse F. Kester, Terre Haute, Ind.

482,263. ELECTRIC ANNUNCIATOR. Erastus D. Moore, New York, N. Y.

482,265. ARMATURE FOR DYNAMO-ELECTRIC MACHINES. John Nebel, Charlton, England.

482,328. ELECTRIC CABLE. John A. Barrett, Brooklyn, N. Y.

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CONTENTS.

EDITORIAL:
Ready-to-Serve and Minimum-Rate Charges 523
The Cost of Deferred Maintenance 524
Assisted Plants 525
Among the Contractors and Supply Men 525
Details of Watt-Hour Meter Manufacture—Conclusion 526
Electricity in the Arden Residence of the Late E. H. Harriman 528-531
Reparation in the Case of Differential Rates on Freight Classification 531
CENTRAL STATION PRACTICE:
Lubricating and Electric Brushes for Commutators and Collector Rings 532
The Largest Power Station in Europe 533
Assisted Electric Generating Plants 534
Gas Engines for Small Central Stations 535
Association of Edison Purchasing Agents 535
The New Power House for the Capitol Buildings in Washington 536
ELECTRIC TRACTION:
Novel Electric Storage-Battery Locomotives in German and Austrian Mines 536
Electrification of Australian Railways 537
Transportation Arrangements for Denver Convention 537
INDUSTRIAL POWER:
Electric-Fan Installation in Bombay Cathedral 539
Current-Limit Control 540
Bituminous Producer in Double Role in Sheet-Metal Factory 541
Cotton Manufacturers to Hold Convention 541
Electric Development in Western Mines 541
TELEGRAPHY—TELEPHONY AND WIRELESS:
The Eiffel Tower Wireless Plant 542
Farmers' Telephones in the South 543
Secret Society for Telephone Men 543
Cedar Telegraph and Telephone Poles 544
Wireless in China 544
ELECTRO-CHEMISTRY AND METALLURGY:
Electrochemical Amalgamation 545
Production of Abrasives in 1908 545
The Validity of Ohm's Law for Electrolytes 546
How to Make a Simple Dry Battery 546
Joint Convention of the Northwest Electric Light and Power Association and the Seattle Section of the American Institute of Electric Engineers 547
Another New Society 547
The Peat Industry in 1908 548
QUESTIONS AND ANSWERS 551
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 552
INDUSTRIAL SECTION:
Series Alternating-Current Arc-Lighting System 554
Detroit Ironclad Meter Box and Fused Switch 555
Westinghouse Turbo-Alternators 555
A New Westinghouse Series-Multiple Direct-Current Arc Lamp 556
Next Best Thing to Individual Motor Drive 556
A Novel Fixture Design 556
Bristol Portable Electric Pyrometer with Thermo-Electric Couple 557
Dubois Single-Cylinder Throttling Gas Engines 557-558
New Type of Self-Restored Magneto Line Signals 559
To Increase Trade with the Latin-American Republics 560
Gas Engine Installations Aggregating 210,000 Horsepower 560
CURRENT ELECTRICAL NEWS 561
RECORD OF ELECTRICAL PATENTS 568

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READY-TO-SERVE AND MINIMUM-RATE CHARGES.

In several cases courts have upheld minimum rates or ready-to-serve charges for electrical supply.

Such a case came up in New York, where the electric company made a minimum charge of $1.50 per month for lighting service, besides the meter rate of one cent per sixteen-candlepower lamp per hour. This minimum charge was not made, however, where the energy consumed as measured by the meter amounted to $1.50 or more per month.

While holding that a consumer who refused to agree to pay this minimum charge was not entitled to the electric service, the Court said:

"It is stated * * * that each additional lamp connected with defendant's system necessitates an additional investment by it in distributing conductors and local appliances of about $20 in addition to the cost of generating and delivering the electric current; that the number of lamps which the plaintiff desired was eleven, and that the total investment thus made necessary in order to comply with this demand for service was at least the sum of $220. How, then, can it be said that a fixed charge, not based upon actual consumption, is of itself improper or unreasonable? * * * One consumer with the same number of lamps will use more than another. In both cases the return to the company may be remunerative, or the use of one may be so inconsiderable as to involve a loss. To meet this contingency the monthly minimum charge of $1.50 is made. * * * I can see nothing unreasonable in this when the service, as I have defined it, which the company is obliged to render is considered. It is not a penalty for a failure to use defendant's product, but is properly to be regarded as compensatory for that part of the service which is at all times being rendered in the maintenance of the apparatus and connections through which the electric current is made available to the consumer for the production of light at his pleasure." Gould vs. Edison Electric Illuminating Company, 60 New York, Sup. 559.

Within the past three months two cases have been decided in favor of ready-to-serve charges. One of these cases was a suit by an electric-lighting company for services rendered at the rate of ten cents per kilowatt-hour, plus a ready-to-serve charge of ten cents per lamp socket per month on twenty-four sockets, plus twenty-five cents per month for meter rent, making a total of $9.32 for the bill in one month. The rate had

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formerly been fourteen cents per kilowatt-hour, with no ready-to-serve charge.

In upholding these charges the Court used the following language:

"It was urged before us that defendant cannot in any event be called upon to pay a charge for the power or current on hand ready for service, but which in fact is never served. I cannot so view it. The two charges, taken together (that is, for the current as shown by the meter and for the current necessarily on hand to be used when lighted), is simply a method of arriving at a fair rate for energy supplied to defendant." Chambers Electric Company vs. Cantwell, Eastern Law Reporter of Canada, June 1, 1909.

Another case was an action by a consumer to recover a penalty from the electric company for failure to supply his residence with electric light as required by a statute which provided that no meter rent should be charged. The refusal of the electric company to supply the light was due to the fact that the consumer would not agree to pay a ready-to-serve charge of $1.11 per month.

In the course of an opinion sustaining the right of the company to make the ready-to-serve charge, it was said:

"Nowhere does this statute attempt to say that persons using different quantities of the commodity in a given time must be charged the same price per thousand units, nor that a minimum charge per month for service may not be imposed. The Legislature did not intend to compel the company to put in a meter and hold itself in readiness to serve those who use none of the commodity to be supplied. * * * So, it matters not whether it be termed a 'readiness-to-serve charge' or a 'minimum-rate charge.' It amounts to the same thing, and is not forbidden by the language of the statute. * * * A regulation of the charges for such service should be just to the company as well as to all its patrons, so as to allow compensation to the former, and reasonable, uniform rates to the latter. One class of patrons should not be favored at the expense of another." Little Rock Railway and Electric Company vs. Newman, 120 Southwestern Rep. 824.

THE COST OF DEFERRED MAINTENANCE.

In the administration of industrial plants the problem of economical maintenance is a matter of constant engineering interest. If operating conditions remained stationary after the establishment of a plant, it would be a comparatively simple task to forecast the amount of money which each year's service legitimately requires for keeping the equipment in efficient condition; but with the tendency toward expansion of output and the changes in methods of production which appear in most installations from time to time, the standards by which maintenance may be judged are continually varying, when the disbursements for one period are compared with those for another. This means that unless general conditions, as well as analyses of the expenditures on the unit basis, are taken into account, the plant is liable on the one hand to suffer from spasmodic appropriations for improving its equipment efficiency and on the other from unwise changes in its design or unjustified departures from previous practice when extensions become necessary.

The fundamental requirements of adequate maintenance are not complex, for they are simply included in the exercise of that prudent foresight known in the vernacular as the "stitch in time," which reduces waste in the field of machinery operation in the same manner as in other fields where wear and tear are higher. The same causes always produce the same results. Unfortunately, with complicated systems of apparatus manipulated by even more intricate personalities, it is extremely difficult to sift the causes of wear and tear to the bottom, and to reduce to figures which are worth anything, the service performance which brings about a definite amount of wear on a machine or group of appliances of known characteristics. In the difficulty of the problem lies its fascination, however, and every engineer who analyzes the performance of his equipment in a scientific way helps to lighten the dark and unexplored areas of puzzling experience with equipment failures and excessive expenditures for rehabilitation. The difficulty is that in so many cases the data collected are not sufficiently complete to enable accurate judgments to be passed. The number of factors neglected or approximated is too great.

Four years' maintenance costs taken from the unusually complete records of a central station of the engine-driven type illustrate the need of full data before one can criticize the administration of a plant from the financial point of view. The station capacity at the beginning of the four years was 450 kilowatts, and in the second year it became 1,250 kilowatts through the addition of another generator. No further increase was made. The energy generated increased from about 930,000 kilowatt-hours to 1,400,000 kilowatt-hours. In the first year the cost of station building, steam and electrical equipment maintenance per kilowatt-hour was 0.20 cent; in the second year it was 0.11 cent; in the third, 0.26 cent; and in the fourth, 0.16 cent. A tenth of a cent is not a very large affair in itself, but when applied to over a million-and-a-third kilowatt-hours in a year it amounts to over a hundred dollars a month. Before an analysis can be made of even so considerable a variation as this in the repair account of any particular subdivision of the station apparatus, one must know not only what were the larger items of expense which produced the variations in unit-repair cost, but the extent of service which was imposed upon different units in the station, the approximate outputs of each, number and extent of severe overloads, character of the preceding repairs, magnitude of fluctuations in the load curve, occurrence of temporary adjustments, and the number and nature of any noteworthy failures. It would be a great help in the future administration of such plants if the unusual occurrences could be recorded more fully by the engineers in charge of the stations, either in the regular log of the daily runs, or

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in a special emergency book having pages of sufficient size to permit the insertion of all the data which would form the principal support of a thorough report of the situation in each instance. It is not enough from the standpoint of high-class maintenance analysis to state that a certain increase in the steam-plant repairs for a given month was due to the replacement of a cylinder head on No. 2 engine. Something of the history of the engine before the change became necessary should be available to the man who has to study the prospective expenditures of the plant in the light of its past records. It is true that, except in very rare instances, it is too much to expect the average operating employe to put down the full and accurate particulars desirable in connection with equipment failures or pending replacements, but this matter can be handled profitably by the engineering staff if the right questions are opportunely considered in conference with the operating force.

It seems to some managers as though refined studies of equipment maintenance were worth little in their effect upon expenses, but experience has shown, notably in the electric-railway field, that the more carefully defects are analyzed, the fewer occur, provided that the results are exhibited before the division heads in charge of the detailed work in the car service. In one notable instance the company has cut down the failures of its cars on the streets by nearly twenty per cent a year through a tabulation of the defects each month and a study of them in the presence and with the co-operation of its car-house foremen and division superintendents. There is still need on this system, however, of getting to the bottom of obscure troubles which occur, for only by such a course can costly interruptions be minimized. Reduced failures mean decreased shop expenses and a lower rate of depreciation, but service reliability is worth more as a rule than a saving in repair costs.

The relation of service reliability to maintenance, and particularly to deferred repairs, neglected through pressure of traffic or shortage of funds, is at present extremely indefinite, but none the less direct and inescapable. When the campaign for economical operation reaches its height in any company it is an easy matter to cut down the repairs from those desirable under the most prosperous conditions to the fewest which will keep the system in motion. The shrinkage in repair bills which such a policy often produces is gratifying in its effect upon net earnings, but there are few policies so hazardous as that of cutting down the necessary routine repairs. Not only are subsequent expenditures for maintenance relatively heavier, but the danger of accidents is increased, the life of the equipment is shortened, the salability of the plant diminished, and the economy of production often seriously impaired. Anxiety to declare early dividends and to maintain a well-established dividend rate should never be permitted to result in the neglect of equipment through deferred maintenance. In the long run the cost of deferred maintenance will prove to be greater than that of normal and regular repairs, faced squarely as they become due in the exigencies of operation.

ASSISTED PLANTS.

In the division "Central-Station Practice" in this issue we reprint a timely article which appeared in a recent issue of the *Manchester Guardian,* one of the leading English newspapers.

The writer of the article in question would appear at first to be considering only the interests of the large manufacturer who could afford profitably to run an isolated plant to supply his minimum demand while using the nearby central station as very much of a convenience to supply the extra current for his peak loads. This extra current, although it might be of considerable amount for short periods, would in most cases be inconsiderable in the aggregate compared to the total load of the factory, and of itself would prove very undesirable business to the central station. Only in dense manufacturing centers, where many factories within a comparatively small radius would be available for such service, would this business on the whole be likely at first to provide a fairly uniform profitable day load to the central station.

But this is not all the argument. Many plants using prime movers other than electric, as well as those using electric service from isolated plants already installed, would be available for their peak-load business, especially in cases where the prime movers in use are not flexible enough to stand an overload, as is the case with gas engines. This possible extra business is largely recognized at the present time by most companies. But here is the subtle point, if one may say so, of the article in question. Manufacturers in the main are constantly increasing their business under normal conditions, and what is more natural than the fact that most of the additional load consequent on this increase should automatically be provided for by the central station? Again, existing manufacturer's plant must deteriorate, and in course of time be scrapped, and here again is a chance for the central station which is, under the new arrangement suggested, already supplying part of the load. The whole matter is certainly worth consideration at any rate, and we shall confidently look forward to further developments along these lines. Time alone can tell what is to be the outcome.

AMONG THE CONTRACTORS AND ELECTRICAL SUPPLY MEN.

Why hide your light under a bushel? If you are doing something worth while in a business way let the business world know about it and you will get more work to do, and more people to supply. This is the order of the new department which appears for the first time under the above caption on page 549 of this issue. Send in your orders at your own discretion and we will tell the world of electricity all about it. It is a good idea and in this age of publicity, those who move with the times and are up and doing will doubtless appreciate the opportunity. Be proud of your legitimate efforts and achievements and you will go on to greater success. Nothing was ever lost by being frank and positive when you have a good thing.

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DETAILS OF WATT-HOUR METER MANUFACTURE.—VI.

BY JOSEPH B. BAKER.

FACTORY INSPECTION AND CALIBRATION OF INDUCTION METERS (CONTINUED).

Power-Factor and Frequency Adjustment.—Adjustment for zero power-factor is made by changing the rack connections so as to put the A phase on the series winding and the C phase, ninety degrees away, on the shunt winding of the meter. The standard has already been calibrated for zero power-factor with the precision wattmeter in conjunction with the synchronization of the former with the "master." The tester obtains zero power-factor on the rack connections by adjusting the potential regulator. When the position of true quadrature has been obtained, as shown by the disk of the standard coming to rest, the tester then effects the adjustment of the meter under test for zero power-factor by shifting its power-factor adjustment until the disk comes to rest.

The theory of the power-factor and frequency adjustment, and its construction and operation in Westinghouse induction meters, may be explained briefly as follows:

Referring first to the power-factor adjustment: When the load on a meter is purely non-inductive, such as a group of incandescent lamps, the current in the shunt-field coil will lag approximately ninety degrees behind that in the series-field coil. If, on the other hand, the load is changed to one which is purely inductive (power-factor equal to zero), the current in the series coil itself will lag ninety degrees behind the line voltage and would therefore be approximately in phase with the current in the shunt-field coil—under which condition there would be no shifting or forward rotation of field, and therefore no torque on the rotating element. These conditions would obtain exactly were it not for the modifying effect of the resistance of the shunt-field windings, the iron loss, etc. Although the design is theoretically correct to give a lag of ninety degrees on purely inductive load, the distribution of copper, iron and shunt-field air gaps in the practical construction cannot be depended upon to make the lag accurately ninety degrees, and some device must be applied to correct for the margin of difference.

The device that is employed as a power-factor and frequency adjustment operates as a power-factor adjustment by varying the phase relation of the shunt-field flux to the series-field flux, and consists of a stamping (Fig. 38) arranged to constitute a short-circuited one-turn coil enclosing the middle pole of the shunt-field core, as shown in Fig. 36 in the last issue and Fig. 21 in the August 28 issue, in which this piece is lettered P. The presence of this short-circuited loop results in a choking effect upon the shunt element as a whole in its relation to the series flux. An induced magnetic field is set up by the loop, which produces, in conjunction with the magnetic field of the shunt, a resultant field which is exactly ninety degrees behind that of the series coil. The reinforcing or modifying effect of this resultant field is utilized, to any extent that may be neecssary to rectify the phase relation between the shunt and series fields, by setting this adjustment (or "shading coil," as it is sometimes termed) in the appropriate position somewhere between the following limits: Up near the top of the middle pole of the shunt-field core, on the line M—N, furthest from the shunt-field air gap, where the effect is a minimum; and down against the shunt-field air gap, on the line x—x¹, where the effect is a maximum.

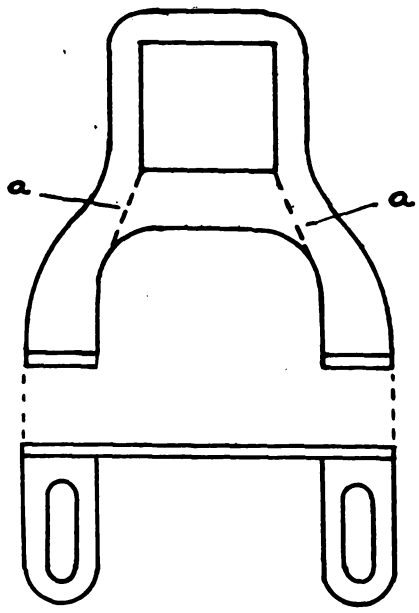

FIG. 38.—POWER-FACTOR AND FREQUENCY ADJUSTMENT.

This method of swinging the resultant into exact quadrature is shown graphically in the vector diagram, Fig. 39, in which:

OA is the voltage of the shunt-field coil.

OY, the current passing through the series-field coil.

YOA, the angle less than ninety degrees due to iron and copper losses in the shunt field.

OS, the induced voltage generated in the "shading strip," exactly opposite in phase to OA, but very small in value; the current passing through the shading strip being in phase with this voltage and represented by OC.

The current OC and main current OY have a combined magnetizing effect on the iron core, which is found by forming the parallelogram OCXY, giving OX as the resultant effect. By raising or lowering the shading strip, the resultant flux can be shifted back to the ninety-degree phase relation, as shown by OX, the meter being thereby adjusted so as to read correctly under all conditions of power-factor.

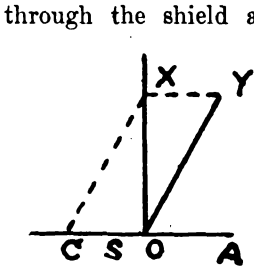

FIG. 39.—DIAGRAM OF POWER-FACTOR ADJUSTMENT.

In contradistinction to the light-load adjustment, the power-factor and frequency adjustment has no unbalancing effect upon the shunt field, *i. e.*, the speed of the meter is unaffected on non-inductive load, because the short-circuited loop encloses the middle pole. The setting of this adjustment is a detail of the calibration of the meter at the factory, and is accomplished by loosening two screws, passing through the shield and tapped into the meter case, and clamping under their heads the slotted lugs of the stamping. The setting is unaffected by variation of jewel friction, and therefore never needs to be changed by the customer's meter inspector.

The function of the device shown in Fig. 38 and at P, Fig. 21, as a frequency adjustment may be explained briefly as follows:

In 133-cycle meters the practical construction of the meter gives more nearly exact lagging than in meters for sixty-cycle service, and renders the employment of a power-factor adjustment unnecessary. But inasmuch as 133 cycles is an odd frequency, and as the services employing that frequency are expected to be changed to ordinary sixty-cycle services, 133-cycle meters are sent out from the factory equipped with an adjustment consisting of the stamping shown in Fig. 38, cut open on the dotted lines a, a, to make an

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open yoke instead of the short-circuited loop described above. This yoke is secured by the same two screws that are employed to hold the stamping in the sixty-cycle meter; but one of the screws is fitted with a fiber bushing, which interrupts what would otherwise amount to a one-turn coil (as in the case of the uncut stamping above referred to, though of larger diameter) when the meter is to be changed to sixty-cycle service. The circuit of the adjustment is, however, in this case completed through the meter fields—in the absence of the fourth side of the square loop—by removing the fiber bushing again and tightening the screw. This "screw-driver adjustment" for adapting the meter to either of two frequencies is obviously superior to other methods involving soldered connections.

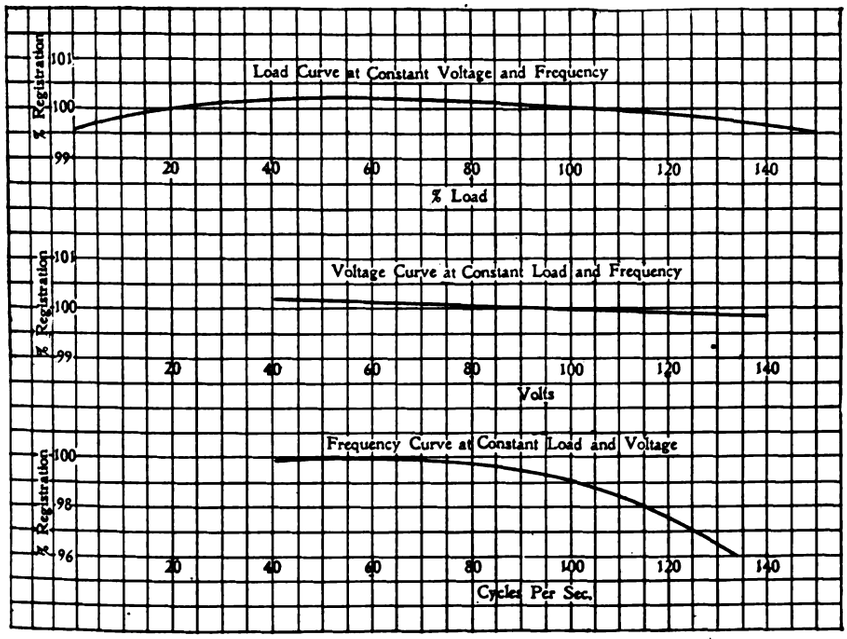

FIG. 40.—VARIATION OF ACCURACY OF INDUCTION METERS WITH FREQUENCY, VOLTAGE AND LOAD.

Although the above-described adjustment is provided on all sixty-cycle meters of this type, it is claimed that their accuracy of registration is but little affected by wide variations from normal frequency—for example, only three or four per cent error is introduced when a sixty-cycle meter is used on a 133-cycle circuit, or vice versa. The variation of percentage accuracy throughout a wide range of frequency is shown in the bottom curve in Fig. 40.

SEALING METERS.

In so-called unsealed meters, such as the T R W meters, the entire meter is accessible to the purchaser (central-station company) and has therefore only the one seal—the central-station company's seal on the meter cover. A single seal, on a loop of wire, joining the two wing nuts that secure the cover, may be used, or a separate seal on each wing nut—the former is the more commonly found. The ordinary round ball or "bullet" seal is used by many central-station companies, but a better form is one in which the two wires of the loop are arranged to cross inside the lead, so that the wires cannot be drawn out without deforming the seal. The wire of the seal may pass through a hole in the wing-nut post above the wing nut, or, better, through that hole and a hole drilled through one wing of this nut also. A felt washer underneath the metal one may be used to advantage to bar the hole in the meter cover against insects, moisture, etc.

In sealed meters, such as the Westinghouse, the meter has two compartments, with separate covers—the meter compartment proper, which is not accessible to the purchaser (central-station company), and the terminal chamber, which is accessible. Sealed meters are accordingly shipped from the factory with the seal of the meter compartment compressed, but the seal of the terminal chamber uncompressed, ready for the central-station company's sealing tools.

The manufacturers of so-called "sealed" meters—in which the binding posts are in a separate compartment, sealed separately from the meter compartment proper—claim the following advantages over unsealed meters, in which the binding posts and the meter are under the one seal of the central-station company:

The cover of the meter proper need not be removed to install the meter, so that there is no risk of getting dust, dirt, bits of insulation, etc., into the meter. The having of separate seals for the meter compartment and terminal chamber protects the central-station company from the carelessness of its own installers. A mistaken impression exists among many central-station men that companies manufacturing sealed meters disclaim responsibility in all cases when the seals are broken. The sealing of the meter, however, so far from importing such a narrow attitude on the part of the meter manufacturing companies, protects the latter and the reputation of their meters from incompetent local calibration, and at the same time really works to the advantage of the purchaser by protecting the meter from tampering by unauthorized persons. The manufacturing companies examine all meters returned as defective, with seals broken, and assume responsibility for repairs where the trouble is due to defects in manufacture or in the factory calibration.

Meters having a light rotating element lend themselves to shipment as sealed meters; whereas meters having comparatively heavy rotating elements cannot be shipped sealed, because the "pound" of the rotating element on the jewel bearing in transportation would be very liable to damage the latter, and the meter must be equipped with a locking device which lifts the rotating element off the jewel during shipment and which must be released when the meter is installed. Thus the rotating element of a well-known make of unsealed induction meter, weighing thirty-three grammes, is equipped with a locking device and is shipped upside down; whereas another well-known make of induction meter, having a rotating element weighing only fifteen grammes, has no locking device, and is shipped sealed. For the latter meter it is claimed that the step bearing is not injured in shipment, this sturdiness being due not only to the lightness of the rotating element, but to the small vertical play (one-thirty-second inch) which it has. That is, both the mass of the rotating element and the distance through which it can move to acquire momentum, when the meter is shaken.

[THE END.]

Japanese Bureau of Electricity.

A Bureau of Electricity has been added to the Japanese Department of Communications, in order to cope with the enormous growth of the electrical industry. In five years the demand for electric current has risen from 58,000 kilowatts to 380,000. The amount generated by hydraulic power has risen from 16,000 to 62,000, and permits have been granted for another 158,000 kilowatts. Of 817 registered manufacturing industries, 198 use electricity.

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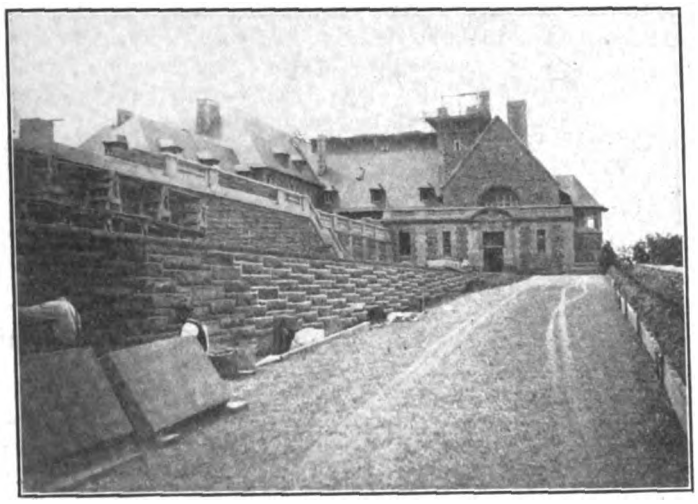
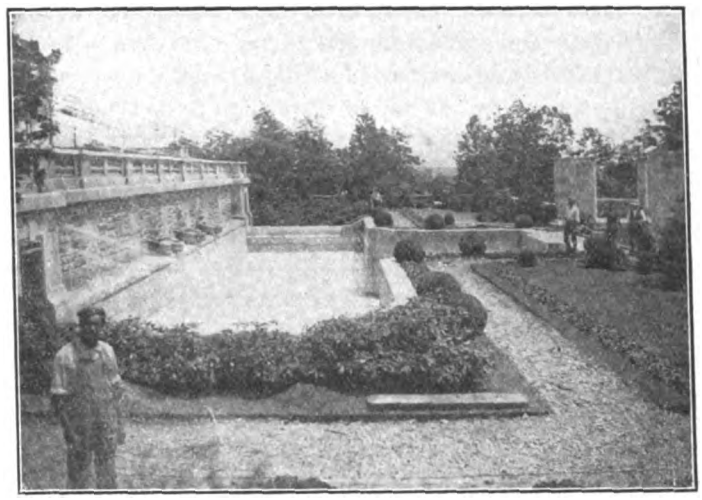
Electricity in the Arden Residence of the Late E. H. Harriman.

The magnificent residence of the late Edward H. Harriman at Arden, N. Y., affords an interesting example of how useful electricity has become in large-scale domestic applications. This new house has been a center of much interest ever since its owner's return from Europe in August of this year, and particularly during the past week subsequent to the demise of the great "rail king." The building is still far from completion, however, in relation to its ultimate architectural construction. The architects for the work are Carrere and Hastings, of New York, and the consulting engineers are Hollis French and Allen Hubbard, of Boston.



Main Entrance.



Terrace and Swimming Pool.

THE HARRIMAN RESIDENCE AT ARDEN, N. Y.

The Harriman residence is located in the Ramapo Mountains, about forty-five miles north of New York city, the nearest railroad station being at Arden, on the Erie system. A driveway about five miles long forms the only approach to the house for vehicles, but to facilitate access to the estate an inclined railway has been installed from the foot of the mountain to a point a few hundred feet from the house. This railway is 3,300 feet long, and attains a rise of about 800 feet in its run, the house itself being about 1,300 feet above the level of the sea. At present the inclined railway is operated by a steam hoisting engine, but it is planned to replace this by electricity as soon as practicable. The house is a granite structure, with limestone trimmings, and is to be 336 feet long by 192 feet wide when completed, the general shape being that of a square central portion with an inner courtyard and wings containing chambers, hallways and quarters for the servants.

The electrical service of the house includes lighting, heating, cooking, motor applications, telephone systems and call-bells. In general, the first floor contains an entrance, with brush-up rooms, music room, living room, reception and dining rooms, refrigerating room, kitchen, pantries, and in one wing, quarters for the large staff of servants employed about the premises. A courtyard, about forty-five feet square, with a fountain in the center which is provided with electric conduits, is a special feature of the establishment adjoining the first floor. On the second and third floors of the residence are all the chambers, with a temporary library. Upon the completion of the house, according to the plans now under construction, a large library was to be set apart on the second floor, with offices for the owner and his secretaries. At present the house

COURTYARD AND FOUNTAIN. HARRIMAN RESIDENCE, ARDEN, N. Y.

contains about 100 rooms. The grounds surrounding it cover over 20,000 acres.

The chief interest of the house, from the electrical point of view, at the present time arises from the careful provision which has been made in the wiring to enable future requirements to be met. As yet no power plant has been designed for the estate, although this work will probably be under way before long, depending upon the desires of the owners. Service is now provided by a temporary installation of a forty-kilowatt, 220-volt, direct-current generator. The house is wired for lighting on the three-wire system. An underground conduit has been provided outside the house for a short distance, so that when the power station is built the cables can be carried into the basement of the residence without obtrusiveness. Eight cables of 1,000,000 circular-mil cross-section each have been provided for connection with the future power house. This large size was selected on account of the unknown distance of the station from the house and the possible extensions of load within the residence which would later have to be carried without undue drop in voltage. About 1,200 incandescent lamps of sixteen-candlepower size are installed at present, but the ultimate installation will probably call for the installation of at least 4,000 lamps in and about the house and grounds. All rooms have been provided with electric-lighting facilities in an unusually liberal manner. The main switchboard of the residence has been designed to control a maximum of about 8,000 lights.

All motor service in the residence is wired on the two-wire system, for operation at 220 volts. At present only a small part of the anticipated power service is under contract, but the house is wired for motor applications as follows:

Laundry.—One five-horsepower motor, to drive two washing machines; one three-horsepower motor, to drive an extractor; one one-horsepower motor, to drive a mangle.

Drying Room.—One one-half-horsepower motor, to drive two fans.

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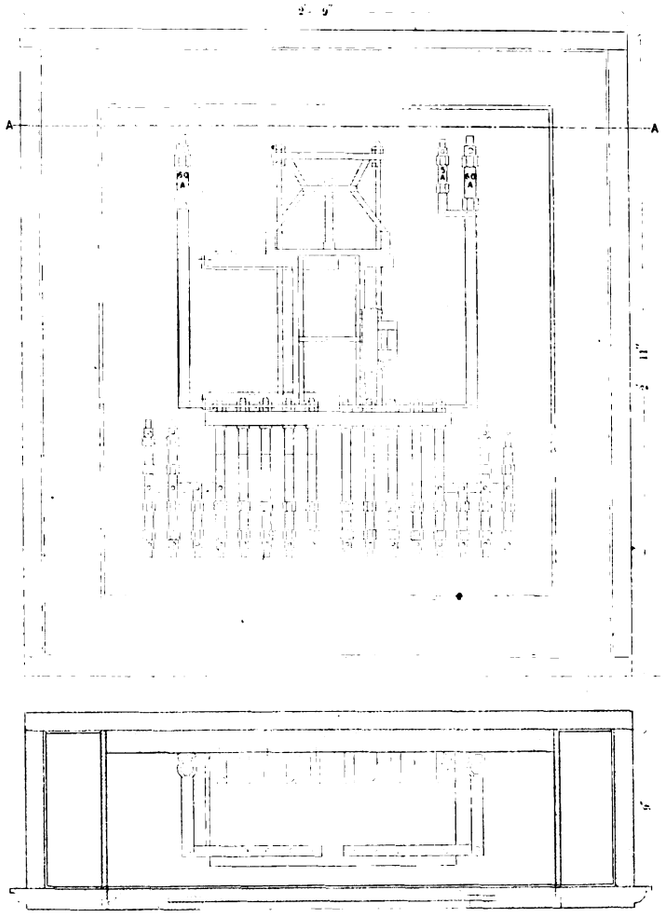
Cleaning Installation.—One seven-and-one-half-horsepower motor, to drive a Spencer four-sweeper vacuum cleaner.



FRONT ELEVATION AND SECTION AT A-A OF EMERGENCY CABINET CONTROLLING TEN LIGHTING CIRCUITS.

Elevator.—One ten-horsepower motor, to drive an Otis elevator, having capacity of 1,000 pounds at 150 feet per minute.

Refrigerating Plant.—One ten-horsepower compressor motor, to drive a six-ton Brunswick ice machine, a one-horsepower motor, to drive brine pump.

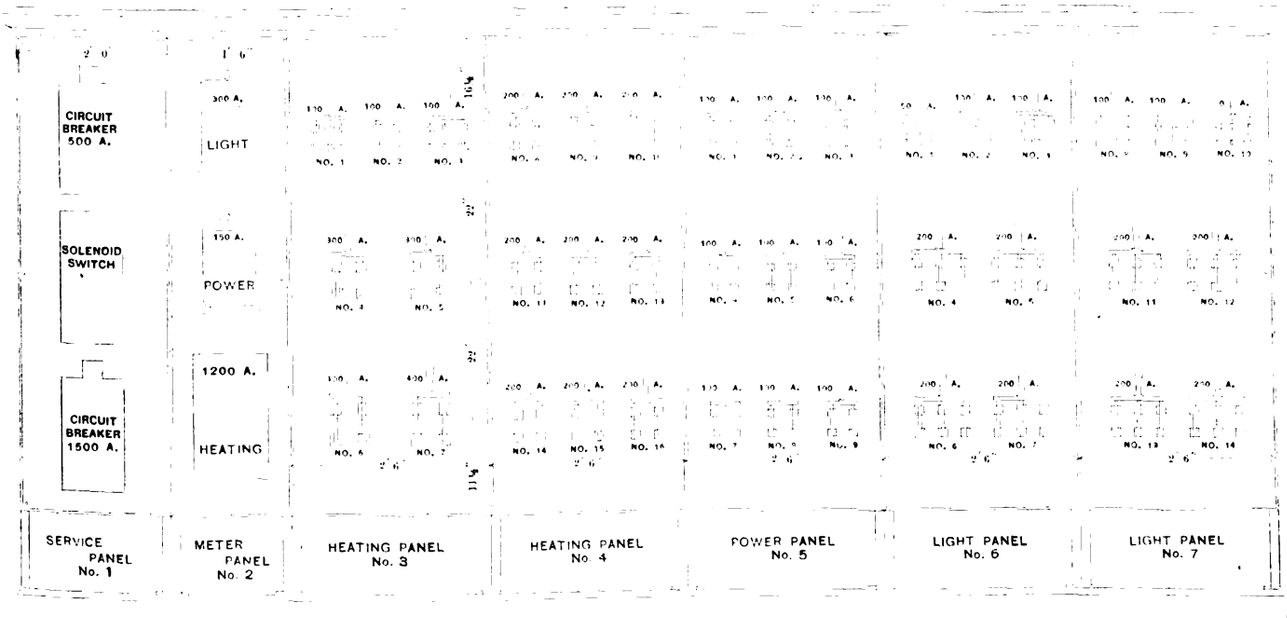
Music Room.—One five-horsepower motor in attic, to drive Aeolian main organ and echo organ blower.

Deep-Well Pump (Future Plan).—One fifteen-horsepower motor, to drive pump for 1,100 feet deep well.

At the present writing the drying room, organ, vacuum cleaner, elevator and refrigerating plant motors are either installed or under contract, representing about sixty per cent of the anticipated power installation.

The center of distribution for the house is at a switchboard located in the basement under the laundry. This board is a blue Vermont marble installation of seven panels, the total length being sixteen feet. It was built by the H. Krantz Company, of Brooklyn, N. Y. There are two lighting panels, a power panel, two heating panels, a meter panel and a service panel. For the power service a 150-ampere watt-hour meter has been installed, with a 300-ampere watt-hour meter for lighting and a 1,200-ampere instrument for recording the electrical energy used in heating. These are all the instruments on the switchboard, but the latter is equipped with a full line of Noark enclosed fuses, mounted on separate marble bases on the back of the board, with two circuit-breakers on the front of the service panel and also a bus-joining solenoid switch which is arranged to throw the lighting and power busbars together in multiple when desired, in case it becomes necessary later to operate the two classes of service independently for most of the time. The watt-hour meters are of the Thomson recording type, and the solenoid switch, which is only one of several of this type installed on the premises, is of Price-McKinlock manufacture. The circuit-breakers are of the Cutter I-T-E type.

From the switchboard the wiring is run in iron conduits to various junction boxes



FRONT ELEVATION OF SWITCHBOARD IN HARRIMAN RESIDENCE, ARDEN, N. Y.

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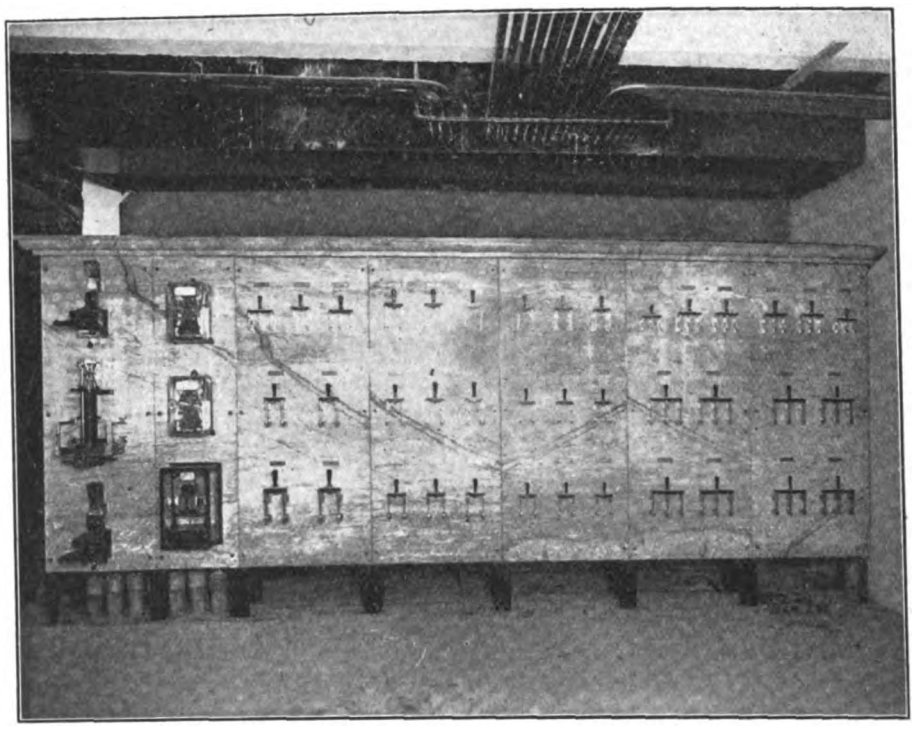
which are employed as distributing centers for their respective service. All wiring above the basement is concealed in the walls or floors. There are no pipe shafts in the house, which makes the wiring somewhat less symmetrical than is possible in office buildings and other large structures where there is considerable duplication of floors and services. Ceiling, wall and floor outlets have been liberally installed, however, to meet any probable demand for any kind of electric service. A special feature of the house is the installation of a separate extra pipe conduit line from every room in the establishment to the basement. This was done at the request of the owner, to anticipate any unforeseen future need of such a service. In the basement the main conduits are run exposed. The house has concrete floors, and is of fireproof construction throughout. The following circuits have been run from the switchboard for power service:

Service.	*Number of Conductors.*	*Size B & S.*
Refrigeration	2	4
Elevator	2	4
Laundry	2	4
Vacuum cleaner	2	6
Organ	2	6
Attic fan, in case of need	2	8

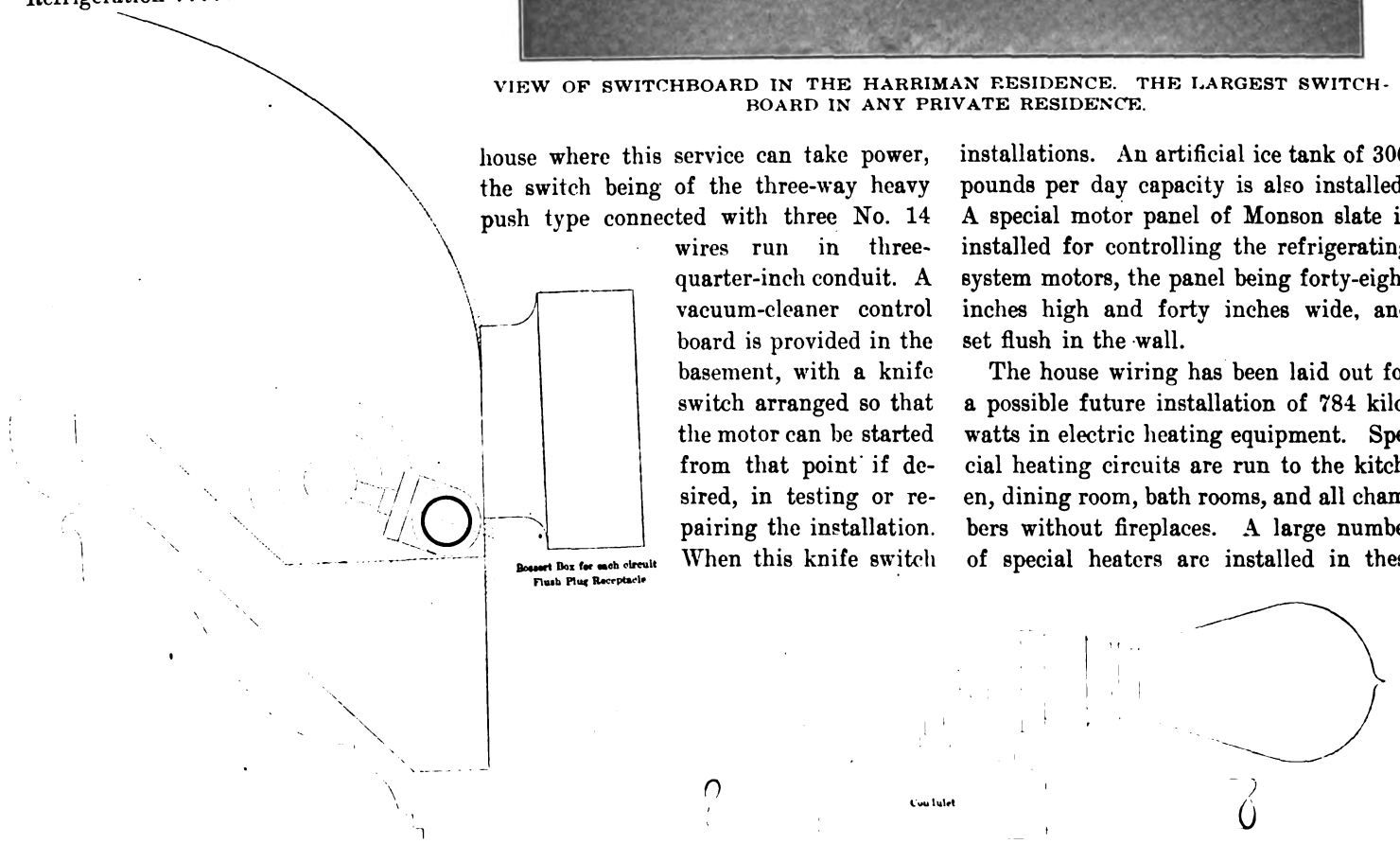
All the wiring was installed by the Attix-Perry Electrical Engineering Company, of Brooklyn. The cabinets contain slate junction boards with busbars and connections for enclosed fuses, with a branch for each circuit. A special feature of the vacuum-cleaner wiring is the provision of a switch at each outlet in the house where this service can take power, the switch being of the three-way heavy push type connected with three No. 14 wires run in three-quarter-inch conduit. A vacuum-cleaner control board is provided in the basement, with a knife switch arranged so that the motor can be started from that point if desired, in testing or repairing the installation. When this knife switch is open it is impossible for the motor to start by the action of any one elsewhere in the house, and tests can thereby be made at leisure.



VIEW OF SWITCHBOARD IN THE HARRIMAN RESIDENCE. THE LARGEST SWITCHBOARD IN ANY PRIVATE RESIDENCE.

The refrigerating plant consists of four separate compartments, arranged for the storage of vegetables, fruit, milk and meats. These compartments are provided with plate-glass shelves and walls, with silver-plated white metal fittings, and are electrically lighted. The cooling is effected by overhead brine coils, and the pantries are also provided with brine-coil installations. An artificial ice tank of 300 pounds per day capacity is also installed. A special motor panel of Monson slate is installed for controlling the refrigerating system motors, the panel being forty-eight inches high and forty inches wide, and set flush in the wall.

The house wiring has been laid out for a possible future installation of 784 kilowatts in electric heating equipment. Special heating circuits are run to the kitchen, dining room, bath rooms, and all chambers without fireplaces. A large number of special heaters are installed in these chambers and in the private bath rooms, for use on cool days, particularly in the spring and fall. In general, the heaters are installed in cast-iron boxes set into the wall flush, with bronze grill covers. the capacity of individual equipments varying from one-and-a-half to six kilowatts.



DETAILS OF COVE LIGHTING IN RECEPTION ROOM.

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The bath-room heaters average two-and-a-half kilowatts, and the chambers average from four to five kilowatts. Heating conduits are run to all the other rooms in the house also. Receptacles for "glow" heaters have also been generally established throughout the house in addition to the other heating outlets. The main heating of the residence is by hot water. It is probable that a combined coal and electric range of about eighteen-kilowatt capacity will be installed in the house kitchen. A separate meter will be provided for this device. At present a total capacity of fifty kilowatts in heating apparatus has been installed.

All the lighting fixtures in the house were supplied by Edward F. Caldwell & Company, of New York. There are numerous wall and ceiling outlets, and practically all the corridors and passageways between rooms are provided with two or three-way switches, so that light can be turned on from any entrance of the corridor or room. In general, all rooms are equipped with Diamond-H flush heater switches. For the lighting of the reception room 108 cornice lights have been provided, the wiring permitting the use of sixteen-candlepower bulbs. These are divided into two circuits, so that half may be turned on at once if desired. These lights are controlled by switches in the walls which in turn operate solenoid switches in the basement, the latter being selected on account of the capacity of the circuits and the desire of the owner to have the equipment take up as little space as possible. Another interesting feature of the electric-lighting service was the provision of a special switch in the owner's room by which he could throw about eighty lamps into service instantly around the house, in case he desired to go about quickly at night. A master switch in the above room controls a Price-McKinlock solenoid switch in the basement mounted in an emergency cabinet about two feet square. This solenoid is provided with multiple contacts, so that ten lighting circuits can be switched in and out simultaneously, the multiple feature being a new one in this type of switch. For this service a one-half-inch conduit is run from each special outlet to be controlled in the principal rooms on the first floor and in the corridors to the basement under the dining room. The solenoid switch is of the double-pole type, with 100 amperes capacity, and it is connected with the master switch by three No. 14 wires run in three-quarter-inch conduit.

The residence was provided with a private Bell telephone line to Mr. Harriman's New York office and a local line to the nearest Bell exchange, the service being handled by the New York Telephone Company. All the guest rooms are equipped with jacks for plugging into a trunk line leading to the butler's pantry in the residence, whence connection can be made with the long-distance Bell lines. Three twenty-pair cables for telephone service are run from a junction board in the basement to the principal distributing centers in the house, each instrument being at the end of a private line. In addition to the Bell service, a forty-station intercommunicating system has been installed by the S. H. Couch Company. The sets are fitted with long-distance transmitters and watch-case receivers, all the wiring being composed of cables built up of twisted pairs of rubber-covered wires, taped and braided after being laid. Each cable to an instrument has four No. 16 wires, the rest being No. 19 wires. The conduit for this service was installed large enough so that all rooms could have separate lines to the junction board in the basement. All outlets in the chambers are located in the baseboards. Besides the telephone service, a complete system of call bells with Holtzer-Cabot annunciators is in service.

Reparation in the Case of Differential Rates on Freight Classification.

An order has been issued by the Interstate Commerce Commission for reparation to be awarded to the Otis Elevator Company, in its claim against the Chicago Great Western Railway Company et al., covering two carload shipments of tee rails, or elevator guides, shipped by the company over the line of the defendant from Chicago, Ill., to Portland, Ore. One shipment moved September 24, 1906, and weighed 42,560 pounds, but this claim was not considered by the Commission, for the reason that the railroad company pleaded the statute of limitations against the claim, as it was not filed within the two-year period. That claim was therefore dismissed, but with regard to the second shipment, forwarded September 24, 1906, at destination the Northern Pacific Railway Company, the delivering carrier, collected freight at the rate of $1.40 per 100 pounds. The complainant contended that the rate should be seventy-five cents, and they asked for reparation for the extent of the overcharge resulting as the difference between those two amounts.

Transcontinental Freight Bureau tariff, I. C. C. No. 376, effective January 8, 1904, and in force on the date of the shipment, named a rate of $1.40 per 100 pounds, in carloads, minimum weight 24,000 pounds, from Chicago, Ill., to Portland, Ore., on machinery and machines, taking Class A rates as specified under the head of "machinery and machines," in current Western Classification. The rate collected on the shipment was assessed under the provisions of the tariff.

Supplement No. 29 to said tariff, effective April 10, 1906, and in effect on date of shipment, published a rate of seventy-five cents per 100 pounds, in carloads, minimum weight 30,000 pounds, from Chicago, Ill., to Portland, Ore., on iron and steel articles, and Supplement No. 45 to the tariff above referred to, effective August 10, 1907, named a specific rate of seventy-five cents per 100 pounds from Chicago, Ill., to Portland, Ore., on elevator guides, in carloads, minimum weight 30,000 pounds.

The claim was presented informally to the Commission, and at that time, April 23, 1908, the general freight agent of the Northren Pacific expressed the opinion that the tee rails or elevator guides referred to were entitled to the seventy-five-cent rate. Subsequent to the filing of the answers in this complaint, the rates on tee rails or elevator guides were raised from seventy-five to eighty-five cents in carloads, and both the defendants admitted that eighty-five cents would have been a reasonable rate to apply on the shipment, and the Northern Pacific expressed itself as being willing to settle on the seventy-five-cent rate if the Commission should hold that the tariff in force at the time the shipment was made, made that rate applicable. The Commission held this view, and reparation will be made on the basis of seventy-five cents.

A. F. T.

Electric Steel Industry in South Africa.

In a recent report, Mr. Kotze, mining engineer to the Transvaal Government, advises the establishment of a bounty system, similar to that of Canada, in the Transvaal iron and steel industry. It appears that there is a profitable field for the products of electrical steel furnaces which can turn out high-class steel with a comparatively small output per kilowatt-hour. Engineer Kotze proposes that the Transvaal Government share the cost with the Central South African Railways on the £1 for £1 basis of establishing an electric furnace.

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Vol. 55—No. 12

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

LUBRICATING AND ELECTRIC BRUSHES FOR COMMUTATORS AND COLLECTOR RINGS.

BY E. O. SCHWEITZER.

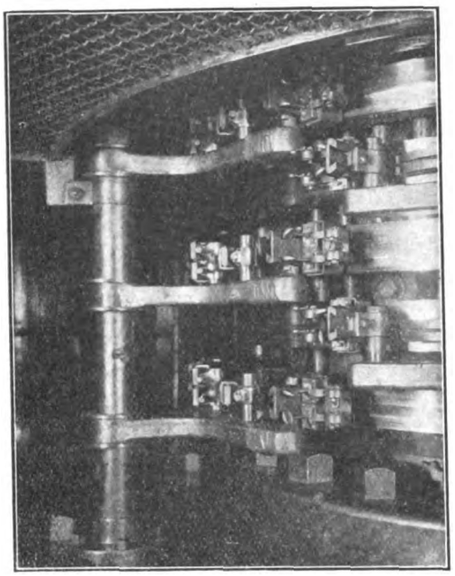
When two surfaces bear against each other and have relative movement, wear results. The elements determining the amount of wear are: relative hardness of the two surfaces, the bearing pressure, the smoothness of the surfaces, and the relative velocity of one surface to the other.

Wear can be largely reduced by sufficiently polishing the surfaces and by applying a lubricant between them.

With collector rings there are usually two metal elements. With commutators the stationary element is usually carbon, but dry carbon contains cutting particles and the commutator must, therefore, be lubricated.

With mechanical bearings, one element can usually be made of anti-friction metal, and it is usually easy to apply sufficient oil to prevent cutting. The conditions are different, however, with two rubbing surfaces which are in electrical contact. With collector rings it is necessary to use copper brushes which are nearly or quite as hard as the ring itself, while on commutators it is necessary to use brushes with certain resistance characteristics and this determines their hardness. A further difficulty in lubricating these surfaces lies in the fact that very little oil may be applied, for oil soaks into and rots the insulation on the machine and collects under the brushes, where it picks up dirt, etc., which in turn getting under the brushes aggravates the condition which the oil was applied to alleviate. Furthermore no successful method of constant application of a very small amount of oil has been found. Oil also in the small quantities in which it is permissible is not a proper lubricant.

The problem of lubrication of commutator and rings is, therefore, a serious one. If commutators and rings are to be allowed to wear away, there is a high maintenance cost as well as an additional first cost of apparatus; for rings and commutator must be liberally enough designed to allow of some of the metal being removed in resurfacing them without reducing the rating of the machine after the resurfacing is done. The cost of resurfacing is a large item (a prohibitive one in small towns) and in addition the



SHOWING BRUSHES WITH CARBON-PASTE LUBRICATING DEVICES, APPLIED TO RINGS OF VERTICAL 2,000-KILOWATT ROTARY CONVERTER.

electrical efficiency of the bearings is very greatly reduced when the polish has been destroyed. Moreover, the noise accompanying the operation of a machine whose commutator or rings are allowed to cut is a very serious objection in any station for obvious reasons.

Many methods have been tried for lubricating commutators and rings, the most familiar probably being the "oily rag" method. The objections to it are so well known that it is hardly necessary to enumerate them. The remedy is intermittent only; it is applied generally after the mischief has been done and does not prevent its recurrence; if enough oil is applied at one application to keep the parts quiet for any length of time, so much is put on that it collects under brushes and soaks into the mica insulation of the commutator and, generally speaking, does more harm than good. In fact, about the only good accomplished is in keeping the rings and commutator quiet for short periods after its application.

Another method of applying oil is to soak carbon brushes in it and to place enough on the commutator and rings so that the entire surface is covered as the machine rotates. The objections to this are practically the same as the oily rag scheme. If the brushes are sufficiently saturated to furnish oil for any length of time, too much is applied at first with consequent soaking of mica and collection of oil under the other brushes. There is the additional objection that when the brushes become warm the oil fries out and leaves the brush dry, which, of course, destroys its lubricating qualities.

Recently the use of dry graphite brushes has become somewhat general. This is a step in the right direction for graphite is an excellent lubricant for commutators and rings, and the use of these brushes materially decreases the abrasion of them. The method of application, however, is faulty. In order to get the lubricant on to the rings or commutators it is necessary for the rings or commutator to wear some of the graphite off the brush. This gives a dry powder which has practically no tendency to adhere to the surface and which is easily blown away by the air blasts caused by the revolving parts. Furthermore, graphite in this form is expensive and doubly so since it is not efficient.

Very finely divided graphite of the unctuous variety mixed with a small quantity of oil and applied with a rag or brush has been found to give very good results, but, of course, the method of application is open to the same objections as the oily rag method. A scheme for applying the graphite paste has been adopted by the Commonwealth Edison Company, of Chicago. The method is essentially the grease cup plan modified so that it can be applied to electrical devices. A copper or brass block is cut

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to a size to fit a standard direct-current brush holder and bored out so as to form a cylindrical space into which a piston can be accurately fitted. It is then shaped so that below the cylinder a carbon brush can be attached to the block and soldered. A cover is fitted oil-tight on top of the block, and a threaded shaft, on end of which the piston is fastened, is passed through a hole threaded to receive it in the cover. By means of a thumbscrew on the end of the shaft the piston position can be varied.

In its application the completed brush is fitted to the commutator or collector ring, like an ordinary direct-current carbon brush. A narrow slot is then cut into the carbon and leads up to the cylindrical space in the copper block. The piston and cover being removed the space is filled with graphite paste and the piston and cover are replaced. The brush is then placed in an ordinary direct-current brush-holder and kept on the commutator or collector rings by spring tension. An occasional twist of the thumbscrew presses the graphite into the slot in the carbon when it gradually feeds itself to the rings or the commutator. The illustration shows these brushes applied to the rings of a vertical 2,000-kilowatt rotary converter. Before the advent of the new type of lubricating brush this machine gave constant trouble. All kinds of lubricating devices had been tried on its rings, but they cut away badly and the copper dust and grease around it were an unusual nuisance. The cutting is worse on this machine than on most rotary converters because it has no end play. So bad had the rings become that it was considered advisable to turn them down. The cost of this operation would have been about $150, besides keeping the machine out of service for several days. So bad was this cutting that the advisability of installing more of this type of rotary converters was seriously questioned.

With the rings in this serious condition the new type lubricating brushes were installed. The results have been astonishing. The cutting ceased. Grease and copper dust are now practically unknown about this machine. The rings have taken a nice polish, and where they were formerly a continual source of trouble they are now considered the easiest in the substation to keep in condition.

The Spanish government has appropriated $2,000,000 to reorganize and develop the telegraph and telephone services.

Effect of Electrical Transmission.

The statement is frequently made that waterpowers have increased in value since it became possible to transmit power electrically. Charles T. Main, mill engineer and architect, Boston, Mass., points out in a recent paper that to be correct the statement should be modified. Since the introduction of electrical transmission many waterpowers which were before unavailable and valueless, have been developed and become of value, and many others will be in the future, but waterpowers which have been developed and the power used adjacent thereto have, as a rule, not increased in value.

To the generally applied methods of calculating the values of an ordinary waterpower there must be added one or two steps in the process when applied to the determination of the value of a remote waterpower, which may be capable of development with electrical transmission to some market.

To the cost of the development must be added the cost of the electrical apparatus and pole line to a point where the power is to be used, and this is a large item of expense in long-distance transmission. Usually, also, there must be added to the cost of the physical part of the plant a considerable amount for purchasing the right-of-way for pole line, legal expenses, and the cost of financing the scheme.

To the running expenses must be added the fixed charges for the electrical apparatus and pole line, and the cost of running and maintaining the same.

A correction must also be made for the loss of power in transmission. A comparison of the cost of producing and transmitting power can be made with the prices which can be obtained for this power to determine if the development has any value, and whether the development is warranted or not. The price which can be obtained for the power depends largely upon the cost of producing power by steam engines, gas engines with or without producer plants, or in some other way, at the point of delivery.

When used for lighting and railways the power is usually exceedingly variable, resulting in a low power-factor. The conditions are so variable that it is generally useless to attempt to calculate the comparative cost of power produced by steam under such varying conditions. Each case must be worked out to meet the special conditions of the problem under consideration.

The Largest Power Station in Europe.

At the end of this year the largest power station in Europe will be completed at the famous Trollhaetta Waterfalls in Sweden, and 80,000 horsepower of electrical energy will thereby become available for railway, municipal, industrial and other purposes. The station is being built by the state, which has gained possession of a number of other waterfalls besides the Trollhaetta, and has established a special water commission with a view to their exploitation. Near the village of Trollhaetta the Goetaelf gradually plunges downward for a distance of about 1,000 metres, forming thus a dozen waterfalls. A canal has been built which will catch the raging waters at the point where the falls begin and lead them to the power station. The canal, which is about 1,100 metres long, has been blasted out of the rock and will conduct 252 cubic metres of water a second, the calculated velocity of the water being two metres a second. At the end there is a collecting basin, from which the water flows into eight vertical turbine chambers thirty-two metres in depth, and blasted out of the rock. These chambers connect with the power station at the foot of the mountain, in which eight turbines of 10,000 horsepower each are erected. From the power station electric current will be transmitted to a number of cities and villages.

According to *Die Turbine* (Berlin, August 5), when the giant power station is put in operation, a complete change of scenery will take place at the Trollhaetta Falls. While at present 262 cubic metres of water a second are plunging down the incline, only about fifty cubic metres will flow there in future, and in place of the madly rushing waters, which excite the admiration of tourists, the dry and smooth-ground rocks of the river bed will stare at the observer. In the northern part of Sweden the government will also erect a large power station. Considering that Sweden's yearly imports of coal from England for the use of its industries and railways amount to sixty million kroner ($16,080,000), it is not strange that steps toward the utilization of its waterpowers are being taken. Its unharnessed waters still present grandiose natural spectacles which attract travelers from great distances, but in time the engineer will take possession of the waterfalls and make the attainments of modern engineering available, even in the remotest parts of the country.

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Assisted Electric Generating Plants.

[The following excellent article, which is replete with good, if debatable, suggestions, is reprinted from a recent issue of the *Manchester Guardian*, a well-known daily newspaper, published in Manchester, Eng. The matter is commented on in one of our editorials.]

The purpose of this article is to outline a scheme under which the electric power of, say, a factory may be derived in part from its own generating plant and partly from an outside source such as a public supply. This arrangement is particularly suitable for adoption where the home generating plant is driven by gas engines, but it is also applicable where steam engines are employed. It is well known that the cost of electric energy is very largely dependent upon the load factor of the generating plant, that is, upon the ratio of its actual to its maximum possible total output for a year. The object of the assisted electric supply scheme is to raise the load factor of the home generating plant by running it at approximately full load during working hours, the peak loads being carried by means of current from the outside supply. This would involve a very irregular demand on the public supply from the individual consumer, and in part this irregularity and the poor (individual) load factor that it denotes would unfavorably influence the central generating station. Where, however, a number of assisted plants were connected to the public supply, the irregularities of their demands would overlap and to a large extent eliminate any detrimental influence.

The load factor of a generating plant affects the cost of power in three ways. The higher the load factor the less are the capital charges per unit or per horsepower-hour, the less are the attendance and repair charges per unit, and the smaller is the fuel consumption per unit. The proportional effect of the first two of these charges is pretty much the same whether steam, gas or oil engines supply the motive power, but the last—fuel consumption—is less influenced in a steam plant than with the other two. Some engineers, reasoning from central-station theory, may be inclined to think that the reverse is true, and that it is in the steam station that the fuel consumpion is most influenced by the load factor. Whether or not this relation would hold in the case of central stations we need not argue here, for in any case the conditions are different. In the central station there are a number of generating sets, and the engineer in charge varies the number in operation, so that each is running at nearly full load, and therefore at nearly maximum economy. On the other hand, the stand-by losses due to banked fires, leakage, and radiation are more serious in steam than in gas plants. Hence it is arguable that a low load factor is especially detrimental to the economy of a central-station steam plant. But in the case of a small factory plant it is seldom possible to adjust the number of engines in use to suit the fluctuations in load, and the average load is, therefore, considerably below full load. In the case of gas and oil engines this means a much greater falling off in economy than with a steam engine, and, further, there being no stand-by plant, the advantage to the gas engine from this cause does not appear. For instance, suppose that the average load is fifty brake-horsepower, and the maximum eighty brake-horsepower, the gas engine must then be capable of supplying continuously eighty-five brake-horsepower, so that its average load would only be fifty-nine per cent of its rated full load, and its gas consumption per horsepower would be about twenty per cent greater than at full rated load. On the other hand, eighty-five brake-horsepower could be carried by a steam engine of which the normal full load was not more than sixty to sixty-five brake-horsepower, provided an expansion valve was fitted to vary the cut-off. The steam engine would then take the average load at its lowest steam consumption per horsepower, and even if a throttle valve was employed, the extra steam consumption would only be twelve per cent. It is not proposed here to compare the value of steam and gas plants for factory driving, but only to point out that an assisted supply is particularly desirable when gas engines are used. Another argument with the same lesson is the fact that the large gas engine on a small load is not only uneconomical of fuel, but also of capital outlay. Since it has no overload capacity, it must always be bought on the basis of the maximum and not of the average load. Thus in the case stated above, the size of the gas plant could be reduced from eighty-five to fifty-five brake-horsepower, and its price cut down by about twenty-five per cent. Even in the case of the steam engine, there would be a reduction in the capital outlay of from ten to twenty per cent according to conditions.

On the technical side there is no great difficulty in satisfactorily arranging an assisted supply. Where the load at the factory changed only slowly, hand regulation of the factory generator would be sufficient. This would almost always be the case in large factories. Where necessary, however, the proper apportionment of the load could be made automatic. For instance, an automatic reversible booster could be placed in series with the external supply, just as is at present done with buffer batteries on traction systems. With this arrangement power would sometimes be delivered from the factory to the outside supply system, but the meter would, of course, register the net inputs. Another method would be to place the switch on the outside supply under the control of the current from the factory generator, so that the public supply would be automatically switched on as the factory load approached the full load of its own generating plant. Once the outside supply had been switched on some device for maintaining approximately full load on the factory plant would be necessary. A booster could be used or, perhaps more simply, an automatic switch regulating the voltage on the factory generator, so as to maintain an approximately full-load current, the switch being brought into operation by the closing of the outside supply switch, and being governed by the factory generator current. In any case no great difficulty should be experienced in devising satisfactory regulating devices.

It is, perhaps, hardly to be expected that central-station engineers will welcome a scheme which appears to be devised to restrict their motor load; their great aim in life being to increase this class of load. However, it is not at all certain that an assisted supply would not add to, rather than reduce the consumption of current for power purposes; although it may be admitted that the load on the power station would not be quite so steady except in the case of large supply systems. One of the most important considerations with a factory owner or tenant is capital outlay. It is quite certain that many such install electric motors in the first instance in order to avoid the heavier capital outlay which would be required if steam or gas engines were to be employed, and it is equally certain that many factory owners are influenced in their decision not to adopt the electric drive and take current from an outside supply because of the cost of scrapping existing engines, boilers, and producers. Hence, when it becomes necessary to extend their power plant, they are likely to extend it along existing lines. If, however, they are offered a satisfactory assistant supply, they are likely to consider it

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favorably. At present, when a manufacturer takes current from an outside supply as well as generates his own, he has to keep the two systems separate, and so loses the advantages of an assisted supply outlined above. Consequently the outside supply does not appear to him in its most attractive light, and it stands correspondingly less chance of favorable consideration. An assistant supply should be an integral part of the whole power supply, and, therefore, capable of indefinite expansion until it absorbs the whole system. This, indeed, is what would be most likely to happen in practice. As the existing plant became too small, or worn out, or inconvenient, the factory owner would be strongly tempted to throw more and more load upon the outside supply until finally the conversion would be complete. Indeed, the assistant supply promises to be the thin edge of the wedge which central-station engineers are so desirous of inserting in the power plants of existing factories.

Gas Engines for Small Central Stations.

To the Editors:

In your issue of September 11 I see that you have published a communication from Mr. E. D. Dreyfus discussing the paper on "Central Stations in Towns of Less than 4,000 Inhabitants" that I read at the National Electric Light Association convention in Atlantic City last June.

I can only say I heartily agree with Mr. Dreyfus that gas engines are now, and in the future undoubtedly will become, an important factor in making the small central stations a success.

My paper, as presented in Atlantic City, expressly states that it was solely intended for plants using steam engines and boilers.

I did not attempt to present the facts as to gas-engine equipments for the reason I did not consider that there has been enough specific information on the actual cost of installation and operation, published, to obtain averages which would be of any value in a general paper. I frankly do not think that Mr. Dreyfus' discussion throws any light on the situation. I do think, however, that Mr. Dreyfus is in a position to very materially assist the small station manager by the publication of a paper which will contain somewhat of the same data on gas engines which I attempted to incorporate in my own paper on steam-operated plants.

James S. Knowlson.

Schenectady, N. Y., September 13.

Trade Journal Enterprise.

The Iron Trade Review, of Cleveland, Ohio, has set the pace for trade journalism by publishing a daily issue which will henceforth appear every day of the business year except Wednesdays, when the regular weekly edition is issued. A special feature of the daily publication is the complete system of daily market quotations in the metal trades, this being the principal reason for the new departure.

Association of Edison Purchasing Agents.

At a meeting of the Association of Edison Purchasing Agents, which took place at Briarcliff Lodge, Briarcliff Manor, N. Y., the following officers were elected:

President—H. C. Lucas, purchasing agent, Philadelphia Electric Company, Philadelphia, Pa.

First vice-president—W. H. Francis, purchasing agent, Edison Electric Illuminating Company of Boston, Boston, Mass.

Second vice-president—J. W. Brennan, purchasing agent, Edison Illuminating Company, Detroit, Mich.

Secretary—H. F. Frasse, purchasing agent, Edison Electric Illuminating Company of Brooklyn, Brooklyn, N. Y.

Treasurer—Andrew Banks, Jr., purchasing agent, Consolidated Gas, Electric Light and Power Company, of Baltimore, Baltimore, Md.

Stock controller—J. J. Miley, purchasing agent, Minneapolis General Electric Company, Minneapolis, Minn.

The meeting took place at the same time as the convention of the Association of Edison Illuminating Companies, and several new members were enrolled. At the present date the roster covers about thirty-five per cent of Edison illuminating companies. The purpose of the association is for general information and to induce friendly business intercourse.

A School of Aeronautics.

A higher school of aeronautics has been established in France. The new school, which is due to the conception and efforts of Commandant Roche, will be concerned with the practical side of aeronautics and aviation, and the pupils who succeed in passing its examinations will receive the title of aeronautical engineer. The course will last a year, and the lectures will be devoted to all the principal branches of aeronautics and aviation, including motors, while additional lectures will be given on subjects concerned with the progress and evolution of aerial navigation.

Protection Demanded for Linemen.

A petition signed by electrical workers of South Bend, Ind., says the *Telephone Engineer,* of Chicago, has been filed with the City Council, asking for the improved methods in electrical construction and better protection for the linemen.

The petition asks that all high-tension wires be placed on yellow cross-arms; primary and arc-light wire on black cross-arms, and low-voltage wires, such as telephone, telegraph, police and fire-alarm, on red cross-arms. Where high and low-voltage wires are on the same poles, the petition asks that a clearance of six feet be made.

Cross-leads are recommended to have a clearance of four feet with proper guards. High-voltage wires should be placed on the tops of the poles, and no street-railway lines should carry more than 1,000 volts on their wires. The petition cites the great number of incidents where electric workmen had been electrocuted and little or nothing had been done to better conditions.

Electrically Driven Kneaders.

The Syndicate of Bakers, of Paris, has made comparative tests of fourteen mechanical kneaders. The measurements of the power consumed were made by Mr. Ringelmann and communicated by him to the French Academy of Science. Each batch of dough weighed 172.75 kilogrammes and was of the same composition. The total mechanical work necessary for one kneading varied from 19,476 to 165,380 kilogramme-metres, according to the system employed, and the maximum power required at the end of the operation varied from 0.41 to five horsepower. Knowing the power at no load, which was from 1.75 to 32.42 kilogramme-metres and the time required for the operation (from six to fifteen-and-one-half minutes), it was found that the work expended for kneading 172.75 kilogrammes of firm dough was from 16,664 to 175,983 kilogramme-metres, according to the machine. The kneaders considered as excellent in all respects by the commission required from 44,400 to 58,000 kilogramme-metres for one kneading. For kneaders driven by electric motors the cost of electrical energy calculated on the basis of the rate in Paris (0.3 franc, or six cents, per kilowatt-hour) amounted to 0.06 to 0.08 franc per kneading—much less than kneading by hand, which is not as sanitary, and does not give bread of as good quality as mechanical kneading.

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The New Power House for the Capitol Buildings in Washington.

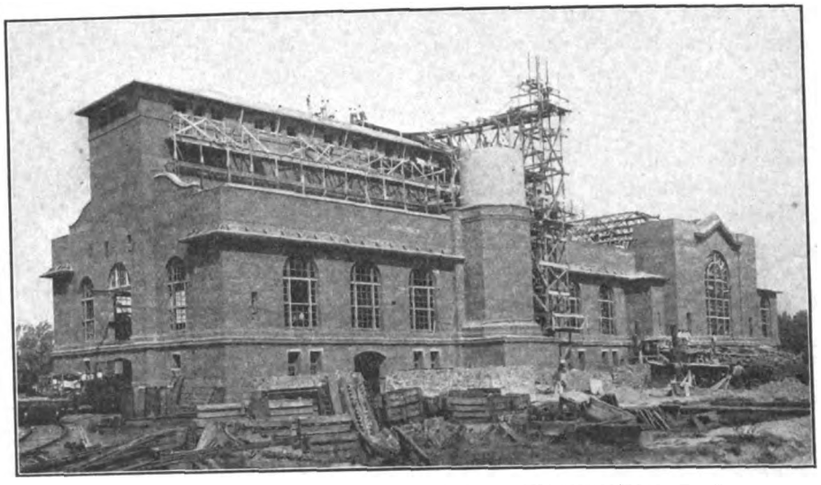
The Federal Government at Washington, D. C., is erecting a large central power house which will supply light, heat and power for the Capitol, the office buildings for the House of Representatives and the Senate, the Congressional Library, and possibly the new Supreme Court Building, when this long-deferred structure is provided for. This plant has been under construction for some time, and, as seen in the accompanying illustration, is rapidly nearing completion.

The plant is located on Capitol Hill in the plot of ground known as Garfield Park, near the intersection of Virginia and New Jersey avenues. The building is about 3,000 feet from the Capitol, and is connected with it and with the other buildings referred to by tunnels through which the steam pipes and electric cables run. Seven thousand feet of tunneling was necessary to connect the various buildings with the plant. These tunnels are large enough for a man to walk through, and are sectionalized so that in case of a breakdown the trouble can be located and isolated without interrupting the service.

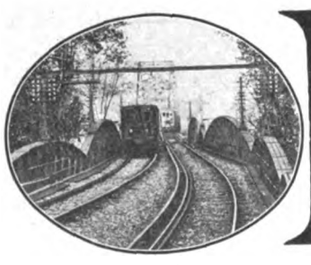
The equipment of the plant will be very complete. The Government is sparing no pains in selecting the latest machinery so as to make the plant one of the finest of its kind in the world. There are already installed sixteen 500-horsepower boilers. In the group of four buildings to be supplied from this central plant there are 46,000 sixteen-candlepower incandescent lamps already in use. These are divided as follows:

Congressional Library, 8,000; office building of the House of Representatives, 10,000; office building of the Senate, 8,000; Capitol Building, 20,000. In addition to these incandescent lamps there are distributed throughout the Capitol grounds about 150 arc lamps.

The corner-stone of the power house was formerly the base stone of the Greenbough statue of George Washington, which stood for many years on the plaza of the east front of the Capitol but was recently removed to the Smithsonian Institution. The power plant, when completed, will cost very nearly $2,000,000.



THE GOVERNMENT POWER PLANT AT WASHINGTON, D. C.
Construction View, Taken August 25, 1909.

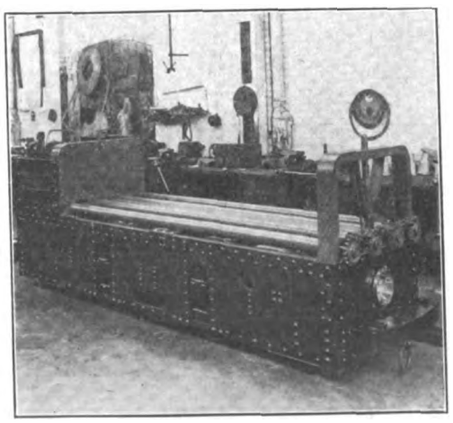


ELECTRIC TRACTION

Novel Electric Storage-Battery Locomotives in German and Austrian Mines.

Throughout Germany and Austria-Hungary there are a number of mines which have been equipped with storage-battery locomotives of the unique construction shown in the accompanying illustrations. The batteries are mounted on the top and are removable for charging. The gearing for this purpose is of special design, with permanent rolls fixed in the locomotive frames directly above the truck. By providing this equipment it is possible to shift the discharged batteries and replace them on the locomotive with fully charged sets with a minimum expenditure of time and labor in making the exchange.

These German storage-battery mining locomotives are equipped with motors of from eight to thirty-two horsepower capacity and each locomotive is provided with two sets of batteries when uninterrupted service is required. One of these is being charged in the charging room while the other is operating the locomotive in the mine.



STORAGE-BATTERY MINING LOCOMOTIVE WITH BATTERY REMOVED.

It is stated that the storage batteries used are seldom discharged more than sixty or seventy per cent of their capacity and it requires for charging only about one-third of the time usually taken for discharging in operating in the mines. When partially discharged the batteries may be fully charged in about one-and-a-half hours.

The mining locomotive of this type of twenty-horsepower capacity has two batteries of ninety cells each, the capacity of each being seventy-four ampere-hours. They are capable of operating 400 effective ton-kilometres on a single charge. When two storage batteries are employed with a smaller locomotive the cost is about 1,200 marks, or $300, per horsepower, while for the larger locomotives the cost

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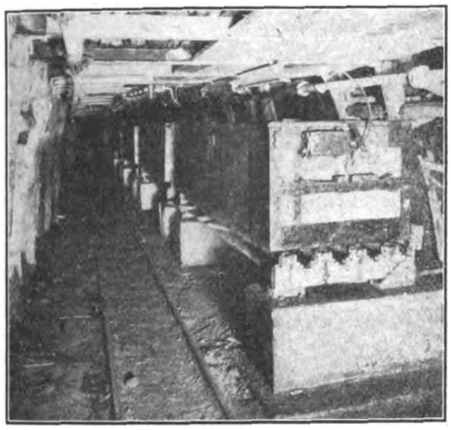
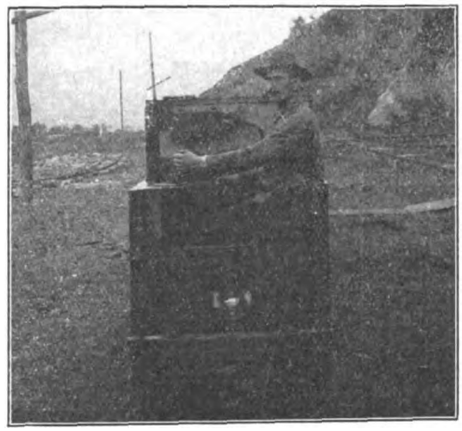
is considerably less, being nearer to $200, or 800 marks, per horsepower.

The cost of operation for these locomotives is from one-third to one-half the cost of animal power, it is claimed, and the current required is from one-fourth to one-third kilowatt-hour per ton-kilometre. One advantage of these equipments over the trolley and third-rail mining locomotive is that no added weight



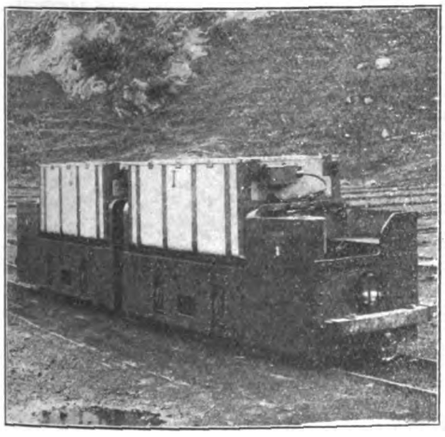
CHARGING TABLES FOR LOCOMOTIVE BATTERIES IN THE MINE.



STORAGE-BATTERY MINING LOCOMOTIVE IN SERVICE.

is needed for adhesion, as the storage battery provides all the necessary weight required.

One of the accompanying illustrations shows the battery-charging tables at Shaft II of the Konigsborn Aktiengesellschaft. There are five battery locomotives at these mines near Heeren in Westphalia, one of which is shown in the



DOUBLE-UNIT STORAGE-BATTERY MINING LOCOMOTIVE.

shops. At this mine there are provided eight storage batteries, each having eighty-one cells of a capacity of seventy-four ampere-hours.

There is no doubt that the storage-battery locomotives have some marked advantages over those operated by overhead trolleys or third-rail conductors. They are thoroughly reliable and without question less dangerous to the miners, as they eliminate the need of any exposed conductors. They also have a large radius of action without extensive overhead construction.

In the Hungarian Petroseny mine there are eight storage-battery locomotives in operation of the type shown in the lower illustration, each having a capacity of twelve horsepower. These locomotives of the Zalgo-Tarjaner Kohlen-Bergbau Aktiengesellschaft are operated in pairs. The double units thus formed are capable of hauling forty coal cars without difficulty.

At this mine there are used sixteen sets of batteries. The Tudor type of cells are employed as built at Budapest by the Tudor Accumulatoren Fabrik Aktiengesellschaft. Each locomotive has fifty-one cells, with a capacity of seventy-four ampere-hours each.

Long Island Road to Issue $16,500,000 Debentures.

The Long Island Railroad has made application to the New York Public Service Commission to be allowed to issue ten-year four per cent debenture bonds to an amount up to $16,500,000.

These bonds are to be delivered to the controlling company, the Pennsylvania Railroad, to reimburse it for advances made for improvements on the Long Island. To date, the Pennsylvania has loaned its subsidiary $6,062,956, and it is planned to advance about $10,500,000 more when these debentures have been authorized. The Long Island is paying the Pennsylvania four-and-one-half per cent for money, so that more than $30,000 a year will be saved by the refunding in interest charges on the money owed the controlling road as of December 31, last. The latter owns 135,958 out of the 240,000 outstanding shares of the Long Island Railroad.

In the last four years, from 1905 to 1908, inclusive, the Long Island has spent a total of $14,427,951 on improvements.

Electrification of Australian Railways.

The suggestion for electrifying the Melbourne suburban railway system, as recommended by Charles H. Merz in a special report to the Victorian Government, has not been favorably received by the Victorian Railway Commissioners, as is now well known.

However, the magnificent success achieved by the conversion of the Sydney suburban system, according to the *Electrical Engineer*, London, refutes the Victorian Commissioners' arguments that electrification would not pay in Melbourne. On June 30, 1908, the New South Wales State Tramways had cost $16,442,500, and they showed a net gain of $357,500, after paying all working expenses and interest on capital. The steam lines, with a total length of 43.25 miles, belonging to the state, are run at a net loss of $15,500 a year. The New South Wales Railway Commissioners announce that they mean to electrify all their steam lines at an early date. During the past nine years, since the inception of electrification, the length of line has increased about eighty per cent at an outlay of double the original capital, and three times the original number of passengers are carried. The interest return on the capital invested has risen from four to nearly six per cent. The total length of single track operated by electricity is 146 miles. The substitution of electric power for steam has been successful in every respect, and the most important result of the change is not seen in the figures—namely, the extension and development of the city of Greater Sydney. The fares are charged on penny sections, about one-and-one-half miles each, and workers can live a long way from their work, in better houses with more land, amid fresher air. The Sydney railway authorities contemplate a complete metropolitan scheme of underground electric traction, designed to help the future development of the city.

With the Sydney example staring them in the face, it is extraordinary that the Victorian Railway Commissioners should object to electrification. Unfortunately they are all three of them steam-railroad men, with no knowledge of electric traction, so the expansion of the great city of Melbourne and the convenience of its citizens must await the advent of more modern railway experts.

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Transportation Arrangements for Denver Convention.

Transportation arrangements for attending the annual convention of the American Street and Interurban Railway Association, at Denver, Colo., October 4 to 9, have been completed and announced in the form of an attractive folder.

A special train de luxe has been arranged for, consisting of the finest of modern equipments, including a buffet-library car, standard Pullman sleeping cars, dining and observation cars, electric lighted throughout.

This train will leave Chicago, over the Burlington Route, Saturday, October 2, at 2 p. m., and will arrive in Denver Sunday, October 3, at 4 p. m.

Returning trains will leave Denver, at the close of the convention, at 4:15 p. m., 10 a. m. and 9 p. m., arriving in Chicago the following day at 8:45 p. m., 4:30 p. m. and on the second day at 7 a. m., respectively.

The fare, round trip, will be thirty dollars, not including meals or berth. The return on these tickets will be good till October 31.

Reorganization Plan Approved.

The Public Service Commission, of New York, has approved the plan and agreement for the reorganization of the Albany & Hudson Railroad Company submitted by ex-Governor Myron T. Herrick, of Ohio, Clinton L. Rossiter, vice-president of the Long Island Loan and Trust Company, and R. A. C. Smith, president of the American Mail Steamship Company, a reorganization committee representing a large number of stockholders and bondholders of the company.

The plan of reorganization provides for the issuance of $2,100,000 preferred and $1,275,000 common stock, to be exchanged for the present outstanding stocks and bonds. The new company also asked for authority to issue a mortgage of $1,500,000, the greater portion of which is to be used in double-tracking the third-rail system, between Rensselaer and Kinderhook, and the purchase of the bridge connecting Albany and Rensselaer.

Without Advertising!

Shut off your correspondence, take down the sign over your door, recall your salesmen, refuse to talk your own business, cut off communication with the outside world entirely and what business you do, if any, may be said to be done without advertising.

The Dangers of Atmospheric Electricity to Airships.

An approaching thunderstorm is a cause of apprehension to air navigators, for the slightest spark arising in the balloon may cause the burning or explosion of the gas it contains. L. Zehnder states that atmospheric electric discharges are dangerous to the balloon particularly when conducting parts are in or on the balloon, or in its vicinity, and indicates means of preventing their disastrous effects. The space surrounding our earth must be considered as an electric field, in which a difference of potential exists in a radial direction, and it has been shown that this difference of potential varies from 1,000 to 10,000 volts per metre of difference in height, according to the conditions of the weather. Furthermore, during thunderstorms, the electrical conditions of the air are subject to great variations, and the charges may change suddenly in sign. The greater these changes, the greater the danger to the airship. If the latter had the same conductivity and dielectric properties as the surrounding air, the probability of its being destroyed by atmospheric discharges would be very small.

In clear weather an ordinary balloon without metal parts, of large size, is not exposed to any danger so long as it floats in the air, as an equalization of static electricity is effected by the conduction of the balloon material; but upon landing, when the trailing rope touches the ground, the formation of a spark is more likely. Ignition of the gas by electric discharges may take place when the poor conductors constituting the balloon are very wet or when metallic parts are present, those of the valve being the most dangerous. A metal valve will retain a charge as long as it lies on the well-insulating balloon material, but will discharge to any conductor coming near it when the valve is opened and the balloon collapses. Therefore the valve should not be touched while gas is flowing from the balloon, and afterward only when it has been discharged slowly and under suitable precautionary measures. A long trailing rope of well-conducting material is recommended as a suitable protection against explosion upon landing. It is possible that after a shower a portion of the balloon envelope in the vicinity of the valve may be dripping wet and that a spark may form between this portion and the valve.

Sudden changes of potential, like those of atmospheric electricity during thunderstorms, are produced artificially in wireless telegraphy, and the sending of wireless messages from a balloon is therefore dangerous. The receiving of such messages, on the other hand, is harmless, as very low pressures are employed in the receiving apparatus. In balloons of rigid or semi-rigid construction with metal frames, like the Zeppelin airship, the conditions for burning are very favorable. According to the above-mentioned measurements, the difference of potential between various parts of a balloon of this kind may be very great, especially when it assumes a slanting position in order to rise or sink. In the Zeppelin airship, with its length of about 130 metres, the difference of potential may amount to 500,000 volts between its ends, while 3,000 volts are sufficient to generate igniting sparks. As protection, the author recommends that either the balloon be provided with projecting points, from which alone the electricity may radiate into the surrounding air beyond the reach of any escaping gas, or else to use thin sheet metal as a balloon envelope. According to electrostatic laws, no sparks could arise in the interior of a balloon thus constructed and static charges would be equalized with facility.—*Abstracted from Elektrotechnische Zeitschrift (Berlin), August 12.*

Electric Locomotive Headlights.

The agitation regarding the compulsory use of electric headlights on the steam railroads in several states has brought forth favorable comment from most of the locomotive engineers that have been called to testify on the matter. Recently in the state of Washington several locomotive engineers stated before the railroad commission that the electric headlight was much better than the acetylene headlight and was the only one that ought to be considered. Its great penetrating power was unexcelled and did not interfere with the reading of signals, as had been claimed by some railroad men.

Further Railroad Electrification in England.

It has been definitely decided to open the public service of electric trains on the newly electrified South London line of the London, Brighton & South Coast Railway on Friday, October 1. The fixing up of the overhead apparatus at the Victoria and London Bridge stations has been completed, and trial trains have been running every night for some time along the whole route.

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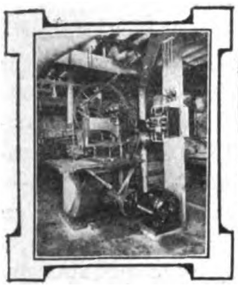
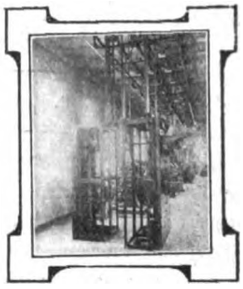


Industrial Power



Electric-Fan Installation in Bombay Cathedral.

In a climate like India some method of moving the air about is absolutely necessary for comfort, and prior to the advent of electricity this was effected by means of the punkah, a heavy wooden pole slung by ropes from the ceiling and having a piece of cloth about two feet deep attached to it. Sometimes several punkahs would be hung one behind another and linked together by ropes. A coolie would stand outside the room and keep the punkahs swinging by means of a rope passing through the wall and over a pulley.

INTERIOR OF BOMBAY CATHEDRAL, SHOWING ELECTRIC FANS.

Punkahs in India are now largely being replaced by electric fans. The accompanying illustration shows a most artistically arranged electric-fan installation in the Bombay Cathedral. Anyone who has seen the interior of this cathedral when (about a year ago) it was darkened and obscured from view by lines of punkahs swinging about eight feet from the ground will be greatly impressed by the difference the electric fan has made in this case. The illustration clearly shows the brightness and cheerfulness of the interior, and it may well be said that the innovation has added to rather than detracted from the æsthetic effect.

The fans, of which there are sixty-four, were supplied by Crompton and Company, Limited, of London and Chelmsford, England, and were installed by Greaves, Cotton and Company, a Bombay electrical contracting firm. Each fan has a sweep of sixty inches, and the aluminum blades are curved after a pattern finally adopted by the Crompton company after an exhaustive system of experimentation, as affording absolutely silent running and giving the most efficient displacement of air. These experiments were fully described in a paper by L. Murphy which appeared in a recent issue of the *Electrical Review*, of London.

The direct current for the fans is supplied by the Bombay Electric Supply and Tramways Company at a pressure of 230 volts. This company has a three-wire 460-volt direct-current service in the city of Bombay, but in the suburbs and outlying districts the company uses a three-phase, four-wire, fifty-cycle, 230-volt service (400 volts between phases).

The total cost of the installation of the sixty-four fans was approximately $3,000. The current used by the fans is about eighty-five watts per hour, and the cost of working is about $65 per month.

Taking into consideration the extremely low cost of labor in India it is a promising sign that electricity should be displacing native labor which is used for operating punkahs in this part of the world.

Thanks are due to T. D. Parry, of the Bombay office of Messrs. Crompton, for supplying the above information.

The Production and Uses of Ozone.

A paper on this subject by Leon Gerard fills the entire August number of the monthly bulletin of the Société Belge d'Electriciens. The various systems of its manufacture now in commercial use, among them that of the author, are described, as well as a number of large installations for the sterilization of water. The most important industrial, commercial and medical uses of ozone are dealt with in separate chapters, and an extended bibliography is appended to the paper. In conclusion, the author states: "The object of this communication is to show that ozone may now be obtained cheaply and in quantity as an industrial product, and many of its applications that have been abandoned simply on account of its cost are now possible. The immediate employment of ozone for the sterilization of drinking water forms a branch of the electrical industry which will absorb thousands of kilowatts in Europe, for pure and cheap water is an essential element of human existence. The fact that ozone costs ten times less today than ten years ago represents an important industrial progress, which has the double advantage of having an economic and general-utility character in view of its bearing on the public health."

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CURRENT-LIMIT CONTROL.

BY E. R. CARICHOFF.

Control of the current input of a motor by the current itself is recognized as superior to any other method of regulating the current input while the motor is accelerating, and the purpose of this article is to explain a few simple diagrams so that anyone can readily see how the control is effected.

It is generally understood that the current-limit device stops the progression of the accelerating devices when the main current exceeds a set value and permits their progression again when the current recedes to the set value. In other words, the current-limit device causes a pause after the main-line contact is closed through the motor and after the withdrawal of each resistance unit and the current curve takes the shape of a series of saw teeth.

The maximum and minimum current values may be made to differ by less than five per cent, although such a small variation is not usual, because it requires a large number of resistance steps. For the same current variation a motor with a series-field winding needs fewer resistance steps than does a similar motor with shunt winding only.

Ordinary conditions of series-motor operation are met by the use of controllers with five or six steps, but exceptional conditions may call for as many as twenty steps. By a five-step controller is meant one with four blocks of resistance, and by a six-step controller one with five blocks of resistance. The current-limit device causes a pause before the withdrawal of each block of resistance.

For series-parallel control of motors ordinarily five steps are used in series with three steps in parallel, or six steps in series with four steps in parallel. For frequent service, such as railway, hoist, and rolling-mill work, controllers are usually built up of a number of magnetically operated unit switches, commonly called contactors, and the contactors forming a controller are alike whether used for making and breaking main-line current or for cutting out or cutting in a block of resistance. They are provided with heavy renewable contact tips protected by magnetic blow-out, and are built so substantially that they may be depended on to operate one million times before requiring renewal of any parts.

As contactors are moderately quick acting, and the time of accelerating a motor is greater than the sum of the fractions of time taken by the several contactors of the controller, it is evident that there must be a pause introduced between the successive operation of contactors.

With a motor always starting the same load on a constant voltage, the pauses may be made fixed intervals of time, but when the load is variable and the voltage also, the length of these pauses must be varied to keep the accelerating current practically constant. This is what the current-limit governor does; the motor does its best, and no more; it takes less time to accelerate for a light load than for a heavy load. On the other hand, with fixed time intervals between the operation of successive contactors, the longest time of starting the maximum load must also be taken for the minimum load resulting in a waste of time. Even if fixed time intervals were satisfactory, it would be found very difficult to get a device suitable for use with controllers which is capable of affording definite time intervals. The ordinary dashpot furnished for such purposes gives an uncertain interval, and is generally regarded as unsatisfactory.

Fig. 1 shows a circuit diagram for a five-point controller, non-reversing. The master switch K has two running positions. On the first position a maintaining circuit is afforded for all the contactors, which are actuated from the second position of the master switch. When the master switch is thrown at once to second position, the contactors are actuated successively under the control of the current-limit device, but the progression may be arrested at any desired moment by returning the master switch to first position, and the progression may be started again by moving K to second position. Repeated movement from position 2 to position 1 serves to notch up the controller in any desired intervals of time.

The current-limit relay has two independent plungers with bridge pieces closing contacts in the actuating circuits to the contactors when the plungers are down; for lifting the two plungers there are two coils, 8 and 9, the circuit for either of which passes through contacts controlled by the other; and for holding up the plungers there are two main-line coils, CL_1 and CL_2, which are provided with adjustments such that the plungers may be set to drop at any fixed value of current within wide limits.

The contactors are each provided with an interlock switch, whose function is to close the contactor coil upon a maintaining circuit, and then to interrupt the actuating circuit from the current-limit relay, so that the lifted plunger of the relay may be free to fall as soon as the main current drops to the set value. The interlock switch of one contactor also bridges a gap in the actuating circuit for the succeeding contactor.

Referring to the diagram, Fig. 1, suppose the operator's switch K is moved to position 2; the only closed path for the current is from L^1 to 7, through 9.

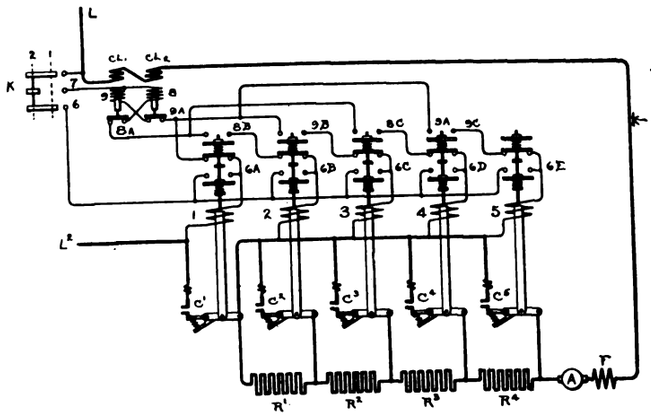

FIG. 1.—FIVE-POINT CURRENT-LIMIT CONTROLLER.

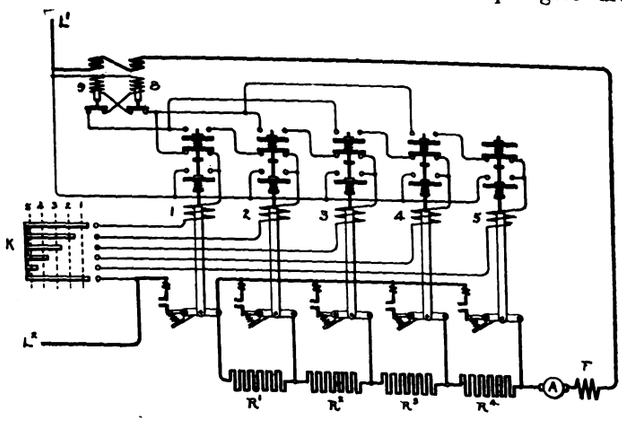

FIG. 2.—CONTROLLER WITH CURRENT-LIMIT AND INDIVIDUAL RUNNING POINTS.

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through contacts controlled by 8 to 9A, through interlock contacts of contactor 1 to 6A, through coil 1 to L^2. Contactor 1 now closes contact C^1, completing the main motor circuit from line L^1, through CL_1, CL_2, field F and armature A of motor, resistance blocks R^4, R^3, R^2, R^1, and contact C^4 to line L^2. The interlock of the contactor closes bridge 6 to 6A, connecting the contactor coil to the circuit from wire 6; this interrupts the circuit from 6A to 9A, permitting the plunger of 9 to drop as soon as the main current recedes to the set value, and closes 8A to 8B in the actuating circuit to contactor 2.

As soon as the main current in CL_1 recedes to the set value, the plunger of CL_1 drops bridge 8 to 8A and current passes from L^1 by wire 7 through coil 8, lifting its plunger and bridging contact, through bridging contact on 9 to 8A, thence across bridge closed by interlock of contactor 1 to 8B, through bridge on interlock of contactor 2 to 6B, then through contactor coil 2, and through contact C^1 to L^2. Contactor 2 then closes contact C^2 and cuts out the block of resistance R^1; at the same time it moves its interlock switch, closing wire 6 on 6B and afterward opening bridge 8B to 6B. The increase of current caused by withdrawal of R^1 causes the main current in CL_2 to hold up the plunger of 8 until the current falls to the set value, when this plunger drops, closing 9 to 9A. Current may now pass by 7, 9, 9A, 9B, and 6C to coil 3. Similarly, contactors 4 and 5 are excited.

Fig. 2 shows a controller and operator's switch with individual running points for each of the contactors, 1, 2, 3, 4, and 5.

In cases where an operator has to manage a number of controllers at the same time or wishes to run on definite resistance points this becomes the preferable form. It is readily seen that the controller K may be thrown by the operator to any point desired, and the contactors up to that point will close as fast as the current-limit relay will permit.

As in other cases, the actuating circuit of each contactor, except the first, has a gap which must be bridged by the contactor immediately preceding. If the controller is thrown to position 5, the only controlling circuit is through contactor coil 1 and relay coil 9. Contactor 1 interlock comes up bridging contact in circuit to 2, but this circuit is still open under 9, and is closed only when the main current drops to the set value, when contactor 2 comes up and a pause occurs, then 3 and a pause, then 4 and so on.

Bituminous Producer in Double Role in Sheet-Metal Factory.

A bituminous gas producer for supplying fuel to gas engines, as well as furnishing gas for solder baths and enameling kilns, has been installed by the S. F. Bowser Manufacturing Company, maker of oil storage and distributing tanks and automatic weighing pumps, in its modern factory at Fort Wayne, Ind. This type T Westinghouse producer plant, of 350-horsepower capacity, supplies three 120-horsepower tandem horizontal engines, direct-connected to direct-current generators. These furnish power to the shops, which are motor-driven throughout. The equipment replaced by the present installation comprised three 150-horsepower Scotch marine boilers, equipped with underfeed stokers, supplying steam to fifty-horsepower and 125-horsepower simple engines. In the shops a large quantity of gasoline was formerly used for melting solder, while coke was required for the enameling kilns.

Recognizing the superior economy to be obtained from producer equipment, as well as the advantage of doing away with gasoline and coke in its own special case, the Bowser company decided to install a complete new equipment for gas engines and gas producers. The matter of selecting a bituminous producer was carefully weighed, and members of the firm visited a number of installations throughout the country to study the performance of the types in operation at the present time. The West Virginia coal, 13,000 heat units a pound, used in the producer at present, is delivered at a cost of $2.55 per ton. A Green County, Indiana, coal, of approximately the same heat value, has been successfully experimented with, and will cost, delivered, $2.25 per ton. The installation has been under the supervision of A. A. Bowser.

Cotton Manufacturers to Hold Convention.

The National Association of Cotton Manufacturers will hold its next semi-annual meeting at the Mount Washington, Bretton Woods, N. H., on Wednesday and Thursday, September 22 and 23, next. The sessions will be held in the ballroom of the hotel at 9 a. m. and 8:15 p. m. each day. An interesting list of papers will be presented and mechanical and electric development relating to textile-mill machinery will be given due consideration. C. J. H. Woodbury, International Trust Building, Boston, Mass. is the secretary.

Electrical Developments and Problems in Western Australia.

Electricity is making rapid headway in the Kalgoorlie mines in Western Australia. The second polyphase turbo-generator of 500 kilowatts is now running on the Horseshoe. These generate power for motors all over the surface, and are giving great satisfaction. As the tonnage is now approaching 25,000 tons per month, fifteen new Wilfley tables are being installed to deal with the tube-mill product; and pumps are being erected to pump the concentrate instead of trucking from the tables. For some time past the Government Water Supply Department has been troubled by rapid decay of the cast-iron water mains in Kalgoorlie and Boulder City, and attributes this to leakage of current from the electric-tramway system. In order to test whether electrolysis is going on or not, twenty-two small meters have been set up in the twenty-and-one-half miles of tramways, at regular intervals, and connected with the rails. The test has just started, and will be watched closely.

Electric Development in Western Mines.

A dispatch from the Alta mine, of the Boston & Alta Copper Company, Alta, Mont., states that within the next two or three months the present hoist will be replaced by a large engine of modern type, operated by an electrically driven air compressor. This latter will also furnish power to run the drills and pumps. A pole line is being erected to connect with the company's power plant on Prickly Pear Creek, where power will be generated to run the entire plant and also to furnish electric light both on the surface and underground.

In South Dakota, work will soon be resumed on the 2,000-horsepower hydro-electric plant, utilizing the waters of Rapid Creek, near Rapid City. The power will be used in the surrounding mines.

The Electrolysis Situation in Dayton.

President Ely, of the Service Board of Dayton, Ohio, has instructed William J. Harris, manager of the Water-Works Department, to prepare a record of pipes in the city discovered to be affected by electrolysis, so that the city may be in a position to fight the electric railways should a legal contest be decided upon in this connection. Construction Superintendent T. J. Hefferman will have charge of the data to be prepared.

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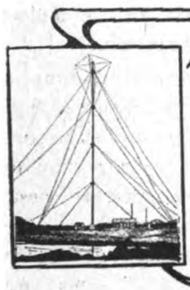
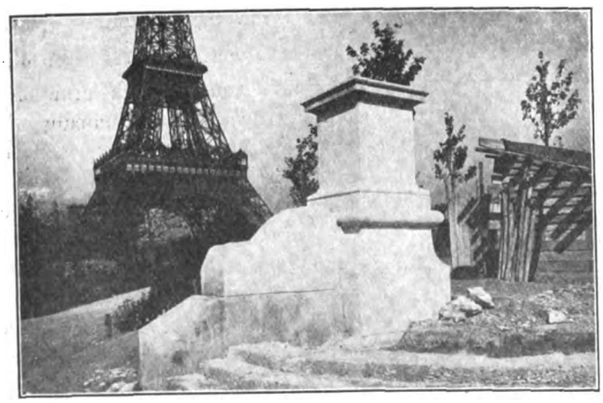


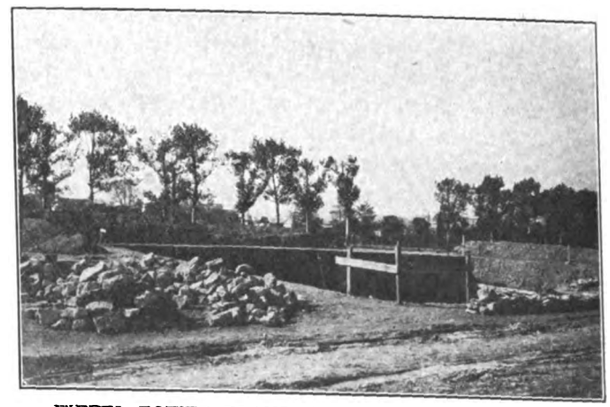
TELEGRAPHY—TELEPHONY, and WIRELESS.

The Eiffel Tower Wireless Plant.

After the French Government had come to an agreement with the municipality of Paris as regards the erection of the new high-power wireless plant at the Eiffel Tower, the War Department took measures to have the construction of the underground station and the mast-wire system carried forward as rapidly as possible, owing to the fact that the new plant is to cover a very wide range and it will thus prove of the greatest value in military operations. The present plant, which is a very small one as regards the power of the machines, is already doing considerable service in the way of wireless connection with Morocco, the scene of the present military operations.



EIFFEL TOWER PLANT—ONE OF THE STONE PILLARS FOR THE WIRELESS INSTALLATION.



EIFFEL TOWER PLANT—SITE FOR UNDERGROUND WIRELESS STATION.

Considerable headway has already been made in the construction of the plant, and the present photographs will give an idea of the work of excavating the space needed for the underground station and also of erecting the pillars for anchoring the mast wires. There are eight stone pillars of the present form, which are now almost finished. As the grounds around the tower are now being laid out as an ornamental park, it was desired to have the pillars of an attractive appearance so as to be in keeping with the rest, and as the station will be entirely underground, it will not interfere with the prospect.

The excavation for the underground plant measures about seventy by ninety feet, which gives ample room for lodging the machines and instruments. A much higher power will be used than before. The present plant was set up several years ago, in the first stages of wireless telegraphy work, and it was not equipped with machines of a large capacity, these not exceeding twenty-five or thirty horsepower.

According to the plans which were drawn up by Captain Ferrie and his aids, the new plant will have the mast wires suspended from a strong support which is built on the upper platform of the tower, and it will serve to keep the wires clear of the metallic part of the construction. This method is employed in the case of the preesnt mast wires leading to the station. There will be eight of these wires, and they will run from the supporting piece to the anchoring points on the ground. For this purpose there are used the corresponding number of stone pillars, which are about ten feet in height, and the wires coming from the tower will be solidly fixed in the top of the pillars. Cross-wires will be used to interconnect the system of eight main wires, so as to form a network, such as is used at present in the high-power stations. The tower plant will differ from the German station of Nauen, from the fact that the mast wires do not extend all around the tower in umbrella fashion, but are brought down at an angle of about forty-five degrees and lie only on one side of the tower. This was made necessary from the configuration of the ground, as the outer pillars in the present case already come near the limits of the enclosure. On the other side of the tower the ground extends for a very short distance, and the Seine is close by, so that there was no room for any additional wires in that direction. These conditions, therefore, account for the method which was used in designing the plant.

The station was placed underground for different reasons, aside from the one mentioned above of not having a structure erected in the park. The explosions of the high-power sparks would easily be heard in the adjoining buildings were the plant to be lodged at the ground level, and this would give quite an objectionable noise, especially as the station is worked during the night. Again, it would be impossible to keep the messages secret, as they could be heard in the vicinity and could be taken by anyone who was familiar with reading by sound. For these reasons it was decided that an underground plant would be by far preferable.

Seeing that there is as yet no example of a 1,000-foot mast used with high-power apparatus, it will be difficult to judge as to what distances can be reached by the tower station. To send messages across the Atlantic to New York or other coast points will, of course, be an easy matter with such a powerful plant. As to what can be done further, this is only

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a matter of conjecture at the present time. Without doubt its performance will greatly exceed that of the existing wireless plants. The question of wireless telephony will also come up in this connection. It will be remembered that Lieutenants Jeance and Colin and Engineer Mercier have already succeeded in covering about 100 miles, having sent messages as far as Dieppe, on the Channel coast. These experiments are being continued with the hope of reaching the Atlantic coast and covering 300 miles. With the new station the range will be greatly increased.

New Method of Transmitting Messages.

About a year ago M. E. Mercadier described in the "Comptes Rendus" a method by which he was able to send several telegrams between Paris and Marseilles along a two-wire circuit, not connected to earth, by alternating-current signals of different frequencies, apparatus of the Hughes type being employed. It was also found that these signals could at the same time be imposed on other signals produced by continuous current, provided that with the Hughes apparatus the former lasted about 1-28th of a second, or, when the Baudot apparatus was used, that the discharges did not exceed 1-70th of a second. It was of interest from the scientific point of view and very important from the practical point of view to discover whether the same results could be obtained on a single telegraphic conductor connected to earth at its two ends, as is usually the case, or whether these phenomena were adversely affected by the natural earth currents and induced currents due to power transmission in the neighborhood of the ends of the wire. Experiments have, therefore, been made on a wire between the telegraph central stations in Paris and Lyons, using three Hughes alternating-current instruments, and also a Hughes apparatus and a four-key Baudot apparatus working with continuous current. M. Magunna succeeded in overcoming the effects of the earth currents at Lyons, where they are particularly strong, with the result that experiments turned out well, as they did in the case where two wires were employed.—*Abstracted from the Electrician (London), August 6.*

Wireless Standardization Rules.

The Wireless Institute, of New York, has appointed a committee to draw up rules for wireless-telegraph standardization similar to those of the American Institute of Electrical Engineers for other branches of the electrical industry.

Farmers' Telephones in the South.

There is something that is highly worthy of notice at this time in the field of electrical development known as the rural telephone, and this development just now is most noted in the Southern States, where a great awakening is being experienced throughout the entire country over the importance of the telephone to the farmer. Many times, for instance, cotton has jumped two, three or four dollars per bale, in a single day, and the farmer, because he lacks proper communication with the town, does not learn of this until it is too late, and the staple had fallen back to its original prices, and the farmer has lost a handsome sum of money.

The Bell Telephone Company and other companies operating in this section are waking up to the importance of the matter on all sides. To call attention to a concrete example, the Southern Bell Telephone Company, through its district manager at Charlotte, N. C., M. B. Spier, whose territory embraces the two Carolinas, is understood to be interested in the working up of "Farmers' Days" in the larger cities, at which speaking and a barbecue dinner constitute the chief attractions. The company, in a legitimate manner, has on the programme some well-informed speaker, who can tell of the advantages and needs of the telephone, while other stock-in-trade stuff is being discussed, and it is not saying too much to state that the farmer will accord an equal or more generous hearing to the man who can interest him in telephones than he will to the man whose discussion is limited to the dairy or the boll weevil, though both are important. This is only one instance of the mutual recognition by the farmer and the telephone people of the existing needs which the farmer has for the telephone service.

It has been noted in all cotton-buying centers that the average farmer is unable to reach the market with his cotton, upon hearing of a rise of fifty points to $2.50 per bale, until several days after the rise occurs, because of slow communication, whereas a telephone in such a case would pay for itself several times over, were it handy, and the farmer had an agent or friend to notify him when cotton was "kiting," for too often the price has dropped again before the farmer is able to learn of the advance and get his staple into the city and on the local market.

The farmer's interest in anything that promises to work to his advantage is always genuine, and if the telephone companies of this section once persuade the farmer that he needs the telephone, he will not be slow to adopt it. At the present time, while there may be a dozen or a score of lines running out for a distance of five to ten miles into the country from the town of 30,000 or 40,000 inhabitants, in the smaller towns the number of rural telephones is practically zero, and communication of that kind is a negligible quantity.

There is a general awakening on this subject at both ends of the line, for the city merchant is realizing that it is of just as much importance for him to be in communication with the cross-roads store or the hamlet as it is for the farmer to have the city on the other end of his telephone.

Secret Society for Telephone Men.

A secret society for independent telephone men was formed at a meeting held at Dallas, Tex., on August 7 last. Membership in the "Knights of the Shield," as the new society is designated, will be strictly limited to those connected with independent telephone companies, manufacturers, or selling agents. The following officers were elected: J. C. Casler, "Grand Inductivator"; H. D. Eberle, "Exalted Buzzer Jop"; T. A. Gould, "Supreme Condenser"; C. A. Shock, "Universal Wire Chief"; J. B. Treascott, "Transpositor"; D. C. Lingo, "Megohm"; W. H. Upham, "Ampere". The following "Trouble Shooters" were also selected: Jack Milburn, E. M. Chamberlain, H. B. Bomar, Aaron Smith, W. S. Kingsbury and J. L. Norman.

Exchanging Telephone Stock.

In accordance with an offer made by the American Telephone and Telegraph Company, about 90 per cent of the stockholders of four subsidiary companies, the New York and New Jersey Telephone Company, the Bell Telephone Company of Pennsylvania, the Central Printing and District Telegraph Company of Pittsburg and the Bell Telephone Company of Buffalo, have presented their stock in exchange for stock of the parent company. In order that stockholders who are abroad may be able to exchange their stock, the time for exchange has been extended. After the exchange of stock of the four above-named subsidiaries has been effected it is expected the company will make similar offers to others of its subsidiaries.

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Cedar Telegraph and Telephone Poles.

TO THE EDITORS:

There has recently been called to my attention an article which appeared in one of the monthly electrical trade papers headed "Wooden Poles and Ties," in which article the writer speaks of the enormous and steadily increasing demand for wooden poles and ties having exhausted the northeastern forests of cedar and chestnut, as also the scant supply of southern cedar or juniper, and sets forth as the only available timber left the southern yellow pine and the cypress round pole, utterly ignoring the large amount of cedar which is produced in Michigan, Wisconsin, Minnesota and in the northwest states of Idaho and Washington, as also in British Columbia.

In answer to this article the writer wishes to state that there is sufficient standing cedar in Michigan today to furnish half a million poles, twenty feet and larger, per year for the next twenty years. About half of this amount can be produced each year in Wisconsin, and in Minnesota there is sufficient standing cedar to produce a million poles per year for the next twenty years.

It seems a shame that anyone should bring forward southern timber and dare to compare it with northern or western cedar in general desirability and lasting qualities. Furthermore, in comparing costs, northern cedar today is cheaper in poles and ties than it has been at any time in the last seven years.

Southern yellow pine is undesirable, owing to its short life as ties or poles unless creosoted or treated in some way to extend its life, and even this treatment will not add materially to its length of life as compared to the same treatment of the northern or western product. A northern cedar pole or tie will outlast it three times unless the southern product is treated—we mean by northern cedar not only the Michigan, Wisconsin and Minnesota product, but the cedar that is produced in the states of Washington and Idaho, and British Columbia. The Michigan, Wisconsin and Minnesota poles in their natural state and the western product treated with creosote or some good wood preservative show a great saving over the southern product.

In view of the prices that are now being offered by the northern producer and the slight expense required covering the treatment of western product, no consumer can afford to use the southern product either treated or untreated.

In the latter part of the article it states that the cypress round pole is said to be the future round pole. Our judgment leads us to make the statement, after careful investigation, that there will still be produced Michigan and western cedar for ties and telegraph poles after what little cypress has all been exhausted.

The last of the article reads as follows: "Cypress is very porous and when used in a cold climate great care should be taken to house and seal the tops of poles thoroughly." We suppose this, being a southern timber, could not be consistently used in the North during the winter months, when it would be subject to severe colds, pneumonia, etc., and it is very certain from this article that the pole that Dr. Cook found was not of cypress or yellow pine, but possibly of cedar, which is used everywhere, in all kinds of climate, in its natural state, and does not have to be housed and sealed.

E. L. CLARK,

President of the Northwestern Cedarmen's Association.

Chicago, September 9.

Wireless in China.

A Shanghai correspondent of a German newspaper, says the *Electrical Review*, of London, reports that a wireless telegraph installation was recently erected on the new building of the English Palace Hotel in that city, for the purpose of establishing communication with incoming and outgoing ships via Wasung. Immediately on the apparatus being brought into use, on the opening of the new hotel in July, the Chinese Government lodged a protest against it on the ground that wireless telegraphy was a state monopoly which could not be granted to private individuals. The owners of the hotel, and the British authorities on their behalf, sought to maintain the British claim, but they finally had to give way after the government expressed readiness to buy and remove the installation. The objections of the Chinese are explained, the correspondent states, by the experiments which the government recently made with systems of wireless telegraphy, and by the value which would be attached to an extension of such a network throughout that enormous empire. Owing to the great distances the existing overland telegraphs are worked at great cost, especially as they are almost exclusively carried along the river valleys and are subject to constant floods and breakages, while the wires have to be guarded in consequence of the attitude of the population.

Wireless Station at Porto Bello.

According to a recent issue of the *Canal Record*, Ancon, Canal Zone, the wireless station at Porto Bello is to be installed solely for the benefit of the Isthmian Canal Commission, for communication with the Colon station, but to be under the control of, and to be equipped and manned by, the Bureau of Equipment, Navy Department. With this understanding the commission has built a house containing the office and condenser room, besides living quarters for three operators, enlisted men of the navy. This house is from a special design drawn in the chief engineer's office, and is situated on the hillside just below the eastern end of the reservoir dam. The mast will be erected on the hill east of the reservoir at a sufficient distance for the aerial wires to reach from its upper end to the office. The "ground" will be obtained by large copper plates sunk in the shore of the reservoir. The house is about finished, and the aerial and guys for the mast have been received, but until the mast, instruments and ground plates are sent by the Navy Department no further progress can be made. These are expected soon. The mast will be about 150 feet high, set on a hill 135 feet above sea level, making the extreme height 285 feet, sufficient for the waves to clear the intervening hills. The power will be carried to the station from the commission's power plant at Porto Bello.

Why Wireless Communication Is Easier Over Water than Over Land.

It is well known, says the *Scientific American*, that Hertzian waves can be transmitted more readily over water than over land. The reason for this was explained quite recently by Prof. J. A. Fleming in a popular lecture. He showed that a current of high frequency could be transmitted over a galvanized-iron wire as readily as by means of a copper wire, but that if the zinc was burned off the wire, so that the current had to traverse an iron path, there was a considerable reluctance. This showed that high-frequency currents, which normally travel over the surface skin of a wire, will penetrate farther into the metal of low conductivity. The Hertzian waves do not penetrate water to a depth of more than a few feet, but when traveling over dry soil there is a much greater penetration, due to the poorer conductivity, which results in a correspondingly greater loss of energy.

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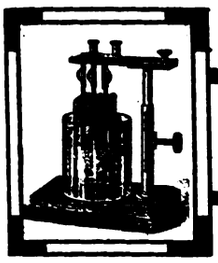

ELECTRO-CHEMISTRY and METALLURGY

Electrochemical Amalgamation.

In a letter to the editor of the *Scientific American,* Elmer Ellsworth Carey, of San Jose, Cal., gives some interesting facts and observations of the subject of electrochemical amalgamation. An abstract of Mr. Carey's letter is given below:

In recent years it has been discovered that there are large areas in southern California, Nevada, Arizona, New and Old Mexico, which contain vast deposits of low-grain sands containing gold values averaging from $1.50 to $7.50 per ton. Many of these deposits are of unknown depth. The values are microscopic, and there is no method at present known to the miner by which the values can be profitably extracted. There are also immense ledges and even mountains of low-grade ore, very refractory, which cannot now be profitably mined. The sea beaches from the Isthmus to the Arctic contain vast deposits of gold-bearing sands, but no practical method is known of recovering the gold, which is fine and flaky, and which cannot be saved by the usual gravity devices. In addition to these unworked gold fields, there are in California many miles of river beds containing debris and tailings from the placer mines; these tailings contain gold to the amount of $1 per ton, this amount being a low average, and the tonnage is beyond computation. The values are too elusive for extraction by any of the standard processes of gold saving.

In Alaska there are hundreds of miles of beach and river deposits containing vast sums of gold which are beyond the reach of the miner.

Scores of gold-saving machines working on the gravity principle have been constructed in a vain endeavor to solve the problem; amalgamating devices have been tried, but the impalpable values will not adhere to the amalgam surface; and when the particles of gold are larger, it is found often that the gold is coated or rusty or oily, so that mercury has no affinity for it.

About twenty years ago tests were made with a device using electrochemical principles and the results were very encouraging. The science of electrochemistry has made wonderful strides in the last decade, and lately the problem of saving the impalpable values mentioned above has been approached in a practical manner by various experimenters.

It has been found that the amalgamating action of mercury is greatly increased in the presence of electrochemical conditions, and devices have been constructed to utilize this fact in a commercial way. The bottom of a sluice box is covered with a copper sheet or plate; suitable electrodes (anodes) are arranged so that they may come in contact with the surface of the water flowing through the device; a solution containing a definite amount of mercuric bichloride is added to the water, and a low-voltage generator is connected with the anodes and the copper plate (cathode). The mercury from the solution is deposited in its nascent form on the copper plate, forming an amalgamating surface of the highest efficiency. The electric current passing through the water (electrolyte) cleans and brightens the gold, and all unfavorable conditions are practically destroyed.

The microscopic gold particles are coated with mercury while in suspension, and the cataphoretic action of the electric current, aided by gravity, forces the values into an amalgamating contact with the mercurial surface. All values are deposited in the form of amalgam, which adheres tenaciously to the plate by the electroplating action of the electric current. Thus there is an electrolytic amalgam which is smooth, firm, tenacious, yet elastic and viscid. The amalgam is not dislodged; and the mercury does not "flour." All the electrochemical processes assist in cleaning the gold, forcing it to the plate and holding the resulting amalgam in place.

A current with a voltage too low to produce a shock is sufficient to give results that are marvelous; the device is so simple that its potency would never be suspected; its cost is trifling, and any electrician can make the installation. Yet the percentage of extraction is so high that ordinarily the tailings contain no values of importance.

Production of Abrasives in 1908.

The total value of the natural abrasive materials produced in the United States in 1908, according to a report by W. C. Phalen, of the United States Geological Survey, was $1,074,039, a decline of $606,698 from the figure for 1907. The value of the artificial abrasives produced in 1908 was $626,340, a decline of $400,906 from the 1907 value. The value of the imports amounted to $476,073, a decrease of $278,067. The total value of the abrasive materials consumed in this country during the year was therefore $2,176,452.

The natural abrasives include oilstones and scythestones, grindstones and pulpstones, buhrstones and millstones, pumice, infusorial earth and tripoli, abrasive quartz and feldspar, garnet, corundum and emery. These were produced in twenty-three states. The artificial abrasives, made in the electric furnace, comprise alundum and carborundum (which are manufactured only at Niagara Falls, N. Y.), and crushed steel. Mr. Phalen's report contains details of the domestic production and imports of these different materials, and notes on the methods of preparing them for the market. It is published as an advance chapter from "Mineral Resources of the United States Calendar Year 1908," and a copy may be had free on application to the director of the Survey, at Washington.

Electrolytic Copper Staybolts and Pipes Claimed Unreliable.

According to statements in recent German trade papers, staybolts of electrolytic copper have given bad results in locomotives on Prussian railroads, and a large number of fractures have resulted. Only one out of twenty-one samples tested of these defective bolts showed arsenic, and it is to be presumed that the lack of "nature" of electrolytic copper may be due to this deficiency. Steam pipes of electrolytic copper are growing into disfavor in England, as they have repeatedly proved unreliable. A reference to this was made in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, April 24, 1909, p. 748.

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The Validity of Ohm's Law for Electrolytes.

It is often assumed tacitly, and, indeed, stated also in textbooks, that Ohm's law will hold for electrolytes. That this is not strictly correct was pointed out many years ago by Kohlrausch. It is only immediately after closing the circuit of an electrolytic cell, before any concentration differences have been established, that Ohm's law can be applied; for Ohm's law presupposes the non-existence of a concentration gradient. During this non-stationary period of short duration relations prevail which, Kohlrausch demonstrated, resemble those required by Ohm's law. But conditions change soon owing to the migration of the ions, and during the ordinary stationary period of the electrolysis Ohm's law is not valid. Calculations have then to be based upon Nernst's equations, and though these equations lead to relations similar to those expressed by Ohm's law, they are by no means identical with them. The terms "stationary" and "non-stationary" periods are used by A. Eucken, of Berlin, in a mathematical paper on the problem published in the *Physikalische Zeitschrift*. In a certain measure the conduction of the current through electrolytes resembles that of conduction by gas ions, which obey Ohm's law for currents of low intensity. The deviations from Ohm's law are, however, not very great in the case of electrolytes, because the stationary period is very difficult to realize, owing to convection currents, at least for the main portion of the electrolytic cell, or trough. Near the electrodes the conditions are fairly stationary, but not further away from them. Yet it should be possible, as Grassi showed in 1903, with certain precautions, to produce an almost stationary concentration gradient throughout the trough, and by experimenting in this direction Eucken's formulas might be tested.—*Abstracted from Engineering (London), September 3.*

A Unique Hydroelectric Plant.

A hydroelectric plant which operates with a twenty-four-hour service without attendance and without a storage-battery auxiliary, has recently been installed at Blair Castle, the Scotch seat of the Duke of Athol. The three dynamos are direct-coupled each to a sixty-horsepower Pelton wheel, and the current generated, besides lighting the duke's house, will also be utilized to light a number of the villages in the vicinity.

To Discover Radium in the United States.

A movement is on foot in this country to place the United States, if possible, to the front as a producer of that rarest and costliest of all elements, radium. Thomas F. Walsh, of Colorado, is taking the initiative in this, through the Vinson-Walsh research department of the Colorado State School of Mines at Golden. This department, which is supported financially by Mr. Walsh, will make free tests of all samples of pitchblende submitted by prospectors and others, and the results will be regarded, if desired, as confidential; this with a view to encouraging prospectors, mine operators, and all others interested in the proposition, to look for this mineral and so found a new mining industry of much profit in this country. Victor C. Alderson, president of the Colorado State School of Mines, has stated that the school will, to a limited extent, be prepared to furnish samples of pitchblende to responsible parties who would be likely to aid in the search and who desire to familiarize themselves with the appearance of the mineral.

Electricity in South African Mining.

The plant at the South African Simmer Deep and Jupiter mines has the distinctive feature of being entirely driven by electricity, from the stamps right down to the last pumps in the extractor house. The 300 stamps are driven in lots of ten by separate three-phase motors of about fifty horsepower each. The pulp, after passing over the amalgam tables, is pumped to twelve classifiers, and the underflow from these goes to four tube mills driven by separate 125-horsepower motors. Twelve conical sand separators are used and the time occupied by the circuit of the sand from the mill to the dumps is only about six-and-one-half days, the usual time for sand treatment being nearly ten days.

A Good Sign.

News dispatches from Pennsylvania state that more than 100 men responded last Monday morning to the call when the whistle at the McCall Ferry power plant, at Lancaster, Pa., gave its signal for beginning work. Two years ago operations ceased on the great dam, and the men who went back to work were employed at the concrete building. The plant is eighty per cent finished, and it is estimated that the power can be turned on in a year.

How to Make a Simple Dry Battery.

In a recent number of the *Scientific American*, George F. Worts gives instructions for making a simple dry battery which will be available for many purposes where the ordinary standard shop cells may not be so adaptable.

To make a cell of the standard size, a strip of zinc of medium thickness, eight-and-one-fourth inches long and six inches wide, is necessary. The zinc is rolled into a cylinder six inches long and eight inches in circumference, thus leaving a quarter of an inch which is to be tightly soldered. A zinc cap is next soldered on one end of the cylinder. Any solder showing on the inside is to be well shellaced. Do not shellac any zinc surface, as that will interfere with the action of the battery. Line the inside of the cylinder with a thin layer of blotting paper. For the positive pole of the battery the carbon from a worn-out cell is the best, if procurable, but if not, a bundle of arc-light carbons with the copper surface well filed off is the next best. The chemicals for producing the action that generates the electricity are one-fourth pound of sal ammoniac, one-fourth pound of chloride of zinc (paste form), one-fourth pound oxide of zinc and one-fourth pound plaster of Paris. These should be thoroughly mixed with a mortar, and packed tightly in the cylinder about the carbon, which is a half inch from the bottom of the cell. This paste will fill the cylinder to within half an inch of the top, the rest being filled with paraffin. A copper terminal soldered to the zinc and a heavy copper wire scraped clean and bound about the protruding end of the carbon, form the negative and positive connections for the cell.

This cell can be easily formed in various other shapes to suit the experimenter's fancy. The cell herein described, if constructed according to specifications, will produce very satisfactory results, especially in ignition work or for wireless. It will register about 1.4 volts and between ten and fifteen amperes.

Electric Drive in Brazilian Mills.

A dispatch from Rio de Janeiro states that the local tramway, light and power company is now furnishing electric power to the following cotton mills: Cia Americana (1,350 horsepower); Fabrica Carica (800 horsepower). The latter mill will ultimately use double its present electric power when satisfactory arrangements can be made to do so.

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Joint Convention of the Northwest Electric Light and Power Association and the Seattle Section of the American Institute of Electric Engineers.

A very successful joint convention of the Northwest Electric Light and Power Association and the Seattle Section of the American Institute of Electrical Engineers was held on the grounds of the Alaska-Yukon-Pacific Exposition, Seattle, Wash., on the 7th, 8th and 9th of this month.

The Northwest Electric Light and Power Association was organized about a year ago, embracing the states of Washington, Oregon, Idaho and Montana, and the territory of Alaska. It is already an influential and live society, and includes in its membership more than ninety per cent of the operating companies in the territory embraced. Its object is "to foster and protect the interests of those engaged in the commercial production of electricity for conversion into light, heat and power, and of their customer's," and its constitution is modeled after that of the National Electric Light Association. The Seattle Section of the American Institute of Electrical Engineers has over a hundred active members throughout the state of Washington, the greater number of whom reside in Seattle, Spokane and Tacoma.

The headquarters of this convention were established in Machinery Hall on the Alaska-Yukon-Pacific Exposition grounds, where the secretaries of the two societies had desks and conducted a bureau of information for the benefit of members and guests. The office had an attractive display of photographic views of interesting engineering features in the different plants represented.

The meetings were held alternately in the lecture rooms of the Fine Arts Palace and the Good Roads Building on the exposition grounds, and in spite of the many other attractions on the grounds were well attended. The opening session was held in the auditorium of the Fine Arts Palace, at 10 o'clock Tuesday morning, with Arthur Gunn, president of the Northwest Electric Light and Power Association in the chair. The address of welcome was delivered by Mayor John F. Miller, of Seattle, and was responded to by O. B. Colwell for the Northwest Association and by Ralph W. Pope, national secretary of the American Institute of Electrical Engineers.

After these preliminary exercises followed the first technical session of the American Institute of Electrical Engineers, with John Harrisburger, president of the Seattle Section, in the chair. Ralph W. Pope, national secretary, made the first address on "Administration of Institute Affairs." He gave the members a glimpse of the inside workings of the Institute and paid the West some flattering compliments on its progress and achievements.

C. E. Fleager, of the Pacific Telephone and Telegraph Company, followed with a paper on "The Modern Central Telephone Station," and Paul M. Lincoln, of the Westinghouse Electric and Manufacturing Company, with a paper on "Protection of Electrical Equipment." Mr. Lincoln elaborated on the water analogy of electrical surges on transmission lines, and showed without the use of mathematics what occurs on line and in apparatus during lightning discharges.

In the afternoon W. M. Hamilton, of the Portland Railway, Light and Power Company, read an interesting paper on "Electrical Illumination from the Central-Station Basis," especially emphasizing the importance of every lighting company employing a man who could devote at least part of his time to studying and solving the many difficult illumination problems that come up, in accordance with more modern scientific practice. He showed how this would greatly lighten the burdens of the complaint department.

E. W. Sherwood read a paper on "High-Efficiency Lamps" and Chas. F. Scott, past president of the American Institute of Electrical Engineers, read a paper on "The Trend of Electrical Development," showing what electricity had done in the past, and hinting at what might reasonably be expected of the future.

On Wednesday forenoon was held the first commercial session of the Northwest Association, and this was taken up with reports of the committee on rates and the committee on uniform accounting, as well as with papers of commercial interest. Among the topics treated may be mentioned "Methods of Handling Complaints," "Electric Appliances and Their Influence on Load Factor," "The Electric Vehicle as a Correction of Poor Load Factor."

On Wednesday afternoon was held the first executive session which was given over to the president's address, reports of the treasurer, the auditing committee, and the legislative committee, and a general discussion of what the association had done and what it had failed to do.

On Thursday morning was held a second executive session at which, among other papers, was an able discussion by J. E. Frost, chairman of the State Board of Tax Commissioners, of the need for uniformity as well as publicity of accounting by public service corporations. Mr. Gunn, president of the Wenatchee Electric Company, read a paper on "Employers' Liability and Employees' Indemnity," outlining means of avoiding present expensive and unsatisfactory legal methods of settling damage suits. He advocated some system of compulsory insurance against accidents as a matter of economy and as affording the quickest and most satisfactory relief both to the injured and those dependent on them.

The entertainment committee deserves especial praise for the excellent entertainment programme provided for the members and guests of the societies during the entire convention period. On Tuesday evening the reception committee and officers of the association held a reception to members and guests in the Washington State Building, followed by dancing. Punch, ice cream and cake were generously served during the evening. Wednesday and Thursday forenoons were given over to trolley rides about the city for the ladies and guests, while Wednesday afternoon was devoted to a boat trip around Lake Washington, and Thursday afternoon to a trip on the Sound around Bainbridge Island to the United States Navy Yard at Bremerton and other points of interest. Thursday evening capped the climax of good things, as well as concluded the convention, with a vaudeville performance and entertainment at the Cafe Chantant, Luna Park. Mr. Ross, of the Seattle city light plant, delighted the audience with his famous high-tension experiments.

Another New Society.

A movement, sponsored by J. C. Jurgensen, head of the new department of "Plant Management" at Columbia University, New York city, is under way toward the formation of a proposed "Society of Operating Engineers." Members will consist of those directly interested in power-plant operation, and associate members will comprise the owners of such plants. Special attention will be paid to the instruction of apprentices, which will include a scheme of co-operation with such evening courses as that at Columbia University under the direction of Mr. Jurgensen. The new movement is one in the right direction, and it is to be hoped that the efforts of the promoters will receive the attention and consideration they deserve.

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The Peat Industry in 1908.

A report on the production of peat in 1908, by C. A. Davis, has just been published by the United States Geological Survey as an advance chapter from "Mineral Resources of the United States, Calendar Year 1908." The total supply of peat in the country, exclusive of Alaska, is estimated at twelve billion tons of air-dry fuel. The peat beds of commercial importance lie almost entirely outside of the territory in which coal and other natural fuels are abundant. Mr. Davis's report contains not only the statistics of production, but a description of the methods of preparation and the uses of this substance.

The most important use of peat is for fuel. It is particularly suited for use as domestic fuel, as, when properly prepared and managed, it makes a hot and durable fire. Its theoretical heating value is about five-eighths of that of the best bituminous coal, but owing to the small waste in ash, etc., its real value is doubtless nearly if not quite as great as that of some coals that are used for domestic purposes.

The most recent fuel use of peat is as a source of producer gas. The gas producer shows so great a fuel economy that it can profitably utilize grades of fuel that could not be used for steam generation, and in Europe peat is finding a growing use for this purpose. Well-prepared peat gives from 40,000 to 80,000 cubic feet of producer gas per ton of dry matter, with a calorific value no less than that of gas made from coal. Some progress has been made in the recovery of valuable by-products in the generation of gas from peat.

Peat is of value for numerous other uses, such as bedding for stock, packing material, deodorizing material, and fertilizer filler. Dry peat powder is used to absorb the refuse molasses of sugar factories, the mixture being sold as stock food. A peat-moss litter and mull plant is operated at Garrett, Ind., and factories for making peat fertilizer filler have been established in New Jersey, Pennsylvania, New York, Ohio, Indiana, Illinois, and Florida; some of these have not been carried beyond the experimental stage. Fibrous peat has been mixed with certain mineral and cementing substances and then subjected to hydraulic pressure, the resulting material being tough and hard and capable of use as a structural material or for paving blocks. This industry is inconsiderable as yet.

The production of peat fertilizer filler in 1908 was 23,000 tons, valued at about $121,000. The peat fuel made during the year was all machine peat, the total output being 900 tons and the selling price from $5 to $7.50 a ton. Peat-moss litter is sold in bales of 225 pounds; the production for 1908 was 8,000 bales, valued at $10,000. The imports of peat during the year consisted of 8,102 tons of fuel moss, valued at $45,414, and a few tons of peat fiber.—*Abstracted from the United States Geological Survey Press Bulletin, September, 1909.*

Electrical Development in Mexican Mines.

According to a recent issue of the *Mining and Scientific Press,* San Francisco, Cal., the Buena Fé Mining Company, operating near Ojuelos, Mexico, is erecting a large plant, including a gas producer using charcoal, a Westinghouse three-cylinder gas engine, which will be used to drive an electric generator and an air compressor. Electrically driven station and sinking pumps will be used in the mines. The G. & O. Braniff Company supplied the plant. The Mexican Coal and Coke Company, which is operating mines at Esperanzas, has recently placed orders for a considerable amount of extra machinery, including an 1,100-horsepower Schoendube and Nengebaur steam turbine and condenser, which will be used to drive an alternating-current generator; also a number of transformers, motors and accessory electrical apparatus. The same company has also ordered sixteen Sulzer pumps, the largest being a 350-horsepower multiple-stage centrifugal pump.

New Process for Extracting Radium.

There seems a probability, according to the London *Mining Journal,* that the extraction of radium is to be taken up energetically at the Trenwith mine, Cornwall, Eng. Sir William Ramsey, the chief consulting chemist to the British Radium Corporation (Ltd.), has produced radium from the ore of this mine by his new and secret process. His researches have already passed the laboratory stage, and he has been enabled to produce this article on a commercial scale. Sir William Ramsey's new process for the extraction of radium is cheaper, quicker and more effective than any hitherto known. The radium produced will be disposed of upon highly remunerative terms.

Pole Preservative Experiments.

The unpleasant discovery that telegraph poles impregnated with copper sulphate by the Boucherie process are so readily attacked by fungi that in some districts they last only eight or ten years, has led the Austrian government telegraph bureau to institute experiments in the preservative action of fluorides. In the preliminary experiments air-dried poles were saturated with solutions of acid zinc fluoride containing a little free hydrofluoric acid. After two years' service from eighty to 100 per cent of these poles showed a surface absolutely intact, while of the poles treated with copper sulphate, after two years' service, only fifty per cent remained free from fungi and ten per cent were badly rotted. In subsequent experiments on a larger scale the poles were impregnated with acid zinc fluoride, both by steeping and by hydrostatic pressure. Analysis of the water which drained from the poles showed that all of the free acid and a large part of the loosely combined acid had been absorbed by the wood.—*Abstracted from Telephone Engineer (Chicago), for September.*

August Meter Tests.

The New York Public Service Commission has issued a report on the testing of gas and electric meters for August. During that month 30,192 gas meters were tested, of which 4,476 were new, 25,539 repaired and 177 complaint meters. Of these complaint meters it was found that 36.7 were two per cent or more fast, 11.1 were two per cent or more slow, and 51.4 between two per cent slow and two per cent fast.

For the same month forty electric meters were tested, and of these it was found that ten per cent were four per cent or more fast, five per cent were four per cent or more slow, and eighty-five per cent between four per cent slow and four per cent fast.

Outing of the Philadelphia Electric Company at New York.

A steamboat trip around Manhattan, three automobile rides through different parts of the city, an exciting game of baseball at the American League Grounds and a dinner at Pabst's Harlem Casino was the programme followed by the New York Edison Company in entertaining the employes of the Philadelphia Electric Company at New York, Saturday, September 11.

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AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing, is always interesting. "Actualities," the actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

THE MOLONEY ELECTRIC COMpany, St. Louis, Mo., has received the following important contracts during the last thirty days:

Three 500-kilowatt water-cooled transformers for the Walla Walla Electric Light and Power Company, Walla Walla, Ore.

Eighty transformers for the lighting department, city of Tacoma, Wash. These transformers range in size from five to forty kilowatts.

One hundred and forty-two transformers, lighting department, city of Pasadena, Cal. These transformers range from three to forty kilowatts.

Seventy-three subway transformers, ranging in size from one to fifteen kilowatts. This order was secured from the Schott Engineering Company, Chicago, and the transformers are to be installed at the United States Naval Training Station, North Chicago, Ill.

THE ALABAMA AUTO AND ELECTRIC COMPANY, Montgomery, Ala., advises that the West Auto and Electric Manufacturing Company has recently taken in more stockholders and reincorporated under the name of the Alabama Auto and Electric Company, and under the new management has discontinued the contracting business and become jobbers of electric supplies as well as automobile sundries, having in this connection a repair shop and automobile garage.

WILLIAM G. REUTER, electrical contractor, Cincinnati, Ohio, has received the contract for the electrical equipment for the Ohio Mechanics' Institute, the building being a gift of a half-million dollars to erect this Institute, from Mrs. Mary Emery, and the theatre therein contained to be called Emery Hall. The amount of the electric contract was $14,000. He has also just completed electric work for the new Hughes High School, which opened for school on September 7.

THE MILLS ELECTRIC COMPANY, Peoria, Ill., advises that it considers the building situation in this vicinity as encouraging, a number of excellent structures being in the course of erection in Peoria. The electrical contractors of this city are busy.

An ordinance recently passed compels all wire men and shop owners to pass an examination and a fee is charged for an annual license. Another provision of the ordinance compels the use of rigid iron conduits in all buildings within the fire district and in other buildings which may be used as stores or occupied by more than two families. Both of the provisions in the above-mentioned ordinance are going to materially benefit the electrical trade. This company is now engaged exclusively in the jobbing business, and looks forward to a very busy fall and believes that conditions generally are improving rapidly in this locality.

THE DES MOINES ELECTRIC CONTRACTING COMPANY, Des Moines, Iowa, was recently awarded the contract for wiring the Des Moines Coliseum and also the White Line warehouse, an eight-story fireproof building.

They were awarded the contract by the Federal Electric Company, of Chicago, to erect one of its electric signs in this city, one for the Hotel Wellington and the other for the Des Moines Brewery. These signs are fifty feet long and twenty feet high.

The company also received the contract for wiring two new public school buildings in this city.

THE RICHARDSON ELECTRIC COMPANY, Duluth, Minn., has just finished the installation of 225 horsepower, in General Electric, three-phase, 440-volt, twenty-five-cycle motors, ranging from nine to seventy-five horsepower in capacity, together with complete installation and equipment required for the substation, consisting of Westinghouse electrolytic lightning arresters, disconnecting switches, series and potential transformers, type "B" oil switches—all for the control of the machinery just being started in the Stott Briquetting Plant, at Superior, Wis. The entire lighting contract for power and lights was executed by this company.

The Stott Briquetting Company takes coal dust from the various large coal docks at the head of the lakes and compresses it into small egg-shaped lumps called "briquets," using a certain amount of pitch or binding materials, and the material can be sold in the open market at very much less than the regular prices on equal qualities of hard coal, and is most excellent material for household or for power house fuel.

THE JAS. B. CLARK, JR., ELECTRIC COMPANY, Louisville, Ky., has just been awarded the contract for one 400-kilowatt, three-phase, sixty-cycle, engine-type alternator, for the new plant of B. F. Avery & Sons, and six fifteen-horsepower elevator motors, sold to the American Machine Company, of this city, for use in connection with their elevators, which it has contracted to furnish the B. F. Avery & Sons firm. Also one 100-kilowatt engine type alternator and twenty-five motors to the Never Split Seat Company, at Evansville, Ind. One 100-kilowatt, engine-type direct-current generator and fifteen motors to the Ingalls Stone Company, Bedford, Ind.

All of the above apparatus is of the Willey type, its own manufacture.

THE AMERICAN ENGINEERING COMPANY, Indianapolis, Ind., has a contract for the engineering and construction of the Des Moines & Sioux City Railroad in Iowa. The survey of this line has been completed, and it will be something over 200 miles in length. It has advices from the owners of the road that construction work on the same will probably begin some time this fall.

THE ELECTRIC CONSTRUCTION COMPANY, Little Rock, Ark., announces that, owing to increase in its business, it will move into larger quarters at 215 Louisiana Street, in the Gazette Building, October 1, this move being made necessary by the addition of a plating and chandelier factory and a steady increase in the business.

It will commence shortly on the wiring of the new ten-story annex to the Marion Hotel of this city. This will be a fireproof reinforced concrete structure, and is one of the largest contracts ever awarded in this city.

Business appears very bright in this locality and every one is busy.

The company is just completing the Carnegie Library, donated to the city by Andrew Carnegie.

THE PIEDMONT ELECTRIC COMPANY, Asheville, N. C., has just closed a contract with the Unity Cotton Mills, La Grange, Ga., for the installation of 750 lights and wiring for power circuits.

It has also just secured the contract for installing in the Manchester Cotton Mills, Manchester, Ga., wiring and lamps for 650 tungsten lamps, also wiring for power circuits.

The company is engaged at the present time in installing wiring system in the million-dollar post office and court house

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being built at Atlanta, Ga., and lighting systems in court houses at Fitzgerald, Ga., and Mocksville, N. C., as well as other smaller contracts in the Carolinas.

Copper Production for August.

August made another new high record in copper production, the output having amounted to 115,101,440 pounds, compared with 113,281,820 pounds in July and 99,048,000 pounds in August a year ago. This compares with a refinery output of refined copper for August of 120,000,000 pounds, which was likewise record-breaking, a figure which would indicate the treatment of foreign ores returning about 10,000,000 pounds of copper.

Mine production figures for August with seven previous months for three years compare as follows:

	1909.	1908.	1907.
January	102,100,509	65,900,000	84,935,143
February	96,304,000	65,036,750	85,288,160
March	107,961,369	79,105,704	98,438,230
April	104,755,000	87,582,805	96,667,700
May	110,163,000	90,880,300	98,500,000
June	111,092,000	79,431,725	96,123,030
July	113,281,820	92,109,000	98,623,870
August	115,101,440	99,048,700	93,298,107
Total	851,759,138	659,094,984	751,774,240

Albany & Hudson Sold.

Referee John P. Kelly, of Troy, N. Y., sold the properties of the Albany & Hudson Railroad at Public auction in Hudson. The purchaser was I. W. Day, of New York, the secretary of the reorganization committee, and the price paid was $550,000. Day was the only bidder.

The special committee on reorganization, Secretary Day, Myron T. Herrick, R. A. C. Smith and Clinton I. Rossiter, will at once perfect the plans of reorganization. After the formal incorporation the company will take steps toward double-tracking the road, the acquirement of the Greenbush bridge, the improvement of the power houses, and the completion of the line to Pittsfield.

The sale was made on an order of court pursuant to a judgment of foreclosure and sale in the action of the Trust Company of America.

A Lubricating Hint.

An experienced motorist, says *Automobile Topics,* suggests the introduction of graphite into lubricating oil, in the proportion of about a teaspoonful to a pint of oil, claiming that it builds up even the most microscopic irregularities on bearing and wearing surfaces of pistons, rings and cylinders, resulting in better lubrication in cylinders, better compression and a saving of oil. He recommends flake graphite.

Low Temperature in Magnetism.

In a recent paper by G. Gray and H. Higgins, presented before the Royal Society of Edinburgh, the authors describe some striking experiments on low-temperature effects in magnetism. The experiments were a continuation of the researches of Dewar and Fleming, which were described in Vol. 60 of the Proceedings of the Royal Society.

The present experiments were performed on steel wire, special hard steel, and manganese steel, starting with a specimen magnetized to saturation at the temperature of liquid air. In the case of the steel wire, magnetized at a temperature of minus 190 degrees centigrade, the effect of warming it to the room temperature decreased the magnetic moment about forty-four per cent, whereupon a cooling to the initial low temperature increased the magnetic moment about 12.5 per cent. When the specimen was annealed and the above procedure repeated, the effect of warming the cooled specimen to room temperature caused a diminution of sixty-five per cent in the magnetic moment, after which each cooling resulted in an increase of nearly forty per cent in the magnetic moment. With the specimen in a quenched condition and magnetized at a temperature of minus 190 degrees centigrade, warming decreased the magnetic moment by sixteen per cent, and with the specimen in this condition the magnetic moment at the low temperature exceeded by about 1.5 per cent the magnetic moment of the piece when it was magnetized to saturation at room temperature.

Some remarkable results were obtained with manganese steel in the annealed condition. When a specimen was magnetized at room temperature the magnetic moment was found to be 250 centimetre-gramme-second units. Cooled to the temperature of liquid air this decreased to ninety-three units, and on allowing it to attain to the temperature of the room it fell further to fifty-nine units. From and after this time, cooling the specimen to a temperature of minus 190 degrees centigrade increased the magnetic moment about nine per cent. When the specimen was magnetized at the low temperature the magnetic moment was found to be 590 centimetre-gramme-second units. Warming to room temperature caused this to become reduced to 387 units, and further cooling to the low temperature increased the magnetic moment about thirteen per cent.

The above were only a portion of the experiments, but enough to indicate the general effects. The results differ from those of Dewar and Fleming in that the reversible condition is arrived at after the first warming up from the low temperature to that of the room, and the percentage change in magnetic moment caused by cooling from the temperature of the room to that of liquid air is much greater than when the specimen is magnetized initially at room temperature.

Exports of Manufactures, 1789-1909.

Twelve billion dollars' worth of manufactures have been exported from the United States in the last 120 years, eight billions, or two-thirds, of this enormous total within the last twenty years, and six billions, or one-half, in the last eleven years. This is the summarization of a statement just prepared by the Bureau of Statistics, of the United States Department of Commerce and Labor, Washington, D. C.

The bureau finds that the total exports of domestic merchandise of all kinds during the 120 years have aggregated forty-six billion dollars, of which twelve billions, or twenty-six per cent, were manufactures. The value of the manufactures exported since 1898 is as great as all that exported in the 109 years prior to that date, while the total for the last twenty years is twice as great as the total of the immediately preceding 100 years.

The share which manufactures form of our exports has steadily advanced as the years have passed. This is shown in the following table, giving the total value of domestic exports, exports of domestic manufactures, and percentage which manufactures formed of total exports, by ten-year periods, 1790-1909.

Ten-Year Period.	Total Domestic Exports.	Manufactures Exported.	Per Cent Which Manufactures Formed of Total.
1790-1799	$ 293,642,204	$ 18,855,859	6.42
1800-1809	371,253,875	29,208,139	7.87
1810-1819	453,384,324	31,266,810	6.90
1820-1829	525,371,141	57,521,133	10.95
1830-1839	828,542,275	78,059,253	9.42
1840-1849	1,096,649,373	114,556,288	10.45
1850-1859	2,140,144,928	353,991,773	16.54
1860-1869	2,329,095,758	479,357,780	20.58
1870-1879	5,301,556,001	1,078,638,471	20.35
1880-1889	7,480,115,627	1,500,552,772	20.06
1890-1899	9,536,355,659	2,411,408,166	25.29
1900-1909	15,550,676,564	5,855,613,378	37.66
Total	$45,906,787,729	$12,009,029,822	26.16

Copper Exports.

Exports of copper for the week ended September 9 were 2,608 tons. Since September 1 they were 4,067 tons, compared with 3,916 tons for the same period of last year.

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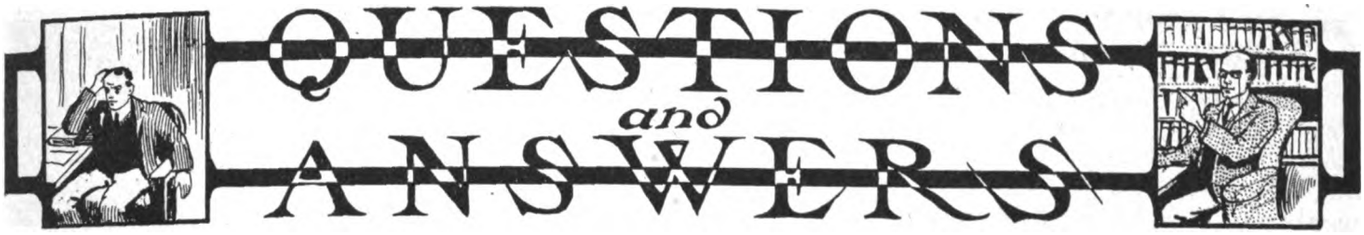

INDUCTION-MOTOR SPEED.—How is it possible to change the speed of an induction motor?—M. S., Tampa, Fla.

The induction motor is primarily a constant-speed machine; however, a number of ways of making this type of motor run at various speeds have been perfected, and of these methods some are quite satisfactory. The induction motor that is referred to in this answer is the ordinary single-phase or polyphase induction motor, but not the single-phase series induction motor. The methods for changing the motor speed are as follows: (A) By changing the number of poles of the motor the speed can be changed in the ratio of two or even three to one. These speeds, however, are fixed, and no intermediate speeds can be provided for by this plan. In carrying out this method taps are brought from the primary winding and connected to a double-throw switch, which is arranged to change the number of poles to one-half of the original number, thus giving two speeds. In some cases three speeds can be provided where three different numbers of poles are permissible. (B) A method that gives a more variable speed adjustment is by the insertion of resistance in the primary circuit of the motor, which in effect cuts down the electromotive-force applied and, therefore, reduces the speed. This method, however, is not very desirable, because it does not give a stable speed for heavy load at low speed. Moreover, the external resistance consumes considerable energy. (C) An improvement over the last method is to use an auto-transformer in place of the resistance. This enables the attainment of a variable primary voltage without appreciable loss. An ordinary transformer with a number of taps on its secondary could be used instead of an auto-transformer. (D) A still more common method than either of these is the insertion of resistance in the rotor circuit. For this method, wound rotors with slip rings are used, the resistance being connected externally to the brushes bearing on the rings. If this external resistance is variable to a considerable extent, a large variation of speed can be attained.

EFFICIENCY OF MERCURY-ARC RECTIFIER.—What is the efficiency of a mercury-arc rectifier for changing alternating into direct current? Does such a rectifier produce a pure direct current?—W. M. P., St. Louis, Mo.

The efficiency of a mercury-arc rectifier depends somewhat upon the operating conditions, particularly upon the voltage of the direct-current circuit fed from the device. From fifteen to twenty-five volts are usually lost in the tube. This represents the energy converted into light and heat. This loss is almost independent of the load. If the rectifier is delivering direct current at a low voltage—say, about twenty-five volts—its efficiency will be only about fifty per cent. If it is developing about eighty volts direct current from the 110-volt alternating current, its efficiency will be probably over eighty per cent. Rectifiers operating on constant-current circuits are said to have an efficiency in excess of ninety per cent at full load. The direct current rectified by means of the mercury-arc device is not a pure direct current of absolutely constant value, but it is a slightly pulsating current, which, for practical purposes, may be considered to be substantially a direct current in the ordinary use of the term, since the wave peaks corresponding to the frequency of the alternating-current circuit are comparatively small.

DIRECT-CURRENT AND ALTERNATING-CURRENT VOLTMETERS.—I understand that an alternating-current voltmeter can be used on direct-current circuits, but that no direct-current voltmeters can be used on alternating-current circuits. Why is this so?—J. O. Z., Fresno, Cal.

Alternating-current voltmeters are built upon either the magnetic-vane or dynamometer principle. They are adaptable to both classes of circuits, that is, a reasonably accurate deflection can be secured with either direct current or alternating current. Direct-current instruments of the better class, however, are built upon the D'Arsonval galvanometer principle, which employs a permanent magnet between whose poles the movable coil swings. Therefore, when an alternating current is applied to a voltmeter of this type, it tends to deflect the needle first in one direction and then in the other, the result being that the needle does not deflect definitely in either direction, but vibrates for a certain range around the zero position. With the instruments of the magnetic-vane or dynamometer types, there is no permanent magnetic field. In the case of the dynamometer, when alternating current is used, the current through both coils changes at the same instant and, therefore, the resultant field is in one direction.

EFFECT OF ELECTRIC CURRENT ON TREES.—I have noticed that the electric wires passing through the trees in this city have rapidly destroyed them. A large number of cases which I have personally observed show that the trees gradually lose their vitality, and in a few months seem to be practically dead. To what kind of action is this due? Does the current destroy the cells of the tree?—A. P. H., Binghamton, N. Y.

It is very unusual for electric companies to run bare wires through the tops of trees, as they realize that there is apt to be considerable waste of current, due to leakage over the branches, especially in wet weather. When circuits must be run through a tree, they are usually protected by extra heavy insulation. There is not likely to be any damage to a tree except by continuous contact of unprotected wires with the trunks and crown branches of the tree. Proximity of the wires alone, even if they are unprotected, can do no damage to the tree. The action of electric currents on woody tissues has not been studied very fully to permit positive statements in regard to the exact effects which various currents have on different species of trees. It has been found that comparatively weak currents passed through living woody tissues produce no appreciable effect, while very strong and long-continued currents cause a cessation of vital action in the living cells, and, if continued through a sufficiently long period, death of the cells and of the entire plant may follow. The general effect upon living tissues of some trees appears similar to that produced by high temperatures of heat. It would be interesting to know in this particular case whether the wires were insulated or bare, and also whether or not the wires were in constant contact with the branches.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

INTERBOROUGH RAPID TRANSIT.

The report of the Interborough Rapid Transit Company, as filed with the New York Public Service Commission, for the quarter ended June 30, 1909, compares, by divisions, as follows:

MANHATTAN (ELEVATED) RAILWAY DIVISION.

April 1 to June 30:

	1909.	1908.
Earnings from operation	$3,636,209	$3,478,691
Operating expenses	1,527,023	1,634,770
Net earnings	$2,109,186	$1,843,920
Other income	90,169	135,053
Gross income	$2,199,355	$1,978,974
Deduct—Taxes on:		
Property used in operation	36,000	30,000
Earnings and capital stock	50,763	49,637
Other than above	350,000	320,000
Rentals	1,458,180	1,504,163
Net income	$ 304,411	$ 75,172

SUBWAY DIVISION.

	1909.	1908.
Earnings from operation	$3,180,639	$2,769,552
Operating expenses	1,129,292	1,161,331
Net earnings	$2,051,347	$1,608,221
Other income	253,041	170,254
Gross income	$2,304,388	$1,778,475
Deduct:		
Interest on funded debt	501,260	425,000
Taxes on property used in operation	18,000	15,000
Rentals	*546,354	*521,320
Amortization of debt, discount and expenses	3,036	†7,984
Net income	$1,235,737	$ 809,169

TOTAL INTERBOROUGH SYSTEM.

	1909.	1908.
Gross	$6,816,848	$6,248,243
Expenses	2,656,315	2,796,102
Net	$4,160,533	$3,452,141
Other income	343,210	305,308
Total income	$4,503,743	$3,757,449
Deductions:		
Taxes on property used in operation	54,000	45,000
Taxes on common and capital stock	50,763	49,637
Taxes on other than above	350,000	320,000
Interest on funded debt	501,260	425,000
Rentals	*2,004,534	2,025,483
Discount and expenses	3,036	†7,988
Total deductions	$2,963,595	$2,873,108
Surplus	1,540,148	884,341

*Rental due city of New York measured by interest and sinking fund on city bonds issued for construction of rapid transit railroad.
†November 1, 1907, to June 30, 1908.

BROOKLYN RAPID TRANSIT.

The New York Public Service Commission has issued the quarterly reports of the various companies in the Brooklyn Transit system for the quarter ended June 30, 1909. The statements of the principal four divisions of the system show as follows:

QUARTER ENDED JUNE 30, 1909.

	Brooklyn Heights R. R.	Brooklyn, Queens Co. & Sub. R. R.	Brooklyn Union Elevated R. R.	The Nassau Electric R. R.
Gross earnings	$1,329,936	$ 328,261	$1,881,347	$1,060,797
Operating expenses	1,292,263	241,500	1,029,750	781,111
Net earnings	$ 537,672	$ 86,760	$ 851,597	$ 279,686
Other inc.	18,735	13,452	40,885	39,643
Gross income	$ 556,408	$ 100,213	$ 892,482	$ 319,329
Total deductions, including taxes	651,574	121,599	537,247	266,380
Net inc. from all sources, surplus	*95,166	*21,386	355,235	52,949
Net inc. for previous qtr. of fiscal year	*42,871	*27,899	485,819	108,925
Surp. for 12 mos. ended June 30, 1909	*$ 138,037	*$ 49,285	$ 841,054	$ 161,874

Increases or decreases over the corresponding period of 1908:

Gross earnings	$ 36,312	* $149,521	$ 204,385	$ 205,320
Oper. exp.	151,680	*31,555	*167,222	232,677
Net earn.	*$ 115,368	* $117,966	$ 371,607	*$ 27,356
Other inc.	*4,954	1,507	6,154	5,024
Gross inc. from all sources	*$ 120,322	* $116,459	$ 377,762	*$ 22,332
Total deduc., including taxes	48,800	6,827	53,736	4,116
Net inc. from all sources, surplus	*169,123	*123,286	324,025	*26,448
Net inc. for prev. qtr. of fiscal year	*34,945	*193,798	*210,198	92,196
Surp. for 12 mos. since July 1	*$204,068	*$317,085	$ 113,827	$ 65,747

*Indicates deficits, losses or decreases.

PACIFIC GAS AND ELECTRIC COMPANY.

Lee, Higginson & Company, of New York, are offering California Gas and Electric Corporation (Pacific Gas and Electric Company) unifying and refunding mortgage five per cent sinking fund thirty-year bonds at ninety-six-and-a-half. In 1901 the corporation acquired substantially all the gas, electric-light and power plants of central California outside of San Francisco, and has since been consolidated with the Pacific Gas and Electric Company, which controls the San Francisco gas and electric systems. The entire funded debt on the properties is $35,153,000 and the physical valuation of the properties subject to the mortgage is approximately $35,000,000. The company has favorable franchises which extend well beyond the life of the bonds and shows net earnings of more than double all interest charges.

WESTERN UNION TELEGRAPH.

The Western Union Telegraph Company has issued its preliminary estimated statement of earnings for the quarter ended September 30, 1909. This compares with the actual figures for the same period of 1908 and 1907 as follows:

	1909.	1908.	1907.
Net revenue	$2,009,000	$1,864,955	*$ 311,493
Bond interest	433,062	433,062	433,062
Balance	$1,566,937	$1,431,893	$ 744,555
Dividends	747,486	497,820	1,217,025
Surplus	$ 819,451	$ 934,073	*$1,961,580

*Deficit.

The actual returns for the quarter ended June 30, 1909 (approximate previously published), compare as follows:

April 1 to June 30:

	1909.	1908.	1907.
Net revenue	$1,867,194	$1,579,660	$1,537,201
Bond interest	433,062	433,062	388,500
Balance	$1,434,132	$1,146,598	$1,148,701
Dividends	747,391	497,546	1,217,025
Surplus	$ 686,741	$ 649,052	*$ 68,324

*Deficit.

The figures for the present quarter ended September 30, 1909, not including the cost of construction or betterments, which has not been included in the regular quarterly reports, show a net profit of 1.57 per cent, or at the rate of 6.28 per cent per annum. Including the cost of construction or betterments, the net profit for the quarter is 1.11 per cent, or at the rate of 4.44 per cent per annum.

INTERBOROUGH RAPID TRANSIT ANNUAL REPORT.

The annual report of the Interborough Rapid Transit Company for the twelve months ended June 30, 1909, has been issued, showing earnings from operations of $25,775, 392, an increase of $1,716,093, or 7.13 per cent, the result of a gain on the subway division of $1,896,774, or 18.93 per cent, and a loss on the Manhattan division of $180,681, or 1.29 per cent.

During the first six months of the year there was a decrease in Manhattan Railway division earnings of $367,123, as compared with the corresponding period of the previous year, while during the last six months earnings increased $186,441.

The net earnings were $15,027,949, a gain of $1,691,344, or 12.68 per cent. There was an increase on the subway division of $1,772,468, or 31.67 per cent, which was partially offset by a decrease on the Manhattan division of $81,123, or 1.05 per cent.

The surplus after providing for seven per cent guarantee on Manhattan Railway Company stock and nine per cent dividend on Interborough Rapid Transit Company stock, was $1,439,823, an increase of $889,163.

The income account compares as follows:

	1909.	Increase.
Earnings from operation	$25,775 392	$1,716,093
Operating expenses	10,747,443	24,748
Net earnings	$15,027.949	$1,691,344
Other income	1,384,643	164,473
Gross income	$16,412,592	$1,855,817
Interest on bonds and three-year gold notes, rentals and amortization charges	$ 5,822 962	$ 753,312
Taxes	1,799,807	213,341
Total interest, rentals and taxes	$ 7,622,769	$ 966,653
Balance	$ 8,789,823	$ 889,163
Manhattan guarantee (7% per annum)	4,200,000	.....
Net income	$ 4,589,823	$ 889,163
Dividend (9% for 1 year)	3,150,000	.....
Total	$ 7,350,000	.....
Surplus	$ 1,439,823	$ 889,163

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Per cent expenses to earnings—		
Excluding taxes	41.69%	*2.88%
Including taxes	48.68%	*2.48%
Passengers carried	514,680,342	31,394,702
Daily average passengers carried	1,410,083	89,631

*Decrease.

In his report President Theodore P. Shonts says:

"The number of passengers carried on the subway division during the year increased 37,990,370, or 18.95 per cent, while on the Manhattan division the number of passengers carried decreased 6,595,668, or 2.33 per cent, the decrease in the latter being due primarily to the business depression prevailing during the first six months of the fiscal year. The increase on the subway was due in a large measure to the opening up and development of new territory.

"Your company owns and controls between four and five million dollars' worth of real estate not required for operating purposes. A considerable part of this real estate is owned by the Manhattan Railway Company, and under the terms of the lease the proceeds can only be expended for the payment of its obligations and in making improvements on its lines. All of this property will be sold from time to time, as favorable opportunity offers, and the proceeds applied for the corporate purposes of the respective companies. Several pieces of property not required for purposes of operation have been rented or sold on advantageous terms during the past year, and other sales and leases are in process of negotiation."

Touching the question of taxes, President Shonts says:

"The disproportion between the burden of taxation borne by the public service corporations of this and those of other states and between such corporations here and individual taxpayers is manifest. It is a serious obstacle in the way of the development of the rapid-transit facilities in this city. Indeed, no prudent plans for the development of these facilities can disregard the excessive taxes now imposed on traction properties in this city, or, in connection with the heavily increased cost of new construction, safely assume its burden."

BINGHAMTON RAILWAY.

The report of the Binghamton (N. Y.) Railway Company for the quarter ended March 31, 1909, compares as follows:

	1909.	1908.
Total operating revenue	$74,925	$65,600
Total operating expenses	42,820	41,923
Net operating revenue	$32,104	$23,677
Outside operations (net)	983	637
Total net from operating	$33,088	$24,314
Taxes accrued	$ 3,792	$ 3,000
Gross income	$29 296	$21,314
Ttl. deductions from gross income	23,709	21,852
Net corporate income	$ 5,586	*$ 537

*Deficit.

WESTERN UNION TELEGRAPH COMPANY.

The following statement exhibits the condition of the company at the close of the quarter ended June 30, 1909:

Surplus April 1, 1909, as per last quarterly report		$16,582,537.25
Net revenues, quarter ended June 30, 1909		1,867,194.58
		$18,449,731.83
From which appropriating for—		
Dividend of ¾ per cent, paid July 15, 1909	$747,391.50	
Interest on bonded debt	433,062.50	
		1,180,454.00
Left surplus June 30, 1909		$17,269,277.83

The following statement exhibits the estimated condition of the company at the close of the quarter ending September 30, 1909:

Surplus June 30, 1909, as above		$17,269,277.83
The net revenues of the quarter ending September 30, instant, based upon nearly completed returns for July, partial returns for August, and estimating the business for September, will be about	$2,000,000.00	
Less interest on bonded debt	433,062.50	
Leaves estimated net earnings for the quarter, less interest on bonded debt		1,566,937.50
		$18,836,215.33
It requires for a dividend of three-fourths of one per cent on capital stock issued about		747,486.00
Deducting which, leaves a surplus, after paying dividend, of		$18,088,729.33

In view of the preceding statements, the committee recommended the adoption by the board of the following:

"Resolved, That a dividend of three-fourths of one per cent on the capital stock of this company be hereby declared payable on and after the 15th day of October next, to stockholders of record at the close of the transfer books on the 20th day of September, instant.

"Resolved, That for the purpose of the annual meeting of stockholders, to be held on Wednesday, the 13th day of October next, and of the dividend hereinbefore declared, the stock books of the company be closed at the close of business on the 20th day of September, instant, and be reopened on the morning of the 14th day of October next.

Second Avenue Suit Delayed.

Judge Lacombe handed down an order in the New York State United States Circuit Court in the suit of the Guaranty Trust Company for the foreclosure and sale of the Second Avenue Railroad of New York city, extending the time for the complainant to take its chief testimony in the case until thirty days after the service of notice by the solicitors for any of the defendants. The defendants are the Second Avenue Railroad, the Metropolitan Street Railway Company, the Norton Trust Company, the Pennsylvania Steel Company and the Degnon Construction Company.

When notice is served by solicitors for the defendants upon the complainant to begin the taking of testimony, the complainants have thirty days from the expiration of the time fixed for the taking of its testimony in chief, the defendants have thirty days' time thereafter for the taking of their testimony, and the complainants have thirty days further to take testimony in rebuttal. This order was granted by Judge Lacombe, despite his decision in July last that the Federal Court had no jurisdiction in the case for the reason that the receiver of the Second Avenue Railroad had been appointed by the State Supreme Court.

Subway Permit Amended.

The New York Public Service Commission has received a letter from Acting Secretary of War Robert Shaw Oliver, granting the petition of the commission for a change in the terms of the permit recently granted by the War Department for carrying the Broadway-Lexington Avenue subway in New York city under the Harlem River.

In the original permit it was required that not more than one-half of the tunnel should be under construction at one time. This restriction is now eliminated. The original permit also required that this city should be responsible for any and all damages that might be caused to navigation through the construction of the tunnel. This requirement is also eliminated, so that the contractors for the work will be responsible if they cause any such damage.

The Glace Bay Wireless Station Destroyed by Fire.

The destruction by fire last month of the Marconi wireless station at Glace Bay, Nova Scotia, is a great setback to the advancement of radiotelegraphy, as well as a serious blow to the Marconi Company. Fortunately, the towers, antennæ, boiler room and manager's house escaped, but inasmuch as the rest of the equipment was specially designed for this installation, the rebuilding will be delayed until new instruments can be made in Europe and imported. The loss in business may prove to be even more costly than the other material losses.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Series Alternating-Current Arc-Lighting System.

The rapid advance in the application of alternating current to electric lighting has brought forth a system for series arc lighting upon alternating-current circuits of constant potential. This system will be found to uphold in every way the high standard maintained by direct-current systems in the past. Although the direct-current series system is still popular, yet the fact remains that alternating current demands recognition for systems of arc lighting.

SWITCHBOARD USED IN SERIES ALTERNATING-CURRENT ARC-LIGHTING SYSTEM.

The Fort Wayne Electric Works, Fort Wayne, Ind., is offering a system for series arc lighting upon alternating-current circuits with a frequency of sixty or 140 cycles, comprising the following apparatus:

Constant-current regulators, constant-potential transformer, high-tension switchboard, constant alternating-current lamps and horn-type lightning arresters. The whole mechanism is mounted in a very compact manner upon a light cast-iron frame, designed to stand upon the floor in a position near the switchboard.

The principle upon which the regulator operates lies in the automatic variation of impedance in the lamp circuit. This variation is accomplished by the movement of a reactance coil up and down over one branch of a divided magnetic circuit. The regulator consists of a reactance coil supported in such a manner

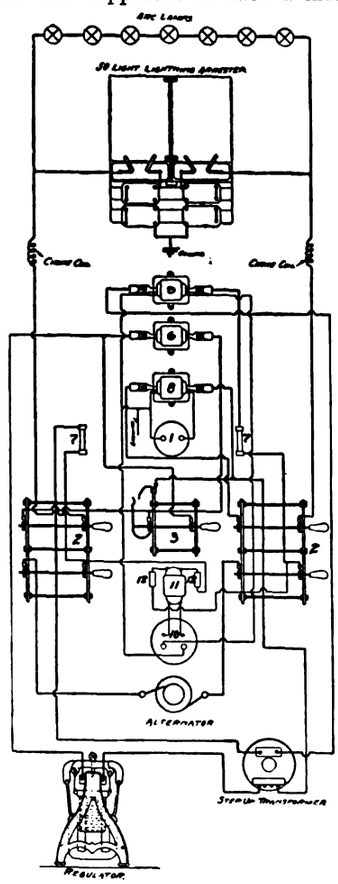

DIAGRAM OF CONNECTIONS WITH TRANSFORMER AND WATTMETER.

from a system of levers as to move freely over the center leg of a branched laminated core. The core is similarly supported from levers so that it may move freely in a vertical plane, thereby including a greater or less number of the turns of the reactance coil as the resistance of the external circuit is respectively decreased or increased. The reactance coil and core are connected with the levers in such a manner as to balance each other, one end of one lever being connected to the coil, while the other end of the same lever is connected with the iron core. With the levers thus connected moving about knife-edge fulcrums, both coil and core are maintained in equilibrium in all positions with the use of external counterbalancing weights.

It is possible to operate the series arc-lighting system from alternating-current distribution of any voltage entirely independent of any other load which the same distribution may be carrying. This is brought about by the introduction of a transformer which furnishes a suitable potential for the regulator circuit.

The use of this transformer with the

FORT WAYNE SERIES ALTERNATING-CURRENT, ENCLOSED ARC LAMP.

one-to-one ratio is advised for insulation purposes, especially where more than one circuit is operated from one set of busbars.

The switchboard illustrated herewith, is of highly polished blue Vermont marble, supported at a convenient height above the floor by means of a rigid iron frame and supplied with all the necessary meters and switches for the starting and operating of the series arc-lighting system. These switchboards are made with and without the sub-base and integrating wattmeters as may be desired. All boards carry the ammeter and card

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receiver as shown in the accompanying cut. Switchboards for these systems are always installed in connection with transformers and are equipped with plug switches. These switches are of the type in which the circuit is closed by brass rods moving between contacts enclosed within a fiber tube projecting from the back of the board. Thus all breaks in the circuit are made within this tube, where no possible damage can be done by any slight arcing which may occur. All connections with line, regulator, reactance coil and meters are made entirely upon the back of the board with metal of sufficient cross-section to carry the small current required with no appreciable temperature rise.

Two lamps have been designed to meet this class of service, one to operate upon sixty-cycle circuits, while the other is adapted for circuits of frequencies varying from 125 to 140 cycles. One-half-inch by twelve-inch carbons are used, with the result that the lamp will operate under favorable conditions throughout a run of from 100 to 125 hours with one trimming. The appearance of this lamp from the outside is similar to that of the multiple-type alternating-current arc lamp and the direct-current series lamp.

The lamp is supported by means of a malleable-iron link, enclosing a porcelain insulator attached to the top of the hood.

The case which protects the mechanism of the lamp from both mechanical injury and the weather is cylindrical in form, having been rolled from heavy sheet copper, lapped together in a single riveted and firmly soldered joint. Upon the removal of this case all the mechanism of the lamp is exposed to view, all parts being easily accessible for adjustment.

Metal porcelain-lined reflectors are regularly supplied with these lamps as part of their equipment. The reflectors are designed to be attached to the lower edge of the case in the lamps by a very simple operation. These interfere in no way with the removal of the outer globe for trimming, since the latter is very quickly released from its bayonet support underneath the reflector, lowered entirely free from the inner globe and supported in such a position by means of a chain secured to the frame of the lamp.

In order to protect the secondary or line circuit of the series arc-lighting system from lightning discharges, and also from excessive voltage between the line wires, the lightning arrester supplied with this system is designed to be connected to the line wire just inside the building.

Detroit Ironclad Meter Box and Fused Switch.

The "Detroit" service and meter box has been designed by the Detroit Fuse and Manufacturing Company to meet the demands for one box that will serve as a main switch and cut-out, prevent theft of current and provide proper terminals for meter testing. This box is compact and substantial, yet allows plenty of room for wiring and testing, and complies with all requirements as to spacing.

The main switch and cut-out embodies the unique knife-switch mechanism of the "Detroit" ironclad fused switch, which is absolutely positive in its action. This mechanism is controlled by a plunger from the outside of the box and is believed to be the only switch that can be sealed

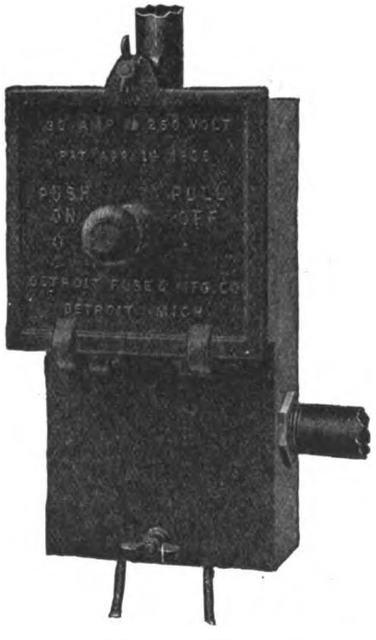

FIG. 1.—DETROIT METER BOX AND FUSED SWITCH.

against tampering and yet is instantly accessible to the consumer. The switch gives complete protection from moisture, dirt, fire and fumes. It offers a superior service switch on account of all live terminals being completely enclosed, there being no possibility of accidental contact in operating the switch. The fuses are mounted on the inside of the cover, swinging away from all live terminals when the cover is opened, and eliminating all danger when replacing blown fuses.

The inspection or meter chamber at the bottom of the switch is provided with a separate seal, and provides for testing the meter without interfering with the service to the consumer and at quite a saving in time over old methods. This feature is of special value, as most lighting companies realize that the frequent testing of meters is decidedly advantageous, and the saving in time from using this device will soon pay for its cost.

Fig. 1 shows the switch as designed for entrance in conduit and open work after leaving the meter box. It is noted that conduit is also run from the meter box to the meter, positively preventing theft of current or tampering. The meter box is drilled on both sides, one side being plugged, making it possible to install the meter in any location.

Fig. 2 shows the mechanism of the "Detroit" ironclad fused switch, and it will be noted that the fuses are mounted on the switch blades, making this portion of

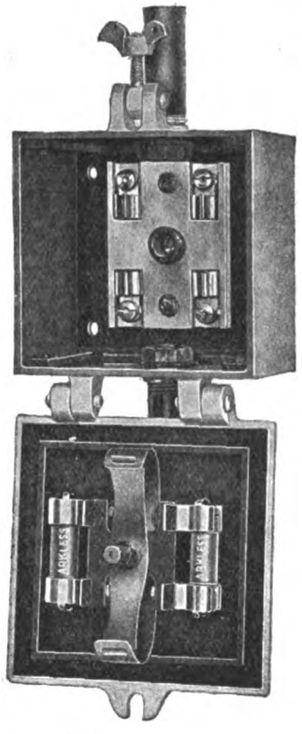

FIG. 2.—INTERIOR VIEW OF DETROIT FUSED SWITCH.

the service box very compact. The mechanism is simple in construction, and the spring of sufficient strength to control the switch independent of outside pressure.

Westinghouse Turbo-Alternators.

The sheet and tin-plate mill of the new Aliquippa Works of the Jones and Laughlin Steel Company, on the Ohio River below Pittsburg, will be served with power to operate a number of direct-current motors, through a rotary converter, from a 500-kilowatt, 6,600-volt, three-phase, sixty-cycle turbo-alternator of Westinghouse make.

The fuel used in the boiler plant will be coke-oven gas, and the turbine will operate on a steam pressure of 150 pounds, exhausting into a vacuum of twenty-eight inches.

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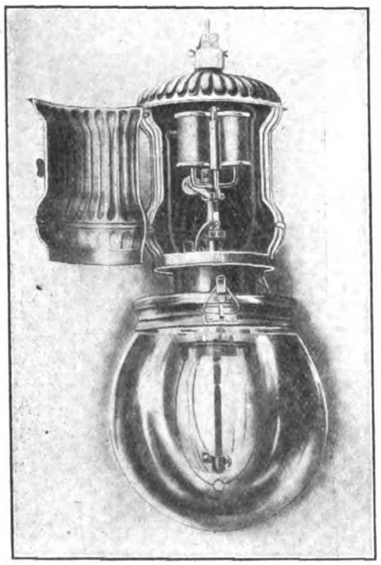
A New Westinghouse Series-Multiple Direct-Current Arc Lamp.

Series-multiple arc lamps have proved a very convenient and satisfactory means of illumination for places where only constant-potential circuits are available. They are adapted for connection in series groups across 220 and 500-volt circuits, and this use makes it possible to operate arc lights with their many inherent advantages, in places where the supply voltage is determined by other considerations. In factories, 250-volt systems are frequently installed for furnishing power to motors, and in pleasure parks and other places that are supplied by trolley voltage, potentials of about 500 volts are common. For service in such places the series-multiple arc lamp finds a wide field of usefulness.



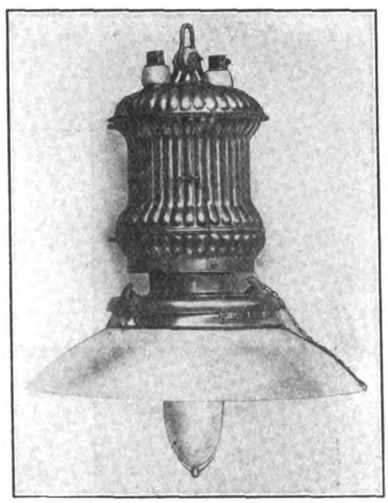
WESTINGHOUSE SERIES-MULTIPLE ARC LAMP FOR OUTDOOR USE.

The Westinghouse Electric and Manufacturing Company has been active in perfecting this class of lamps, and has recently brought out a new and interesting type. It is self-contained, that is, it has no external resistance that ordinarily must be mounted separately from the lamp. The mechanical development has been in the direction of simplification and the reduction of the number of parts, yet producing a lamp that is automatic and reliable in its operation.

The moving parts of this lamp are made of solid brass, and will not rust and stick, as iron parts do. Other details of construction are correspondingly strong and durable, the insulation being fireproof and the circuits so arranged that the points of potential stress are few and well spaced. The lamp case is made in sections of high-grade sheet copper pressed into a fluted form with outlines pleasing to the eye. One-third of the case can be swung open, making the mechanism readily accessible. This feature, together with the small number and durable nature of the working parts, tends to lower maintenance costs.

All the characteristics of primary importance—prompt and silent starting and steady burning—have been successfully attained in this type of lamp. Since best results are obtained with an eighty-volt, five-ampere arc, the lamp resistance is made adjustable, so that the lamps may be connected two in series on 220-250-volt circuits, or five in series on 500-550-volt circuits.

These lamps are designed for operation in series groups, and if, for any reason, one lamp has its arc broken, an automatic cut-out switch short-circuits the mechanism, thus protecting the shunt coils and inserting an equivalent resistance. This enables the other lamps in the group to operate normally.



WESTINGHOUSE SERIES-MULTIPLE ARC LAMP FOR INDOOR USE.

Next Best Thing to Individual Motor Drive.

When a machine shop is fitted with line shafting and countershafting, and driven by a main engine, there is always a great deal of power lost in friction when only a portion of the machinery is to be used, as in working overtime. The Dodge Manufacturing Company, of Mishawaka, Ind., has contrived to do away with a great portion of this loss by making the machine-shop line shaft in sections connected by clutches. Any of these isolated sections can be driven by a portable motor which can be moved about the shop by the traveling crane and fastened to the floor in any desired place. In this way only that portion of the line shafting is driven which is actually needed for a group of tools on an overtime job.

A Novel Fixture Design.

In the endeavor to produce lighting fixtures having both original and artistic merit, the Mitchell Vance Company, of 836-38 Broadway, New York city, has perfected the novel electrolier illustrated herewith. This fixture has a length of fifty-five inches and a spread of twenty-four inches.

MITCHELL VANCE FLORAL EFFECT ELECTROLIER

The design is made up by using a knotted ribbon in metal terminating in two pendent tassels; through the knot in the center of the ribbon is arranged a cluster of arms made of overlapping leaves of a cornucopia or horn-of-plenty shape, into the ends of which are inserted glass shades representing fuchsias. These shades are of various colors, with a crystal matt termination at the ends of the leaves. The shades carry within them eight-candlepower frosted miniature lamps. The whole fixture is suspended by a woven rope and tassel stem from the canopy which attaches to the ceiling. The metal work of this chandelier is finished in a soft dull matt gold color, giving it a very rich and artistic effect.

This company is making electroliers in many similarly original designs.

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Bristol Portable Electric Pyrometer with Thermo-Electric Couple.

The Wm. H. Bristol electric pyrometers have become well known in many processes where temperatures lower than 2,000 degrees are used. These pyrometers have been made in both switchboard and portable form to indicate or record high temperatures, but most of the instruments now in service are for ranges of temperature lower than 2,000 degrees. There are quite a number of processes in

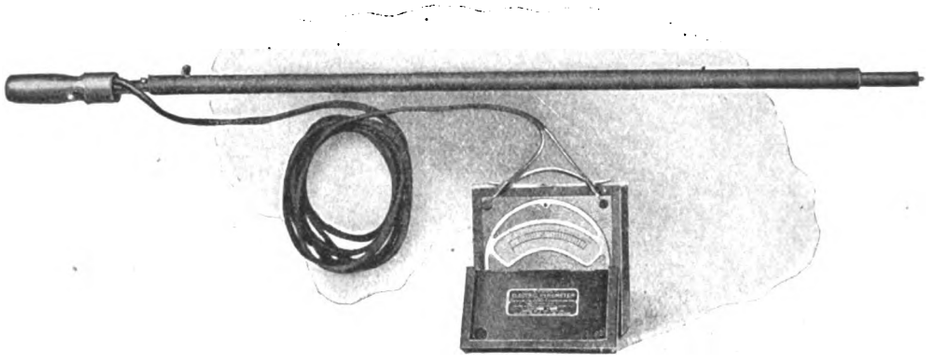

FIG. 1.—BRISTOL PORTABLE PYROMETER WITH THERMO-ELECTRIC COUPLE.

which excessively high temperatures are used and these temperatures should be measured intermittently in order to make control possible and to obtain a uniform product. In experimental work temperatures in the neighborhood of 25,000 degrees Fahrenheit should often be measured as, for instance, in boiler tests where the boiler-furnace temperature is to be determined.

A new quick-reading form of these pyrometers has been designed and pre-

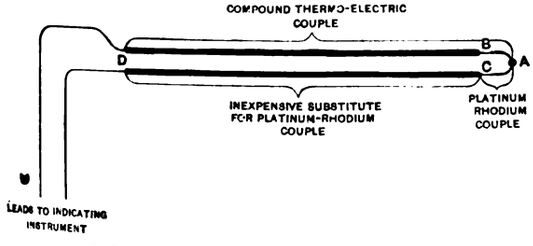

FIG. 2.—CONSTRUCTION OF THERMO-ELECTRIC COUPLE.

liminary models tested in actual service in several different processes where the temperatures are excessively high and the requirements very severe. This special pyrometer consists of a patented compound thermo-electric couple used in connection with a special portable instrument equipped with a pivot jewel-bearing Weston movement. The complete outfit is shown in Fig. 1.

The thermo-electric couple is shown externally in Fig. 1, this being a view of the couple with the protecting sheath pulled back against a stop, leaving the tip of the thermo-couple exposed. When a reading is to be taken with this special thermo-couple it is inserted into the furnace or kiln, with the tip protected from mechanical injury, and as soon as the couple has been inserted at the proper point in the kiln the iron pipe-protecting sheath is slipped back so that the tip is exposed to the hot gases whose temperature is to be measured. After a reading has been taken the couple should be quickly withdrawn and partially cooled off before another reading is taken.

This form of couple is the invention of Prof. Wm. H. Bristol, formerly of Stevens Institute and now president of the Bristol Company. United States patents were issued July 5, 1904, and August 29, 1905. The compound construction of this couple is shown in Fig. 2. The point A corresponds to the regular junction of an ordinary thermo-couple and the two elements which join at the point A are platinum and platinum-rhodium, this being the particular couple selected as a standard by the German government. The platinum and platinum-rhodium elements extend to the points B and C, where they are welded to two other wires made of inexpensive alloys, which are such that the electromotive forces generated at B and C are practically equal and opposed when these junctions are both exposed to temperatures not higher than 1,200 degrees Fahrenheit. These inexpensive alloy elements are extended to the point D, which is the cold end of the couple.

This construction of the quick-reading couple is such that the platinum-rhodium tip of the couple A may be exposed to excessively high temperatures up to 3,000 degrees Fahrenheit without having the temperature of the junction B and C exceed a safe limit. The temperature at A may be quickly measured with this special couple, as the platinum-rhodium tip is exposed directly to the hot gases in the furnace or kiln. In this way an inexpensive substitute is provided for the expensive platinum-rhodium couples previously employed for the measurement of such high temperatures.

This quick-reading form of the Wm. H. Bristol electric pyrometers, with the patented compound couple, has been tested under very severe conditions and found extremely valuable for such applications as brick-kiln temperatures, boiler-furnace firebox temperatures, by-product coke-oven combustion-flue temperatures, soaking-pit temperatures, etc. The complete outfit is portable and readings of temperatures in the neighborhood of 2,500 degrees may be obtained in a very few seconds after inserting the tip of the couple to the point where the temperature is to be measured. By using a special form of the platinum and platinum-rhodium tip this type of thermo-couple can be used to measure the temperature of red-hot surfaces of metal or other material.

DuBois Single-Cylinder Throttling Gas Engines.

The DuBois Iron Works, DuBois, Pa., is placing on the market a new single-cylinder throttling gas engine suitable to be operated by natural, illuminating and producer gas and gasoline. As this engine is a departure from the regular type of engines manufactured by this company, a brief description of it will prove interesting.

An engine of high economy, together with low fuel consumption, has been obtained without complicated engine construction, and an idea of its simplicity may be gained from the accompanying illustration. The massive iron base, so essential to the operation of single-cylinder engines, gives support to the cylinder two-thirds of its length, and this, in addition to the cylinder's being carried half the diameter into the base, makes it a straight-line machine and insures rigidity and perfect alinement.

The cylinder barrel with the water jacket is cast in one piece. The water compartments are segregated by longitudinal rods, so designed that free expansion is allowed immediately surrounding each end of the cylinder when the explosion takes place. These rods further provide for taking up a portion of the strain on the inner shell, and also serve to distribute the cooling water uniformly

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throughout the entire length of the cylinder.

The lay shaft is the means of operating the valves, electric igniters and governor. It is supported along the side of the cylinder in babbitted bar brackets, and runs parallel to the center of the engine. It is driven by cut spiral gears, which run in an enclosed oil bath, that reduces natural wear to the minimum and leaves the operation noiseless.

A governor of the fly-ball type is employed. Its spindle is driven through cut spiral gears from the lay shaft, and the balls and sliding member are enclosed in a stationary housing. The governor gears are located between the forward cam and the main shaft or between two lay-shaft bearings, consequently the angular velocity of the governor is not disturbed or made irregular by the tensional yielding of the lay shaft to the stresses imposed by the cams and the valve mechanism.

The igniter is of the make-and-break type, located in the cylinder head, and is operated by a push rod connected to a small crank pin on the shaft and so arranged as to be adjustable for early or late ignition by means of a hand lever. This lever raises and lowers the horizontal finger with the bent end, which trips the igniter, and thereby alters the point of firing.

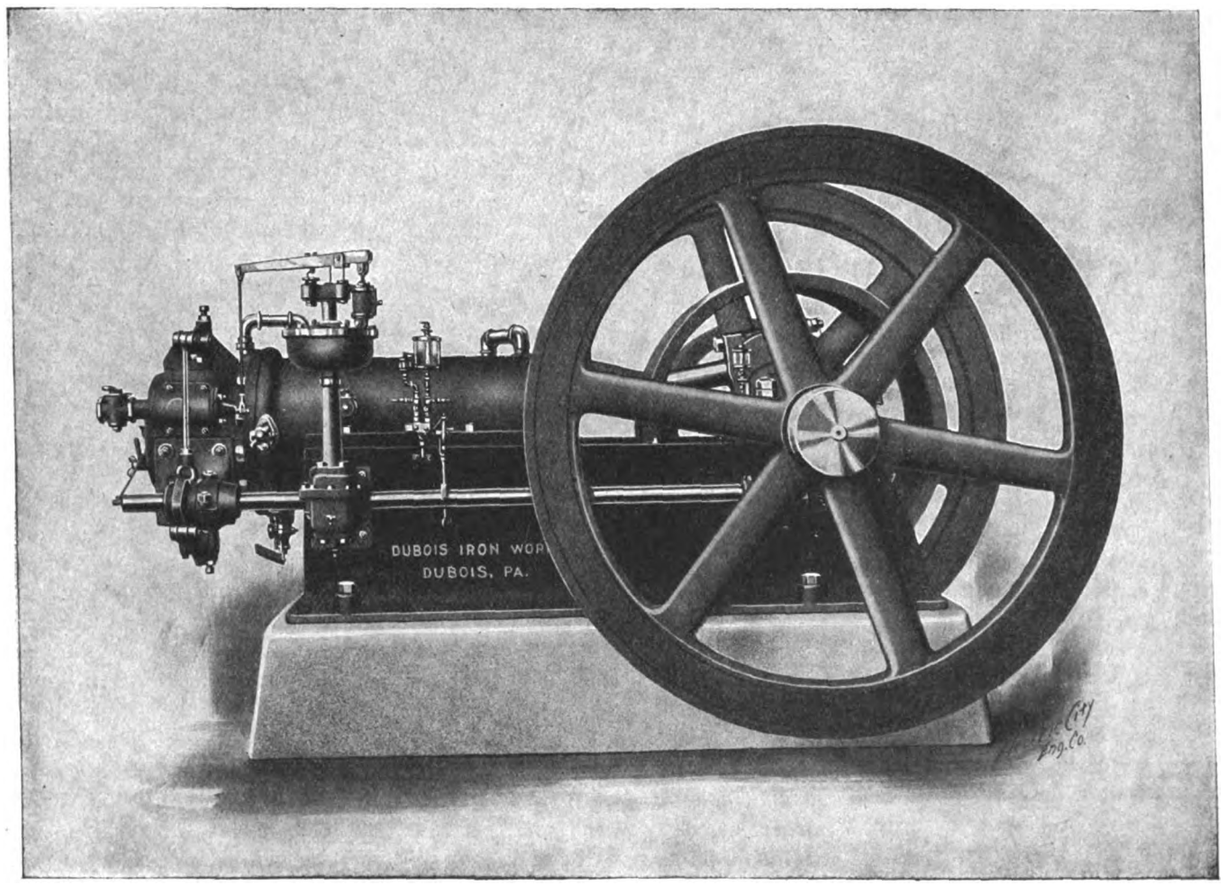
The fuel supply to the cylinder is controlled by means of an improved type of rotating throttling valve, located in the gas supply passage and operated from the governor. The gas entering from this rotary valve passes directly to the main inlet or mixing valve, and is admitted to the cylinder through a series of round holes drilled through the inlet valve seat. The gas coming in on one side and opposite to that of the air, and both being drawn in through the numerous holes in the inlet-valve seat, thoroughly mixes and combines the two, making possible a powerful explosion.

The piston is of the trunk type, and is equipped with four cast-iron spring rings.

The portion of the piston that is exposed to the explosion is designed with a convex head, which demands that contraction and expansion act on the piston uniformly.

The crank shaft, crank cheeks and pin are made in one piece, a solid steel forging, and the balancing weights are bolted on. The main bearings are lined with genuine babbitt and are adjustable by means of liners.

The inlet and exhaust valves are of the small poppet type and are carried in the cylinder head and operated vertically. Each valve is operated mechanically by means of the cam on the lay-shaft push rods and rocker arms. These push or valve rods are right-and-left-hand threaded, so that adjustment for natural wear can be made while the engine is running. Roller contacts are provided to take the thrust of the cam and to deliver the motion of the rocker arm to the valve stem.



DU BOIS SINGLE-CYLINDER THROTTLING GAS ENGINE.

The auxiliary exhaust is a series of round holes drilled through a rib connecting the water-jacket wall to the cylinder barrel, on the left side of each cylinder, the holes being drilled instead of cored, in order to obtain absolute accuracy in dimensions and location. These openings are not uncovered until the exploded charge in the cylinder has expended its full force in power and the piston has completed its expansion or forward stroke. Immediately thereafter, the auxiliary exhaust port is uncovered, and the greater percentage of exploded gases escape to the muffler, the remaining being discharged through the main exhaust valve.

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New Type of Self-Restored Magneto Line Signals.

The Western Electric Company has recently introduced an improved form of self-restored line signal and associated jack which overcomes many of the objectionable features that are inherent in those types which employ a form of drop shutter for a signal. This new piece of apparatus is known as the No. 2 combined jack and signal. Fig. 1 shows a strip of five of these.

The signal consists of an indestructible steel ball which is mounted on a pivot. The upper half of this ball is covered with a black enamel, and the lower half with red enamel. When in an inoperative position, only the black surface of the ball shows through the opening of the face-plate and when in an operative position only the red surface of the signal ball is in view. This steel ball is counterbalanced in such a way that when the armature is attracted the ball is allowed to revolve through nearly 180 degrees. The signal is restored to its normal position by the act of plugging in to answer a call. The plug, when inserted in the jack, acts directly against a lever which engages a projecting lug on the target, which causes it to revolve back into its normal position.

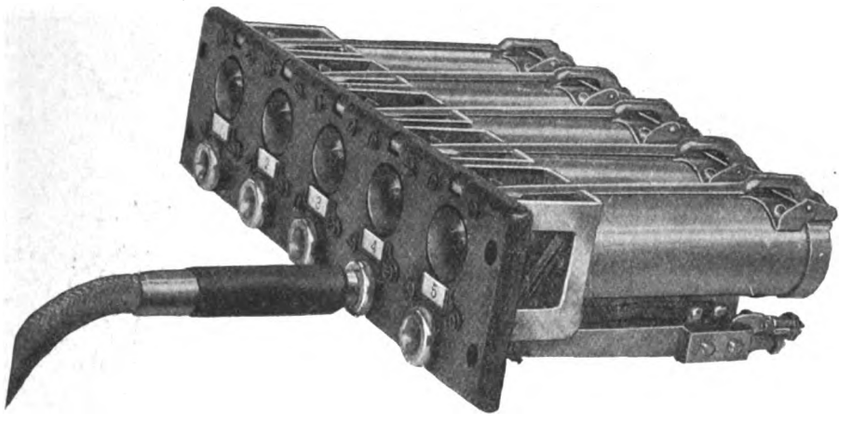

FIG. 1.—WESTERN ELECTRIC COMPANY'S NEW COMBINED JACKS AND SIGNALS.

A few of the novel features of this piece of apparatus are as follows:

The red spherical target, which is displayed when the signal is operated, resembles the lamp signal of the central-battery system and almost equals it in signaling qualities.

Due to the fact that the spherical target of the signal extends a portion of its surface through the face-plate, it can be easily seen from the side as well as from the front of the switchboard.

On account of this signal ball having a smooth spherical shape, it avoids interference with the operator's cords and injury to the operator's hands or clothing.

Since the signal ball is made of punched steel, any amount of impact with the operator's plugs will not injure the target or interfere with its adjustment or render it inoperative.

The restoring mechanism and all of those parts which are subject to injury from impact with the operator's plugs are placed back of the face-plate out of the way of injury.

The surface of this spherical target is covered with an indestructible enamel which will stand any amount of impact with the operator's plugs. Especial attention has been given to the night-alarm contacts. This circuit is completed by means of a pair of flexible german silver springs having pure platinum contacts. These springs are so placed that they are positive in action, not subjected to mechanical injury, and are accessible for inspection and adjustment.

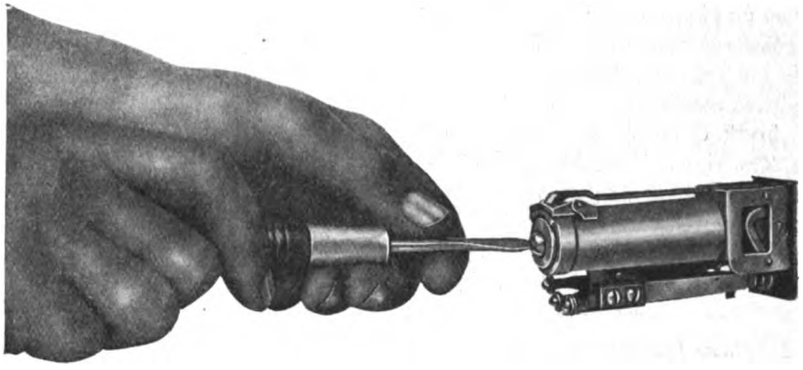

FIG. 2.—METHOD OF REMOVING COIL.

These night-alarm springs are shown in Fig. 1.

It will be noted from Figs. 2 and 3 that in order to remove the coil it is not necessary to break any wire or clip connections.

This is accomplished by simply removing one screw. In removing a coil the fixed relation of these parts which maintain the adjustment of the signal is in no way disturbed.

These signals are furnished with coils of different resistances. All coils are interchangeable.

All coils are wound with black enamel insulated wire. This insulation is less affected by heat than silk, which is ordinarily employed for this purpose, and also its insulation properties hold up better where there is an excessive amount of humidity.

These signals are provided with a small rectangular type of indicator, which audibly and visually receives signals from the subscriber after the spherical target has been operated. This feature is extremely

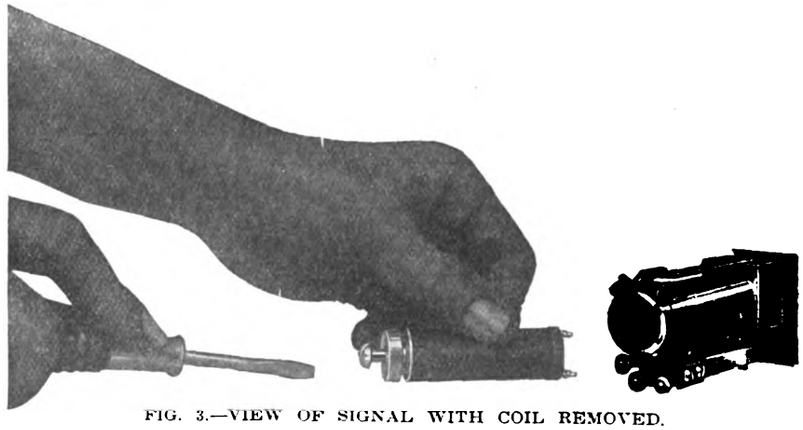

FIG. 3.—VIEW OF SIGNAL WITH COIL REMOVED.

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desirable on non-selective party lines on which code ringing is employed.

The No. 2 combined jack and signal is furnished on individual mounting strips and also on strips with five.

The jacks that are associated with these signals are regularly made up having a single-break contact for ordinary lines and double-break contacts for bridging toll lines. The signal is also made up with an audible-code ringing attachment which consists of a relay type of contact that closes a local bell circuit each time that a code signaling impulse is received.

To Increase Trade with the Latin-American Republics.

Statistics for 1907 show that the total foreign trade between Latin America and the United States in that year amounted to $558,000,000—about one-fourth only of the total foreign trade of the sister republics. Moreover, the balance of trade is against the United States to the extent of about $78,000,000 a year. This, therefore, all goes to show what a field there is for development with the republics of the south.

In order to increase the sale of American engineering products in the Latin-American countries, Alfred J. Thompson, 71 Broadway, New York city, has formed an expert selling organization to hustle for business in this rapidly developing section. During the past sixteen years Mr. Thompson has lived in and traveled extensively through Cuba and every republic of South America and has established most pleasant personal relations with the largest consumers in these localities. He finds, however, that one of the principal reasons for this country not getting its full share of this business, especially in the mechanical and machinery lines, is the fact that the agents or representatives do not appear to have sufficient technical training or knowledge of either United States shop conditions of manufacture, or the "duty" of the machinery required. The few American salesmen who have attempted to canvass this extensive and profitable trade have generally been commission men with too varied a line, including such unmechanical articles as lard, dry goods, drugs, etc., and it stands to reason that a provision or a dry-goods man is not apt to forward a very intelligent specification for a lathe, a mining pump, or for railroad supplies.

Mr. Thompson has associated with him in his new enterprise a number of graduate engineers, each one of whom makes his permanent residence in a principal city in the Latin republic or section he will cover as his territory, and who is therefore well acquainted with the conditions of service and the technical requirements thereof. Frequent visits are made by these men to the large mining plants, railroad shops and other actual and prospective users of American products.

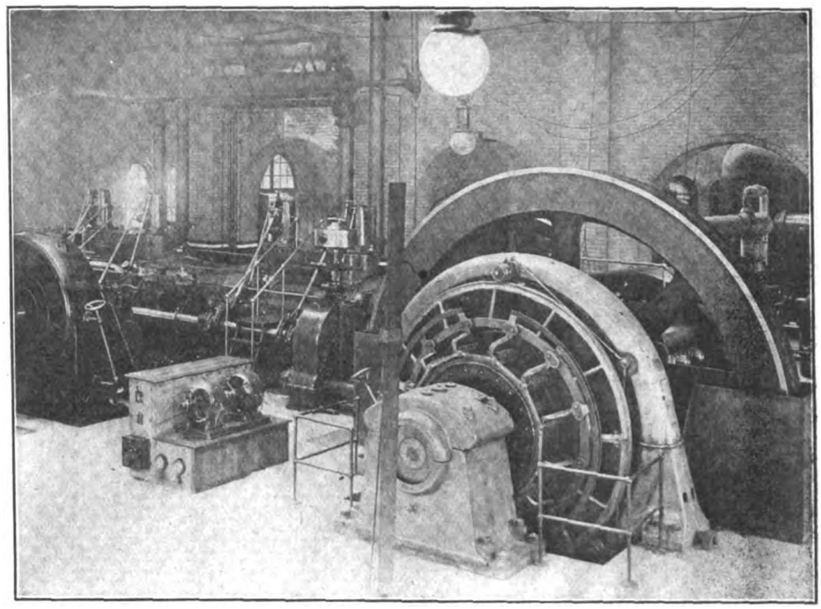
The organization will have its headquarters in New York and Mr. Thompson will make periodical trips to these countries to call on his resident representatives and secure advance information bearing on local conditions.

His traveling associates all speak Spanish, and have had extensive shop training in the United States and selling experience in Latin America, and Mr. Thompson's plan should meet with the approval of every wide-awake concern with progress and expansion for its motto.

Gas Engine Installations Aggregating 210,000 Horsepower.

In the accompanying illustration is shown an Allis-Chalmers horizontal, double-acting tandem gas engine, of 500 horsepower, driving a direct-current generator of the same company's build in the power house of the Illinois Steel Company's Bay View Mills at Milwaukee, Wis. During the two years this has been in operation the unit has not cost $50 for repairs, and its record has been such as to demonstrate conclusively the reliability of gas engines, properly designed, for industrial service of the most severe character.

Machines in operation for about the same period of time, or longer, include gas engines and generators of from 300 to 5,000 horsepower capacity, which, with others now going into commission, furnish power for iron works, steel mills, clay-products plants, cement mills, automobile shops, plate-glass works, tube mills, wireworks, central power, lighting and traction stations, phosphate plants, factories and other industrial establishments. In the list are engines operating on producer, natural and furnace gas, and their capacity for continuous service aggregates no less than 210,000 horsepower Among the larger users of gas power in the industrial field is the Pittsburg Plate Glass Company, which was one of the earliest to install the improved type of engine and electric generator built by Allis-Chalmers Company, and has just placed an order for the eleventh of these units.



ALLIS-CHALMERS DOUBLE-ACTING TANDEM GAS ENGINE, 500 HORSEPOWER.

Galveston to Use Arch Lighting.

The first electric arch erected in Galveston, Tex., at the corner of Twentieth and Market streets, has been offered to the city by the citizens who installed it, provided the city will undertake to light it. It is a permanent arch of metal, equipped with 116 two-candlepower ten-volt incandescent lamps, and is very handsome and costly. A movement is on foot to make Galveston as well lighted a city as it is now poorly lighted. The current consumed by the arch is but little more than that taken by the arc lamps it is designed to replace.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, SEPTEMBER 6.—The annual report of the British Thomson-Houston Company, which is just issued, states that the firm sold Curtis turbines during 1908 of an aggregate capacity of 15,000 kilowatts, and that, since the accounts were closed on March 31, the number of machines of this type sold amounts to a capacity of 18,569 kilowatts.

Recent shipping disasters have once more brought prominently to the fore the question of the compulsory use of wireless telegraph apparatus on all vessels. In the House of Commons this week, the president of the Board of Trade stated that consideration had been given to the proposition by the Board, but it was not deemed advisable to take any action in this direction at present. It is quite possible that in the absence of government action the desired end will be brought about by the action of the underwriters, who propose that smaller insurance rates should hold where a ship is fitted with wireless. The cost of installing the apparatus, of course, is the obstacle to universal use of wireless apparatus, especially on those vessels where there would be no return from messages transmitted to and from the vessel, such as cargo boats, but efforts are being made to overcome this drawback by the design of a cheap set which can be manipulated by one of the crew. Mr. Marconi, in an interview with a daily newspaper representative over here, has given the exact terms upon which the Marconi Company supplies wireless installations upon the big liners, viz., $1,000 per annum, including the operator, and it is obvious that these terms are far too onerous in the case of cargo boats pure and simple. A bill for the compulsory use of wireless on French boats is said to have been introduced into the French Chamber.

The accounts of the working of the Pacific Cable for the year to March 31, 1909, again show a large deficit after meeting capital charges. As a matter of fact, there is a credit balance of about $35,000 as between the actual receipts and expenditure, but the amount necessary to cover interest and sinking fund charges is about $390,000. The revenue was about $15,000 better than in the previous year, and was $25,000 better than the estimate arrived at at the beginning of the year. During the year there were 232,304 ordinary messages transmitted, 9,086 government messages and 2,532 press messages, the figures for the previous year being, respectively, 238,088, 8,310 and 3,193. The total number of messages transmitted during the year under review was, therefore, 243,922, against 249,590 in the previous year, the first time since the opening of the cable in 1902 that there has been a falling off compared with the previous year. The report states that improved methods of increasing the duplex speed of the Bamfield-Fanning section have met with great success, and this cable, laid with the anticipation that the speed would not, in actual practice, exceed 65 letters per minute, is now daily working at a speed of from 90 to 97 letters per minute.

The increasing use of electricity in mines and its rapid development during the past few years has naturally resulted in a number of accidents, some of them fatal, mainly owing to faulty installation work or wilful disregard of regulations. As the present regulations apparently are not sufficiently wide to cover all possible cases, in the light of five years' experience, the government have decided to appoint a commission to go into the question of making modifications and alterations in the present code. It is a startling fact that under the dangerous conditions of mine working apparatus of the most careless design has been installed and only a fatal accident has revealed its presence to the inspectors. It is clear that a most systematic inspection of all colliery electrical equipments will have to be made by the Home Office department having charge of this work.

The working of the Underground Electric Railways Company, of London—which controls the Speyer group of tube railways and the District Railway in London—for the first half of 1909 shows the considerable loss of $80,000. This, however, is a considerable improvement upon the results of previous half years, and was foreshadowed by the satisfactory reports issued a few weeks ago by the affiliated tube railway companies. In fact, the actual return upon the investments in the tube railways for the past six months represents about 1¼ per cent. At present the total debit balance of the company amounts to $140,000, and the attempt to put the working of London's underground railway upon a satisfactory basis has certainly proved a much more formidable task than was ever anticipated by the late Mr. Yerkes when he first tackled the problem.

The shadow of forthcoming events may possibly be discerned in applications to amend some of the original metal-filament lamp patents. In connection with a purely British-made lamp and British patent, one infringement action is pending and presumably others are threatened. In the meantime, the action for infringement of the Bremer arc-lamp patent, which was heard some time ago, has not yet been adjudicated upon. The long vacation having commenced before the judge could prepare his judgment, it will now be quite a considerable time before the case is disposed of in the court of first instance. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, SEPTEMBER 5.—Among the new electric-lighting projects in France, I note the following localities which are making arrangements for lighting stations: Dun-le-Palleteau, Dozulé, Ferté-Macé. At Nimes there are being carried out some improvements in the city tramway system. The Municipal Council of Ballon d'Alsace is considering a project for electric tramways in that locality, part of the capital to be furnished by the town and the remainder by the company which is to receive the concession. This latter company intends also to install a traction line from Barr to Odilienberg during next year.

The municipality of Berne, Switzerland, is taking measures to secure a supply of hydraulic power for lighting and motors for the city and suburbs. It is likely that a turbine station will be erected on the Aar River and the site will be chosen between Niederuntigen and Wileroltigen. The Aar stream will afford a seventy-foot head of water in this locality, and it is intended to secure from 8,000 to 10,000 horsepower. The capacity of the machines to be erected in the plant will be from 12,000 to 15,000 horsepower. The tail race will empty into the Aar Canal.

In order to secure the current which is needed for the proposed electrification of different sections of the Austrian State Railroads, there is to be erected a hydraulic plant of some size, and it will be located near the town of Pinegg. The barrage will be an extensive piece of engineering work, and will be 0.8 mile in length, according to the present plans. The stream known as the Brandenberger Ache is to be utilized in this case, and it will afford a 600-foot head of water. In this way there will be obtained from 10,000 to 15,000 horsepower for the station.

In Austria there is to be run an electric automobile service from the town of Pozsony to the suburbs, using the trackless trolley method. What is known as the "Mercedes-Stoll" system is to be used for this line. Such a system is stated to cost only one-fourth of what would be needed for an electric traction line. The overhead trolley line is run double throughout the whole course, so that the cars are not obliged to stop on the road. A type of 20-horsepower motor is used on the cars. A. DE C.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, SEPTEMBER 13.—Over six hundred householders of the city of Winnipeg are unable to use electric current to light their homes because of the litigation between the city and the Winnipeg Electric Company. These six hundred homes are now using oil lamps and it is doubtful if the ruling of the courts will be obtained for some time, as both sides are determined to appeal to the highest courts. The city's statement of claim was filed on November 12, 1906, and there is but little prospect of the case coming up this year. The trouble started in 1904. A livery barn sued the city for $16.50 damages resulting from one of their livery rigs falling into an excavation on the street which was not properly guarded. The permit for the excavation was obtained by the Manitoba Gas and Electric Company, since absorbed by the Winnipeg Electric. The city endeavored to make the company a third party to the suit, but the application was opposed on the grounds that at the time the suit was started there was no such company as the Manitoba Gas and Electric Company, all its holdings having been absorbed by the Winnipeg Electric. The Manitoba Gas and Electric Company is the only company which ever made a contract with the city to supply gas and electric light. On the ruling the city did not know who it was dealing with. Suddenly the city solicitor informed the city engineer he was issuing permits for the erection of light poles to a company which did not exist. The city solicitor then notified the Winnipeg Electric that it had no right to bring power into the city without the consent of the civic authorities. The company, however, brought in the power and sold it despite the fact its power plant was some miles out of the city, while the by-law relating to the company provides that all its works must be within the city limits. The city then stopped issuing permits for the erection of poles. The last two weeks has been

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devoted to arguments between the company and the city, with the result the city has ordered the company to supply light to those desiring it and the company has issued an ultimatum to the city that it will at once proceed with the erection of poles without going through the formality of taking out permits, in fact since this ultimatum the company has erected a number of poles, but the city has made no move. A long drawn-out legal fight is expected and the probabilities are it will be taken to the House of Lords in England for final settlement.

Great things are being planned in connection with the municipal electric railway system jointly owned by the cities of Port Arthur and Fort William, in Western Ontario. In Port Arthur construction will be started at once on new carbarns, while the City Council is endeavoring to organize a company to build extensions throughout several of the adjoining townships, the system to operate in conjunction, and auxiliary to, the municipal system. In addition several extensions are being planned to be built in the two cities. Port Arthur offers to assume sixty per cent of the burden of the indebtedness of the new company. Address J. J. Carrick, Port Arthur, Ont.

A statement has been issued by the British Columbia Electric Street Railway System showing the work done and the money expended since the company entered into an agreement with the city of Vancouver in 1900. The money spent is but $50,000 short of six millions, which provided for a considerable amount of new tracking, besides a power and light system at Ladner, a power development at Lake Buntzen which cost $2,000,000 and approximately 100 miles of extensions. The company proposes to spend large sums on development work in the immediate future and during the present month has placed in the London market bonds to the value of $2,500,000. R. H. Sperling is general superintendent of the company with head office at Vancouver, B. C.

The entire telephone system of the Temiskaming & Northern Ontario Railway between North Bay and New Liskeard, in Western Ontario, is being reconstructed and several important extensions will also be made this fall.

It is expected that the Dominion Government telegraph line from Athabasca Landing to the Lesser Slave Lake, in Northwestern Alberta, will be completed this fall.

The City Council of Vancouver, B. C., has passed a resolution in favor of engaging an engineer to report on the available water powers in the vicinity of the city. The Burrard Power Company has offered its plant to the city for $150,000 and the British Columbia Electric Company has also made an offer. The city proposes to go into the municipal power business. Address Alderman Goodman.

Charles Mitchell, C. E., Toronto, Ont., who was engaged by the City Council of Prince Albert, Sask., to survey the waterpowers to the north of that city, has reported that there is at least 10,000 horsepower available for development in the vicinity of the city. In three miles of the river there is a drop of thirty feet.

W. H. Hayes, chairman of the Manitoba Telephone Commission, announces that the province of Manitoba has been divided into seven districts for the purpose of better operating the government telephone system. There are six provincial districts, the seventh being Winnipeg. In each division there will be three managers, one each for the traffic, commercial and plant. These managers will be directly responsible for everything in their department to three superintendents, who will have their headquarters, and they will report to the commission. The system was inaugurated on September 1 and is already proving a success.

At Calgary, Alta., the pay-as-you-enter cars have proved very popular and the City Council considers they have been so successful that six more cars will at once be ordered. Incidentally the system is a financial success, but the motormen and conductors who are now receiving twenty-one and one-half cents per hour have demanded an increase to twenty-five cents, which has been refused, as there are three applicants for every position now held on the system. R.

IMPORTANT DEVELOPMENT.

(Special Correspondence.)

TEN-MILLION-DOLLAR TRACTION LINE — Announcement has been made by Samuel M. Clement, Jr., an attorney, that the Kentucky Rapid Transit Company, with a capital of $10,000, has been chartered at Dover, Del., the corporation being authorized to take over traction companies in Kentucky. The principal operations of the company at present, it is stated, will be in Louisville, Lexington and Frankfort. The company, which was organized by Boston, New York and Philadelphia capitalists, is also authorized to operate electric light and gas plants. The directors and officers of the company will be chosen on September 28.

LIGHTING AND POWER.

(Special Correspondence.)

ST. PETER, MINN.—The extension of the municipal lighting plant to Kasota has been completed and is in successful operation. C.

UNION, ORE.—This city has voted to issue bonds for the erection of an electric-lighting plant.

FRIDAY HARBOR, WASH.—A light franchise has been granted to the Western Mills and Lumber Company. U.

FARGO, N. D.—The Union Light, Heat and Power Company has reduced the price for electricity 20 per cent. C.

FAIRFAX, MINN.—The village will take a vote on issuing bonds for $18,000 for the installation of an electric light plant.

ORLAND, CAL.—The voters of this place have voted in favor of levying a special tax to establish and maintain street lights.

LOS ANGELES, CAL.—Sealed bids are being received by the municipality for 10,000 sixteen-candlepower incandescent lamps.

SANDPOINT, IDAHO—Manager T. J. Humbird has announced that the company is to install a new plant at the Humbird mine at Kootenai. U.

INDEPENDENCE, CAL.—The Board of Supervisors will, on October 7, offer for sale a franchise for an electric-lighting system in this place.

BOISE, IDAHO—The Big Giant Gold Mining Company, of Boise, Idaho, has decided to equip its property with a modern, 300-ton milling plant. U.

HIGHLAND, CAL.—At a special election last week, the voters decided to organize as a lighting district under the law passed by the last Legislature.

TROPICO, CAL.—A new lighting district, to include part of this place, part of North Glendale and all of West Glendale, was organized here this week.

INDEX, WASH.—J. A. Soderberg, owner of the Index Granite Works, is installing an electric light plant which will supply light and power to Index and neighboring towns. C.

STAUNTON, VA.—The Beverly Garage Company has been incorporated here, having $25,000 capital, by M. W. Mercereau and associates, to conduct a garage business. L.

GRAHAM COUNTY, ARIZ.—J. Blackstein, of Clifton, has secured a three years' option on the Gold Belt property and will erect a twenty-ton reduction plant at the mine. U.

CHOTEAU, MONT.—The property of the Choteau Milling and Power Company was sold at sheriff's sale to Julius Hirshberg for $11,800. He will operate the mill and electric light plant. C.

SIGOURNEY, IOWA—J. F. Bray has purchased the plant of the Sigourney Electric Light and Power Company and will install a new plant with twice the power needed now. C.

TOLEDO, OHIO—The Consumers' Electric Company, of Forest, Ohio, has been incorporated, with a capital stock of $35,000, by E. B. King, A. K. Nier, C. B. Horn, M. S. Wilcox and A. C. Bowser. H.

IDAHO COUNTY, IDAHO—William L. Sendker, superintendent of the Penn-Dixie Mining Company, is authority for the statement that the company will erect a mill at the mine in the near future. U.

FRUITVALE, CAL.—At an election this week the voters of this place established a new lighting district. The new district will spend about $9,000 in the maintenance of electric lights during the coming year.

SALT LAKE, UTAH—The Portage Reservoir and Power Company has been incorporated here, with a capital stock of $10,000, by Charles W. Hall, Robert C. Harris, W. H. Gibbs, John Heaton, John F. Conley and others.

SEATTLE, WASH.—The Board of Public Works has contracted with the Forbes Electrical Supply Company for incandescent electric lights for the ensuing year. It is estimated that the contract will amount to about $40,000.

YREKA, CAL.—The Siskiyou Power and Electric Light Company has completed one-half of its electric power transmission line between its Fall Creek plant and Dunsmuir. The remainder of the line is to be completed in about two months.

CŒUR D'ALENE, IDAHO—The Carney Copper Mining Company, J. L. Martin, manager, operating in the Cœur d'Alene district, Idaho, has practically completed plans and specifications for the installation of a five to seven-drill water-driven compressor plant. U.

WASHBURN, WIS.—The city has entered into a contract with the Ashland Power Company, of Ashland, for furnishing electric power to the city from the White River dam. The line will be built at once and the power ready by November 1. A substation will be installed here. C.

OLEAN, N. Y.—The Olean Electric Light and Power Company has completed arrangements for the expenditure of between $40,000 and $50,000 for the doubling of the present capacity of its plant in this city. Every piece of machinery in the plant

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is to be duplicated to be used in case of emergency. Two 200-horsepower gas engines are to be installed, with new generators, etc., for relay, which will insure the patrons uninterrupted service.

NASHVILLE, TENN.—The Etowah Electric Light and Power Company, McMinn County, has been incorporated; capital, $10,000; incorporators, P. A. Kinser, W. C. Reynolds, C. A. Graham, J. R. B. Rose, Dr. G. O. Bicknell.

PARK CITY, UTAH—The Daly-Judge Mining Company, of Park City, Utah, has decided to add to its compressor capacity. The company will utilize electric power, instead of steam, for the operation of its compressors. U.

LEWISTON, IDAHO—Articles of incorporation of the Northwestern Corporation of Walla Walla, with a capital stock of $5,000,000, have been filed. This is supposed to indicate extensive power development in this vicinity. U.

RENO, NEV.—Those members of the Reno Commercial Club who have been assisting John S. Loder in securing subscriptions to stock for the erection of a 400-ton smelter in this city, state that Reno is pretty sure to get the smelter. U.

DEMING, N. M.—The Northern Construction Company of Kansas City, Mo., has made an offer to the city to install an 800-horsepower electric power plant here under certain conditions, and their proposition has been favorably considered. U.

SWEETWATER, NEV.—The Walker River Electric Power Company, of which George B. Costigan and Dr. A. L. Pollard of Denver are heavy stockholders, will put in a $750,000 electric power plant on the East Walker River, near Sweetwater. U.

SAN FRANCISCO, CAL.—The directors of the Mojave Water and Power Company have voted to increase the bonded indebtedness of the company by $15,000,000. No plans for the expenditure of the money derived from the sale of the bonds have been made public.

NEWBERRY, S. C.—The Southern Power Company has completed the survey for transmission lines to this city and Whitmire, the lines to be about forty miles in length, tapping the main transmission lines from the power plant at Great Falls to Greenville, S. C. L.

HART, CAL.—Another big mill that will rival the Montgomery Shoshone of Ryholite is under advisement by a company of capitalists who have the funds to execute their plans. This is the Aurora Bullfrog Company, operating two miles north of Springdale, Nev., in the Pioneer distrist. U.

HICKORY, N. C.—Col. M. E. Thornton, largely interested in electric development in this section, is issuing a prospectus for "the largest cotton mill under one roof in the world," which he proposes to organize, the same to be operated by 6,000 electric horsepower, the company to have $4,000,000 capital. L.

RAMSEY, NEV.—A custom milling and reduction plant is to be built at Alamo canyon at the mouth of the working tunnel now being driven into the base of the Comstock Mountain, by the Wire Gold Mining and Milling Company. D. J. Kennedy and J. W. Halterman, Nevada mine owners, are interested. U.

OREGON CITY, ORE.—A big power plant, capable of furnishing light and power for factories, private enterprises, and the towns surrounding Oswego, is being projected by the Oregon Iron and Steel Company at Oswego. It is intended to install the plant at the lower end of Tualatin Lake, just above Oswego. U.

GRAHAM, N. C.—Stock is being subscribed for the launching of a new cotton mill to utilize the power that is to be developed from River Falls, below Saxapahaw. The power will be sufficient to drive a large plant, and J. W. Menefee, who owns the power site, is certain of the success of the cotton-mill project.

MACON, GA.—A number of land owners along the line of the Central Georgia Power Company transmission route have been served with legal notices, and condemnation proceedings will be ordered where necessary, thus insuring the speedy entrance of hydroelectric power into Macon. The power comes from Capps shoals and Lloyd shoals, W. Jordan Massee being president of the company L.

TOLEDO, OHIO—A company to furnish light and power for Waterville, Ohio, was recently incorporated at Columbus. The concern has a capital stock of $10,000. The incorporators are Delmar J. Farnsworth, G. D. Dedrich, C. J. Stickney, H. F. Van Fleet, G. G. Schwind and J. M. Bennett, all of Waterville. The company plans the erection of a plant to supply light and power for the village and its industries. H.

JOPLIN, MO.—The Empire District Electric Company has been incorporated under the laws of Kansas, with an authorized capital of $6,000,000, to take over the properties of the Consolidated Light and Power and Ice Company, of Joplin, the Joplin Light, Power and Water Company, and the Galena Light and Power Company, and fifty-seven per cent of the stock of the Spring River Power Company of Missouri.

COLUMBIA, S. C.—P. L. Vogt, of the bureau of corporations of the Department of Commerce and Labor, was a recent visitor to this city, where he came to procure data, figures, etc., relative to the waterpower development in South Carolina, and the hydroelectric companies of the state. State officials gave all the information available at the capital. L.

SANTA BARBARA, CAL.—The Santa Barbara Gas and Electric Company has been incorporated here by C. H. Frink, W. R. H. Weldon, S. M. Kennedy, R. H. Ballard and Wm. Dieterle. The company has an authorized capital stock of $1,000,000. The new company will take over the properties of the Merchants' Mutual and Edison companies in this place.

PERU, IND.—The Peru Gas and Light Company has filed articles of incorporation with the secretary of state. The amount of the capital stock is $60,000. The corporation proposes to erect and equip a plant to furnish light, heat and power to the city of Peru and adjacent villages and communities by means of natural and artificial gas, electricity, steam and hot water, etc. George M. Dolby, Oscar Ridenour and Otto Sample, directors. S.

ELECTRIC RAILWAYS.

(Special Correspondence.)

MAYFIELD, CAL.—The Peninsula Railroad Company has been awarded the electric-railway franchise in this city, which it recently applied for.

CLAREMONT, CAL.—The Ontario & San Antonio Heights Railway Company has secured a franchise for an electric street railway in this place.

COLUSA, CAL.—The Northern Electric Company has asked that its franchise in this place, which is about to expire, be extended for another year.

WEBSTER CITY, IOWA—It is stated that the Fort Dodge, Des Moines & Southern will buy the right-of-way of the Crooked Creek Railroad from Fort Dodge to Brushy. C.

EVANSVILLE, IND.—It is reported that the Evansville, Mt. Carmel and Olney Electric Railroad has been financed by Chicago bankers, and that work is to be begun on the construction in a short time. S.

SCOTTSBURG, IND.—Subsidy elections in aid of a tax for the construction of the Cincinnati, Madison & Western traction line will be held in three additional townships in Scott County, September 28. S.

STOCKTON, CAL.—The Central California Traction Company, operating city and suburban lines in and about this city, is preparing to build a seventeen-mile extension to Linden and Bellota in this county.

FRAZER, IOWA—The Fort Dodge, Des Moines & Southern Interurban Company is installing $20,000 worth of additional machinery in its power house, which, when completed, will be one of the finest plants in the United States. C.

SANTA ROSA, CAL.—J. E. Fulton, of the Sonoma County and Lake County Railroad Company, states that the company has secured rights-of-way for a standard-gauge electric railroad from Santa Rosa through Alexander Valley as far as Preston.

MENOMONEE FALLS, WIS.—The final move in assuring the building of the electric line through to Beaver Dam by the Milwaukee Electric Railway and Light Company was taken last week when application for the franchise was made to the town.

GARY, IND.—The officials of the Air Line Traction line started work with a vim on the construction of the Gary-Hammond line during the past week. Ties are on the ground and rails are arriving and will be laid as rapidly as the roadbed can be constructed. S.

BLUFFTON, IND.—Arrangements have been made for switch connection between the Muncie, Bluffton and Eastern Traction Company and the Cloverleaf steam line in this city. When completed the traction line will be able to send through freight over the steam line. S.

GEORGETOWN, S. C.—It is reported that the proposed electric-railway system here has materialized, that rolling stock and equipment has been purchased, the local electric-lighting plant capacity increased to meet the larger power demand, and that the tracks will be laid soon. L.

MACON, GA.—It is stated that the building of the Atlanta-Macon trolley will be completed within one year. The merger of the building company with other electric interests and the floating of bonds, backed by the four merged concerns, has been under negotiation for some time. L.

SAVANNAH, GA.—Savannah is to have a new traction company and over $500,000 is expected to be expended upon the plant and equipment. Plans have already been prepared for much of the improvements, and modern electric equipment is already being added to the present plant by the Savannah Lighting Company. The company will be a competitor of the Savannah Electric Com-

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pany, which is owned by the Stone & Webster interests of Boston. It is understood that the plans considered embrace the laying of over thirty or forty miles of track service to Tybee, Isle of Hope, Montgomery and possibly other sections of the county.

COLUMBIA CITY, IND.—The City Council is asking for bids for the complete rebuilding of the municipal electric-light plant, including the furnishing and installation of three vertical boilers of 200-horsepower capacity, generators and other necessary equipment. E. R. Vincent is the city engineer. S.

SAN FRANCISCO, CAL.—It is reported from Los Angeles that J. M. Neeland, of Redlands, G. A. Atwood and M. N. Newmark, of Los Angeles, and others are preparing to build an electric railroad from Redlands to the townsite of Yucaipa City, a distance of nine miles, with a branch to Oak Glen.

WARSAW, IND.—The Winona Traction Company has been reorganized and H. J. Heinz, of Pittsburg, elected president. The road will now be operated independent of the Winona Assembly, and the work of completing the Warsaw-Peru branch rushed along and the division put in operation before winter. S.

RALEIGH, N. C.—The recent "electric headlight act" of the state Legislature, after being vigorously fought before the corporation commission, has been declared legal and will become effective, twenty-five per cent of all engines to be equipped annually, beginning April, 1910, until all engines are so equipped. L.

FT. WAYNE, IND.—The beginning of the construction work on the new Ft. Wayne and Bryan Traction line was started near this city last week. The event was made the occasion of a celebration largely attended by citizens interested in the line. The first shovelful of dirt was thrown by R. T. Bastress, president of the company. S.

KALAMAZOO, MICH.—A mortgage for $3,000,000 has been given by the Michigan & Chicago Westbound Transportation Company to the Chicago Title & Trust Company, and covers interurban property. The filing of this mortgage assures electric railroad connection between Kalamazoo and Grand Rapids. The mortgage provides that loans are not to exceed $25,000 a mile of railroad.

KINGMAN, IND.—Superintendent Peoples, of the Covington and Northwestern Traction Company, announces that the construction of the line from Kingman to Wallace is almost ready for operation. The power house is completed and all the machinery in place, except the generator and switchboard. The stringing of the trolley wire will be completed in about two weeks. S.

OTTAWA, ILL.—The Chicago, Ottawa & Peoria Railway Company is making dirt fly between Grand Ridge and Ottawa, building the line that will connect Ottawa with Streator. The men having the contract for the grading are pushing the work as rapidly as possible, and arrangements are now being made for carrying the electric power from La Salle to the Grand Ridge substation.

HARTFORD, CONN.—It is announced that on September 1 the Farmington Street Railway Company was taken over by the Connecticut company, the trolley-operating company of the New York, New Haven & Hartford Railroad. The authorized capital stock is $189,000, of which $157,000 is outstanding. The bonded debt of the company is $30,000 and the floating debt $35,905.86. The president is E. D. Robbins.

TOLEDO, OHIO—The Toledo Railways and Light Company handled more than a million people during Wamba Week. Saturday night the congestion surpassed all records because of masked Calathumpian privileges. During the first half of the night the company operated 250 cars, only owl cars being operated the last half of the night. The receipts were a trifle under those of Grand Army Encampment week last year. H.

POTTSVILLE, PA.—Surveys are to be made for a new trolley line from Pottsville, through St. Clair, Morea and Delano to Shenandoah, to connect with the Schuylkill Traction System. The new link will connect with the system of the Eastern Pennsylvania Railways Company. The route approximates fifteen miles, and will complete a chain of 100 miles of trolley road in Schuylkill through Carbon County to Mauch Chunk.

OKLAHOMA CITY, OKLA.—The Oklahoma City & Suburban Railway Company has incorporated here for $250,000. The new company will construct four interurban lines, according to the charter, the main line to extend from Britton to Edmond and Oklahoma City to Moore, thirty-two miles in length. The incorporators are Charles W. Ford, superintendent of the Oklahoma Railway Company, and J. J. Johnson, secretary. U.

BRIDGEPORT, CONN.—The Connecticut Company has placed a contract for twenty double-truck closed trolley cars for use on the lines in the Bridgeport district. The order calls for the expenditure of about $130,000 and the cars are to be ready for delivery by December 1. The work on the car barns and repair shops which the Connecticut Company is erecting at Bridgeport at an expense of over $250,000 is steadily progressing.

PIERRE, S. D.—Articles of incorporation have been filed with the secretary of state for the Missouri River & Northern Railway Company, with headquarters at Gann Valley, and a capital of $1,000,000. The proposed line is to be 100 miles in length, and in the counties of Charles Mix, Brule, Buffalo, Hand and Faulk. The incorporators are: W. O. Crockett, J. B. Ingersoll, J. E. Zelbach, Gann Valley; J. Q. Anderson, Chamberlain; J. B. Ross, Miller.

AUSTIN, TEX.—The charter of the San Angelo Street Railway Company, having a capital stock of $100,000, has been filed. The company is composed of citizens of San Angelo, who have taken over the property of the street railway company, which has been in the hands of a federal receiver. Also, the Port Arthur Traction Company, with a capital stock of $200,000, has filed articles of incorporation. The company is composed principally of Ohioans.

INDIANAPOLIS, IND.—The South Bend and Logansport Traction Company, capitalized at $400,000, has filed articles of incorporation with the secretary of state. The company proposes to build a traction line from South Bend to Logansport by way of Rochester, Plymouth and other intervening towns. The incorporators are: Thos. P. Moredock, Virginius Nicar, Patrick J. Houlihan, South Bend; Henry Coleman, Logansport, and David Pepper of Philadelphia. S.

BARTLETT, TEX.—Construction work will soon begin on the railway between Bartlett and Florence, a distance of twenty miles. The contract has been let by the Bartlett-Florence Railway Company, of which G. W. Hubbard is president and W. J. McDaniel first vice-president and general manager. The line will be operated by steam at first, but will be changed into an electric traction line as soon as practicable. The road passes through a rich agricultural country. D.

TOLEDO, OHIO—Eli West, of Columbus, and George Whysall, of Marion, were this week appointed receivers for the Columbus, Marion & Bucyrus Electric Railroad. The appointment was made by Judge Daniel Babst, of the Marion Common Pleas Court upon the application of the Cincinnati Trust Company and the Webb Construction Company. The petition recites that the company has bonded indebtedness of $500,000, on which accrued interest of $12,500 is unpaid, and in addition that it owes to the trust company $7,500 borrowed money. The road was built from Marion to Bucyrus two years ago and has been operated by the Webb Construction Company, never having been turned over to the holding company. H.

BALTIMORE, MD.—Articles of incorporation for a company to operate a trolley line on the Eastern Shore, with connection by ferry with Baltimore, have been filed at Chestertown, Kent County, and subscriptions to the stock of the concern are likely to be invited. The present plan of the promoters is to offer the stock to the public, in the belief that small investors will welcome the opportunity of backing the enterprise. The company will be called the Baltimore and Eastern Railway Company. On conservative estimates the promoters believe that the road can be completely equipped at a cost of $2,500,000 to $3,000,000, this to include rolling stock, power houses and all the requisites of a first-class road. The road will pass through Kent, Queen Anne's and Talbot counties, and it is also proposed to maintain a fast steamer ferry service between Rock Hall and Bay Shore, which will be a valuable addition to the main line. The organization of the new company is the first practical step toward a connecting link of rapid transit between Baltimore and the Eastern Shore, and the means of bringing that rich territory in direct communication and quick access of the markets of this and other nearby cities.

PEORIA, ILL.—A party of newspaper men of the local papers were guests of the Illinois Traction System last week, going to St. Louis via the electric line, and examined the new bridge that the company is building across the Mississippi at that city. The construction has reached the river, the approaches being finished; the piers that are in the river are also all built, and the work of building up the steelwork will commence soon. To enter the city the company just purchased twenty acres of ground that it will use for storage tracks and switching yards. The route goes clear uptown to the point at East Gay and Lucas streets, where the company will erect an immense freight house, with a loop up Gay Street to Fourteenth Street and down Lucas Street to Twelfth Street. The bridge will be completed early in the year and with the finishing of the bridge passenger service will be at once commenced. This is the greatest improvement the company has planned, as it gives it southern terminals in St. Louis, whereas they now end at Granite City. Through cars will be placed on all the lines, with sleeping-car sarvice at night. With the completion of the bridge across the Mississippi the Illinois Traction Company will begin a system of electric interurban lines in Missouri, leading from St. Louis, a direct line to Kansas City. At least, this is the announcement of Congressman W. B. McKinley, head of the interurban system. V.

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TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

LADYSMITH, WIS.—A franchise has been awarded to the Rusk County Rural Telephone Company.

JANESVILLE, MINN.—The Cannon Valley Telephone Company is to make extensive improvements in its equipment.

KERKHOVEN, MINN.—The Kerkhoven Telephone Exchange Company has been incorporated with a capital stock of $10,000.

DEERWOOD, MINN.—Work has been started on an exchange building for the Deerwood & Bay Lake Telephone Company.

VALPARAISO, IND.—The Northwestern Indiana Telephone Company has notified the secretary of state that the company had increased its capital stock from $50.000 to $100,000. The purpose is to make extensions and improvements in the telephone system. J. H. McGill, president, and L. R. Skinner, secretary. S.

WATERBURY, CONN.—A new telegraph line is soon to be built by the Western Union between this city and Hawleyville, a distance of twenty-four miles. The new line is necessitated to facilitate communication between the central division railroad offices at the new station in this city and the Berkshire division. The new telegraph line will be used for railroad business only and is about all that remains to be finished before the transfer of the western division offices from New Haven to this city.

FORT COLLINS, COLO.—Construction began last week on an extension of the government telephone line on the Medicine Bow forest, from the Rustic hotel on the Poudre River to Glendevy on the Laramie River. Co-operation between the forest service and the Laramie Poudre Reservoir and Irrigation Company made the building of the line possible. It will be twenty-eight miles long and will give the government 110 miles of telephones on the Medicine Bow forest. It will bring the settlers on the upper Laramie River into communication with Fort Collins by way of the Estes park exchange of the Colorado Telephone Company.

LUCAS, KAN.—A new telephone company has been organized in this city with a view to purchasing the present system and improving it. The company is composed of merchants and farmers of this county, and is capitalized at $12,000. The company elected officers as follows: President, F. A. Vopat; treasurer, C. M. Lansbury; secretary, J. H. Moore; directors A. G. T. Cooper, B. G. Servian, F. A. Vopat, Charles Lansbury and F. W. Barr. The company has obtained a charter and took possession of the business on September 1. All the country lines in this county will be put in first-class condition as well as the lines in the city.

NEW MANUFACTURING COMPANIES.

(Special Correspondence.)

LOS ANGELES, CAL.—The General Special Electrical Company has been incorporated here, with a capital stock of $100,000, by O. A. Hansen and F. T. Broiles.

SAN FRANCISCO, CAL.—The Sierra Pacific Electric Company has been incorporated here, with a capital stock of $5,000, by C. P. Eells, Hugh Goodfellow, J. S. Eells.

FAYETTEVILLE, N. C.—The Electric Cleaning Company has been incorporated at this place by F. H. Bradley and associates, with a capital of $25,000, to operate electrically-driven renovating machines, etc. L.

LONG BEACH, CAL.—The Long Beach Electrical Manufacturing Company has been incorporated here, with a capital stock of $20,000, by T. J. Corbrey, W. H. Tidmarsh, S. F. Estell, J. Gleason and C. Gleason.

PERTH AMBOY, N. J.—The Modern Art Lamp Works has been incorporated, with a capital of $50,000, to manufacture gas and electric fixtures. The incorporators are: A. Scheadow, S. Spitzer and H. Ellis, of Perth Amboy.

NEW YORK, N. Y.—The Automatic Electric Igniter Company has been incorporated to manufacture gas and electric light fixtures. The capital is $40,000, and the incorporators are N. Candelora, E. De Feo and V. Blasio, New York city.

BINGHAMTON, N. Y.—The Diamond Electric Company has been incorporated to manufacture electrical devices and appliances, with a capital of $100,000. The incorporators are: S. J. Hirschmann, J. Schwab and H. C. Price, Binghamton.

NEW YORK, N. Y.—The Manhattan Railway Supply Company has been incorporated with a capital of $110,000 to manufacture and deal in railway supplies. The incorporators are: A. J. Hammerslough, A. L. Strasser and L. M. Wallstein, New York city.

SARANAC LAKE, MICH.—The Flint Sanitary Mouth Piece Manufacturing Company has been incorporated to manufacture telephone, telegraph, musical and surgical instruments; capital, $25,000. Incorporators: B. B. Flint, G. A. Rutherford, A. K. Botsford, Saranac Lake.

ELECTRICAL SECURITIES.

It is always the unexpected that happens, and while the stock market has been agitated over the question of the late Edward H. Harriman's health, he quietly died. Stocks did not decline. On the contrary, the best known Harriman securities advanced very sharply. That wise perspicuity which ever characterized the man stood in the breach; and even after death he remained a tower of strength.

In the issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 4, there appeared a short item with the caption, "Harriman Has Crossed the Rubicon." He has indeed crossed it and in a way not expected, but as far as electrical securities are concerned he gave the living world his opinion of what the future he left behind must be. He, first of all the great railway men of the country, saw the handwriting on the wall, and it will be afterwards found one of his greatest monuments that his railways in California were the first practically in the whole United States to be electrified in a comprehensive, systematic and far-reaching manner.

The ups and downs of the market may come and go. But there is a solid basis of extraordinary prosperity behind it all, clearly expressed in the late railway chief's own words, "I come back to my country, and I see no reason to alter the opinion expressed when I left, that it will grow and grow and prosper—and the future is bright."

The dying man has left his seal mark on electrical securities that are legitimate and based on conservative business principles. What better recommendation?

The following have been added to the regular list of the Philadelphia Stock Exchange: $765,000 additional capital stock of the American Telephone and Telegraph Company, issued in exchange for $1,025,000 four per cent convertible bonds, making the total amount of stock listed at this date $241,896,300 and reducing the amount of said bonds outstanding to $67,665,000.

The August passenger receipts of the Philadelphia Rapid Transit Company increased about $91,000 over August, 1908, following an increase in July of $139,767, so that in the first two months of the current fiscal year the gross earnings gained $231,000 over the corresponding period of the previous year.

For seven months ending with July the Northern Ohio Traction Company shows gross earnings of $1.200,953; net, $531,937; interest, $306,710; surplus for stock, $325,226.

The Michigan State Telephone Company, the securities of which are owned largely in Chicago, reports for the first seven months of this year a gross revenue of $2,162,115, which is an increase of $223,420 over the gross in the corresponding period last year. The surplus earnings, after the payment of all operating and interest charges and dividends on the stocks, were $175,168. The company expended out of its surplus earnings $816,306 between February, 1904, and the first of the present month. The net gain in new stations in the first seven months this year was 10,385.

DIVIDENDS.

The Canadian General Electric Company has declared the regular quarterly dividend of three-fourths per cent on its preferred stock.

The General Chemical Company has declared the regular quarterly dividend of one-and-one-half per cent on its preferred stock, payable October 1 to stockholders of record September 20.

Carolina Power and Light Company; regular quarterly dividend of one-and-one-half per cent on the preferred stock of the company, payable October 1 to stock of record August 31.

Cincinnati & Suburban Bell Telephone Company; regular quarterly dividend of two per cent payable October 1.

Columbus Railway and Light Company; quarterly dividend of three-quarters of one per cent, payable October 1 to stock of record September 15. This is an increase of one-fourth of one per cent over the dividend three months ago.

Duluth Superior Traction Company; an initial dividend of one per cent on the common stock, payable on and after October 1 to stockholders of record September 15.

Louisville Traction Company; regular quarterly dividend of one per cent on the common stock, payable October 1.

Manila Electric Railway and Lighting Corporation; regular quarterly dividend of one per cent on the common stock, payable October 1 to stock of record September 20.

Manhattan Railways Company; regular quarterly dividend of one-and-three-fourths per cent, payable October 1 to stock of record September 15.

San Diego Consolidated Gas and Electric Company; quarterly dividend of one-and-one-fourth per cent, upon the common stock, payable September 15 to stockholders of record as of the close of business September 15.

St. Joseph Railway Light, Heat and Power Company; regu-

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lar quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable October 1 to stock of record September 15.

Twin City Rapid Transit Company; regular quarterly dividend of one-and-three-fourths per cent on the preferred stock, payable October 1 to stock of record September 15.

Union Traction Company of Indiana; regular semiannual dividend of two-and-one-half per cent on the preferred stock, payable October 1 to stock of record September 25.

United Gas Improvement Company; regular quarterly dividend of two per cent, payable October 15 to stock of record September 30.

United Traction and Electric Company; regular quarterly dividend of one-and-one-fourth per cent on the stock of the company, payable October 1.

West End Street Railway; semiannual dividend of $1.75 per share on the common stock October 1.

West Jersey & Seashore Railroad; semiannual dividend of two-and-one-half per cent, an increase of one-half of one per cent over the similar period in 1908, and making four-and-one-half per cent paid on the stock in 1909. The dividend is payable October 1 to stock of record September 15.

Western Union Telegraph Company; regular quarterly dividend of three-fourths of one per cent, payable October 15 to stock of record September 20.

NEW YORK.

	Sept. 13.	Sept. 6.
Allis-Chalmers common	14⅞	15⅜
Allis-Chalmers preferred	51½	52½
Amalgamated Copper	78⅛	84
American Tel. & Cable	*80	*80
American Tel. & Tel.	140¼	141¾
Brooklyn Rapid Transit	77	78⅞
General Electric	165	166
Interborough-Metropolitan common	14	14¼
Interborough-Metropolitan preferred	45½	46½
Kings County Electric	130	130
Mackay Companies (Postal Telegraph and Cables) common	81	82½
Mackay Companies (Postal Telegraph and Cables) preferred	73¾	74½
Manhattan Elevated	142	141
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	137	138
U. S. Steel common	79	80
U. S. Steel preferred	125½	127¼
Western Union	76	75⅜
Westinghouse common	84½	85½
Westinghouse preferred	130	130

*Last price quoted.

BOSTON.

	Sept. 13.	Sept. 6.
American Tel. & Tel.	140¼	141¾
Edison Elec. Illuminating	254	256
General Electric	165	166
Massachusetts Electric common	16	17
Massachusetts Electric preferred	77	78
New England Telephone	134	136½
Western Tel. & Tel. common	10	11½
Western Tel. & Tel. preferred	88	90

PHILADELPHIA.

	Sept. 13.	Sept. 6.
American Railways	46	46
Electric Company of America	12	12¼
Electric Storage Battery common	62½	63
Electric Storage Battery preferred	62½	63
Philadelphia Electric	12¾	12⅝
Philadelphia Rapid Transit	29⅞	30
Philadelphia Traction	91	90¾
Union Traction	53½	53

CHICAGO.

	Sept. 13.	Sept. 6.
Chicago Railways, Series 1	110	110
Chicago Railways, Series 2	36¾	37¼
Chicago Subway	16	17¾
Chicago Telephone	130	135
Commonwealth Edison	120	120
Metropolitan Elevated common	15¼	15⅛
Metropolitan Elevated preferred	48½	49
National Carbon common	95	95
National Carbon preferred	119	119

PERSONAL MENTION.

E. G. CONNETTE, recently appointed transportation engineer of the New York Public Service Commission, has begun his duties in that position.

R. R. KELLY, M. Can. Soc. C. E., and formerly city engineer of Edmonton, Alberta, has been appointed professor of electric engineering in the Nova Scotia Technical College, Halifax, N. S.

E. L. CLARK, president of the Valentine-Clark Company, Chicago, and president of the Northwestern Cedarmen's Association, has practically recovered from the painful accident with which he met several months ago. Mr. Clark is again at his office and ready to resume his duties. His friends unite in congratulating him on his recovery.

JOHN B. PARSONS, president of the Philadelphia Rapid Transit Company, retired from that position on September 15. Announcement of the retirement was made after a meeting of the Board of Directors on September 9. The Board created a new office, Chairman of the Board of Directors, to which Mr. Parsons was elected. No successor as president was named.

OBITUARY.

E. H. HARRIMAN, capitalist, railroad man and financial genius, died on Thursday, September 9. Mr. Harriman, at the time of his death, was easily the leading railroad man in America, and it is doubtful if he had any peers in this connection in the world. Edward Henry Harriman was born at Hempstead, Long Island, New York, on February 25, 1848, the son of the Reverend Orlando H. Harriman. He received a common school education and became a broker's clerk in Wall Street at the age of fourteen. Later on he became a broker for himself, and so unassuming was his nature that he was a potent influence in the membership of the New York and other Stock Exchanges for many years before his affiliation with these bodies was a matter of note. Mr. Harriman's career has been almost unparalleled, and his rise to the mastery of some 65,000 miles of transcontinental railroad, to the presidency of a score of important railway and financial institutions, and his participation in the directorate of a score more of enterprises of a similar nature made him a conspicuous figure in the world of commerce and finance. He was deeply interested in electrification, and it may be said that his properties were among the first to take on in a systematic and practical way the benefits of this modern use of power, and he was on the directorate of a number of large electrical public service corporations. In fact, his endorsement and acceptance of electrical securities gave to these a stability which might otherwise have been lacking for some time. Despite his wonderful business career and the demands which his interest in so many commercial directions must have demanded, Mr. Harriman created for himself a remarkable portion of esteem in the minds and hearts of all who came in close contact with him. There is a wealth of information concerning his active and practical philanthropy and his great interest in the welfare of his brother man. Personally he was genial and cordial and devoted not a little time to recreation and the finer qualities of sportsmanship. He was well beloved by those who knew him, particularly by those who had the management of his immediate personal affairs. Recently Mr. Harriman built a beautiful country seat at Arden, N. Y., which, however, he did not live to enjoy. He was brought there a very sick man, and the mechanics had to suspend work during the last illness of their employer. He was buried at Arden, on September 12.

PROPOSALS.

POST OFFICE, DENISON, TEX.—The Supervising Architect, Washington, D. C., will receive sealed proposals until Oct. 1 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Denison, Tex., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Denison, Tex., or at the supervising architect's office.

POST OFFICE, ELGIN, ILL.—The Supervising Architect will receive sealed proposals until October 19 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the United States Post Office at Elgin, Ill., in accordance with drawings and specification, copies of which may be obtained from the custodian at Elgin, Ill., or at the discretion of the Supervising Architect.

POST OFFICE, LANCASTER, OHIO—The Supervising Architect, Washington, D. C., will receive sealed proposals until October 6 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Lancaster, Ohio, in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Lancaster, Ohio, or at the supervising architect's office.

POST OFFICE, FREDERICKSBURG, VA.—The Supervising Architect, Washington, D. C., will receive sealed proposals until October 4 for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Fredericksburg, Va., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Fredericksburg, Va., or at the supervising architect's office.

POST OFFICE, JACKSON, MICH.—The Supervising Architect, Washington, D. C., will receive sealed proposals until October 7 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the U. S. Post Office, Jackson, Mich., in accordance with the drawings and specifications, copies of which may be obtained from the custodian of site at Jackson, Mich., or at the supervising architect's office.

POST OFFICE, GREAT FALLS, MONT.—The Supervising Architect, Washington, D. C., will receive sealed proposals until September 29, for the construction (including plumbing, gas piping, heating and ventilating apparatus, electric conduits and wiring, and standard clock system) of the U. S. Post Office and Court House at Great Falls, Mont., in accordance with the drawings and specifications, copies of which may be had from the custodian of site at Great Falls, Mont., or at the supervising architect's office.

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POST OFFICE, MANITOWOC, WIS.—The Supervising Architect, Washington, D. C., will receive sealed proposals until October 20 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Manitowoc, Wis., in accordance with drawings and specification, copies of which may be had from the custodian of site at Manitowoc, Wis., or at the Supervising Architect's office.

POST OFFICE AND CUSTOM HOUSE, BELFAST, ME.—The Supervising Architect, Washington, D. C., will receive sealed proposals until Oct. 14 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the U. S. Post Office and Custom House, Belfast, Me., in accordance with drawings and specifications, copies of which may be obtained from the custodian at Belfast, Me., or at the supervising architect's office.

NEW PUBLICATIONS.

POLYTECHNIC INSTITUTE OF BROOKLYN—A prospectus has recently been issued by the Brooklyn Polytechnic Institute relating to a series of evening technical courses of that institution.

WORCESTER, MASSACHUSETTS, THE IDEAL INDUSTRIAL CITY.—This is the title of a heart-shaped booklet which is being distributed by the Chicago Association of Commerce. The booklet was got up and published in connection with the excursion from Worcester and neighboring towns to the Pacific Coast and to the Alaska-Yukon-Pacific Exposition at Seattle, under the auspices of the Worcester Board of Trade. In the words of the introduction, "this booklet is designed to epitomize the civic and industrial growth of Worcester from its founding, and to serve as a souvenir for distribution among the members of commercial organizations, in various western cities, who have so generously offered us their hospitality during our brief stays with them."

NATIONAL ELECTRIC LAMP ASSOCIATION BULLETINS—Two new bulletins have just been issued by the Engineering Department of the National Electric Lamp Association. Bulletin 9, entitled "Conservation of Our Natural Resources Through the Use of High-Efficiency Lamps," is extremely readable and treats of a subject of timely interest. It discusses in detail the placing of the central-station rates and charges on a logical basis, which will allow of a more extensive use of high-efficiency lamps than has heretofore been possible. Bulletin 8A, entitled "Tungsten Miniature and Low-Voltage Lamps," describes and illustrates with cuts and tables, lamps for automobile service, general battery service, novelty battery service and dental, optical or surgical battery service. In a separate section, this bulletin deals with large (i. e., not miniature) tungsten lamps for voltages from four to twenty. There should be a large field of usefulness for these low-voltage lamps in candlepowers ranging from four to twenty-four for certain special classes of service, such as isolated lighting installations supplied from storage batteries, decorative lighting, fire-exit marking, and for all cases which require lamps of lower candlepower than can be obtained with metallic filaments in the higher voltages.

INDUSTRIAL ITEMS.

THE COLUMBIA INCANDESCENT LAMP COMPANY, ST. LOUIS, MO., is distributing post-cards describing the Columbia tungsten lamps.

THE OSHKOSH LOGGING TOOL COMPANY, OSHKOSH, WIS., is distributing a catalogue describing its line of construction and linemen's tools.

THE McROY CLAY WORKS, Brazil, Ind., is distributing a blotter containing a calendar for the current month, also a pleasing poem entitled "Fishing."

THE NEW YORK INSULATED WIRE COMPANY, NEW YORK, N. Y., is distributing two advertising blotters containing descriptions of its wire and tape.

THE SCIPLE SECTIONAL POLE COMPANY, Minneapolis, Minn., has recently published a booklet describing and illustrating its various types of sectional steel poles.

J. W. CARTER AND COMPANY, Abilene, Tex., have recently appointed the Canadian General Electric Company of Toronto, Ont., their agent to handle the Eclipse adjuster throughout Canada.

THE THORDARSON ELECTRIC MANUFACTURING COMPANY, Chicago, Ill., has issued "Thorardson's Electrical Specialties," for distribution to the trade, describing the various kinds of ignition coils, large and small capacity transformers, laboratory equipment, etc., manufactured by the company.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has issued the August number of its popular magazinette, "Trumbull Cheer," which, besides the usual miscellaneous assortment of light literature, contains particulars of switches, flush receptacles, etc., made by the company. An enclosed leaflet invites every one of the 7,500 concerns already on the company's list to send in the names of its customers and other persons interested, so that they may be sent "Trumbull Cheer" as it comes out each month. It is worth having.

THE R. WILLIAMSON COMPANY, CHICAGO, ILL., announces that it will erect an addition to the present building to accommodate the increased demand for its fixtures.

THE PHILADELPHIA STORAGE BATTERY COMPANY, PHILADELPHIA, PA., is sending out postal cards announcing the removal of its offices from the present site to the new factory building, Ontario and C streets, Philadelphia, Pa.

THE GARWOOD ELECTRIC COMPANY, Garwood, N. J., reports taking a number of orders for electrical apparatus recently, among which are a slow-speed engine-type 150-kilowatt generator, seventeen motors of various sizes for ventilating work, and a 250-kilowatt engine-type generator for export.

THE GREEN FUEL ECONOMIZER COMPANY, MATTEAWAN, N. Y., has recently issued bulletin No. 126, devoted to drying in industrial plants. It contains a description of drying equipments as used in various industries, also a brief discussion on the theory of drying. Copies of this bulletin may be had on request.

THE EXCELLO ARC LAMP COMPANY, New York, N. Y., has issued an amusing little chart entitled "The Philosophy of Life," which shows the disconcerting contradictions of which this life is made. At the end is a facetious remark to the effect that by means of an Excello flaming arc one will look at things in a different light.

THE MOORE ELECTRICAL COMPANY, Newark, N. J., has received an order for three installations of the Moore Light in Berlin, Germany. The necessary apparatus has been forwarded and James A. Holt, who will have charge of the work, sailed for Bremen, on August 5, on the North German Lloyd steamship, "George Washington."

THE ALLIS-CHALMERS COMPANY, of Milwaukee, Wis., has entered the field as manufacturer of machinery for sand lime brick and has employed as commercial engineer Franklin Henshaw, an engineer of wide experience in this line and formerly associated with the International Sand-Lime Brick Company of New York city.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., announces that it is now in a position to furnish Sunbeam tungsten lamps in voltages between 200 and 250. The lamps are made in four sizes at present, namely, forty-five, seventy, 112 and 180 watts. Information and prices may be obtained from the nearest branch house of the company.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has recently published a number of bulletins which indicate a radical departure from the usual argument of such publications. A bulletin on the subject of alternating-current generators is typical. It contains much valuable information regarding alternating-current generators and synchronous motors.

THE ELECTRICAL CONSTRUCTION SUPPLY COMPANY, Springfield, Ohio, has ready for distribution some interesting literature and price-lists devoted to malleable iron brackets, pins and break arms for electric-light and telephone companies, and automatic suspension pulleys. This company is the owner and manufacturer of these devices, made under the Chubbuck patents.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., has issued a folder with a striking red cover, extolling the merits of sherardized National Metal Molding and showing particularly its advantages and lasting qualities, as compared with wood molding. Enclosed in the folder is a postcard for use in reply for further particulars and for requesting a sample of the molding.

THE MINNEAPOLIS STEEL AND MACHINERY COMPANY, MINNEAPOLIS, MINN., announces that it has recently taken the agency for the west, for the roofing and siding manufactured by the Asbestos Protected Metal Company, Canton, Mass. This material is particularly adapted for use on gas houses, chemical works, etc., being immune to the attack of acid fumes, gases and moisture by reason of its peculiar construction. The above announcement appears in a recent publication of the Asbestos Protected Metal Company.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., has devoted sections G4a and G5 of its new perpetual catalogue to showing various mountings of its enameled resistance units for telephone and telegraph, signal service, etc. The units are arranged for mounting in Edison base lamp sockets, or in fuse clips, and many other new methods of mounting are shown. The enameled resistance unit consists of a bare wire wound upon a porcelain tube covered with enamel, thereby protecting the wire from electrical, mechanical and chemical depreciation.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY reports that its business for August reached an amount equal to that of the preceding month, July, which showed

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a record of $3,000,000 and represented the largest orders in two years. The recent order of the Chicago Railways Company for 1,400 street-railway motors has just been swelled by an additional order for 200 of the same type. The Pittsburg Railways Company has also placed an order for 240 motors of 100 horsepower, in addition to other railway machinery. The Maryland Electric Railway Company will extend its single-phase equipment at Baltimore, and has also entered an order for additional motive-power apparatus.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has issued the following recent publications: Bulletin 4664 describes a new line of improved direct-connected, engine-driven railway generators, Form S. These generators range in capacity from 100 to 2,700 kilowatts, and the speeds have been carefully selected to adapt the generators for direct-connection to steam engines. They are designed to run at constant speed, and for the prevailing full-load railway voltages. The bulletin illustrates the generator and important parts, and gives a table of general dimensions. Bulletin 4666 describes an improved form of the well-known Type H transformer, of which there are more than 50,000 in use at the present time. The advantages claimed for the new design are: Better efficiencies, greater uniformity of impedances, an improved connection board, together with an improved method of supporting the primary and secondary leads, and a new type of suspension hook; as well as a new device for clamping the transformers in the cases. The bulletin contains numerous illustrations of the transformer, and shows the methods used in the different processes of manufacture. Tables showing the frequency limits, and a curve indicating the reduction in the core and total losses of the improved Type H transformer over previous designs, are also shown. Bulletin 4668 describes the G. E. 216-A railway motor, which is of the box-frame type, with commutating poles, mica-insulated brush-holders, and removable armature shaft. Among the advantages claimed for this type of construction, in addition to the substantial mechanical features, are: Practically sparkless commutation on even heavy overloads, reduced wear on commutator, together with a marked reduction in commutator heating, increased life for the brushes and increased efficiency and free-running capacity. The motors are of fifty-horsepower capacity, designed for operation on 600-volt railway circuits. The bulletin contains lists of gear ratios, and shows characteristic curves as well as dimension diagrams. There is also a carefully prepared table of schedule speeds and a comprehensive data sheet for those desiring quotations. Bulletin 4670 describes gaskets and bell mouths for conduit wiring, underground circuits, etc. The illustrations in the bulletin include dimension diagrams of the soft-rubber gaskets and metallic bell mouths, and a complete set of tables enables the customer to determine the size of bell mouths required for any particular service, and to ascertain readily the proper gasket which should be used.

DATES AHEAD.

Kansas Gas, Water, Electric Light and Street Railway Association. Next meeting, Wichita, Kan., September 23-24.

Illuminating Engineering Society. Annual convention, New York, N. Y., September 27, 28 and 29.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Railway Signal Association. Annual meeting, Louisville, Ky., October 12-14.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 18.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) August 31, 1909.

933,084. TROLLEY. Joseph Ledwinka, Philadelphia, Pa. Filed November 11, 1905. Renewed October 8, 1908. Two parallel frames, connected to a cross-arm but insulated from one another, carry each a pair of axially-movable spring-controlled trolley wheels arranged in tandem.

933,094. ART OF TREATING GASES ELECTRICALLY. Ignacy Moscicki, Gambach, near Fribourg, Switzerland. Filed August 6, 1907. The arc between electrodes of an electric furnace is magnetically moved; one electrode is transverse to the movement of the gas, and the other is provided with passages through which the gas may flow.

933,095. ACCURATE-AIM FLASH-SIGHT. Dosier H. Mosteller, Chicago, Ill., assignor to the Mosteller Manufacturing Company, Chicago, Ill. Filed April 13, 1909. The shadow of the bead from light rays of an electric lamp shows where the bullet will strike.

933,115. COMBINATION SPARK GAP AND PLUG. Arthur L. Ryder, Pasadena, Cal. Filed May 15, 1907. The plug is hollow and is devised so that the spark gap may be seen through a transparent wall.

933,132. ELECTRIC-LIGHT FIXTURE. Theodore Smith, Chicago, Ill., assignor to Theo. Smith Manufacturing Company, Chicago, Ill. Filed October 3, 1904. Has a curved composite adjustable standard.

933,133. PROCESS OF TREATING ZINC ORES. Frederick T. Snyder, Oak Park, Ill., assignor to Electric Metals Company, Chicago, Ill. Filed June 23, 1905. The ore is smelted with carbon on a slag bath (in contact with an electrode) which is floated on a molten lead electrode in an air-free electric furnace so that the zinc is volatilized and the molten lead sinks through the slag.

933,137. ELECTRIC FLASHER. Daniel D. Swem, Chicago, Ill. Filed June 27, 1908. Describes the details and action of an electric flasher.

933,149. TELEPHONE TRUNKING SYSTEM. Charles S. Winston, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company. Filed September 21, 1904. Gives the connections of a trunk circuit and a cord circuit associated with a branch connection.

933,150. TELEPHONE SYSTEM. Charles S. Winston, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company. Filed November 29, 1907. Describes a telephone system in detail.

933,157. ELECTRIC CONTROLLER. Tracy V. Buckwalter, Altoona, Pa. Filed January 20, 1909. A reciprocating part of insulating material has fixed to it brushes which are electrically connected respectively to a pair of carbons.

933,169. ELECTRIC TRANSFORMER-FURNACE. Otto Frick, Saltsjöbaden, Sweden, assignor to The Gröndal Kjellin Company, Limited, London, England. Filed September 14, 1906. Renewed March 20, 1908. Windings on a conductor are arranged in inductive relation to the leakage field and main field of the furnace so that the combined inductive effect upon the conductor due to these fields will be zero.

933,195. ELECTROLIER. James McGavin, Springfield, Ill. Filed September 9, 1908. The lamp (or lamps) is (or are) connected to a winding mechanism.

933,197. SIGNALING SYSTEM. James G. Nolen, Chicago, Ill., assignor of one-half to Frank B. Cook, Chicago, Ill. Filed May 4, 1903. The transmitting mechanism includes a normally wound-up, electromagnetically-controlled, clockwork, switch-operating device, the electromagnetic controller being in series with the line circuit and a make-and-break device, and a shunt includes a signal-initiating device, etc.

933,208. TROLLEY-POLE. Samuel Speer, Pittsburg, Pa. Filed March 29, 1909. The trolley-pole proper consists of two telescoping sections which can be adjusted longitudinally against the action of a spring by means of a parallelogram device.

933,211. SYSTEM OF DISTRIBUTION. Hermon L. Van Valkenburg, Norwood, Ohio, assignor to The Bullock Electric Manufacturing Company. Filed June 22, 1905. A high-potential system of distribution includes two interlocking electromagnetically-operated switches, one an oil switch and the other a transfer switch for connecting the oil switch to either of two conductors.

933,217. TIME-CONTROLLER CIRCUIT-CONTROLLING MECHANISM. Frank W. Wood, Newport News, Va., assignor to Charles Cory and John M. Cory, New York, N. Y. Filed April 20, 1906. A transmitter, comprising a periodically actuated circuit-closer, electrically controls an indicator to display successive intelligencies.

933,218. DANGER-ZONE SIGNAL FOR TURRETS. Frank W. Wood, Newport News, Va., assignor to Charles Cory & Son, New York, N. Y. Filed June 8, 1908. Each of a number of circuit-controlling devices for respective signaling instruments comprises a series of contact strips of progressively increasing length, and contact brushes on a sweep

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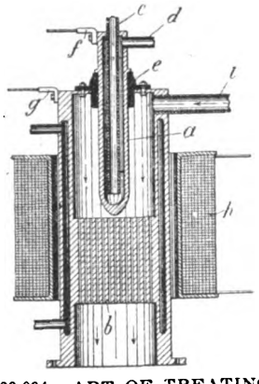
arm engage these strips as the turret is turned, thereby establishing electrical connections to the signaling instruments.

933,220. DYNAMO-ELECTRIC MACHINE. Alfred H. Wouters, Norwood, Ohio, assignor to Allis-Chalmers Company and The Bullock Electric Manufacturing Company. Filed November 3, 1906. Describes in detail a rotor for a dynamo-electric machine.

933,226. DYNAMO-MACHINE CONSTRUCTION. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and The Bullock Electric Manufacturing Company. Filed May 17, 1906. A combined brush yoke and oil guard consists of a circular member secured to the shaft bearing and closely surrounding the shaft. In its surface adjacent the shaft is a groove containing an absorbent material in contact with the shaft. One or more brush studs are secured to it.

933,228. TELEPHONE ATTACHMENT. Joseph B. Burkholder, Minneapolis, Minn. Filed April 3, 1909. Has two perforated disks, one of which may be turned so that the perforations are out of register so as to exclude air when telephone is not in use; an antiseptic pad is also included.

933,267. DYNAMO-ELECTRIC MACHINE. Walter J. Richards, Norwood, Ohio, assignor to Allis-Chalmers Company. Filed January 31, 1907. The field magnet pole-piece has a pair of concentric shunt coils near the armature end of the pole, a superimposed series coil, and tee or channel-shaped spacing members between all the coils.



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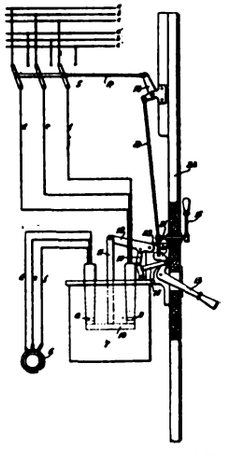
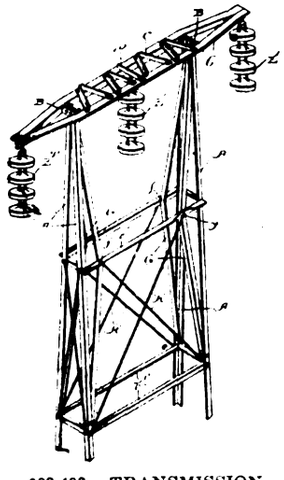


933,211.—SYSTEM OF DISTRIBUTION.



933,493.—TRANSMISSION TOWER.

933,296. LOCKING DEVICE FOR INCANDESCENT-ELECTRIC LAMP BULBS. Levi Davis, Alton, Ill. Filed March 15, 1909. Seated in the lamp socket is a bulb which engages with a locking member movable in a ring fitted to the socket.

933,335. TELEPHONE SUPERVISORY SYSTEM. William S. Paca, Oil City, Pa. Filed November 13, 1908. Includes a device for producing a clicking sound in the operator's receiving telephone when the circuit is opened or closed by a subscriber's hook switch.

933,369. ELECTRIC ALARM-SIGNAL. Henry J. Hovey, Chicago, Ill., assignor to Bryant Zinc Company, Chicago, Ill. Filed July 18, 1908. Diagonally arranged electromagnets actuate a centrally pivoted armature which operates a hammer device, all being contained within the gong.

933,399. DYNAMO-ELECTRIC MACHINE. William Stanley, Great Barrington, Mass., assignor to General Electric Company. Filed February 2, 1905. Describes the details of a dynamo-electric machine devised so that an energizing field of definite frequency is produced and which rotates relatively in the same direction as the rotor windings.

933,404. TELEPHONE APPARATUS. Kelley M. Turner, New York, and Howell W. Haff, Babylon, N. Y., assignors to General Acoustic Company. Filed January 6, 1909. The cover of the battery case has a depression in its upper face from which project upwardly spring arms to engage a transmitter adapted to be inset in the depression; a receiver and flexible cord connections to establish a telephone circuit are also included.

933,412. ELECTRIC CALL AND ALARM SYSTEM. Otis O. Baker, Port Allegany, Pa., assignor of one-tenth to Joseph Silman, one-twentieth to Daniel S. Helmer, one-twentieth to William J. Barrho, one-twentieth to Mark M. Pomery, one-twentieth to M. Lafayette App, one-twentieth to Daniel McConeghy, one-twentieth to Miles N. Allen, one-twentieth to Barber D. Allen, and one-twentieth to Manley C. Field, Port Allegany, Pa. Filed March 23, 1907. Includes an electric alarm and annunciator.

933,418. DEVICE FOR TIMING WAGONS. Edward F. Chandler, Brooklyn, N. Y. Filed September 29, 1906. An electromagnetic perforating device is connected to a rotating mechanism on the dial of which it operates when jarring produced by the motion of the vehicle operates a spring-actuated, gravity-operated, circuit-controlling device.

933,440. AUTOMATIC TRAIN STOP AND SIGNAL. William H. Harris, Stark, Mont., assignor of one-half to William Garriety, Lothrop, Mont. Filed February 1, 1909. Trip-operated means connect with a device to control the engine throttle-valve and also energize a solenoid to operate an electric alarm signal.

933,450. ELECTRIC IGNITER FOR GAS-STOVES. Rudolf Hofmeister, St. Louis, Mo., assignor of one-half to John P. Casey and one-fourth to Louis C. Pausch, St. Louis, Mo. Filed February 9, 1909. Comprises a pair of electrodes, contacts for the same, and means for causing a spark between the former when desired.

933,457. PROCESS FOR UNITING RAILS AND OTHER METAL PIECES. Charles F. Jacobs, Chicago, Ill., assignor to Jacobs Welding Company, Chicago, Ill. Filed October 11, 1907. Molten flux and metal are applied to the joint through which an electric current is passed to heat it further and pressure is applied to bring the parts to be joined into close contact.

933,458. PROCESS FOR BONDING RAILS. Charles F. Jacobs, Chicago, Ill. Filed May 28, 1908. Similar to the preceding.

933,459. PROCESS OF UNITING METAL PIECES. Charles F. Jacobs, Chicago, Ill. Filed May 28, 1908. Similar to No. 933,457.

933,489. ELECTRIC SWITCH. Henry E. Reeve, New York, N. Y. Filed May 12, 1908. Renewed June 17, 1909. A cam engages the shoulder of a spring contact arm (carried by the frame of the switch) to move the arm in one direction and to release the arm by moving a spring catch which supports the arm.

933,493. TRANSMISSION-TOWER. Daniel R. Scholes, Chicago, Ill., assignor to Air Motor Company, Chicago, Ill. Filed September 21, 1907. At each side is a vertical standard consisting of two upwardly-converging corner posts; a pair of horizontal braces connect the posts at their upper ends, and a number of horizontal braces connect the posts at various levels so as to divide the faces of the tower into panels.

933,499. HEAD-GEAR FOR SUPPORTING LIGHTS. Daniel E. Taylor, Willimantic, Conn. Filed October 30, 1908. An adjustable spring-metal band, adapted to extend over and clutch the head, carries at one end an electric light.

933,505. TROLLEY-BASE. Ferdinand Volk, Pittsburg, Pa. Filed November 3, 1908. Comprises a spring-carrying cap revolubly mounted on a suitable support, with housings, connected by tracks, mounted on the springs, a yoke carried by the cap, and means carried by the yoke to engage the tracks and simultaneously depress the housings to put the springs under tension.

933,506. ELEVATOR. Benjamin M. Walpole, Providence, R. I. Filed February 2, 1909. Differential gearing controlling the

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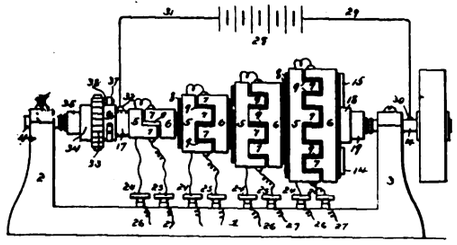
elevating mechanism is driven by two motors revolving in opposite directions; an electromagnetically controlled brake for the rotating drum of the elevating mechanism, in circuit with the motors, is also provided.

933,525. PRIMARY BATTERY. William M. Brodie, East Orange, N. J. Filed April 7, 1909. The metal jar serves as one pole of the battery; a resilient support for one of the elements is electrically bonded to the jar and an element opposite polarity is resiliently secured to the top of the jar and insulated therefrom.

933,539. INCANDESCENT ELECTRIC LAMP. Carl Farkas and Herman J. Jaeger, New York, N. Y. Filed August 24, 1908. A metallic-filament lamp has a metallic filament of four loops hanging in the hooks of flat elastic hangers (secured near the top end of a standard of non-conducting material) and cemented alternately with their free ends to the leading-in wires and the free side ends of T-shaped elastic conductive supports (secured to the bottom portion of the standard) so that the loops are connected in series.



933,557.—ELECTRICAL SIGNALING APPARATUS.

933,557. ELECTRICAL SIGNALING APPARATUS. Owen L. Harrison, Coleta, Ill. Filed October 2, 1908. Comprises a series of rotary commutators, each adapted to interrupt an electric circuit at a different frequency from the others, means for including each of the commutators in a different external circuit, an electromagnetic device for operating the commutators simultaneously, and means for operating this device at uniform speeds.

933,564. TELPHER SYSTEM. Beverly T. Hitch, Allen, Md. Filed October 9, 1908. Includes a main line with upper and lower trolley wires, a siding, a movable cross-arm constituting a switch member, and a car having two trolley wheels, one adapted to run over, and the other under, the cross-arm.

933,577. TEMPERATURE-CONTROLLING DEVICE. William B. D. Penniman, Baltimore, Md. Filed November 20, 1905. High and low temperature conduits, with a valve in each of the latter, are connected to a main conduit; a motor-driven power shaft is normally disconnected from the valves, and means controlled by the shaft operate to connect one or other of the valves to the shaft. The motor current is controlled by a thermostatic device.

933,622. ELECTRICAL COOKING APPARATUS. Trevor M. Caven, Kansas City, Mo., assignor to Isaac C. Soule, Kansas City, Mo. Filed September 24, 1907. Describes in detail an electric cooker.

933,644. WEATHERPROOF SOCKET FOR ELECTRIC LAMPS. Gilbert W. Goodbridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Filed June 1, 1908. Comprises an insulating body with lamp-holding terminals therein, terminal plates with binding screws on the back of the insulating body, an inclosing and supporting cap for the back of the socket, electrical connections from the lamp-holding terminals to the plates, and insulating compound filling the space in the body back of the lamp-holding terminals.

933,661. WALL-CABINET FOR ELECTRICAL APPARATUS. Henry T. Paiste, Philadelphia, Pa. Filed March 24, 1908. Consists of independent pressed-up sheet metal end and intermediate units, with castings forming corner pieces connected to hold together the end and side portions of the end units, the corner pieces having each an inwardly and an outwardly extending lug and being also extended to form a supporting foot.

933,664. SUPPORT FOR INCANDESCENT ELECTRIC LIGHTS. Frank D. Powell, Monroe, Mich. Filed August 8, 1908. A perforated member is attached to the electric-lamp socket and may be suspended from any of the perforations by a rod attached to a clamp gripping the electric-light wires, so that the position of the lamp may be adjusted to a desired angle.

933,697. ELECTROLYTIC CONDENSER COMBINED WITH AUTO-TRANSFORMER. Elmer E. F. Creighton, Schenectady, N. Y., assignor to General Electric Company. Filed July 13, 1907. In combination with an electrolytic condenser of many cells is an auto-transformer having its coils divided into portions each in shunt to one of the condenser cells.

933,716. SWITCHBOARD. Reason C. Livingston, Spring Valley, Minn. Original application filed May 21, 1908. Divided and this application filed November 20, 1908. Describes a form of telephone switchboard.

933,717. PROCESS OF TREATING ORES. Alfred A. Lockwood and Marcus R. A. Samuel, London, England. Filed January 11, 1909. The ore is mixed with a magnetic substance and oil gas tar which causes the magnetic substance to adhere to some constitutent part of the ore in preference to others, so that the mixture can be magnetically separated.

933,720. SUBMARINE SIGNALING. Josiah B. Millet, Boston, Mass., assignor to Millet Signal Company, Boston, Mass. Filed May 18, 1909. A contact wall is in acoustic contact with an electro-microphonic device, and means are provided for adjustably applying the contact wall to the ship's skin or other solid body acoustically connected thereto.

933,726. TELEGRAPH-KEY. Frank W. Smith and De Witt C. Conkling, New York, N. Y. Filed June 6, 1908. Comprises an electromagnet, an armature vibrated thereby, means controlled by the armature for making and breaking circuit to line, a manually controlled device for closing circuit to the magnet, and means for normally retaining the armature against the poles of the magnet.

REISSUE.

13,019. CONTROL SYSTEM FOR ELECTRIC HOISTS. Jay H. Hall, Cleveland, Ohio, and James F. Schnabel, New York, N. Y., assignors to The Electric Controller and Manufacturing Company, Cleveland, Ohio. Filed May 3, 1909. Original No. 915,290, dated March 16, 1909. Comprises an electric motor, a magnetic brake having its releasing winding normally in series with the motor, and a controller arranged to connect the field windings of the motor and the winding of the brake in a circuit containing a resistance and to connect the armature of the motor in another circuit containing a resistance.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired September 13, 1909:

482,339. ELECTRIC LIGHT FIXTURE. Edwin R. Crolius, Chicago, Ill.

482,343. ENCLOSED CONDUCTOR FOR ELECTRIC RAILWAYS. George A. Dupuis, Detroit, Mich.

482,374. AUTOMATIC ELECTRIC CUTOUT. Cyprien O. Mailloux, New York, N. Y.

482,397. VENTILATING ARMATURE FOR DYNAMO-ELECTRIC MACHINES. Elihu Thomson, Lynn, Mass.

482,420. ADJUSTABLE THERMOSTAT. Melvin D. Compton, Newark, N. J.

482,422 and 482,423. RAILWAY-CROSSING PROTECTOR. Robert J. M. Danley, Columbus, Ohio.

482,425. GALVANIC BATTERY. Thomas T. Eckert, New York, N. Y.

482,433. SAFETY DEVICE FOR ELECTRIC CIRCUITS. Llewelyn B. Atkinson, London, England.

482,435. ELECTRIC ARC LAMP. Henry J. Cutler, Waltham, Mass.

482,440. TELEGRAPH RELAY. William Maver, Jr., New York, N. Y.

482,444. VOLTAIC PILE. William E. Washburn, Cedar Rapids, Iowa.

482,464. BURGLAR ALARM. Homer T. Wilson, Louisville, Ky.

482,486. LINE-WIRE-TIGHTENING DEVICE FOR ELECTRIC LAMP SUPPORTS. Charles A. Pfluger, Chicago, Ill.

482,549. MEANS FOR CONTROLLING ELECTRIC GENERATION. Thomas A. Edison, Menlo Park, N. J.

482,568. ELECTRIC ARC LAMP. Hubert H. Bigland and John Burns, Newcastle-on-Tyne, England.

482,586. ELECTRICAL FURNACE. Thomas Parker, Newbridge, England.

482,594. ELECTRIC LOCOMOTIVE. Wm. H. Soley and Wm. W. Perkins, Philadelphia, Pa.

482,668. ELECTRICAL APPARATUS. Leonidas G. Wolley, Grand Rapids, Mich.

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CONTENTS.

EDITORIAL:
The Worcester Appeal 571
Electricity for an Awakened Nation 572
Electric Power for Industrial Purposes 573
Second Annual Convention of the Pennsylvania Electric Association 574
American Manufactures to Europe 578
Canada's Exports of Electricity and Natural Gas 578
Electric Supply of a Scottish Coal-Field 578
New York's Illuminations 582
Standard Oil in Columbia Gas and Electric 582
Western Electric's Position 582
American Institute of Electrical Engineers 582
Meeting of the Chicago Electric Club 583
Rate of Helium Production from the Complete Series of Uranium Products 584
Electric Lights to Flash Fire Alarm 584
New England Section, National Electric Light Association 585
Autumn Meeting of the American Physical Society 586
International Association of Municipal Electricians 587
Fulton Exhibit at the Engineering Societies Building 588
CENTRAL STATION PRACTICE:
Rise of Generator Capacity 589
A New Battery-Charging Device 591
Electrical Sterilization of Drinking Water in Dwellings 591
INDUSTRIAL POWER:
Electric Hoist for Handling Pier Cars 592
Southern Expansion 592
Switchboard for Group Electric Drive 593
Protecting Underground Cables in Collieries 593
Extended Uses of Electricity on Board Ship.—I 594
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
The Absolute Standard of Light 595
Convention of Car-Lighting Engineers 596
Special Street-Lighting Projects 596
Convention of the Illuminating Engineering Society 597
A Concrete Case of Tungsten Economy 597
Metal-Filament Lamps in England 598
Navy Department Supplies 598
Meeting of Central Electric Accountants' Association 598
ELECTRICAL ADVERTISING AND SELLING:
Follow-Up System of Advertising 599
Testing Advertising 599
Central Station Advertising 600
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 601
INDUSTRIAL SECTION:
Bissell Sewing-Machine Motors 602
Electric Shaving and Massage Mirror 602
Examples of Individual Motor Drive 603
Steam Turbine in the Textile Industry 603
New Line of Industrial Staples 603
The Triumph Electric Company's New Factory at Cincinnati 604
Composite Telephones Provide Additional Facilities 606
An Electrically Driven Rail Bender 606
Some Westinghouse Contracts for Japan 606
Lumber Cars Run by Electricity 606
A New Galvanometer Protecting Device 607
Large Electric Shining Hoist 607
What Constitutes a Good Lubricant? 608
CURRENT ELECTRICAL NEWS 609
RECORD OF ELECTRICAL PATENTS 616

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THE WORCESTER APPEAL.

During the past fortnight there was heard the second appeal to the Gas and Electric Light Commissioners of Massachusetts from franchises for the distribution and sale of electric power granted to the Connecticut River Transmission Company. In this case the appeal was made by the Worcester Electric Light Company from a grant of the Worcester aldermen authorizing the Connecticut River Transmission Company to supply any consumer of electricity in that city whose motors and other apparatus connected for use is of rated capacity of not less than fifteen horsepower, and whose annual consumption shall be not less than 22,500 horsepower-hours.

As previously noted in the REVIEW, the commissioners decided in the Fitchburg case that the Connecticut River Company might supply electricity in that city to any customer whose motors and apparatus connected for use shall be of an aggregate rated capacity of not less than 300 electrical horsepower, and whose annual consumption shall be not less than 450,000 horsepower-hours. This decision on the Fitchburg appeal annulled the provision in the grant by the aldermen of that city that the Connecticut River company should not refuse to deliver electricity for power or manufacturing purposes to any applicant for the sole reason that he was a small user.

In the Worcester hearing, it appeared on behalf of the Connecticut River company that its power is generated at the hydroelectric plant on the Connecticut River at Vernon, Vt., where the present capacity amounts to 12,500 kilowatts, made up of five units rated at 2,500 kilowatts each. Three three-phase transformers of 5,000 kilowatts each increase the voltage to 66,000 for transmission, and the lines now run to Gardner, Fitchburg, Clinton, Leominster and Worcester, and power is being delivered in the first three of these places. At Worcester a substation is being constructed, and the Connecticut company will be ready to deliver power there within thirty days. The power house at Vernon is designed for eight of the 2,500-kilowatt generators, or a total capacity of 20,000 kilowatts.

Two three-phase circuits are planned to enter Worcester on steel towers and to reach the substation there partly over private land and partly over public streets, and these circuits will operate at 13,500 volts. It is the preference of the Connecticut River company to supply consumers with apparatus of 100 or more electric horsepower capacity, and it does not wish to supply consumers with only fifteen horsepower, as mentioned

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in the grant of the Worcester aldermen. For consumers that take 200 to 300 horsepower the Connecticut River company expects to make lower rates than the Worcester company is able to do, and it is thought that as many as fifteen consumers in Worcester will take 300 horsepower each. The opinion for the Connecticut River company was that it would not be seriously damaged if the minimum limit for its supply to one consumer was put as high as 300 horsepower. On the part of the American Steel and Wire Company, there was expressed a strong desire for the power of the Connecticut River company for use in an electric furnace that will make high-grade steel.

The Worcester Electric Light Company objects to any sales by the Connecticut River company to consumers of less than 300 horsepower, but if this limit is fixed the Worcester company will permit the use of its conduits on a reasonable basis to reach the large consumers. At present the station capacity of the Worcester company for power business is 4,700 kilowatts, and it has a maximum power load of 500 kilowatts, which will be increased to 1,000 kilowatts in about four weeks. This increase of load will include two consumers that require 300 horsepower each. On September 1, 1909, the Worcester company put into effect a new schedule of power rates that range from six cents per kilowatt-hour below 150 kilowatt-hours per month down to three cents per kilowatt-hour for 5,500 to 6,500 per month, and down to two cents for 25,000 kilowatt-hours or more per month. These new power rates are said to represent a reduction of twenty-five per cent from those previously in force.

ELECTRICITY FOR AN AWAKENED NATION.

History is the organized record of yesterdays into logical sequences which show in true perspectives those occurrences as a guide to similar actions in the future, but collections of events in chronological order are annals, not history, and serve only as a useful basis from which history can be compiled.

Patrick Henry's declaration, "I know of no way to judge the future except by the past," gave in few words the purpose of history which has justified the devotions of many learned men and the applications of vast sums of money in keeping true records and building many libraries throughout civilization.

The barbarian operates on different lines. When Omar, with the remark, "If the books are contrary to the Koran, they are pernicious and should be destroyed; if they are in harmony with the Koran, they are redundant, and therefore useless," ordered the Alexandrian Library burned, he made a declaration satisfactory alike to his mind and his conscience.

Under such conditions of historical precedent, it is somewhat unexpected that a recent occurrence of contemporaneous history in the center of Islam should indicate an awakening of the Ottomans to modern civilization.

When as Mehemed V the new Sultan returned to his palace from the Chamber of Deputies, where he had been invested with the sword of the Prophet, he is reported to have sent for those who understood the appliances of civilization, and at the first said: "I have heard and read that there are machines which can be put into houses by means of which one can talk to people too far off to be seen, and I want them." Of course, he referred to telephones, which were generally forbidden in Constantinople, and the few in the city at the time were owned by foreigners.

Abdul-Hamid, the deposed Sultan, it is true, used the telegraph unsparingly and practically governed the Turkish Empire through his private telegraph office in the Yildiz Kiosk; but he despised everything "European," that is, foreign, and if his counter-revolution in his own favor had been successful his orders to the soldiers were to kill every Turkish man, woman and child having European or foreign affiliations or found in the foreign quarters of Constantinople.

The new Sultan is different. He is an Oriental and a Turk, but he believes more or less in general progress. At any rate, he does not seem to want to confine the conveniences and inventions of civilization exclusively to himself.

The new Sultan's attitude is more than interesting; it means that this partial awakening of a great nation will open the way for a large amount of electric appliances throughout the Ottoman Empire.

Although the peasantry of the various races which populate this land are poor, yet the rulers, merchants, and nobility, who are in much the same relation of dominance over the common people as were the feudal barons in Europe 500 years ago, are rich and luxurious in their oriental magnificence.

As the returning crusaders gave to England and Europe many of the comforts of life, from ideas which they had obtained from the oriental luxury of the Saracens, so it is now the opportunity for the western civilization to return the gift by availing themselves of the forthcoming opportunity for a profitable commerce in electrical appliances of all descriptions.

Under the free list of the new Tariff Law, paragraph 647 reads as follows: "Philosophical and scientific apparatus, utensils, instruments and preparations, including bottles and boxes containing the same, specially imported for religious, philosophical, educational, scientific or literary purposes."

Dr. E. P. Hyde has recently imported for the research laboratory of the National Electric Lamp Association several specially designed scientific instruments, and it appears that a fine point is raised concerning whether these should come in duty free or not. The laboratory is certainly scientific, its nature is philosophic and its results are unquestionably educational in the highest degree.

For the great good which is being accomplished through the work which the laboratory is doing, everyone interested in lamp development and in the utilization of light is profoundly grateful. And it seems only reasonable that Dr. Hyde should receive the benefit of the kindliest literal interpretation of the clause above quoted.

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ELECTRIC POWER FOR INDUSTRIAL PURPOSES.

To state broadly that electric power will gradually supersede all other forms for industrial purposes, would probably be as incorrect as to state that automobiles will supersede horses for all purposes. That power in the form of electrical energy will supersede other forms in a great many directions is very evident. The great value of electric power lies in its flexibility as well as in its efficiency.

Contrary to the erroneous but popular impression electricity is a transmission medium only. The custom of referring to electricity in the loose manner so frequently done has caused non-technical readers to assume, perhaps unconsciously, that electricity is a prime mover. That this is not the case should be evident to anyone who has ever given the matter thought, even though they have never had technical knowledge nor mechanical experience. Its general adoption is because of its convenience and superiority over belts, shafts, ropes, etc., as a power transmission medium.

It has been possible to effect great economies in many lines of industries because of the ease in determining the exact amount of power used for various purposes through the use of electrical devices. It frequently happened in the old days that the amount of power required for driving a machine shop, for example, could not be determined within twenty-five to fifty per cent until after the apparatus was installed and placed in operation. This meant that, as often as otherwise, the power plant was too small, and then additional boilers and engines had to be installed later. The possibility of using portable machine tools is in itself a very valuable result of the adoption of electric power for manufacturing purposes, in a great many cases. This is especially true in large electrical establishments, where it is actually cheaper to move certain of the machine tools to the work than it is to move the work to the machine. This is often seen in the application of two or three portable devices such as vertical planers and slotters, drills, grinders, etc., to work on one large generator frame, the frame being bolted to the iron floor and the tools located to suit the work.

Another benefit from the use of electric power for industrial purposes has been gained by the more progressive manufacturers by the placing of recording electrical instruments in the office of the superintendent or works manager. These devices keep an accurate record of the amount of power consumed by the motors driving the principal machine tools, or groups of small tools, and is a direct index of the amount of work done and consequently the earning value of both tools and workmen. The result of this system causes the foreman to keep both tools and men busy as much of the time as possible, with a consequent reduction in the cost of manufacture. This system has also eliminated a great many misunderstandings between the shop and the management, because the record is permanent and indisputable.

Another notable result of the adoption of electricity for industrial purposes is the provision now made by practically all machine tool makers for the attachment of motors to their product. A glance at the advertising pages in the mechanical trade journals will show motors attached to a large percentage of tools advertised therein. The development of motor controlling devices has been very rapid and has helped in the adoption of electric power for industrial purposes. As an index of the increased use of electricity for motors, as well as lights and other devices, might be mentioned the increasing number of breweries, water works, cement plants, wood-working establishments, foundries and shipyards, which have adopted this form of transmission for their power.

The use of electrically-controlled lifting magnets in foundries, steel mills, shipyards, railroad yards, structural steel works and stock rooms, etc., has increased a great deal during the past few months, and numerous notable installations have been described. The extreme simplicity, convenience and reliability of these devices is remarkable, considering how many years passed between the discovery or invention of the electromagnet and the development of the practical commercial device of today.

The increasing use of electric motors as well as electric lights in foundries is also worthy of note. This is one field that the compressed-air devices have practically monopolized for a great many years, but now foundries use motors for driving their blowers, tumblers, hoists and grinders, as well as for driving the various machines in their pattern shops. The development of the flaming arc lamp has also been of special value to foundrymen because of the great penetrative ability of the rays of light from this device.

The use of motors for driving machine tools has increased for various reasons. Among them might be mentioned economy of power; increased production due to ease of control of speed, and convenience of handling; better arrangement of tools in the shop; the fact that the power is always ready at any place; decreased losses in transmission over line shafting and belts, and the ability to determine accurately the amount of power required for each tool under various operating conditions. This matter of knowing the exact amount of power required has undoubtedly assisted greatly in the satisfactory application of high-speed tool steel, and this is but one of many illustrations of the great value of the use of electric power for industrial purposes.

T. C. MARTIN, PERMANENT SECRETARY, NATIONAL ELECTRIC LIGHT ASSOCIATION.

Announcement is made of the retirement of T. Commerford Martin from active work as an editor of the *Electrical World*, and his assumption of the distinguished post of permanent secretary of the National Electric Light Association. Mr. Martin brings to this position a rare combination of natural tact, experience, and possession of the confidence of a host of men in every walk of electrical life. For over a quarter of a century he has been busy, in a most intelligent, earnest way, helping to build up the empire of electricity. His opportunity for good work in the new position is unlimited and he will prove a tower of strength to this great organization.

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Second Annual Convention of the Pennsylvania Electric Association.

The second annual convention of the Pennsylvania Electric Association was held at The Forest Inn, Eagles Mere, Pa., on September 8, 9 and 10. In view of the fact that this association was only organized last year, the size of the attendance and the amount of business transacted were noteworthy. The association was organized at Eagles Mere last September, as the first state section of the National Electric Light Association, with forty-one Class A members, no Class B members and six associate members. President L. H. Conklin, of Scranton, in his opening address, stated that there are now enrolled seventy-two Class A members, 235 Class B members and fifteen associate members. There were about 200 present at this convention as against eighty-five last year, and the sessions themselves were very well attended. Most of the members gathered at Eagles Mere on Tueslay evening, when there was held a reception and dance in the amusement hall.

WEDNESDAY MORNING SESSION.

The first session of the convention was held on Wednesday morning at 9 o'clock, opening with the roll call and reading of the minutes. President Conklin, in a very able address, welcomed the members and guests, reviewed the growth of the association in the past year and congratulated the members on the fact that the association in its first year had actively participated in the work of the member companies. A great many appeals have been made to the officers of the association for information and assistance of one sort and another, and they have been able through the active co-operation of the members to exercise the real function of an association.

Then followed the reports of the secretary and treasurer, reports of the committees on by-laws and overhead line construction.

The report of the latter committee was made by Thos. Sproule, of Philadelphia, chairman. The report was printed and presented as a special guide to the Pennsylvania companies in the application of the recommendations made in the report of the similar committee to the National Electric Light Association at the Atlantic City convention last June. It was felt that these National Electric Light Association data could be made particularly useful to Pennsylvania companies, if those portions applying to the special conditions in that state were discussed and, if need be, revised. The national committee expects to conclude its work this year after considering such suggestions and to submit its final report in pocketbook form to the next national convention. The report as completed so far is confined to street-lighting circuits and to constant-potential circuits up to 2,300 volts.

In discussing the report of the committee on overhead line construction, R. S. Orr, of Pittsburg, said that the importance of standardizing material could hardly be exaggerated, as it unquestionably led to better material and better prices. He recommended the continuation of the work by the present committee.

E. B. Greene, of Altoona, in speaking of his experience with poles, stated that he considered second growth chestnut most satisfactory. On account of the difficulty he had had in securing poles, he has made it a practice to buy the poles a year in advance and allow them to weather, piled up on skids so as to be raised off the ground. He finds that the weathered poles give twice the life of the green poles.

E. F. McCabe, of Lewistown, said that he had found that poles cut in February are far superior to those cut at other seasons of the year, as at that time they are entirely free from sap. He makes use of white pine cross-arms that are air-dried and, before putting them into service, fills up all cracks and holes with putty and gives them a coat of white lead.

Mr. Camp, of Philadelphia, gave as his experience, that the kind of pole which gives the best service depends largely on the nature of the ground. He has found chestnut poles superior in some localities, while in others Michigan pine, Maine cedar or Georgia pine poles were more lasting. Great interest was shown in the subject of poles, and there was a strong sentiment in favor of further investigation on the part of the association.

In addition to the regular programme, a list of "Pertinent Questions" had been prepared and distributed among the members. These were considered in connection with the papers on similar topics. Question No. 4 was: "Have any of the member companies experimented with or do they know anyone who has used concrete poles for electric lighting pole line?"

R. S. Orr, of Pittsburg, stated that the Allegheny County Lighting Company has done considerable experimenting with concrete poles with very good results. This has been largely the reinforcing of partly decayed poles. Mr. Orr figures that he can reinforce a thirty-five or forty-foot pole for about $3 per pole, which effects a very considerable economy. He expects to adopt concrete poles as standard for replacing of decayed timbers.

Mr. Scroll, of Philadelphia, said that he regarded the cost of transportation and the hauling and handling of concrete poles as prohibitive.

Mr. Orr asked for the experience of the members with iron cross-arms, and a general discussion ensued. A great deal of interest was shown in the subject, and it seemed to be the sense of the convention that the use of iron cross-arms under ordinary conditions introduced an element of danger and weakness; that the lightning hazard and the danger to linemen working on live lines made the advisability of their use questionable.

At this point and before continuing the regular programme, President Conklin introduced President Frank W. Frueauff, of the National Electric Light Association, who was in attendance the first day of the convention. Mr. Frueauff was very warmly received.

In his address to the convention he expressed great gratification at the large attendance and the very earnest interest displayed. Mr. Frueauff made a strong appeal for co-operation with the national association and outlined the mutual advantages which would be obtained. He announced the appointment of a committee of the national body to report on the preservation of poles and cross-arms, a subject which had already been discussed at the meeting. The national association has also appointed a committee on "terminology" and has taken steps to secure the introduction of standard tables of electrical units in the text books of schools and colleges. The committee is also looking into the best methods of resuscitation. Methods in vogue in Europe differ materially from the practice in this country, and the national association expects to cover the matter fully at its next convention. The public policy committee is also studying the effect of the new tariff bill on depreciation of figures in various departments, and he urged the Pennsylvania Association to take this matter up and, if possible, become authority on the subject. Mr. Frueauff announced that on October 1 T. C. Martin, well known to the electrical industry, will become permanent secretary of the National Electric Light Association, to devote his entire time to the service of the member companies.

A standing vote of thanks was extended to Mr. Frueauff, and several of the members personally expressed their appreciation of his interest in the welfare of the Pennsylvania association. E. T. Penrose, of Tyrone, announced that he had compiled a considerable number of power data charts similar to those which appeared in his paper on "Power" and tendered them to the National Electric Light Association for use in future editions of its handbook. Mr. Frueauff accepted the offer, and invited any of the members to contribute along similar lines.

The paper on "Steam Heating in Connection with Central Stations," by Paul Mueller, of Erie, was read by M. J. Fo-

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garty, also of Erie, as Mr. Mueller had been unable to reach the convention.

The best practice of steam heating, in the opinion of the author, is a system in which the exhaust steam from the plant will meet the average demand in ordinary weather, live steam being used to supplement this whenever necessary. It is advisable to organize a steam-heating company, and merge it with the central-station company, when the latter decides to start a steam-heating system. The method of constructing the mains was given in detail, as were also the various kinks to be noted in laying out the installation. Services to buildings should be installed at cost. Meter rates are preferable to flat rates. Figures for both of these were given for typical installations. Some details were introduced of the condensation meter and the methods of its installation and supervision. A list of advantages to customers, with an illustrative example of a typical plant, concluded the paper.

This paper called forth a very spirited discussion. James E. Pyle, of Westchester, does not believe in the company doing the steam fitting. In Westchester the local steam fitters set the meters, make connections and do all construction work, and he finds that they lend the company very active support.

Mr. White, of Renovo, said that he has operated his steam plant for eight years, and that better results were obtained when the company took care of all construction work itself, both inside and out, as he had found that local steam fitters could not be trusted. His plan operates with a back pressure of about three pounds.

A motion was passed that a committee be appointed to investigate and report on the subject of steam heat at the next meeting of the convention.

The session was concluded with the reading of a paper by A. R. Cheyney, of Philadelphia, on the subject of "Plant Economy with Special Reference to the Boiler Room."

Starting with the assertion that in the best modern steam plants a thermal efficiency of only from eight to twelve per cent is attained of the energy in the fuel to the main station busbars, the author proceeds to discuss means for increasing this efficiency. Reference is made to the many excellent bulletins published by the United States Geological Survey on topics directly affecting this question. Attention is drawn to the necessity of so improving the apparatus and instruments for indicating and recording the performances of the furnace, etc., that they may thereby be correctly analyzed and brought to the highest perfection. The supervision of the boiler room and its attendants are given, with the aid of charts for proper organization and the conducting of tests. Instructions are given at some length and with due regard to the best practice, for the proper precautions to be observed in order to obtain the best results from the fuel and apparatus used. The subject of buying coal on a heat-unit basis is then taken up, with reference to government bulletins on this subject. The question of the proper choice and treatment of feed water, with especial regard to its scale-forming proclivities, is discussed at length and approximate analyses of certain waters are given, with remarks on their proper chemical treatment. The relation between gas temperature, heating surface passed over, and the amount of steam generated, is considered, with the aid of diagrams; also the losses in combustion due to excess of air above a theoretical minimum for perfect combustion. The smoke problem is then taken up with reference to gas analyses and curves plotted from the data adduced. Means for reducing smoke, without increasing the excess-air input to the boiler and thereby decreasing the efficiency of combustion, are considered with reference to some typical examples from modern practice. This excellent and exhaustive paper concludes with a minute discussion of the distribution of heat expenses.

In discussing this paper, J. W. Graves, of Pittsburg, stated that in his coal analyses, he considered the heat units, sulphur and ash, but the careful regulation of the sulphur has been productive of the best results.

Mr. Orr, in speaking of the difficulty in securing proper grades of coal, told of an experience with a broker with whom he had had a contract. This provided for a system of penalties and premiums, depending on the analysis of the coal supplied. The arrangement worked out very successfully, and has led to a very healthy competition among the coal companies on a basis of strict quality. Mr. Orr recommended the use of the recording CO_2 meter as a check on the firemen.

President Conkling stated that he had been carrying on some experiments in Scranton in the utilizing of the culm piles. His company owns three very large culm banks, and is testing various mixtures of culm with different grades of anthracite, bituminous washed coal, etc. He expects to be able to report on this experiment in the near future, and offers the data to the members of the association.

THURSDAY MORNING SESSION.

Thursday's session was devoted to commercial subjects, and the meeting was presided over by Duncan T. Campbell, of Scranton, chairman of the commercial day programme committee.

The first paper, entitled "Dollar Ideas," was presented by Earl E. Whitehorne, editor of *Selling Electricity*, New York.

Mr. Whitehorne's paper dealt with a discussion and examples of successful applications of revenue-producing ideas. He asserted that there are no formulas or rules for selling electric light, heat and power. It requires ability of many kinds —creative, executive and selling ability— all are essential, and it is well-nigh impossible for any one man to attain efficiency in all branches. He must gather in the good ideas wherever he can find them and hold them in readiness. The man who leads the sales force of any prospering central station is a man not necessarily older or longer in the business, but stronger than the average in resource, courage, optimism and ingenuity. He must be able to point the way and suggest the means. The more such "Dollar Ideas," original and borrowed, that man has at hand, the greater is his ability to inspire his men with constantly refreshened points of view. A number of cases were cited wherein central stations made use of "Dollar Ideas" in popularizing electricity to the material benefit of their resources.

This was followed by a paper by Van Dusen Rickert, of Pottsville, on the subject of "Methods of Securing New Business," a paper by R. A. Granger, of Chester, on "Commercial Effects of Tungsten Lamps," and a paper by D. T. Campbell, entitled "Advertising, Direct and Indirect."

Methods of securing new business, asserted Mr. Rickert, are mixed with questions of rates, of competition from gas, gasoline and acetylene, and at times of department relations. His paper deals quite fully with methods of securing new business for the departments of business lighting, small-residence lighting, sign, window and decorative lighting. Mr. Rickert urges that central stations keep in touch with the electrical publications which devote space to the sale of electricity, that they call upon the manufacturers for the information which they ever have been ready to give, and that from these various sources they select those methods which will stand the test of increased receipts which justify the expense of putting any plan into effect.

Mr. Granger's paper points out that the public is taking an increasing interest in matters of artificial lighting and the cost of obtaining lights. He regards this as an omen of good business for the central-station companies, particularly where the tungsten lamp is being introduced. Of twenty-nine central stations in Pennsylvania that replied in regard to the subject of this paper ninety-five per cent handle tungsten lamps. Their use is encouraged to displace gas lighting and for satisfying disgruntled customers. The tendency is to increase the standard of illumination without materially reducing the wattage except in cases of dissatisfied consumers and occasional large installations. The most popular sizes of tungsten lamps were found to be in the following order: Forty watt, sixty watt, one hundred watt, twenty-five watt. Regarding renewals, eighty-nine per cent of these companies find this matter to be quite satisfactory, and even where the cost of renewals is higher than the cost of replacing gas mantles the consumers generally have no complaint. In a given number of cases where tungsten lamps have been introduced sixty per cent of such installations have shown an increase in revenue, while forty per cent have shown a decrease. The majority of central stations in Pennsylvania find that new business has increased considerably. One year ago many managers were rather skeptical regarding tungsten lamps and only handled them on a small scale; but today everyone realizes their value to the electric-lighting industry. The manufacturers have made good their promise and the lamp today exceeds in useful life the claims that are made for it.

An extended abstract of Mr. Campbell's paper will be given in the section devoted to "Electrical Advertising and Selling," in an early issue.

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These four papers were discussed jointly. The discussion was earnest and spirited, and embraced the various phases of the central-station selling problem.

E. F. McCabe, of Lewistown, asked for information as to the policy of member companies toward making long extensions for churches, citing an instance where he was asked to connect a small Lutheran church, 800 feet from his lines. The general opinion seemed to be in favor of connecting all churches, if possible, in consideration of the favorable impression which it makes on the church members.

Mr. Granger, of Chester, told of an arrangement he makes in such cases, whereby the customer pays half the cost of the line extension and is rebated as new customers are secured along the line.

E. B. Greene, of Altoona, gave an interesting account of an electrical installation on a farm situated six miles from his station, which brings in a revenue of about $200 a month, there being a full equipment of motor-driven churns, saws, etc.

Mr. Barton, of Philadelphia, in speaking of the tungsten lamp, warned the members against letting enthusiasm run away with better judgment, as the market for carbon lamps for use in closets and out-of-the-way places will continue for many years.

Mr. McCabe said that his attitude toward the tungsten lamp at present was very much that of the foreman of his electric department. He overheard him remark to the foreman of the gas department, that "if these here tungstens didn't cost so much and didn't break so easy and had a longer life, they would be the h—l of a good thing!"

R. A. McGregor, of Easton, cited an experience in a western city, where the gas company was supreme. When the tungsten lamp was placed on the market, he succeeded in installing seventy-five four-light tungsten clusters inside of three weeks, with a very marked effect on public opinion.

W. C. Anderson, of Plymouth, then read an interesting paper on the subject of "Co-operation with Contractors."

From the principle that several forces acting in the same direction will produce greater and more rapid progress along a given line it follows that co-operation between contractors and the central station will develop further and better the resultant of increased load and the wider use of electricity in any community. The development of this resultant being the natural common aim of central station and contractor alike, it brings up the consideration of the component forces and how best to apply them. One great difficulty to contend with is the reluctance of the consuming public to pay proper and legitimate prices to a corporation for work that it undertakes for them. The right to a fair profit will be accorded to an individual contractor, while not only is it denied to the corporation seeking to increase its business by entering the same field, but the proper conception of the amount of free work a company should do in return for the privilege of entering a new name in its consumers' ledger is a thing to marvel at. By leaving this work to a local contractor, this difficulty is overcome and the company also avoids the criticism, always ready to be hurled at the corporation, of crushing trade and creating a monopoly outside of its legitimate field. The contractor in many cases probably lived in the community before the present management of the company, and in return for the assistance he can be given in building up and extending a profitable business for himself, he can bring to the company the good-will and friendliness of the people who have confidence in him as an individual. A certain portion of the public will, by learning his opinion of the company and the treatment accorded him, come to a knowledge of the fairness and correctness of its methods and become willing to enter into relations with it. Co-operation which can be obtained between company and contractor depends to a large extent on the type of contractors doing business in any particular town, but it can hardly be denied that co-operation is not only desirable but necessary for the best interest of all concerned.

The discussion of this paper was opened by M. J. Fogarty, of Erie, who stated that his company had been forced to do contracting and carry supplies. It sells annually about $20,000 worth of supplies, $30,000 worth of fixtures and secures as revenue from wiring from $3,000 to $5,000. Customers are required to pay for a part of the cost of extensions on a yearly percentage basis. He said that he had made some interesting experiments to determine the practical life of the tungsten lamp and had a sixty-watt lamp which had burned over 3,500 hours. A general discussion ensued, in which a large number of the members participated.

Mr. Hoffman, of Philadelphia, described a very effective system in vogue in his city. The Philadelphia Electric Company has a standing offer of twenty-five cents per socket which is paid to any builder who secures the installation of electric wiring in any building he may erect. This arrangement has been in effect since 1896, and in one section 196 houses have been built with a cost of about $3,500 for extensions, etc. The first year's revenue from 149 of these houses was somewhere in the neighborhood of $4,250, the other forty-seven houses being unoccupied. About 4,900 sixteen-candle-power lamp equivalents were installed, the bonus to the contractors amounting to over $800. Mr. Hoffman does not believe in the company doing any repairing, citing an instance where a customer objected to paying for a new switch, though the old one had been in service some eighteen years. It happened that Mr. Hoffman lived in the neighborhood and was able to call this customer's attention to the fact that she had had her roof repaired on four different occasions, and the comparison was effective.

The session closed with the reading of a paper on "Power," by E. T. Penrose, of Tyrone.

This paper comprises an introduction (including definitions of the terms power, load factor, diversity factor, and power factor), and a series of short papers by the assistant editors, as follows: "Value of Off-Peak Business," by J. W. Reeves, Johnstown, Pa.; "The Influence of Off-Peak Business on the Cost of Manufacture at the Station," by T. E. Spence, Plymouth, Pa.; "How to Obtain Power Business," by R. A. MacGregor, Easton, Pa.; "High Load-Factor Business as a Money Getter for the Central Station," by J. B. Kilmore, Scranton, Pa. The objects sought are: (1) To prove that the small central station needs a day circuit, if in a manufacturing town. (2) To prove that the central station of whatever size must have a day load for its success, and that the day-load business must not be lost even though the rate made is less than the average cost. (3) How to obtain the business.

In connection with this paper Mr. Penrose submitted a number of selected data sheets, from figures which he had secured from various parts of the country, covering specific installations. These figures were worked out through successive stages to show the consumption per unit of product. He made a strong appeal for co-operation in the circulation of such data.

E. F. McCabe, of Lewistown, decried the tendency of central-station men to conceal exact power rates. He urged all members to join hands in the movement and show liberality in the interchange of real facts and figures.

THURSDAY EVENING SESSION.

Thursday evening was devoted to a demonstration and lecture by Prof. E. E. F. Creighton, of Schenectady, N. Y., on the subject of "Lightning and Lightning Phenomena." There was a large attendance of members, guests and ladies, and the experiments were exceedingly interesting. After the lecture, a number of the central-station men gathered in front, and there was a profitable discussion of the lightning arrester.

FRIDAY MORNING SESSION.

The Friday session was scheduled to open with an address by T. C. Martin. Mr. Martin was unable to be present, and his address was read by the secretary.

E. B. Greene, of Altoona, read a paper on the "Commercial Value of Constant and Efficient Service."

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The author estimated the cost of interruptions of service to be two cents per minute for each inhabitant in the company's territory. An excellent advertisement is afforded by prompt and efficient re-establishment of service interrupted by fire or other causes. Practically constant voltage can be obtained by means of a Tirrill regulator, and a check on boiler rooms by the Venturi meter. Service means more than connecting up a customer's place to the company's line; it means also the thorough satisfaction of the customer by the convenience and reliability of each detail of the electric service. Instruction to prospective users on how to obtain the best results from the electric service is extremely desirable. Complaints should receive every attention and an attempt made to put one's self in the customer's place in dealing with them. Attention should be paid to the training of an efficient organization and the apprenticeship system should be carefully fostered, as thereby many of the best managers and executives are made. In conclusion, a special effort is essential to obtain a perfect harmony and co-operation among the members of the working organization, as only thus can ideal conditions be obtained.

V. D. Rickert, of Pottsville, took exception to Mr. Greene's statement, that the cost of a lapse of service could be computed at two cents per minute per inhabitant. Mr. Greene explained that this was based on the number of customers affected.

There was a general discussion in which Messrs. Granger, McCabe and Hoffman took prominent part and cited instances where a lapse of service meant actual damage and expense to consumers.

This was followed by a paper on "New Methods and Specifications for Street Lighting," by J. H. Perkins, of Wilkes-Barre. An extended abstract of this paper will be given in the department "Electric Lighting and Illuminating Engineering" in a forthcoming issue.

In discussing this paper, Mr. Davis, of Williamsport, urged the adoption of the foot-candle as the unit of illumination in street lighting, as it enables the company to take advantage of new apparatus which may give better results in illumination at a lower initial candlepower.

Mr. Scroll, of Philadelphia, endorsed this recommendation. He said that he had given considerable attention to this matter, and stated as his opinion that it was dangerous to make official tests of lamps in place, inasmuch as the figures will be materially affected by pavement, color of adjacent buildings, atmospheric conditions, season, etc. Marked interest was shown in the subject of street lighting contracts, and a recommendation was made that the association secure further data on the subject.

At this point of the programme the meeting went into executive session to receive the report of the nominating committee. The nominating committee moved the re-election of the present officers. President Conklin, however, after expressing his appreciation of the honor, urged the association against the establishing of such a precedent and asked that the matter be reconsidered, as he felt that it would serve the best interest of the association if the term of the chief executive were limited to one year by custom, if not by law. The committee took the matter under further consideration and the following officers were subsequently nominated and elected:

E. L. Smith, of Towanda, president.

R. A. Granger, of Chester, vice-president.

Van Dusen Rickert, of Pottsville, secretary.

Members of the executive committee: R. S. Orr, of Pittsburg; E. F. McCabe, of Lewistown; J. H. Perkins, of Wilkes-Barre, and M. J. Fogarty, of Erie.

The remainder of the session was given up to further consideration of commercial subjects, and a motion was passed instructing the executive committee to consider ways and means to secure adequate legislation for protecting central stations against current theft. W. C. Anderson, of Plymouth, recited a case where the guilt of the accused was unquestioned, but in spite of that fact conviction could not be secured owing to the faulty construction of the law, inasmuch as it could not be proved that the consumer was personally responsible for the theft. He urged that all effort should be made to effect such legislation that the customer might be held responsible for conditions on the premises. Other members had had similar experiences and expressed hope that the association by concerted action might be able to relieve the situation.

In considering Pertinent Question 3—"What is the proper location for a customer's meter?"—F. M. Noecker, of Renovo, gave some interesting information with photographs showing the practice in his territory. All new houses are being built with a meter cabinet, opening on the side or rear porch, and in a great many instances he has been able to change the location of the meter in old houses. A customer finds it more satisfactory, because the meter reader does not have to enter the building and is able to read 300 meters a day, against eighty where it was necessary to obtain admission to the premises. The men start out at 7 o'clock in the morning, which is, of course, impossible with inside meters. Cabinets are built flush with the walls and protected against changes in temperature. The expense to the consumer in cases of new houses is no greater, and the advantages are such that in many instances present consumers have requested that the change be made.

In discussing Pertinent Question 10—"Is it not advisable for the association to maintain a list of solicitors who have specialized in different departments of the work?"—President Conklin stated that he had received several calls from member companies for special solicitors and this should be seriously considered. "The function of the association," he said, "is to give real and tangible assistance to the member companies, and it should be possible to make some arrangements for the securing of such specialists."

The introduction of the list of pertinent questions at this convention is an indication of the activity of the individual members, as the questions had been submitted by various members of the association for consideration at the convention. The discussions at all sessions were earnest and pertinent, and brought out a great deal of interesting information.

Eagles Mere itself proved an ideal spot for a real business convention. The extreme beauty of the lake and mountain scenery came as a distinct surprise to all, and the selection was a happy one in that there was a gratifying absence of all noise and confusion.

Among the social features were a reception and dance on Tuesday evening, a drive for the ladies on Wednesday morning, and a baseball game between the central-station and supply men on Wednesday afternoon. The baseball game was a great success from the entertainment standpoint, the central-station men being the victors with a score of 11 to 4. In the evening boating and dancing were enjoyed. Thursday morning there were cards for the ladies, Thursday afternoon a scenic railway trip to Lake Mokoma, and in the evening a very successful corn roast immediately following the lecture by Professor Creighton. Friday morning was spent by the ladies in driving and in the afternoon there were aquatic sports in which the various members participated.

The manufacturers were well represented and there were especially interesting exhibits of recent electrical products of the General Electric Company and the Westinghouse Electric and Manufacturing Company. Special lighting equipment

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was installed by the lamp manufacturers, prominent among which were the regenerative arc lamp manufactured by the Adams-Bagnall Company and the new tungsten "arc" lamp made by the Philadelphia Electrical and Manufacturing Company. A representative of the Holophane Company gave demonstrations of combined Holophane-tungsten efficiency.

American Manufactures to Europe.

Exports of American manufactures to Europe rose from a value of $111,500,000 in 1905 to $367,500,000 in 1908, a gain of $252,000,000, or a little over 230 per cent. Other exports to Europe increased from $509,000,000, or seventy-seven per cent. These figures of exported manufactures include manufactures ready for consumption (or finished manufactures) and manufactures for further use in manufacturing. In finished manufactures the rise was from $62,500,000 to $173,000,000, a gain of nearly 200 per cent. The export growth in the group of manufactures for further use in manufacturing was even greater, the total value of articles in this group sent to all Europe in 1895 having been in round terms $19,000,000, and in 1908, $194,000,000, having thus practically quadrupled in the thirteen years, says the Bureau of Statistics.

The 1908 fiscal year exports of manufactures to Germany included principally:

Copper	$19,750,000
Illuminating oil	7,846,803
Rosin	3,676,803
Lubricating oil	2,891,511
Furs and fur skins	2,030,591
Metal working machinery	1,935,468
Spirits of turpentine	1,874,547
Boards, deals and planks	1,749,472
Mowers and reapers	1,651,483
Sewing machines	1,170,598
Upper leather for shoes	1,164,567
Typewriters	1,023,440

Other manufacturers sent to Germany in 1908 included cash registers, builders' hardware, tools, artificial teeth, varnish, electrical machinery, laundry machinery, boots and shoes (leather and rubber), corn, oil, bicycles, plows and cultivators, brass manufactures, automobiles, watches, cotton knit goods, twine, cutlery, fire-arms, steam engines, wood-working machinery, printing presses, pipes and fittings, stoves and ranges, pianos, organs, automatic piano-players, nickel oxide, paraffine, staves, sawed timber, hewn timber, vulcanized fibers, and a host of other manufactured articles of lesser importance.

Railway Legislation in Connecticut.

The session of the Connecticut General Assembly that recently adjourned made a large addition to the volume of railroad legislation, both general and special.

Among the new street-railway laws is an act authorizing the Railroad Commissioners to direct trolley cars to be equipped with air brakes and to direct suburban cars to be supplied with stools for motormen. Another measure specifies that orders concerning the relocating and removal of tracks and changes in grade, except on the application of a railroad company, shall be made only for the purpose of public improvement, and that when the petition is made by the company the cost of the changes shall be borne by the corporation. Corporations, partnershhips and individuals operating an express business on electric railways are required to make an annual report to the State Tax Commissioner and to pay a tax of two per cent on their gross revenues.

Among the special trolley laws are resolutions incorporating the Tolland County Street Railway Company, the Tolland Street Railway Company, and the West Peak Railway Company, and authorizing the construction of an industrial railway in Bridgeport.

An International Aerial Exhibition.

From *Engineering,* of London, we learn that an International Exhibition of Aerial Navigation is to be held at the Grand Palais, Paris, from September 25 to October 17, under the patronage of the President of the Republic and all the French Ministers of State. Among the honorary presidents we find the name of Mr. d'Estournelles de Constant. The executive committee contains the names of several well-known aeroplane builders and aviators. The exhibits are to include balloons, dirigibles and accessories, flying machines, motors and accessories, scientific instruments, raw materials and manufactured articles for aviation, devices for packing and transporting flying machines, etc. In calling the attention of its readers to this exhibition, *L'Industrie Electrique* adds that electricians cannot remain indifferent to the progress made by aeroplanes, to which they have greatly contributed, for had it not been for electric ignition, the motor-car industry would never have been brought to its present state of perfection, and aviation would probably not have been possible.

Canada's Exports of Electricity and Natural Gas.

The annual report of the gas and electricity inspection branch of the Inland Revenue Department at Ottawa, Canada, shows that during the last fiscal year the total amount of electricity exported by the four companies operating under the electricity and fluid exportation act was 359,283,286 kilowatt-hours, as compared with 135,075,680 kilowatt-hours generated for home consumption. The Canadian Niagara Power Company exported 221,927,240 units, and generated for home consumption 5,405,760 units. The Electrical Development Company exported 4,680,500 units, and generated for home consumption 85,515,700 units. The Ontario Power Company exported 131,833,782 units, and the home consumption was 44,150,580 units. The Maine & New Brunswick Power Company generated for export 841,764 units, and the home consumption was 3,940 units. Only one company was licensed to export natural gas during the year. The Provincial Natural Gas and Fuel Company, of Ontario, exported 387,019,000 cubic feet, and its home consumption was 462,707,000 cubic feet. After this no licenses will be issued allowing exportation of natural gas.

Of 45,693 gas meters presented to the department for verification, 8,190 were verified as correct, 11,482 were found fast, and 24,576 slow, but the error in each case came within the variation tolerated by law. The total number of gas meters rejected was 437.

Bronx Gas and Electric Company.

The Bronx Gas and Electric Company has applied to the New York Public Service Commission for approval to an issue of $1,500,000 of bonds, the bonds to be secured by a first mortgage on the company's property. There is, at the present time, a mortgage outstanding of $500,000 to secure that amount of outstanding bonds and three small mortgages upon real estate belonging to the company, aggregating $30,100.

The outstanding stock of the company has a par value of $486,500, upon which the company has been paying five per cent dividends during the years 1904, 1906, 1907 and 1908.

The company states in its application that, of the one-and-a-half million dollars of bonds for which it asks approval, it is its plan to issue at the present time only $740,000 worth, chiefly to retire outstanding obligations, including the prior bonds.

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Electric Supply System of a Scottish Coal-Field.

BY A. H. BRIDGE.

Mining engineers and officials in Scotland have lately been interested in inspecting the new electrical system that has been completed for supplying energy to five pits of the Lochgelly Iron and Coal Company, Limited. The entire coal-field comprises ten pits extending over an area of some sixteen square miles, and from these an aggregate of one-and-one-quarter million tons of coal are raised annually. Electricity has been employed on a more limited scale for some years, a number of isolated continuous plants generating low and medium-pressure current, serving for lighting and power requirements. The work detailed in the following notes is a modernizing and extension scheme which has been carried out under the advice, and to the designs, of James E. Sayers and Caldwell, consulting engineers of Glasgow, who, on various grounds, recommended high-pressure generation at a convenient point with distribution to the several consuming points. The writer desires to express his indebtedness to the consulting engineers for the accompanying photographs of the installation, and to the paper recently published by John Paul before the Institution of Mining Engineers, for the drawings, as well as for the main information forming the basis of this article.

The plan shows the position of the generating station, and the various transformer stations at the electrified pits which are known as Nellie, Mary, Newton, Jenny Gray and Melgund. High-pressure three-phase plant sufficient for these five pits has been installed in the first instance, though the general design provides for, or facilitates, the ultimate inclusion of the other five. Investigation showed that an estimated load of 613 brake-horsepower between the hours of 6 p. m. and 6 a. m. had to be provided for, and of 761 brake-horsepower during the remainder of the twenty-four hours, so two 450-kilowatt generators were first proceeded with, leaving place for a third set of similar size and a 1,000-kilowatt exhaust or mixed-pressure turbo-generator; and the object of the engineers was to avoid modification of the present plant when these additions are proceeded with.

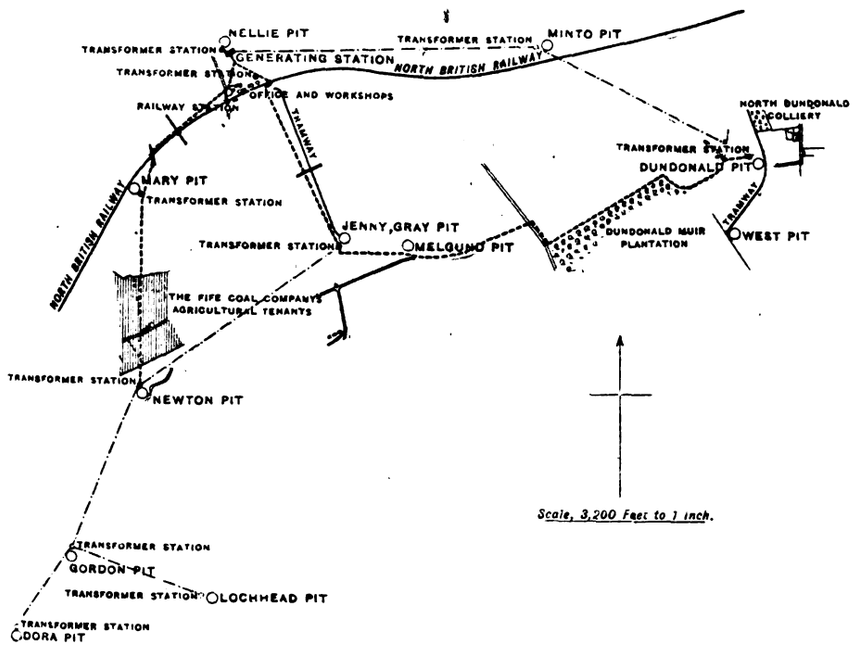

FIG. 1.—PLAN SHOWING POSITION OF THE COLLIERIES SERVED BY THE GENERATING STATION.

The heavy dotted line indicates the two lines now in operation. The dotted line from Jenny Gray to Dundonald Colliery is the extension not yet at work. The chain-dotted lines are probable future extensions.

The generating station is near Nellie, at which pit a second winding engine will be required later, when the question of utilizing the exhaust steam from the winding and other engines there—now deferred—will come further under attention. It should be mentioned, however, that it is with a view to the ultimate adoption of this principle that the power house has been located at the Nellie pit. It is understood that reciprocating engines were adopted because makers quoted prices, and guaranteed steam consumptions, which were in favor of this type for sets up to 1,000 kilowatts capacity, but the fact that on the mines Belliss steam engines had previously proved satisfactory also told in their favor. Evaporative condensers are in vogue, as these only require twenty-five per cent of the circulating water required for a surface-condensing plant. The vacuum obtained is not more than twenty-five or twenty-six inches, but a hot feed is obtained. When the proposed turbo-generator set is put down, either surface or ejector condenser plant will be installed in connection with it. The boilers, which are of the water-tube variety, are 200 feet away from the nearest generating unit, owing, Mr. Paul says, to the necessity of selecting a site convenient for the future collection of steam for the proposed exhaust turbo-generator, and the necessity for placing the new boilers in line with the Lancashire boilers already in use.

The change over from the old direct-current drives to the new three-phase supply was commenced early in this year, and has since been proceeding gradually, taking place almost entirely on Sundays. In the plan it will be observed that the Dundonald pit is shown in addition to the others named. This colliery has been only recently acquired, and it involved two miles' extension of the transmission line from the Jenny Gray transformer house.

Coming now to the particulars of the plant, the power house is lined with glazed bricks and is served by a ten-ton crane. There are four Babcock and Wilcox boilers in two batteries, each boiler having 2,531 square feet of heating surface, and being fitted with a new type chain-grate mechanical stoker, and integral type superheaters. The two Belliss and Morcom self-lubricating, three-crank, triple-expansion engines are direct-coupled to two Bruce Peebles, three-phase, fifty-period alternators having exciters on the same shaft. Each set is to give a continuous output of 420 kilowatts on a 0.8

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power-factor at 3,000 to 3,300 volts, at 375 revolutions per minute. The condenser consists of 336 corrugated pipes in fourteen coils of twenty-four pipes each.

The high-tension switchgear consists of four generator and six feeder panels, two of the former and four of the latter being at present fully completed. The feeder panels are supplying the transformer for the Nellie pit, and for the power-house motors, the overhead line supplying the Mary and Newton pits and the overhead line supplying the workshops, Jenny Gray, and the Dundonald colliery. Two further panels control the low-tension three-phase current from the power-house transformer, one controlling a fifty-kilowatt motor-generator for giving 200-volt continuous current for the lighting of the power house, Nellie pit-head, and the offices and shops; the other controls the air pump, condenser and centrifugal-pump motors. There are no "live" metal parts or connections on the front of the three-phase panels. All but the measuring and indicating instruments and the oil-switch handles are placed in screened cubicles in a switchboard recess, which is guarded with Boswick gates with locking arrangements. The synchronizing busbar voltmeter and earth-detecting panels are on the sides of the brick piers within which the main panels are placed.

On each of the equipped generator panels is mounted (1) a three-pole oil switch having automatic reverse power trip-gear, arranged to disconnect a faulty machine from the busbars; (2) an indicating wattmeter; (3) an ammeter; and (4) the necessary plug connections for the operation of synchronizing.

In front of each of these panels is an exciter pillar, comprising a rheostat handle for varying the exciting current to the generators, an ammeter, a voltmeter, and an exciter-field switch.

On each of the feeder panels is mounted (1) a three-pole oil switch having automatic overload and out-of-balance trip-gear, arranged to disconnect a feeder in the event of a predetermined overload, or in the event of any line or lines of the circuit becoming earthed; (2) an indicating wattmeter; (3) an ammeter; and (4) a kilowatt-hour or integrating wattmeter, to measure the units of electrical energy supplied to the individual circuits.

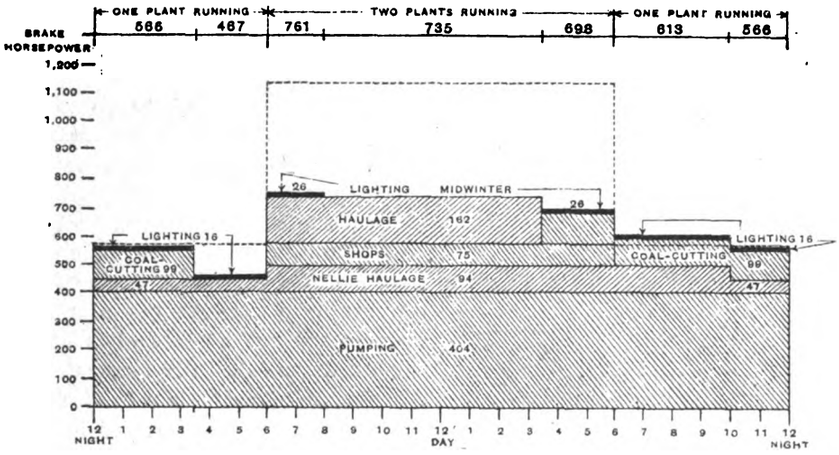

FIG. 2.—INDICATING INCIDENCE OF LOAD OVER 24 HOURS FOR ESTIMATED IMMEDIATE REQUIREMENTS OF NELLIE, MARY, JENNY GRAY AND NEWTON PITS, AND THE WORKSHOPS.

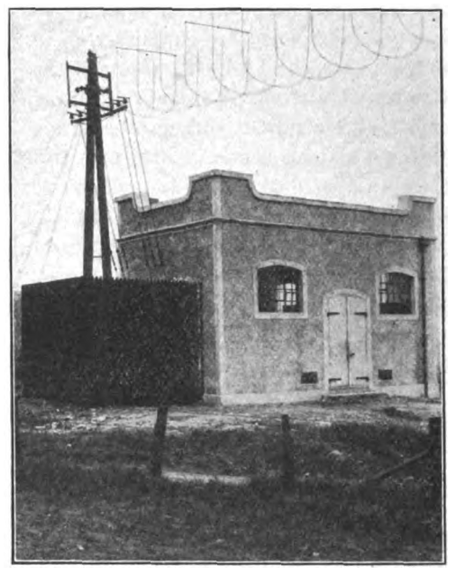

FIG. 3.—VIEW OF A LOCHGELLY TRANSFORMER HOUSE, SHOWING CONNECTIONS TO TRANSMISSION LINE.

On each of the low-tension three-phase panels is mounted (1) a three-pole oil switch, as on the high-tension feeder panels; (2) an ammeter; and (3) one volt meter common to both panels.

There are no fuses on any of the three-phase panels. On the 200-volt continuous-current lighting panel is mounted (1) a main switch and three circuit knife switches; (2) a pair of main and three pairs of circuit fuses; (3) a voltmeter; (4) three ammeters; and (5) a field rheostat for voltage control.

The whole supporting structure is of iron, the sides and tops of the cubicles

FIG. 4.—VIEW OF SWITCHBOARDS AND TRANSFORMERS FOR NELLIE PIT AND POWER-HOUSE MOTORS.

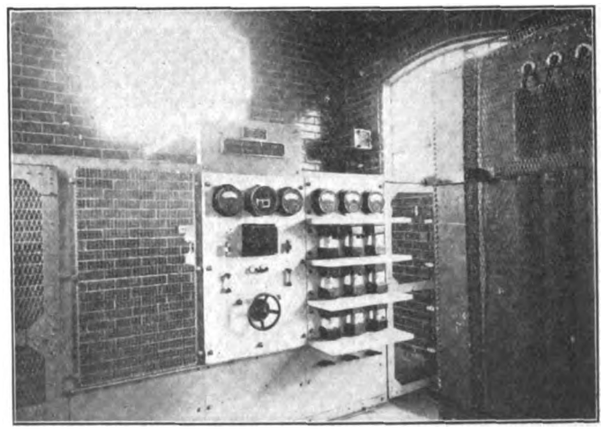

FIG. 5.—LOW-TENSION SIDE OF TRANSFORMER HOUSE.

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are of slate, and the panels themselves are of marble.

The switchboard is not entirely dependent upon the motor-generator for lighting supply, and is provided, as a safeguard, with lamps fed by a small static transformer.

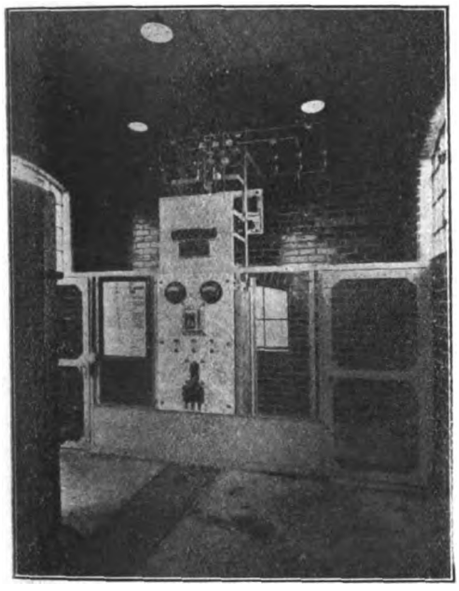

FIG. 6.—HIGH-TENSION SIDE OF TRANSFORMER STATION.

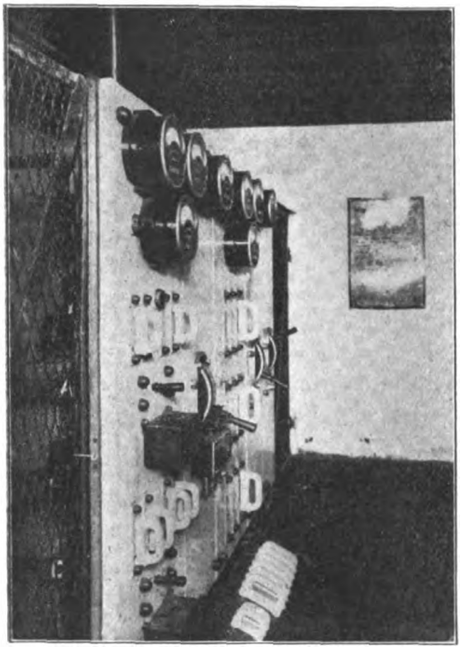

FIG. 7.—ONE OF THE IN-BYE SWITCHBOARDS.

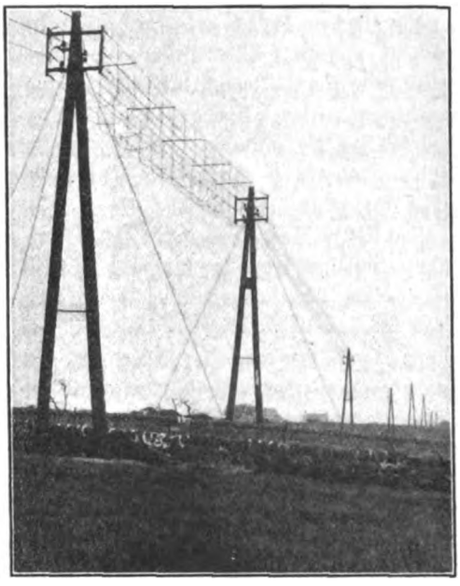

FIG. 8.—VIEW OF OVERHEAD LINE WORK, SHOWING CRADLING OVER ROADWAY.

The high-tension distributing system consists of overhead lines from the power station to the Mary and Newton pits to the southwest, to the workshops and the Jenny Gray pits to the southeast, and several lengths of lead-covered and armored paper cables under the North British Railway track and from the power house to the adjacent terminal pole. All the overhead line wires and apparatus are protected against lightning and excessive pressures by spark gaps, and over public roadways and at certain points near the pits adequate cradling is observed.

Each transformer house has two 200-kilowatt oil-cooled transformers (0.8 power-factor) and the requisite switchgear. The transformers are wound to transform three-phase current from 3,000, 3,150 and 3,300 volts to 525 volts. Ferranti type switchgear is used, comprising a high and a low-tension panel for each transformer, with automatic oil switches, indicating instruments, and an integrating wattmeter. Faulty transformers are automatically cut out. On the high-tension side of the board, space is left for a high-tension feeder panel should it be required to take high-tension circuits down the mine shafts. On the low-tension side there are three circuits, each of 200 kilowatts capacity, for transmission of 525-volt current for shaft cable or other purposes. The shaft and in-bye cables are of three-core bitumen, insulated and filled, and double-armored with galvanized steel wires. Cleats of special design support them at intervals of forty to fifty feet, and they are suspended in-bye by hempen slings. Substantial armor clamping rings assure electrical continuity of the armoring throughout each network, and the whole is effectively earthed. The in-bye switchboards were designed for underground conditions, and are of substantial construction. Each board has an auto-transformer for the supply of current to fifty lamps. The sub-circuit fuse boards are of heavy mining type, with porcelain barrel fuses, and all have connections on the front of the slate panels; they are enclosed in cast-iron cases with armor anchor rings, and the lids of braced iron plate are hinged and secured by wing-nuts.

The uses to which motors are put in the pits comprise haulage, pumping and fan driving, also coal-cutter driving.

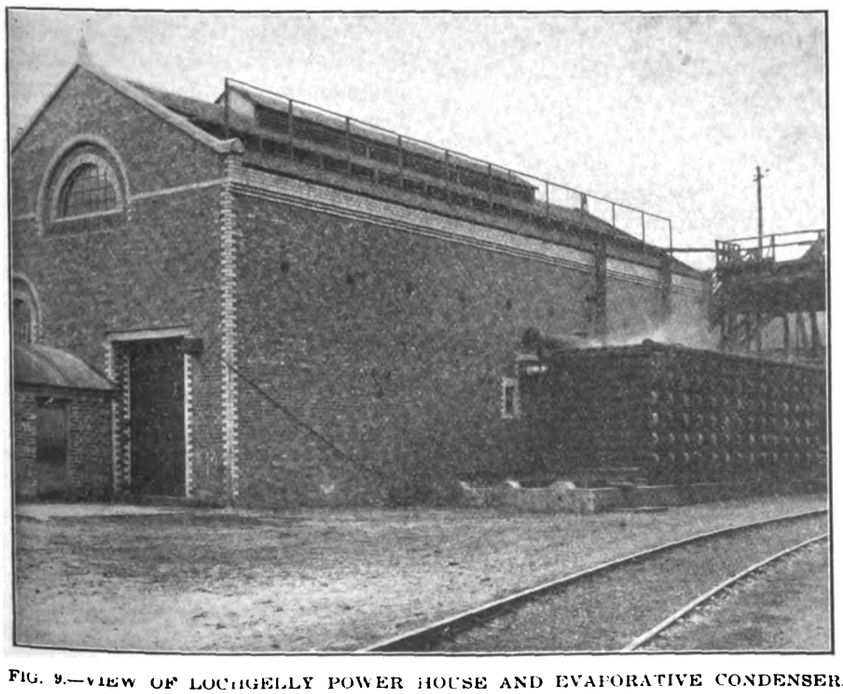

FIG. 9.—VIEW OF LOCHGELLY POWER HOUSE AND EVAPORATIVE CONDENSER.

It is reported on good authority that telephone and telegraph extensions projected in the Transvaal will total up to no less than $1,250,000.

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New York's Illuminations.

The City Hall, the Washington Arch, Brooklyn Borough Hall and the Brooklyn Bridge were electrically lighted by the New York Edison Company on one or two occasions last week with many thousands of incandescent bulbs, to show how they will appear during the eight nights of the Hudson-Fulton celebration allotted to this section. The illuminations last week were for the benefit of the illuminations committee of the Hudson-Fulton Celebration Commission. The system of lighting shown is similar to that to be used during the celebration.

The City Hall was first lighted up. All its outlines were brought out by lines of electric lights, stretching across the front and sides of the building, up and down the pillars and the dome was also lined. There were 3,500 eight-candlepower incandescent lamps, strung twelve inches apart, making a total of 28,000 candlepower.

Washington Arch, on Fifth Avenue and Washington Square, north, close to the end of the route of the three land parades of the celebration, was illuminated by 1,500 lamps, of the same power and spaced as at the City Hall. Every detail of the arch was brought out distinctly by the great flood of light. There was a total candlepower of 12,000 and the horsepower required was approximately fifty.

Brooklyn Borough Hall required more for its illumination than the City Hall in Manhattan. It took 3,600 eight-candlepower lamps, or a total candlepower of 28,000, to bring its outline into bright relief, and a horsepower of about 120.

Brooklyn Bridge produced the finest spectacle of all. Cables, towers and roadway were shown in bright lines of electric light, hanging like a fairy span above the river. It gave a promise of the grand scenic effect when all four of the bridges will be illuminated when the celebration begins this evening. For the Brooklyn Bridge alone 13,000 lamps, strung in eighteen inches apart, with a total candlepower of 104,000, using approximately 433 horsepower, were necessary. On all of the four bridges there will be about 49,000 incandescent lamps.

It is certain that the illuminations, both in originality and scope, will far surpass anything before seen. A huge, blazing national advertisement to all the nations of the earth, the spectacle afforded will be a fitting tribute to the pioneers honored thereby.

Standard Oil in Columbia Gas and Electric.

Conferences have been held in Cleveland, O., between representatives of the Standard Oil Company and officials of the Columbia Gas and Electric Company, with a view of organizing a $20,000,000 concern to merge gas and lighting companies in Ohio. A. C. Bedford and J. W. R. Crawford, representing 26 Broadway, and Archibald S. White and F. B. Enslow, president and vice-president, respectively, of the Columbia Gas and Electric Company, are handling the deal, which, it is expected, will be closed so that the consolidation may become effective by October 1.

It is planned to merge the Cleveland city gas companies, owned by the Columbia Gas and Electric, and the East Ohio Gas Company, of the Standard Oil Company. The two Columbia companies are the Cleveland Gas Light and Coke Company and the People's Gas Light Company. These properties will be acquired by the new corporation, which will probably be known as the Ohio Gas Company.

The stocks owned by each in the present individual companies will be exchanged for stocks and bonds in the new company, and in this way the control of the big new company will rest in the Columbia company and the Standard Oil interests.

The Cleveland Gas Light and Coke Company, which serves the territory east of the Cuyahoga River, was incorporated in 1846, and the People's Gas Light Company, operating west of the Cuyahoga River, was incorporated in 1868.

The former has 537 miles of mains with 42,000 meters installed and owns valuable real estate on which are situated its manufacturing plants, etc. The daily capacity is 5,000,000 cubic feet and the annual output about 1,500,000,000 cubic feet.

The People's Gas Light Company has 203 miles of pipe line with 14,000 meters installed and owns much real estate for its requirements and corporate uses.

Classified Telephone List.

The first issue of the New York Classified Telephone Directory, hitherto published under the name of the Alcolm Red Book, containing complete classified lists of New York business houses in the boroughs of Manhattan and the Bronx, subscribing to the New York Telephone Company service, is ready for distribution by the publisher, Reuben H. Donnelly, 227 Fulton Street.

Western Electric's Position.

The Western Electric Company has shown considerable and steady growth during the nine months of its fiscal year which have elapsed, and which will go to make the year 1908-9, ending November 30, loom large in comparison with the preceding fiscal year.

Returns for August show that the month ran sixty per cent ahead of August, 1908; also showing a gain of about five per cent over July. August, 1909, was ten per cent ahead of August, 1907, the year in which the Western Electric's sales reached $53,000,000, the second largest total in the history of the corporation. At the rate of the August increase the business for the current year would run in excess of $53,000,000.

The three quarters of the fiscal year which have elapsed indicate gross sales for the year of about $47,000,000. While this figure is far below the $69,000,000 total for 1906, and the $53,000,000 for 1907, it is eminently satisfactory, as compared with last year, representing, as it does, a gain of $14,000,000, or forty-two per cent, over the total gross sales in 1907-8 of approximately $33,000,000.

In the United States, outside of the Bell system, there are about sixteen thousand so-called independent telephone companies. Of the "outside" operating companies, 6,000, or thirty-seven-and-one-half per cent, are customers of the Western Electric Company, although the company has followed the policy of selling to outside companies not longer than two years. The company's business with the Bell companies is reported as showing a satisfactory rate of increase.

The year to date has also been marked by especially good sales in cable, electric machinery, and general electric-light supplies, and in these lines many records of other years have been broken.

American Institute of Electrical Engineers.

The next regular meeting of the American Institute of Electrical Engineers will be held in the auditorium of the Engineers Building, 33 West Thirty-ninth Street, New York, on Friday, October 8, 1909, at 8 p. m. John B. Taylor, of the railway and traction department of the General Electric Company, Schenectady, N. Y., will present a paper entitled "Telegraph and Telephone Systems as Affected by Alternating-Current Lines." The paper will be printed in the October Proceedings of the Institute.

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MEETING OF THE CHICAGO ELECTRIC CLUB.

RESIGNATION OF PRESIDENT HOWLETT, UPON WHOM IS CONFERRED A LIFE MEMBERSHIP.

The regular midday meeting of the Chicago Electric Club was held in the grill room of the Chicago Automobile Association at 12:15 p. m., Wednesday, September 15. The principal address was delivered by Frederic A. Delano, president of the Wabash Railroad. Mr. Delano took for his topic, "A Plan for a New Union Passenger Railway Terminal for Chicago."

Mr. Delano first began talking about the terminal question in Chicago about five years ago. At that time he published a pamphlet analyzing the conditions, and about two years later he discussed the subject before the Chicago Real Estate Board. The paper which was delivered at that time had been reprinted, and this paper was distributed to the members of the Electric Club, so that Mr. Delano sketched briefly only the principal features of the problem.

For nearly ten years Mr. Delano was superintendent of the yards for the Burlington & Quincy Railroad at Chicago. It seemed to him that in the rapid growth of the railway systems and the interlacing of one railroad with another, a very much confused condition of affairs had come about. In studying this problem, one of the first things that was apparent was that of the twenty-six railroads terminating in Chicago, some of them representing lines with two or three entrances to the city, most of them entered the city from the south. Most all those that enter the city from the west come in along Sixteenth Street, so that with the exception of the Chicago, Milwaukee & St. Paul and the Chicago & Northwestern, every trunk line entering Chicago comes in from a point south of Sixteenth Street. This seemed to indicate that it would be possible to choose some main thoroughfare and line up the railroads and bring together a group of stations along one main street. This group of stations would accommodate all of the railroads, and by adopting more than one level, the transfer of both passenger and freight traffic would be greatly facilitated.

There are six main depots in Chicago now. Each of the roads interested in each of these groups of stations might spend $20,000,000, as the Northwestern is now doing, and might greatly improve its individual station. Yet, on the whole, the result would not be satisfactory to the city of Chicago and to travelers generally, because in scattering the stations about the city it is impossible to secure the advantage of any system of intramural transportation. At the present time every through ticket reading beyond the city of Chicago carries a fifty-cent coupon for the conveying of passengers and baggage from one depot to another. This involves a very heavy impost on the traffic. All passengers and baggage and less than carload freight has to be transferred through the city by team, and this involves a very uneconomical method of handling this business.

Mr. Delano said he would be glad to see the engineers of the city make a special study of the problem. The solution

C. A. S. HOWLETT.

which he offers is not the only one available, and he has made these suggestions as an engineer and a citizen and entirely without consideration of his official connection with any railway system.

In deciding upon the point for the massing or grouping of the series of stations, Mr. Delano has selected Twelfth Street because it so happens that it is the only thoroughfare between Harrison Street on the north and Eighteenth Street on the south, a distance of three-quarters of a mile, which goes from the lake front to the West Side. This street offers every facility for tapping the other main thoroughfares from every other section of the city. It is also apparent that the club and business life of the city is moving in this direction, and it is a fact that Eighteenth Street today is no further south with regard to the business center than Twelfth Street was five years ago.

It is quite possible, and only fair, to assume that the immense expenditure that the Northwestern road is now making will render unfeasible the co-operation of this road in establishing a station on Twelfth Street on the South Side. In this event it would be possible to establish two groups of stations, one on the South Side and one on the West Side. It would not be as convenient in all respects, but would still be far superior to the present conditions.

At the close of his address, Mr. Delano replied to several questions, speaking at some length with regard to the effect electrification of the main lines would have on his proposed plans for a union terminal. Mr. Delano said that there was nothing in the plan that could not be carried out more readily with electrification than with steam. It is recognized that with a multiple-level system there are difficulties of operation with steam locomotives which would be eliminated by the use of electricity. Any development of electricity would help rather than hinder this proposition.

In closing, Mr. Delano said that it is not a new thing to move a station back of where it once was. So far-sighted a man as Cornelius Vanderbilt, when he built the Grand Central Station in New York city, abandoned a site at Twenty-Sixth Street and Fifth Avenue, where the New Haven road had a station, and abandoned a site at Thirty-third Street and Seventh Avenue, where the New York Central had a station, and built his big terminal at Forty-second Street. At the time this station was built there were no office buildings in that part of the town.

Upon motion, Mr. Delano was given a hearty vote of thanks for his address.

Following Mr. Delano's address, C. A. S. Howlett, who has been president of the club since its inception, announced that, owing to his change of address to New York city, it had been necessary for him to place his resignation in the hands of the Board of Managers. Mr. Howlett then reviewed the past and present history of the organization, and in discussing the future laid before the club an admirable series of suggestions, looking to its development and increasing advantage.

The club is now in its second year. There is a comfortable balance in the bank, and the 375 members in good standing are representative of the most aggressive and enterprising men in the electrical business or profession. There are, however, a great many men in the electrical business in Chicago who are not now members. When these men join and

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add their influence, the club will be appreciably benefited.

Among the important suggestions made by Mr. Howlett were the preservation of the addresses and discussions and the publication of a monthly or quarterly bulletin for distribution to the members; the preparation of an emblem; the co-operation of the club with other organizations in movements of a public nature; the establishment of correspondence with clubs in other cities, and arrangements for interchange of recognition on the part of traveling members. Mr. Howlett also suggested the development of plans for permanent quarters, the immediate enhancement of the work of the membership committee, the taking up by the club in a strong way of assistance to the city electrician in securing from the State Legislature increased appropriation for a better lighting of the city streets. The organization and development of a glee club, several plans for the work of the entertainment committee, and a general discussion of a plan for co-operation between the officers and the several committees was also presented.

Mr. Howlett announced his sincere regret at being compelled to resign from the office of president and extended his thanks and best wishes to the remaining officers and the Board of Managers and to his successor.

Upon motion, Mr. Howlett's address was referred to the Board of Managers for action.

W. S. Taussig, secretary of the club, took charge of the meeting and requested A. A. Gray, on behalf of the members, to express their regret at the retirement of Mr. Howlett from his active duties in the club and their appreciation of his services. Mr. Gray rehearsed very briefly the strong individual work which Mr. Howlett had rendered and extended to him the best wishes of the organization for his continued success. The meeting then adjourned.

At the meeting of the Board of Managers held on Friday, September 17, a resolution was passed tendering to Mr. Howlett a life membership in the club in recognition of his services. This action was heartily endorsed by the members at the meeting on September 22.

Favors the Electromobile.

In the great parks in London, Eng., one is permitted to run an electromobile at hours when the use of other forms of self-propelled vehicles is prohibited.

Rate of Helium Production from the Complete Series of Uranium Products.

In a letter to the editor in a recent issue of *Nature,* of London, the Hon. R. J. Strutt writes as follows:

"A knowledge of this constant (the rate of helium production from the complete series of uranium products) is essential to the estimation of the ages of minerals from their helium content. In a paper published in the proceedings of the Royal Society, July 28, 1908, I gave the ages of some minerals provisionally on the assumption that the rate was 9.13×10^{-8} cubic centimetres per gramme U_3O_8 per annum. This rate was calculated from Rutherford's indirect data. It has received much support from Sir J. Dewar's determination of the rate of production by radium with its immediate products. I am now in a position to confirm it further by an experiment on the rate of growth of helium in a solution of pitchblende; I speak of a solution, but it has been found impracticable to take up all the constituents by one solvent. Two solutions were necessary. The pitchblende solutions contained 115 grammes of U_3O_8, and yielded in sixty-one days a quantity of helium which was measured as 2×10^{-6} cubic centimetres in the capillary of a McLeod gauge. This gives the rate as 10.4×10^{-8} cubic centimetres per gramme U_3O_8 per annum. No stress can be laid on the close agreement with Rutherford's estimate in view of the very small gas volume measured. The experiment proves, however, that that estimate is of the right order of magnitude. Larger scale experiments are in progress, and these, in conjunction with similar experiments on thorianite, will, it is hoped, enable data on the quantity of helium in minerals to be translated into estimates of time with full confidence."

Electric Lights to Flash Fire Alarm.

Fire Chief Hamilton, of Lawrence, Mass., has installed a unique fire-alarm box and signal system on Essex Street in that city, according to a recent issue of the *Municipal Journal and Engineer.* New boxes are installed, upon each of which is a red electric light. These lights will flash at each stroke of the alarm, so that it will be possible to learn the box by just watching the light. On the south side of Essex Street, near the transfer station, will be a large gong on a box to be located there. This gong will ring at every alarm, and can be heard for a distance of 100 yards.

Electric Furnace Development in Mexico.

The Mexican Steel and Chemical Company has been organized in the City of Mexico, where a plant for the manufacture of calcium carbide using a continuous type of furnace is already under construction. The company also proposes to utilize the Héroult type of electric furnace for steel refining. Tool and drill steel, shoes and dies, forgings and castings and also light steel rails will be manufactured.

The current will be purchased from the Mexican Light and Power Company, and will be taken from the mains at a pressure of 20,000 volts. Both furnaces will be operated on the single-phase system. The carbide furnace will be designed and constructed by Charles Bingham, of London, England, and the steel furnace by Robert Turnbull, of St. Catharines, Ont., Can., acting for Doctor Héroult. J. T. Morrow, of New York city, is the managing director of the company.

Dry Storage Batteries.

From Christiania, says *The Electrical Engineer,* of London, come vague rumors of what may prove to be a triumphant forward movement in electrotechnics. It is said that a local electrician has invented that long-sought desideratum, a dry storage battery. So far, it appears, his apparatus has a capacity at sixty volts of one-quarter of an indicated horsepower, but he is in hopes of increasing this to 100 volts and over one-half of an indicated horsepower. There is said to be an enormous saving of weight, the accumulator only weighing a little over two-and-one-half pounds, while its prime cost and maintenance charges are correspondingly reduced. It is said to be most easy to manipulate. There is certainly a great future before such an invention, if practical.

McAdoo Tube Expansion.

The Hudson & Manhattan Railroad Company has obtained the permission of the Jersey City Street and Water Board to extend its Cortlandt Street tunnel system under Railroad Avenue to Summit Avenue.

The ordinance was adopted at a recent board meeting, but it is understood that Mayor Wittpen will veto it because no proviso is included that a five-cent fare shall hold good from any place in Jersey City to the New York terminal.

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New England Section, National Electric Light Association.

The first convention of the New England Section of the National Electric Light Association was held at Newcastle, N. H., on September 8, 9 and 10. The headquarters were opened at the famous Hotel Wentworth Wednesday evening, when the larger portion of the final attendance of 150 were already registered. The convention was opened by a reception on this evening that was given in the hotel parlors by the officers of the section. Throughout the convention a great deal of interest was shown in the proceedings; a number of very good papers were read and ably discussed, and on the whole the prospects for this geographic section of the national association were shown to be very bright.

THURSDAY SESSION.

The first technical session of the convention assembled on Thursday morning at the call of President S. F. Smith. Mayor Adams of Portsmouth made a very pleasing address of welcome, after which Mr. Smith delivered his presidential address.

In President Smith's address he calls attention to the conditions that had brought about the organization of the New England Section. There had been a number of separate local organizations which were largely duplicating their work, and by their amalgamation into the New England geographic section their efforts were combined harmoniously. The New England section now has 413 members, and is the strongest geographic section of the association. Mr. Smith showed clearly the advantages of affiliation with the larger organization, and also pointed out the value to the latter of having sections organized in the various parts of the country. He advocated the plan of organizing similar geographic sections which should combine the central-station interests of a number of states having similar local conditions, and he declared that this plan was preferable to having a large number of strictly state associations.

The recommendations of the president's address were referred to a committee, of which A. J. Campbell was made chairman. A paper was then presented by W. L. Mulligan, of Springfield, Mass., its subject being "Liability Insurance and How It Affects the Employe."

In this paper Mr. Mulligan described the practice of the United Electric Light Company, of which he is general manager. This company has carried both public and employes' liability insurance for several years on the plan of handling this feature directly instead of leaving it entirely to the insurance companies. In case of injury to any employe during the carrying out of his duties, he is promptly taken care of by the company, which provides medical and hospital services without expense to him, and tries its utmost to restore him to perfect condition as rapidly as possible. Practically the entire force of employes, except those in the office, about 150 altogether, are protected by insurance of this order. It has been found that men do not hesitate to assume unpleasant duties, and are more loyal to the company since they know they are properly protected in the execution of all orders. The total amount of money required last year for all forms of insurance was $2,500, of which a little over two-thirds represented liability insurance. Cases of minor injury are handled directly by the company, without the necessity of the insurance company being put to any expense. The latter is, therefore, more liberal in adjusting the larger cases for which its aid is required. There are few cases which reach the courts by the general plan that has been followed.

The discussion of this paper consisted of the relating by a number of members of similar plans that had been put into use, and of a series of questions directed to Mr. Mulligan with reference to the details of his system. The general opinion was expressed that a liberal policy in regard to accident compensation resulted in decidedly improved loyalty of the employes. A number of speakers advocated the plan of having the central-station company carry its own insurance in a special fund of this kind. Among those who discussed the subject along these lines were H. T. Sands, of Malden, Mass.; J. E. Davidson, of Montpelier, Vt.; R. W. Rollins, Hartford, Conn.; A. J. Campbell, New London, Conn.; L. D. Gibbs, Boston, Mass.; C. D. W. Jarvis, Boston, Mass..; Mr. Wilson, of Berlin, N. H., and President Smith.

A paper entitled "The Advantages of Steam Heating for Electric Lighting Companies" was then presented by C. R. Bishop, of the American District Steam Company, of Lockport, N. Y.

Mr. Bishop's paper reviewed the gradual growth of central-station heating, and showed that New England is backward in this direction. In Pennsylvania, having eighty-two cities of over 5,000 inhabitants, there are central-heating plants in sixty-nine cities. Illinois, with fifty-one cities of over 5,000, has thirty cities having such systems. Throughout New England there are 172 cities with a population in excess of 5,000; in only three, however, is central-station heating carried out. Central heating has been perfected by recent developments and is now completely standardized. The development of correct meters has enabled the provision of fair systems of rates. The general plan followed is to have the heating season begin on October 1 and extend pretty well into May. Mr. Bishop pointed out clearly that with a properly designed heating installation the revenue derived from this service practically pays the entire costs of the power house, so that the electric current generated might be considered as a by-product. He gave interesting examples to verify these statements. He went into the details of central-station heating quite fully, and stated that it is feasible to install a system of this kind having mains as long as two miles from the power house. It is desirable to arrange the piping of the stations so that any of the engines may exhaust into the heating system, into the atmosphere or into the condenser. The marked advantage of a central-station heating system is that it permits of the entire shutting down of isolated plants, and thus removes practically the last hindrance to central-station lighting and power service. A large number of consumers were added to the central-station electric systems when it was made possible for them to receive the central-station heat as well.

Mr. Bishop's excellent paper brought out quite a number of questions with regard to central heating. It was quite evident that there is a dearth of information on this subject among the New England members, many of whom expressed their pleasure in having its possibilities opened to them. Practically all the heating is done on the low-pressure system, and seldom is more than two pounds service pressure required at any building. In a number of cities steam-turbine plants are running in connection with exhaust-steam heating equipment and giving excellent results.

FRIDAY SESSION.

At the opening of the second business session of the convention President Frueauff, of the National Electric Light Association, was introduced. He had made a special trip from Schenectady, N. Y., where the preliminary organization of the first-class "D" company section had been undertaken. He made an excellent address to the association, in which he referred to the enthusiastic meeting which he had just left, and to the great interest taken in all of the enlarged activities of the national association. Mr. Frueauff explained the work that is being carried on by the more important committees, and spoke of the library which is rapidly accumulating at the association's offices in New York city. He pointed out a number of cases where small companies are getting the direct benefit of affiliation with the association through the services of its experts at ridiculously low cost in comparison with what would have been required if the company had acted independently.

President Smith announced to the convention that T. C. Martin, who has been prominently associated with all electrical activities for the past quarter century, particularly in the journalistic field, had been induced to accept the position of permanent secretary to the National Electric Light Association. He congratulated both the national and the local associations upon the acquirement of Mr. Martin's able services in their behalf. He thereupon introduced Mr. Martin, who had come with President Frueauff.

In a short address Mr. Martin expressed his regret at leaving the field of

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technical journalism. He spoke of the high importance of the work of the National Electric Light Association; of the rapidly broadening scope of its activities, and the possibilities that would be open to him in supplying information of all kinds in relation to the industry for the benefit of the various local sections and individual members of the association. In conclusion he advocated the most hearty co-operation on the part of all the members in promoting its welfare.

At this point Chairman Campbell, of the committee on the president's address, reported that it seemed desirable to place a copy of President Smith's address in the hands of each member. The committee also recommended that special efforts be made to secure friendly relations with the central-station men employed in the municipal plants.

F. W. Prince, of Hartford, Conn., then read a paper on "The Low-Voltage Tungsten Lamp in Residentlal Lighting."

In this paper Mr. Prince described the practice of the Hartford Electric Light Company in installing low-voltage tungsten lamps. The advantages of this type of lamp in comparison with the normal 110-volt tungsten lamp he declared to be very marked. The lamp is more rugged and can be handled with practically no breakage; it does not blacken, and has a useful life of nearly 2,000 hours; it can be burned at any angle, and requires only the standard ten or sixteen candlepower bulbs. Furthermore, the price of this low-voltage lamp is only about sixty-five per cent of the high-voltage tungsten. The best way to install the low-voltage system, Mr. Prince declares, is by the use of a transformer or a balance coil, with 112-volt primary and four twenty-eight-volt secondary circuits. By the provision of special primary taps the voltage could be adjusted to prevent excessive drop in long secondary circuits in large houses. The use of twenty-eight-volt circuits, however, prevented the installations of the regular flat irons, fans, sewing machines, motors and other household utilities which required separate 112-volt circuits. In order to overcome this need, a sixty-volt lamp was adopted as standard, since sixty-volt appliances were available. The Hartford company adopted a series of flat rates for installation of low-voltage tungsten lamps, and claims to have got excellent returns from this plant. Particular headway has been made on this basis in the wiring of houses formerly equipped with gas. This is usually done on the three-wire system at a very low cost.

The discussion of Mr. Prince's paper was quite spirited. In fact, it was a difficult thing to say which side of the debate, for or against the low-voltage lamps, had the best of the argument. On behalf of the low-voltage advocates it was said that a large number of consumers can be obtained in this manner which it is impossible to reach with the high-voltage tungsten-lamp proposition. There are no complaints from the customers. The costs of the economy coil, or transformer, and of the flat-rate controller are about the same as that of a meter. The energy lost in the former is fifty per cent in excess of that in the meter, but there are no maintenance, meter-reading or billing costs.

In opposition to these arguments G. C. Osborne, of the General Electric Company, said that recent improvements in both metallic and metalized-filament lamps have increased their life materially before they reach the point of twenty per cent depreciation from the initial candlepower. Along with this improvement has come a steady reduction of prices for the normal voltage lamps. He deprecated the use of low-voltage tungsten lamps for regular residential lighting, as he thought this was not a proper field for their installation.

L. D. Gibbs, of the Boston Edison Illuminating Company, also advised against the adoption of low-voltage lamps for residential lighting. He believes that even the twenty-candlepower tungsten lamp is not too bright for proper illumination. Central-station interests should rather encourage the use of the higher standard illumination than the opposite.

The session was concluded by the reading of a paper by H. I. Harriman, general manager of the Connecticut River Power Company.

This paper described the hydroelectric developments of this company. The details of the station and line equipment were gone into, and the special conditions which had to be met with described. The variable flow in this river necessitated the installation of a third turbo-generator, which operates during times of high water that results in a reduction of the available head. By this provision the plant can be operated under full load in even flood conditions. Mr. Harriman also described details relating to the distribution system, and the general operation of the entire installation.

In the discussion a number of questions were asked in regard to the provisions for non-interference with telephone circuits. Mr. Prince went into the details of this matter at some length, and spoke also of the difficulties that had to be overcome in the securing of the private right-of-way for the transmission line. The transmission extends to the city of Worcester, sixty-six miles from the plant. In case of exceedingly low water the company operates an auxiliary steam plant.

On Friday afternoon a short business session was held, at which the constitution and by-laws that had been previously drawn up for the New England section were formally adopted. After the adoption of a number of resolutions of thanks for courtesies extended to the association in connection with its meetings, the convention finally adjourned.

ENTERTAINMENT FEATURES.

One of the leading adjuncts to the success of any convention of this order is the provision of entertainment features, particularly for the ladies accompanying the members. In this regard the New England section achieved marked success by the pleasing variety and excellent arrangements that were made in this connection. During the sessions of the convention on both Thursday and Friday mornings the ladies of the party were the guests of the Portsmouth Board of Trade, which had provided an automobile trip.

On Thursday afternoon practically all the members and guests attendant on the convention had a very pleasant trip around the bay on the steamer "Alice Howard." A number of stops were made at the Navy Yard, where is located the historic conference chamber where the treaty of peace between Japan and Russia had been signed, also at the power plant of the Rockingham County Light and Power Company at Portsmouth. On Thursday evening a banquet was held in the dining room of the Hotel Wentworth. This was attended by the entire convention party, including members, ladies and guests. After partaking of a sumptuous menu in the beautifully decorated dining room, a number of excellent after-dinner addresses were made by L. D. Gibbs, of Boston, who was toastmaster; J. S. Whittaker, of Portsmouth; H. T. Sands, of Malden; C. B. Burleigh, of Boston; T. N. Brady, of New Britain, and A. J. Campbell, of New London, Conn.

Fishing By Telephone.

Consul Louis Goldschmidt, of Nantes, France, reports that a use for the telephone in fishing has been discovered in Norway. A microphone for amplifying submarine sounds is shut up in a thin, watertight steel box and connected by metallic wires with a telephone receiver on the fishing boat. It is stated that with this apparatus the fisherman is always informed of the approach of fish.

Autumn Meeting of the American Physical Society.

The autumn meeting of the American Physical Society will be held this year at Princeton University, on Saturday, October 23. This date has been chosen on account of the opening of the new Palmer Physical Laboratory, which will take place on the evening of October 22.

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International Association of Municipal Electricians.

The fourteenth annual convention of the International Association of Municipal Electricians was called to order by President J. B. Yeakle at 11 a. m., Tuesday, September 14, in the convention hall of Young's Pier, Atlantic City, N. J. Mayor Stoy of Atlantic City delivered an address of welcome in which he emphasized the fact that the safety of lives and property was dependent on the members, and that too much care and attention could not be devoted to their duties. He extended the freedom of the city to all.

Past-President Thompson, of Richmond, Va., responded on behalf of the association. He stated that it was not the first time the association had met in Atlantic City, and the previous welcome was still fresh in the minds of the members. At that time, the wonderful invention of wireless telegraphy was in its infancy, and a lecture and demonstration had attracted wide attention. He thanked the mayor for the courtesy extended.

The afternoon session was opened by the president's annual address. In it he gave a brief review of the past, stating how at first the membership had been composed of fire-alarm and police-telegraph superintendents. Now the field has broadened and all classes of municipal electrical engineers have been included. The municipal electrician of today was not developed from the ranks of fire-alarm or police-telegraph superintendents. He must have a broader education and be capable of attacking much more complicated problems. The underground systems and the troubles incident thereto were quoted as illustrations. He advocated the training of men for all such positions and spoke of the advantages gained by joining such associations as this and the American Institute of Electrical Engineers.

Following the president's address C. S. Downs, of Altoona, Pa., read a paper on "Grounding of Alternating-Current Secondaries." In this he alluded to the great danger arising from failure of insulation on primary and secondary circuits. This could be avoided by grounding, and he presented a resolution that the association demand the enactment of legislation requiring the grounding of alternating-current secondaries, when the voltage between the earth and any part of the secondary system will not exceed 250 volts. In the discussion which followed several instances were cited where loss of life, which could have been avoided, had resulted from the non-grounding of such circuits. There was shown a disposition to object to the rather arbitrary resolution demanding legislation on the subject, but it was carried. Mr. Downs asked that the association suggest some form of standard ground, but no action was taken on this suggestion.

At the opening of the third session, that of Wednesday morning, Messrs. Kingsbury, Ellett and Diehl were appointed a committee on exhibits. R. A. Smith, of Norfolk, Va., read a paper on "The National Electrical Code, its Proper Interpretation and Bearing on Fire Alarms and Police-Signal Work." In it the author said he wished to bring out the rules which are so often misunderstood, especially those bearing on fire and police-signal work. The fire and police central-office wiring is often far from being what is required by the Code, suitable fireproof racks and cabinets being conspicuous by their absence, high-tension and sneak-current protectors not being provided and often bell wiring being used to carry heavy voltage currents. The source of energy often being a trolley circuit, with its voltage above 500 and one side grounded, it could be easily seen that the protection necessary must be of the best. The proper observance and interpetation of this and other rules of the Code, relating to line work and lighting in general, are of vast importance to the city electrician, and he will find constant study and application necessary in order to keep abreast of the march of improvements and changes in the rules.

Discussing the paper, several members spoke of the occasional conflict of district and national committees' rules. On motion the president was empowered to appoint a committee to represent the association at the meetings of the National Conference on Electrical Rules. The president appointed the following committee on nominations: H. C. Bundy, Jas. Warren, J. C. Simpson, C. E. George, R. A. Smith.

A paper on the "Progress of the Fire-Alarm Telegraph" was next read by S. W. Manning, of St. Paul. Mr. Manning's paper reviewed the development of this branch of telegraphy since the adaptation of the Morse telegraph in 1851. Among the improvements noted were the Gamewell fire-alarm box and its development into the perfect non-interfering succession fire-alarm box; the use of storage batteries; the non-interfering firm-alarm repeater; use of the punching register, and improvements in the central office, such as the manual transmitter, the automatic line tester and reliable protection from abnormal potentials.

This paper was followed by H. C. Bundy, of Syracuse, with a paper on "Telephones and Their General Use for Fire Alarms." He decried the use of telephones for sending alarms, as many serious mistakes had happened by misunderstanding the names of streets. If it was to be adopted, a specially trained operator should be stationed at the exchange to take care of such calls. In the ensuing discussion the majority of members agreed with Mr. Bundy.

The Wednesday afternoon session was opened by a demonstration of a device for determining when insulation is growing weak. After this, A. C. Farrand, of Atlantic City, read a paper on "Locating Faults on Fire and Police-Telegraph Lines without Opening the Circuits." He illustrated and described his plan at length. This was commented upon favorably by the members.

W. S. Devlin, of New Castle, Pa., then read a paper on "The Construction of Underground Conduits." In this paper he briefly described the three types of conduit construction most commonly used, the cement duct, the clay duct and the fiber duct. He also pointed out the precautions to be observed in all conduit construction and the proper order of procedure. Manhole construction was also briefly commented on. In the discussion of Mr. Devlin's paper some advocated oval manholes without corners to avoid bending of cable. Various means of protecting cables were also suggested.

At the Thursday morning session a paper by Mr. Dixon on "Storage Batteries for Fire and Police Telegraphs" was read and demonstrated by means of a model battery. In the discussion the matter of covers for the jars was brought up and some favored glass in preference to porcelain for this purpose. A query was submitted whether in a system with a great number of circuits where the power plant is a storage battery, it would be considered entirely safe to have one battery of large capacity supplying currents to all circuits through a busbar, with a duplicate set in reserve, one set charging while the other is in use. The impression seemed to be that the scheme would not be good practice. In the general remarks that followed a member stated that the membership of the association represented

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cities having a combined population of 25,000,000 persons.

At the session on Thursday afternoon the nominating committee presented the following names, and upon motion the secretary was instructed to cast a ballot for these gentlemen for the various offices to be filled for the ensuing year:

President, J. B. Yeakle, Baltimore, Md.

First vice-president, J. S. Craig, Toronto, Can.

Second vice-president, A. L. Kittredge, New Haven, Conn.

Third vice-president, A. J. Bell, New Rochelle, N. Y.

Fourth vice-president, C. S. McCosker, Mobile, Ala.

Secretary, F. P. Foster, Corning, N. Y.

Treasurer, C. E. Diehl, Harrisburg, Pa.

Executive committee: S. W. Manning, St. Paul; H. G. Kennedy, Rochester; H. L. Kingsbury, Baltimore; O. M. Schaefer, Trenton, N. J.; A. L. Pierce, Wallingford, Conn.; J. C. Simpson, Washington, D. C.; Clarence George, Houston, Tex.; C. S. Downs, Altoona, Pa.; J. W. Kelly, Camden, N. J.

Finance committee: T. C. O'Hearn, Cambridge, Mass.; J. Murphy, Cleveland, O., and O. F. Gall.

A motion was passed recommending that at future conventions the association hold four days' sessions instead of three. Also that the executive committee prepare a certificate of membership. Rochester, N. Y., was chosen as the place for the next convention, the date to be set by the executive committee.

The local chairman, A. C. Farr, of Atlantic City, deserves great credit for the very interesting programme of entertainment provided for the members and friends. The ladies especially were well provided for.

Among the municipal electricians and their guests who were registered as in attendance at the convention were the following, the name of the city being given first:

Albany, N. Y.—J. J. Gillespie.
Allentown, Pa.—P. J. Beisel.
Altoona, Pa.—Mr. and Mrs. C. S. Downs.
Atlantic City, N. J.—Mr. and Mrs. A. C. Farrand, Mr. and Mrs. E. M. Plummer, Mr. and Mrs. E. E. Ingalls, Mr. and Mrs. T. W. Garey, W. L. Crook, D. B. Scarborough, Horace Turner.
Baltimore, Md.—Mr. and Mrs. J. B. Yeakle and Miss Yeakle, Mr. and Mrs. Lester Kingsbury.
Bayonne, N. J.—Mr. and Mrs. R. Arbuckle and Master Arbuckle.
Boonton, N. J.—James Dixon.
Bridgeport, Conn.—F. O. Snow.
Bristol, Pa.—Frank T. Chambers.
Bristol, R. I.—P. F. Lyons.
Cambridge, Mass.—Timothy C. O'Hearn.
Camden, N. J.—John W. Kelly.
Charleston, S. C.—Ion Simmons.
Chicago, Ill.—Frank F. Stover, H. D. Fargo, H. B. McMeal.
Cleveland, O.—Jerry Murphy.
Corning, N. Y.—Mr. and Mrs. Frank P. Foster, John W. McCarthy.
Detroit, Mich.—Louis Gascoigne.
Elizabeth, N. J.—M. L. Van Houten.
Elmira, N. Y.—Mr. and Mrs. Will Y. Ellett.
Erie, Pa.—William Crane.
Harrisburg, Pa.—Mr. and Mrs. C. E. Diehl and Miss Diehl.
Houston, Tex.—Mr. and Mrs. Clarence R. George.
Louisville, Ky.—C. F. Gall, P. G. Kern.
Meadville, Pa.—A. J. Balizet.
Minneapolis, Minn.—Z. F. Morrison.
Mobile, Ala.—C. S. McCosker.
Morristown, N. J.—Mr. and Mrs. Frank E. Pierson.
Mount Vernon, N. Y.—W. H. Flandreau.
New Castle, Pa.—Wm. S. Devlin.
New Haven, Conn.—Mr. and Mrs. James Grant.
New Rochelle, N. Y.—Mr. and Mrs. A. J. Bell.
Newark, N. J.—Mr. and Mrs. Adam Bosch and Miss Bosch.
New York, N. Y.—E. C. Chamberlain, Albert H. Cross, A. P. Eckert, J. A. Nerr, C. C. Johnson, James F. Kinder, Romaine Mace, H. G. Madden, T. Mahoney, George T. Manson, Joseph Maxwell, P. W. Miller, W. J. Minidell, Mr. and Mrs. Frederick Pearce, Charles W. Price, Harry E. Reid, Richard C. Smith, V. Stanley, Mr. and Mrs. J. B. Taltavall and Miss Taltavall, G. L. Wiley.
Norfolk, Va.—R. A. Smith, L. R. Willis.
Ottawa, Can.—Miss Garfoot, G. F. Macdonald.
Peoria, Ill.—W. E. Wolgamott.
Philadelphia, Pa.—F. W. Hall, T. E. Hughes, Charles S. Redding, Julius Bernstein.
Pittsburg, Pa.—Elmer Loomis, G. L. Ross, J. M. Spader.
Reading, Pa.—W. C. Matthias.
Richmond, Va.—W. H. Thompson and Master Thompson.
Rochester, N. Y.—H. G. Kennedy, Joseph B. Smith.
Scranton, Pa.—Mr. and Mrs. W. J. Neare.
St. Louis, Mo.—Robert Quain.
St. Paul, Minn.—Mr. and Mrs. Stanley W. Manning.
Syracuse, N. Y.—M. J. Myers.
Toledo, O.—Mr. and Mrs. Mark Winchester.
Toronto, Ont.—Mr. and Mrs. John S. Craig.
Trenton, N. J.—Mr. and Mrs. O. M. Schaefer.
Wallingford, Conn.—Mr. and Mrs. A. L. Pierce.
Washington, D. C.—Mr. and Mrs. James Simpson.
Watertown, N. Y.—H. C. Bundy.
York, Pa.—Warren E. Fastnacht.

Among the manufacturers exhibiting appliances and other companies represented at the convention were the following:

Queen & Company, Inc., Philadelphia, exhibiting testing instruments of various kinds.
Safety Insulated Wire and Cable Company, New York, represented by R. C. Wilson, R. C. Smith and W. H. Rodier.
National District Telegraph Company, New York, represented by C. C. Johnson, superintendent, and Joseph Maxwell, assistant superintendent.
Frederick Pearce Company, New York, represented by Frederick Pearce; the company's fire-alarm and police instruments were exhibited.
Gould Storage Battery Company, New York, represented by H. N. Powers.
National India Rubber Company, Bristol, R. I., represented by Avery P. Eckert, New York.
Okonite Company, New York, represented by George T. Manson and Romaine Mace.
Westinghouse Storage Battery Company, Boonton, N. J., represented by A. C. Farrand, chief engineer, of Atlantic City.
Walker Company, Philadelphia, represented by Mr. Boyd; the company exhibited its non-replaceable fuse device.
Kerite Insulated Wire and Cable Company, New York, represented by P. W. Miller.
Standard Underground Cable Company, Pittsburg, represented by George L. Wiley of New York.
Sprague Electric Company, New York, represented by F. W. Hall and Joseph A. Herr of Philadelphia; exhibited flexible-steel conduit and armored-steel conductors.
Gamewell Fire-Alarm Telegraph Company, New York; exhibited its fire-alarm system.
Leeds & Northrup Company, Philadelphia; exhibited electrical measuring instruments and distributed some interesting literature.
Duplex Metals Company, New York, represented by H. G. Madden, who gave out a dainty little souvenir.

Bond Issue Authorized.

The Albany & Southern Railroad Company has been authorized by the New York Public Service Commission to issue $1,375,000 of its common capital stock and $2,029,000 of its preferred stock to acquire the property of the Albany & Hudson Railroad Company, recently reorganized as the Albany & Southern.

Fulton Exhibit at the Engineering Societies Building.

The Hudson-Fulton celebration is essentially a recognition of the explorer and the engineer. To show the relation of the latter to the celebration, models of the Clermont and other early steamboats, through the courtesy of the Smithsonian Institution, are now on exhibition at the rooms of the American Society of Mechanical Engineers in the Engineering Societies Building, 29 West Thirty-ninth Street, New York city. The exhibit includes the Clermont; the Phoenix, built by John Stevens; and one of John Fitch's early types. Original drawings by Fulton, an oil portrait of Fulton painted by himself, Fulton's dining table, oil portraits and bronze bust of John Ericsson, models of the Monitor, all owned by the society, and Ericsson's personal exhibit at the Centennial Exposition, are also exhibited. Through the courtesy of the Hamburg-American line, a beautiful model of the Deutschland is also shown for the sake of comparison with latter-day practice.

The exhibition will be open to the public every week day from 9 a. m. to 5 p. m.

International Traction Company.

A report recently current regarding the International Traction Company is to the effect that there is soon to be a readjustment of the company's affairs, while another has it that back dividends are to be paid shortly. It seems reasonably certain that some action will be taken in the near future, and it looks more like a readjustment than an immediate payment of back dividends.

The International Traction Company owns the entire capital stock of the International Railway Company, which operates the street railways in Buffalo and vicinity, and dividends, if paid, must come from the operation of the railway. The traction company has now due and unpaid accumulated dividends for the past ten years, amounting to a total of forty per cent. For the past three years earnings have shown a steady decline, last year surpassing the others in this respect; and this, in spite of the fact that operating expenses were considerably reduced.

At the end of the last fiscal year earnings of the railway company applicable for dividends amounted to only $172,291, comparing with $312,260 for the year before, a decrease of $139,959. This is not enough to meet the preferred dividends of four per cent on $5,000,000 of preferred stock to the proprietary company.

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RISE OF GENERATOR CAPACITY.

BY ALTON D. ADAMS.

Great changes have taken place in the capacity and types of electric generators in central stations during the past score of years, and their full scope is hard to appreciate without the figures before us. Such figures are best understood when coupled with the facts as to methods of driving, kinds and amounts of loads, and extensions of service areas.

A typical record of the changes of generators in the electrical supply system of one of our great cities is here presented, and a diagram has been prepared to bring out the relation of time to their types, capacities and voltages.

The base line of this diagram scales a score of years from 1888 to 1908 inclusive, and the ordinates measure the capacity in kilowatts of the generators connected to the electrical supply system. Each horizontal line parallel with the base indicates the generator capacity of the system in kilowatts from the earlier year at which the line starts to the date of the next increase of capacity, and all of these horizontal lines are carried through to 1908, so that the amount and type of each increment of capacity added up to any given year may be seen at a glance. Horizontal lines starting in 1888 and 1890 are not carried through to 1908, however, because the generators of these years were of the same type as those added in 1891.

The electrical supply system under consideration had, in 1888, two generating stations where city water was used in the boilers and was the only supply available for condensing, though all of the steam engines were of the high-speed, simple, non-condensing type. Neither of these two stations had connection with railway or water transportation, and both coal and ashes had to be carted. In 1892, a third station, located on navigable water, began to operate and before 1902 a fourth station, also located on the water front, was added to the system. Since 1891, all additions to the generator capacity have been made at the two stations on tide-water, and after 1893 the use of the first two stations for generating purposes rapidly diminished.

In 1888 the electrical supply system had sixteen bi-polar dynamos of fifty kilowatts each and six of 37.5 kilowatts each, at 125 volts, in its two generating stations, and by 1891 the number of dynamos had increased to sixty-four of fifty kilowatts each and of the above type. These sixty-four, 125-volt dynamos were connected to a three-wire system of underground distribution in the heart of the city, and this system was almost if not entirely within a one-half-mile radius of at least one of the generating stations. Besides more than 44,000 commercial incandescent lamps and some 197 arc lamps, this electric system had motors of more than 2,000 horsepower aggregate capacity, connected in 1891.

When the first two generating stations reached the aggregate capacity of 3,200 kilowatts, in 1891, it was evident that further extensions at these sites would be unwise, because the advantage of short radii of distribution was more than offset by the cartage of fuel and lack of condensing water. The location of the third station on the water front was more than one mile from same points in the distributing system and thus created a demand for somewhat higher voltage. Accordingly the first eight generators of 200 kilowatts each, installed at this third station by 1893, had their capacity based on 160 instead of 125 volts, so that more pressure would be available for loss in the feeders.

Constantly increasing load made it desirable to give the capacity of 200 kilowatts to each of these eight generators so as to keep down the number of units, and they were direct-connected in pairs to their engines, instead of being belted like the sixty-four fifty-kilowatt dynamos. The steam engines for the 200-kilowatt generators were vertical and triple expansion, and operated condensing.

A desire to keep down the number of units is seen again in the selection of the 400-kilowatt generators, added by 1896, and their voltage was put at 160 for the reason just given. The 160-volt generators, like the bi-polar 125-volt machines, were connected in pairs to the three-wire system, the connection between each pair being joined to the third wire.

By 1900, further capacity was added, and the policy of doubling the size of the largest previous units gave generators of 800 kilowatts each in this year. With these two 800-kilowatt machines the generator capacity of 1900 reached 7,200 kilowatts, instead of the 3,200 kilowatts in 1891, and out of the total of forty-four generators the increase of 4,000 kilowatts was made with twelve. The 400-kilowatt units of 1896 and the 800-kilowatt units of 1900 were direct-connected to vertical compound engines, leaving the triple-expansion engines of 1893 the only examples of that type in the system.

A point of novelty in the 800-kilowatt generators was their design for 300 volts each, so as to be connected only to the two outside wires of the three-wire system, the smaller machines of 125 to 160 volts being more than sufficient to balance the loads on the opposite sides of the third wire. It was not necessary that the voltage of 300 be double the 160 volts of the earlier generators at the third station, for boosters were brought into use to supply extra pressure to compensate for the loss in feeders to some extent.

The year 1901 found a generator of 1,600 kilowatts at 300 volts added to the equipment of the station on the water front, thus doubling the capacity of the largest existing unit for the fourth time in eight years, and the following year saw a duplicate of this 1,600 kilowatt generator installed. A feature of interest in the 1,600-kilowatt generator of 1902 is its double current character which is obtained by the use of a commutator connected at one end of the armature and six collector rings at the other. This generator has thirty poles and operates at 100 revolutions per minute, so that it will deliver six-phase alternating current of twenty-five cycles per second, besides direct current. While this alternating current is generated at only 184 volts, it

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can obviously be raised by transformers to any pressure desired for transmission to substations or elsewhere.

Prior to 1902 the electrical supply system under consideration had been operated entirely on the three-wire direct-current plan with the great bulk of its connected load located within one mile of the water-front station where most of the energy was generated. By means of two-wire tie lines at about 300 volts between this main generating plant and a number of substations, supplemented by storage batteries and boosters, besides the ordinary feeders into the network of service mains, the voltage of supply was regulated.

The connected load of this three-wire electrical supply system, in 1901, included above 2,300 commercial arc lamps, nearly 248,000 incandescent lamps and motors aggregating more than 10,600 horsepower. Compared with the connected load of 1891, the number of arc lamps was more than eleven times as great, and the number of incandescent lamps and the total horsepower of motors were more than five times as great, respectively, in 1901.

During this same decade, the number of generators in the system, at 125 to 300 volts each, increased from sixty-four with an aggregate capacity of 3,200 kilowatts, in 1891, to seventy-eight with an aggregate capacity of 10,400 kilowatts, in 1901, and in this later year nearly all the energy was generated with the fourteen generators of 7,200 kilowatts total capacity that had been added since 1891. In this last statement of capacity is included the 1,600-kilowatt generator of 1902, as it was actually in position before the close of 1901. While the increase of load just named was going on, the generators had thus risen to more than three times their total capacity in 1891.

Before the beginning of this three-wire system in 1888, several electric stations using arc dynamos had been started in the same city, two of them in 1883, and after the consolidation of these several arc stations, about 1886, incandescent lighting with alternating current and the operation of motors with direct current at about 500 volts were extensively developed by the combined plants. In 1901, the system that had been built up from the combination of stations that were devoted mainly to arc lighting had a connected load of 4,913 arc lamps, of which 2,885 were devoted to street lighting, more than 112,000 commercial incandescent lamps, and electric motors of above 5,400 total horsepower. While this load was confined to the city limits, it was distributed over a much wider area than that of the three-wire system above described.

By 1901 most of the equipment of the early arc-lighting stations had been discarded, and the arc, alternating current and power loads just mentioned were operated in the main from a station on the water front containing six alternators, each rated at 1,500 kilowatts and 2,250 volts, sixty-cycle and three-phase. These alternators were direct-connected to an equal number of vertical compound condensing engines.

The time had now come for the combination of the above competing systems, and this was brought about in 1902, so that the six 1,500-kilowatt alternators, representing 9,000 kilowatts, were added to the 10,400 kilowatts of direct-current generating capacity in the three-wire system, during that year, giving a total capacity of approximately 19,000 kilowatts.

In 1903, two more of the 1,600-kilowatt, 300-volt, direct-current generators were added to the equipment of the three-wire station on the water front, and up to the present year no further machines of this type have come into the system.

Before 1905, an important change was made in the type of generators by the erection of two steam-turbine units at the station where the 1,500-kilowatt alternators were located. Each of these turbine units was rated at 5,000 kilowatts and 6,900 volts, at sixty cycles per second, three-phase. At about this time the system supplied by the above generating stations had been extended to a number of cities and towns that were in some cases twenty to twenty-five miles distant, and the voltage of the turbine generators was applied directly to the transmission lines. Current from these turbine units is also reduced by transformers to about 2,300 volts for distribution about the city.

The year 1907 saw a third turbine generator like each of the other two added to the system.

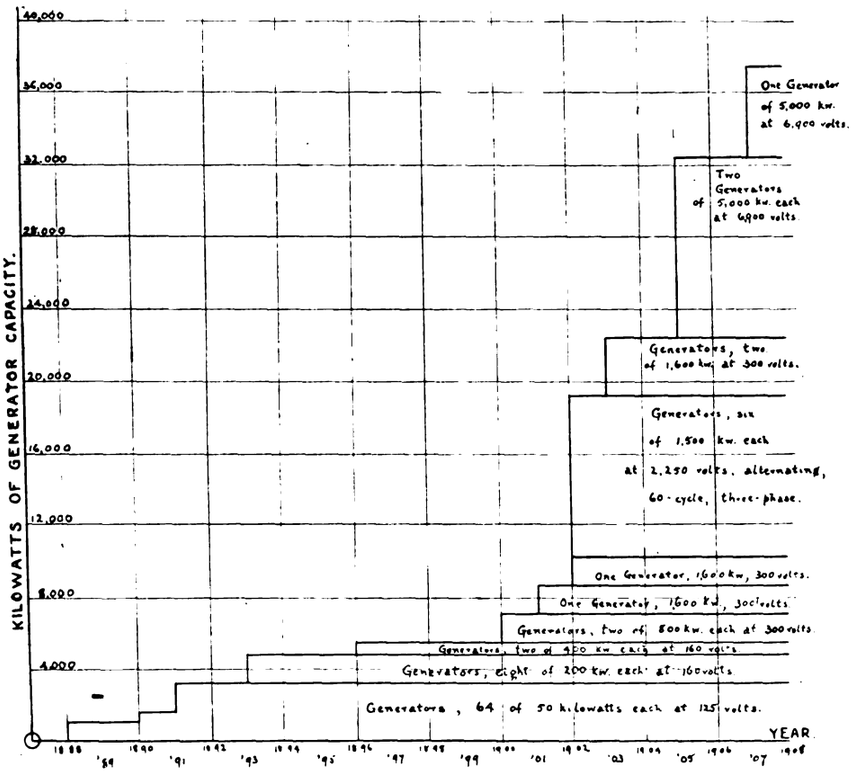

CHART SHOWING TOTAL GENERATOR CAPACITIES IN DIFFERENT YEARS.

Since 1882, the generating capacity of all the electrical supply systems in the city under consideration has grown from nothing to fully 39,400 kilowatts, and its radius of service has extended to more than twenty-five miles.

Development of Waterpower in India.

According to Consul-General William H. Michael, at Calcutta, the government of India has given out the information that there are at present no laws relating to the development and use of waterpower in India, and that the terms of licenses granted for waterpower schemes for the generation of electrical energy are settled by special agreement between the applicant and the government.

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A New Battery-Charging Device.

A dispatch from San Jose, Cal., states that Prof. John J. Montgomery, of Santa Clara, has invented a device by means of which storage batteries can be charged with the common low-voltage currents used in residences. The invention is more particularly useful for users of automobiles and power boats driven by electricity, but is almost a necessity for all users of storage batteries.

Owners of electric automobiles are at present forced to seek a garage which possesses a mercury rectifier, which costs something like $200. It is, moreover, very delicate, and the expansion of the globe under the influence of its own heat often breaks the glass, rendering it useless. Hence, few garages have rectifiers.

Professor Montgomery's apparatus may be attached to an electric-lighting wire anywhere at night, and in the morning the car will be ready for use. The charging current may be turned on whenever the car is not in use, insuring plenty of power for every emergency.

Professor Montgomery is instructor of electrical engineering at Santa Clara College and was experimenting with wireless telegraph and telephone apparatus in the college laboratories when he discovered the value of a portion of the instrument for recharging batteries.

American Waterpowers.

Two papers on waterpowers, prepared for the report of the National Conservation Commission, by W. M. Steuart and M. O. Leighton, of the United States Geological Survey, give statistics as to the total amount of waterpower in the United States, developed and undeveloped. More than five-and-one-third million horsepower has been developed, the average per wheel being about 100 horsepower. There are ten powers of more than 40,000 horsepower, six of more than 60,000 and three of 100,000 or more. Pennsylvania has the greatest number—3,721—and New York is next, with 3,148.

A conservative estimate of the undeveloped power is that, if all practicable storage sites were utilized and the water properly applied, there might be established eventually a total installation of at least 200,000,000 horsepower. The region offering the greatest possibilities of waterpower development is the northern Pacific, which includes the basin of the Columbia and Sacramento rivers, the possibilities there being about one-third of those of the whole United States.

New York Subway Situation.

With the semi-weekly conferences between Theodore P. Shonts, president of the Interborough Rapid Transit Company, and William R. Willcox, chairman of the Public Service Commission, a new era of subway construction is to be looked for. Although the conferences have not up to the present time developed any definite points, it is generally understood that the two parties are coming to a better understanding of the situation, and such phrases as "inadequate facilities" and "monopolistic control" will shortly be a thing of the past.

The commission has laid out and proposes to advertise for bids at once for the Broadway-Lexington Avenue system, which it is estimated will cost over $100,000,000. This line will provide for a four-track subway running from the Battery to the Harlem River and through the Bronx in two branches, one going northeasterly to Pelham Bay Park and the other through Jerome Avenue to Woodlawn Cemetery. It also provides for a new cross-town subway through Canal Street from the Hudson River to the East River. This line will connect with a line going over the Manhattan Bridge and with the Fourth Avenue, Brooklyn, subway in Brooklyn, and includes the construction of the Brooklyn loop and the two branches of the Fourth Avenue subway to Fort Hamilton and Coney Island.

Copper Output in Japan.

In the last ten years Japan's output of copper has increased from 27,560 pounds to 44,751,722 pounds a year, giving the country fourth rank as a producer of the metal. This is due to an open-minded policy regarding new mining methods and a national willingness to learn.

There are about 200 copper mines on the Japanese islands, the Ashio, in the province of Shimotsake, being the largest and the Kosaka, in the Rikuchu district, coming second. Both of these mines are now producing about 1,000,000 pounds of fine copper a month, and net their operators close to $4,000,000 a year.

Copper is the most important metallic resource of the Nipponese, and averages a high degree of purity, sometimes reaching 99.96. Only about a quarter of the copper mined is used locally, the balance being exported. Last year $10,627,506 worth was shipped abroad, of which amount $1,654,246 came to this country.

Electrical Sterilization of Drinking Water in Dwellings.

The Felten & Guilleaume-Lahmeyer Company has put on the market a small apparatus for sterilizing drinking water in dwellings by ozone. This may be easily attached to ordinary faucets in houses having an electric-light circuit. The apparatus comprises an electric ozonizer and a sterilizer, in which the water is mixed with the ozone as it leaves the faucet. The ozonizer consists of an aluminum plate and a glass plate covered by a metallic envelope. Electric discharges produced by the aid of a small transformer pass between these plates. The transformer and ozonizer are contained in a case conveniently connected to the ground in order to eliminate all possible danger.

When the faucet is opened a membrane makes a contact and automatically puts the transformer in circuit, and discharges are produced between the plates, which transform the oxygen of the air into ozone. The ozone is aspirated through a thin metal pipe and led into a mixing tube screwed to the water faucet. This tube contains a small pump and several compartments formed by perforated metal pieces arranged over each other. The water jet thus divides itself into numerous thin threads and drops and is mixed with the ozone. This intimate mixture is necessary in order to obtain an immediate sterilization of the liquid, as its contact with the ozone is of very short duration. The mixing tube offers the advantage that even with low water pressure a sufficient quantity of ozone is aspirated to destroy the germs. In a test it was found that a pressure of one kilogramme per square centimetre was sufficient to reduce the number of germs present in one cubic centimetre of water from 43,000 to eleven units. Current is consumed only when the faucet is opened, and the consumption is less than that of an ordinary sixteen-candlepower incandescent electric lamp.—*Translated and abstracted from L'Electricien (Paris), August 14.*

Telephone Concession Canceled.

President Gomez has issued a decree canceling the contract of the Havana Telephone Company for the exclusive right in Havana and empowering the Cuban Telephone Company to establish local and long-distance systems in accordance with the telephone law passed by Congress July 18.

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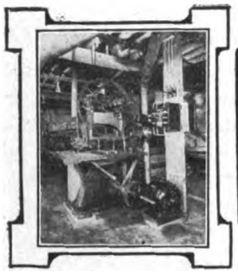

Industrial Power

Electric Hoist for Handling Pier Cars.

The coal shipping terminal at Sewall's Point, near Norfolk, Va., of the newly opened Virginia Railway just completed by the late H. H. Rogers at a cost of over $40,000,000, is operated in a novel manner and contains some very interesting machinery, including a 1,000-horsepower electric hoist designed and built for the purpose by the Lidgerwood Manufacturing Company, of New York.

The pier has a capacity for handling thirty cars per hour, 15,000 tons in ten hours, or 4,500,000 tons per year of 300 working days. Eventually the plan calls for four such piers giving a capacity of 18,000,000 tons a year.

The design of the pier and equipment was adopted so as to enable the company to bring coal from the West Virginia mines to the seaboard in gondola cars which could be utilized for taking other freight westward. As the road expects eventually to have fully 5,000 cars in service, this was considered particularly desirable.

The terminal designed will not only be the largest for its purpose in the world, but it is the most up-to-date in every part of its equipment.

The coal pier is 1,860 feet long from the shore line to the main harbor channel. It is of steel resting on concrete foundations. The operation of getting the coal from the cars that bring it to tidewater into the hoppers from which vessels are loading comprises two operations. In the first of these the cars are allowed to drift down by gravity, one by one, to where a barney car can pick them up and carry them up a short incline to a dumper. The dumper picks each car up bodily, tips it to an angle of sixty-five degrees, so that the coal is poured out into a special conveyor car of larger capacity, to be taken to the hoppers on the pier. There are ten of these special conveyor cars. They are the largest cars of this kind ever constructed. They are of steel, with hopper bottoms, and each carries a load of 100,000 pounds of coal. As soon as each conveyor car is loaded it is taken in hand by the big hoist, which, by means of a barney car, draws it up a twenty-five per cent incline at a speed of 480 feet per minute. The incline is 480 feet long. It takes forty-five seconds for the car to reach the knuckle. Once upon the higher level, and past the "knuckle" of the incline, the conveyor car proceeds down the pier under its own power, as each is equipped with electric motors, taking power from an overhead trolley and controlled from a cab at one end. The big hoist returns the barney car to the foot of the incline, ready for another trip, at a speed of 555 feet per minute. The round trip is made in one minute and twenty seconds. The conveyor car goes to hoppers along the pier and deposits its load wherever it is wanted. The hopper bottoms of the cars are operated by compressed air supplied by automatic electric compressors on the cars.

Having deposited its load, the conveyor car returns by a kickback system, which allows it to drift back down a gentle incline to the bottom of the slope, to be refilled.

The Lidgerwood hoist which hauls the conveyor cars up the incline is an interesting part of the equipment. Each conveyor car with its load weighs nearly 200,000 pounds. The hoist complete, with its two motors, weighs 180,000 pounds. But one motor is used at a time, the other being provided to insure constant operation. The motors are of the General Electric Company's make, of the M. P. C. class. They are rated at 550 horsepower and actually develop 980 horsepower each. The drum is eighty-four inches in diameter, with a face of forty-two-and-one-half inches in width, grooved for a one-and-three-fourths-inch main cable and having also a section with a seven-inch face grooved for a three-fourths-inch tail rope, for insuring the return of the barney car. The flanges are six inches in depth. The main gear wheel is 116 inches in diameter. The pinion which drives this is nineteen inches in diameter. The intermediate gear wheel is seventy-two inches in diameter, with a twenty-one-inch pinion. All the gears are of cast steel, with machine-cut teeth.

The drum has powerful post brakes. These are controlled by a solenoid through the medium of compressed air. The compressed air is supplied at a pressure of thirty pounds to the inch by an electric compressor, which forms part of the hoist outfit. The general operation of the hoist is controlled by an operator near the barney-car pit, 350 feet distant from the hoist, but the hoist is provided with an emergency limit switch, which makes certain that it cannot overwind in either direction. The brake is set by a weight of 1,400 pounds acting upon a suitable lever. When the current is turned on, the solenoid acts and, by means of the compressed air, releases the brake. When the current is cut off, whether by intention or accident, the solenoid drops, releases the air, and the weight brings the brake into action, holding the load safely in any position.

Southern Expansion.

Memphis, Tenn., advices state that the Southern Steel Company has awarded to the Northern Electric Company a contract for electrical equipment costing $75,000, and it is said a contract has been given for electrical cars valued at $65,000. Various small contracts for necessities to extend the open-hearth mill at Gadsden are being given without any let up. The company has purchased from the Tennessee Coal, Iron and Railroad Company all the coke output of that company in Tennessee for the remainder of this year. This coke is for consumption at Gadsden.

From China.

The Canton authorities have completed arrangements for the purchase of the Canton electric-light works, which they will soon take over from the China Light and Power Company. The purchase price is $553,520 gold, one-half of which will be furnished by the provincial government, the other half by Chinese individuals.

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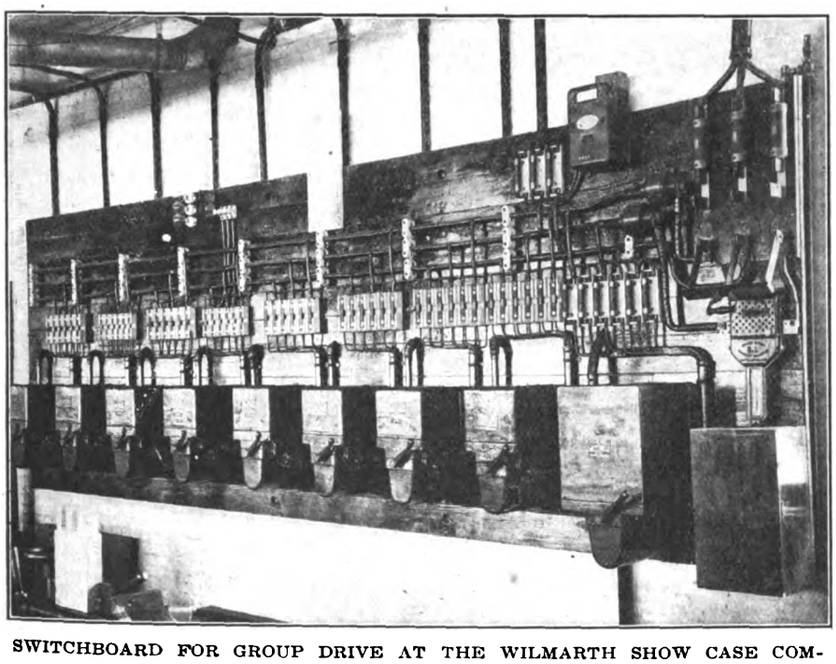
Switchboard for Group Electric Drive.

The accompanying illustration shows the controlling switchboard in the factory of the Wilmarth Show Case Company, Grand Rapids, Mich., where the woodworking machinery is operated by means of group, instead of individual, electric drive. In this installation all the controllers for the factory are grouped and labeled, so that motors for different sets of machines can be started and stopped from one point. Thanks are due to F. M. Feiker, technical editor of *Factory*, a well-known magazine of organization and equipment, published in Chicago, for the loan of the photograph from which the illustrative halftone was made.



SWITCHBOARD FOR GROUP DRIVE AT THE WILMARTH SHOW CASE COMPANY'S WORKS, GRAND RAPIDS, MICH.

A New Electric Meter.

Professor Fery, of Paris, has recently constructed an apparatus based on the same principle as the Aron pendulum meter, but differing greatly therefrom in mechanical arrangement. The meter comprises two independent sets of apparatus which may be installed at a distance from one another. One of them is a system of two equal pendulums, in which the mass consists of a curved solenoid with iron core. In the center of each core there is a polarized block which is exposed to the effect of a fixed coil opposite the lowest point of the pendulum's travel through which the current flows. The movable solenoids of both pendulums are polarized by a weak current derived from the tension. The peculiarity of the pendulums is that they do not come in contact with any fixed parts. To make this possible a small auxiliary pendulum is used, the mass of which consists of a bare copper ring, into the end of which the end of the pendulum-solenoid projects.

The oscillation of the auxiliary pendulum is displaced by one-quarter period with respect to that of the main pendulum; when the latter therefore reaches its maximum velocity, the auxiliary pendulum is at its minimum. The contacts are made by the auxiliary pendulum. One of them serves for sending a weak current into one of the fixed coils surrounding the other pole of the solenoid, during one-half oscillation. The other contact sends a current through the second part of the apparatus, the function of which is the addition of the oscillations of the pendulums.

The adding device is a rotary-field motor, the stator of which carries four poles. Two of its coils are traversed by the interrupted currents of one pendulum, and the other two coils by those of the other pendulum. When the current impulses of one pendulum arrive before those of the other, the rotor will revolve, say, from left to right. The rotation will change in direction, when the second pendulum has come up to and passed the first. The rotor revolves only by the small angle necessary for advancing the integrating clockwork by one tooth by means of a thumb and lever. The pendulums start automatically as soon as current flows through the apparatus; they require very little energy for maintaining their movement and there is no friction between moving parts.—*Abstracted from Elektrotechnischer Anzeiger (Berlin), August 25, 1909.*

Protecting Underground Cables in Collieries.

In a letter to the editor, which was printed in a recent number of *Electrical Engineering*, of London, Eng., Walter Winsborough, electrical engineer to the Douglas Bank Colliery Company, of Wigan, Lancashire, gives a brief account of the methods he adopts in his practice for protecting the underground cables, and of the earthing arrangements.

The system of which Mr. Winsborough has charge, is three-phase, 500 volts, forty cycles, and is used for haulage, pumping and lighting. There are two sets of bitumen cables running from the power house down the shaft in casing to the top mine to cast-iron distribution boxes at pit eye "main intake," and from there by three-core bitumen cables armored, taped and braided to the motors, etc., which are all situated in the main intake roads.

The cables are run behind the bar legs, which is a splendid protection from falls of roof, etc., and suspended by leather suspenders. These cables have been installed nearly six years, and have never been crushed by falls of roof or runs of tubs. At all junction and distribution boxes there is a cast-iron dividing box clamped to the armor on either side, and these are connected to the boxes and across to the opposite dividing box, which makes the earthing continuous right through the whole system. All motors, switches, fuse boxes and transformers are earthed to the armoring, which is connected to an earth plate in the main lodge at pit bottom, and also to the pump stocks which run into the canal at pit bank.

There is also on the main switchboard a leakage indicator, which is always in circuit, and readings are taken and booked every hour. Mr. Winsborough frequently makes a test from the far end of each system which immediately indicates at the power house. He has also an electrician on duty at each mine during the day, and one during the night, who have to make a daily report. The whole of the installation is inspected once a week either by himself or one of his assistants, and he thinks that if proper precautions were taken to see that the earthing arrangements were good, and adequate inspection made, there would be very few accidents.

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EXTENDED USES OF ELECTRICITY ON BOARD SHIP.[1]—I.

BY JOHN MCLAREN.

The application of electricity on board ship for driving auxiliary machinery has made rapid headway of late years. The time has now arrived for engineers to consider the most economical means of applying electric power for ship works, as at present there is great scope for such.

My proposal is to drive all the auxiliary machinery by the use of electric motors, which will include all cargo winches and hoists, capstans and ventilating machinery, etc., and also to use electricity for the heating of cabins and passages and for cooking. In the engine department, to drive all pumping, refrigerating, lifting machinery and fans by the use of electric motors, and, of course, to use electricity for lighting the ship throughout.

Since my last paper, which was read before the Institute of Marine Engineers, I have had several communications from superintendents and shipowners on the subject; some were good enough to place their ships at my disposal for the purpose of studying the efficiency of the steam auxiliary plant at present in use. It was rather difficult to get at exact figures, but I came to the conclusion that the efficiency of the steam plant was about twenty-five per cent. Owing to the great length of present-day ships and the great increase of auxiliary machinery, the steam has greater distances to travel, with very great loss by radiation. The back pressure of the exhaust steam traveling away to the engine room to get to the winch condenser is very considerable. Several ships had no winch condenser; the exhaust from the winches went up the waste steam pipe up alongside the funnel; the water that gathered at the bottom of the waste steam pipe was carried away by a small drain pipe to a tank, which was pumped out by a donkey feed pump. This would, of course, reduce the efficiency very considerably. I suppose that there was not more than ten per cent to twenty per cent of the water returned to the boiler.

A suction gas installation is one of the cheapest and most efficient forms of power known at the present day, which is suitable for commercial purposes. I am also convinced that it is admirably suitable for auxiliary purposes on board ship, used in conjunction with electricity. I will not say that it would be cheaper on the first cost, horsepower for horsepower, but for equal powers, the working of the plant would show a very considerable reduction in working costs, and in a very short time it would more than pay for any increased capital outlay.

In the system which I propose all these losses, or at least the greater part of them, would be obviated. A moderate estimate of the efficiency of a plant, such as I propose to describe, is eighty per cent; this figure, compared with the efficiency figure for the steam plant, which is, as I mentioned before, a maximum of twenty-five per cent, gives a difference in favor of the suction electrical plant of no less than fifty-five per cent.

In my last paper I was asked what objection I had to the continuous-current motor, which is at present largely used for ship's work; my answer to this is, that it is my object to eliminate all rubbed surfaces, such as brush and commutators, from the exposed motors, which are well known to be a source of trouble and expense. This can be only got over by the use of alternating current for driving the motors, as the induction motor has no commutator proper, and possesses many advantages over the continuous-current motor, chiefly in simplicity and freedom from breakdown.

The size of plant required for driving the auxiliaries on board ship, of course, depends upon the size of the ship and the number of machines required, but for the purpose of this paper I suggest a 300-horsepower unit.

The approximate weight of the producer plant for 300 horsepower would be nineteen long tons, and the space occupied about fourteen feet by ten feet six inches by sixteen feet.

The type of gas engine I would suggest as being the most suitable one for our purpose would be a vertical multiple cylinder, single-acting type, operating on the Otto or four-cycle principle. The speed of the engine should be about 200 revolutions per minute to suit the alternator. A good governor should be fitted. The whole system can be started up in thirty minutes from cold, and from fifteen minutes when standing by, which means under banked fires. A silencer would be fitted to the exhaust pipe.

In a moderate-sized vessel I suggest that alternating currents should be generated at 250 volts and carried direct to the machinery. Such generator should be built upon the flywheel of the gas engine and generate three-phase currents at 250 volts at a periodicity of, say, fifty cycles. In a three-phase generator the armature has three distinct windings which generate three separate currents, the waves of which succeed each other at regular intervals. By connecting the inner ends of these circuits together only three cables are needed to convey this current, but for our purpose I propose to bring out a fourth wire from this point, called the neutral wire, the purpose of which I will explain later on.

The armature of our generator should be of the stationary type with a revolving-field magnet built up on the rim of the gas-engine flywheel. A small direct-current exciter should be coupled direct to the armature shaft. The exciting current is carried to the revolving field of the alternator by means of two small slip rings with metal brushes. It is worthy of note that this is the only electrical rubbing device on the alternator, and it is of such a simple nature that it could give hardly any trouble. The armature would be wound to give three-phase currents and would be star-connected.

In selecting the type of alternator, care should be taken to see that the wave form of the currents is sinusoidal; this would eliminate those heavy potential stresses which are often a source of danger to the windings and power circuits of alternators which have a peaked wave form. This danger is a very serious one in those machines generating high pressures.

The generator should have a liberal factor of safety to enable it to deal with large overloads, should the necessity arise, without danger of breakdown.

The switchboard should be placed in some convenient position in the gas-engine room and would be divided into two distinct sections, one for the power circuits and one for the lighting circuits. The power section would be divided into panels for each power circuit, and from each panel would be led a three-core cable, suitably insulated and armored, to supply current to each distributing center. From this point smaller mains would be taken off to each alternating-current motor in the group controlled from this center.

For the smaller motors I propose to use the induction type of motor, commonly known as the squirrel-cage motor. This type of motor would have no commutator or collecting device of any kind, and would be switched straight on to the mains when starting.

[To be continued.]

[1] Abstract of paper read on September 4, in the Congress Hall, Imperial Exhibition, Shepherd's Bush, London.

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ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

THE ABSOLUTE STANDARD OF LIGHT.

BY JOSEPH H. HART.

Quite recently there has been a series of interesting discussions and suggestions in the various scientific societies and technical journals in regard to the necessity of an absolute standard of light and the difficulties involved in its conception and practical development. The recent suggestion of Dr. C. P. Steinmetz in regard to the use of three mercury lamps providing for a combination of three colors, equally distributed in position in the spectrum, and furnishing an approximate standard for white light, and one capable of easy and absolute measurement and variation, presents essentially the practical viewpoint in regard to the desirability of a standard and is derived from theoretical conditions as well. This conception is worthy of serious consideration, although it practically eliminates as a working condition the physiological effect and any attempt at its measurement or standardization, although the production of light is obviously intended primarily for its utilization as a physiological effect. The fact that a standard is at once available, involving to a certain extent this physiological condition, is seldom, if ever, considered and is due primarily to the fact that conditions which formerly limited its applicability have been largely eliminated or reduced and that even in practical work it presents some special advantages, although its operating conditions are such that it might often require the utilization of a secondary standard, capable of ready comparison, however, with this primary unit.

Reference is made more especially to the utilization of sunlight as a primary standard for lighting measurement. From a physiological, as well as physical, viewpoint, the problem can be considered essentially complicated, due to the following facts: Visible light consists of a practically infinite number of the different wave-lengths in the ether or from an electrical viewpoint can be recorded as a complex combination of alternating wave-forms of a large number of frequencies. The precise effect of each individual wave-length separately and in conjunction with the other types upon the retina of the eye is unknown. Again, the shape, or the wave-form, of the individual alternating frequency is practically unknown and may be different for each individual frequency for best physiological conditions or effects. Thus, the average wave-form in alternating-current work for transformers, induction coils, spark gaps, etc., can be readily determined by means of the oscillograph, but until some such instrument is developed for the recording of frequencies equivalent to that of light, this phase of the problem will always remain unknown.

However, the fact remains that the complexity of different wave-forms and frequencies existing in the radiation from the sun can be recorded as approximately constant under normal conditions, if unaffected by terrestrial phenomena, and are probably best suited for physiological effect upon the eye, since undoubtedly this latter organ was evolved in response to the conditions existing in this form of radiation. While this latter statement may be questoned and the fact assumed that much more efficient conditions in regard to physiological effect may be attained by artificial conditions, in the lack of absolute knowledge in this regard and the total impossibility, under present conditions, of ever obtaining the same, it is reasonable to suppose that the ordinary light source can be regarded as eminently satisfactory from this viewpoint and variations from it undesirable.

Now, white light as obtained from the sun is made up of a large number of combinations of different spectrum colors in small units, and we have no reason to believe that the physiological effect of white light, as made up of the combination of three primary colors in stated proportions, is identical in any respect with that of the natural agent. Under the circumstances it does not seem best to totally disregard the physiological effect and the conditions best suited for this by jumping to a physical standard absolutely, especially when the latter is attained only as the result of considerable complexity of mechanism and the standardization of conditions of production.

Nobody questions the stability of the gravitational standard, and yet this effect may be varying considerably in absolute value, but its stability is generally accepted as unquestioned, and this is so largely on account of its known stability or constancy under all terrestrial conditions. There probably exists no question in regard to the uniformity of the character of the radiation from the sun as existing in empty space in the vicinity of the earth. The fact that this radiation is largely affected on its entrance to terrestrial regions with marked variation due to presence of moisture and other impurities in the atmosphere, temperature conditions, etc., is responsible for its repudiation as a light standard, coupled with the fact that it is not always available, even in altered form, for commercial operations and utilization. Undoubtedly, however, the problems involved in the attaining of some standard form of solar radiation are at least on a parity with those involved in its artificial production, and the conditions involved in its variation with time, when known influencing conditions are practically eliminated, are much less. Above all other considerations the situation of this standard in regard to the physiological conditions involved in the problem is such that it should attain pre-eminence over other competing standards.

The question of wave-form and its variation with the different frequencies would not be so pronounced. The possibility of green light, or the individual mercury-vapor line, existing with a peaked wave-form, and possibly the red wave-length with a flat-topped curve, would not possess significance from a physiological viewpoint, since the existence of conditions in molecular aggregates which would give the multitudinous series of current frequencies common in

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natural light would probably be very analogous to that existing in natural conditions for the standard and the possibility of excessive variation in wave-form would be comparatively remote. The use of such a standard would put the difficulties of new radiation and the possibility of inefficiency in optical effect where they belong, since the assumption would obviously exist that individual frequency, such as is often produced in the spectrum line of a given source in artificial conditions, would possess equally anomalous wave-forms and hence present marked limitations in physiological efficiency from this condition as well.

The difficulties of obtaining standard radiation from the solar source are not near as great as those formerly existing. The entire solar spectrum has been mapped from time to time with energy recorders such as the bolometers, or radiation micrometers, based upon thermo-electric or resistance principles with a high degree of delicacy and considerable sensibility. Marked variation exists in the solar spectrum, due to the presence of the atmosphere, the water-vapor in the same in variable amounts, and dust and other impurities in the air. The absorption due to water-vapor could readily be reduced to some kind of standard conditions by the use of a prism of water or water-vapor, for absorption, of variable thickness, the extent of its insertion being determined by a fixed known effect upon an energy recorder in a given absorption line. The variable effect of the atmosphere could be investigated in the same way and approximatly standard conditions reached with a fairly high degree of reliability. The presence of dust and other impurities and temperature variations alone present the important difficulties. The quantity of dust in the atmosphere and the size and amount of this can be determined under some conditions by optical means with a fairly high degree of accuracy, and the variation in the effect on radiation of different amounts of this could be readily studied by means of the various energy recorders or measurers in the different parts of the spectrum.

When it is considered further that the artificial standard generally used possesses a comparatively low illuminating power, that its variation with time and other conditions is quite large, and that the accuracy of comparison with ordinary commercial lamps is also small, the desirability of having a standard of even equal permanence and of considerably higher intrinsic intensity is at once apparent. In the light of modern developments the ordinary candlepower standard, such as the amyl acetate flame, or some other laboratory unit, is obviously too small as a commercial standard for practical purposes. It is somewhat analogous to the measurement of large distances with an inch rule and the utilization of solar radiation at once eliminates this difficulty. Again, when its relation to the physiological factor becomes thoroughly evident the advantages of its utilization become more pronounced. The plea is not made especially for this solar radiation to be used as a device for actual operative conditions. Its development and utilization as an absolute primary standard is dependent only upon conditions and investigations which have scarcely been started as yet in the physical laboratory, but undoubtedly presents possibilities for future development and standardization not present in types capable of development along any of the lines hitherto considered.

Convention of Car-Lighting Engineers.

The next annual meeting of the Association of Car-Lighting Engineers will be held at the Hotel La Salle, Chicago, Ill., on October 4 to 7. A programme of papers of unusual interest will be presented.

Besides the technical matters to be discussed, there will be brought up the question of changing the scope of the association. It has been thought advisable to change the name to "Association of Railway Electrical Engineers," as most of the electrical engineers and chief electricians of the railroads have to do with general railway electrical work and are not confined to car-lighting alone, although at the time of the organization of the association this subject was the one of most engrossing character.

Big Japanese Electrical Manufacturing Company.

Interests in close touch with the Mitsui family, the leading financial persons of Japan, announce that one of the possibilities of the near future is the incorporation of the General Electric Company of this country and the Shibaura Engineering Company, of Tokio, for the joint manufacturing and selling of electrical goods in Japan. The present Japanese demands for electrical machinery amount to about $3,000,000 per year, and this has largely been taken care of by the Shibaura company.

Special Street-Lighting Projects.

Copying the successful establishment of a "White Way" in quite a number of our enterprising American cities, a number of similar projects have been set on foot for several of the prominent streets in other cities that do not wish to be outdone. Among these are the spectacular illumination of Fifth Avenue, New York city; the brilliant lighting of Jersey City streets; special tungsten street lamps in the business district of Dayton, Ohio; additional street lighting in Youngstown, Ohio; flaming-arc lamp installation on the Seventh Street Bridge in Pittsburg, Pa. Most of these projects have been practically completed through the concerted action of adjoining merchants and other property owners, who realize that the cry for "more light" can be turned to good advantage in making an attractive street that will draw the public to inspecting their window displays by night as well as by day.

First Year's Results of the British Patent Act.

According to Consul Horace Lee Washington, of Liverpool, the result of the first year's working of the British patents act has been that $2,500,000 of foreign capital has been introduced into the United Kingdom.

The value of the land and premises acquired by foreign firms which have decided to carry on their manufactures in Great Britain in order to maintain patent rights is estimated at $635,000. The expenditure for buildings was $880,000; plant and machinery, $895,000, making a total of $2,410,000. The annual local assessment on these new enterprises is estimated at $135,692. In addition, it is stated that a great many firms have arranged for English factories to manufacture their patented articles on a royalty basis. A specialist in factory property stated in a recently published interview that his firm was in negotiation with several German and American firms for the acquisition of sites and factories, principally in the chemical, engineering, electrical, and rubber-making trades, and that a French firm of pottery makers is seeking a site for a model village. He estimated that twenty-four firms are already manufacturing in Great Britain as a result of the act.

According to British Consul Thomas Erkine, of Chicago and St. Louis, at least half a dozen Chicago firms have established factories in England.

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Convention of the Illuminating Engineering Society.

What will undoubtedly be the largest and from all indications the most successful convention in the history of the Illuminating Engineering Society will be held on September 27, 28 and 29, in the Engineering Societies Building, 25 to 33 West Thirty-ninth Street, New York city. The committee in charge has prepared a very elaborate programme, not only of technical papers but also for the entertainment of the members and guests. It can be safely said that the meeting of the society at the same time as the Hudson-Fulton Celebration offers to non-resident members and guests an opportunity which seldom comes. The arrangements for the entertainments, as well as for the exhibition of historical and most modern lighting appliances, were already described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 11, on page 460.

The programme for the technical sessions as finally prepared, but subject to slight alterations, is as follows:

Monday, September 27, 10:30 a. m.—Address of welcome, T. C. Martin; response, Dr. Louis Bell; president's address, W. H. Gartley; report of committee on nomenclature and standards, Dr. Alexander C. Humphreys, chairman; report of sub-committee on units of flux, Dr. Clayton H. Sharp, chairman.

Monday, 2:30 p. m.—Papers: "The Ethics of Illuminating Engineering," E. L. Elliott; "The Work of Dr. Carl Auer von Welsbach in the Field of Artificial Illumination," George S. Barrows; "The Progress of Illuminating Engineering in Europe," H. Thurston Owens; "Diffusing Mediums," A. J. Marshall; "Facilities at Cornell University for a Study of the Fundamentals of Illuminating Engineering," F. K. Richtmyer.

Tuesday, September 28, 10:30 a. m.—Papers: "The Photometrical Laboratory of the United Gas Improvement Company," Charles O. Bond; "The Physical Laboratory of the National Electric Lamp Association," Dr. Edward P. Hyde; "Notes on Chemical Luminescence of Rare Earths," Dr. Angelo Simonini; "The Light of the Firefly," Drs. H. E. Ives and W. W. Coblentz.

Tuesday, 8:15 p. m.—Lecture: "The Physiological Effects of Radiation," Dr. Charles P. Steinmetz.

Wednesday, September 29, 10:30 a. m.—Papers: "Allowable Amplitudes and Frequencies of Voltage Fluctuations in Incandescent-Lamp Work," Dr. H. E. Ives; "The Principles of Shades and Reflectors," Dr. Louis Bell; "Standard Relations of Light Distribution," A. J. Sweet.

Wednesday, 2:30 p. m.—Papers: "The Problem of Heterochronous Photometry," Preston S. Millar; "Some Results Obtained Through Illuminometry," Norman Macbeth; "Factory Lighting," L. B. Marks; "Operating Efficiencies of Some Commercial Installations of Lighting Systems," A. L. Eustice; "Tests of Moore Tube Installation—New York Post Office," Dr. E. P. Hyde and J. E. Woodwell; "Tests of a Moore Tube," Dr. C. H. Sharp and P. S. Millar.

Arrangements are being completed at the time of this writing for the members of the Chicago Section of the Illuminating Engineering Society, and their friends who wish to attend the convention to leave Chicago on the Michigan Central limited train at 5 p. m. Saturday, September 25, arriving at Niagara Falls (Victoria Park Station) at 6 o'clock next morning. A special stop is to be made at this station and the party will proceed to the new Clifton House. After breakfast a trip via Belt Line to Lewiston has been arranged, returning via Gorge Route to the starting point. After luncheon will come visits to the power plants, Prospect Park and Goat Island. Leaving Niagara Falls at 9:25 p. m., the train is due to arrive at Grand Central Station, New York, 9:03 a. m. Monday.

The stop at Niagara Falls will undoubtedly be enjoyed by all, as well as the trip along the Hudson River early Monday morning. The round-trip fare is $26.85, limited to thirty days for the return. The sleeper rate is $5 from Chicago to New York.

Tickets should be secured from F. E. Deal, city passenger agent, Michigan Central Railway, 236 Clark Street, Chicago. The secretary of the Chicago Section is T. R. Beebe, 155 Michigan Avenue, Chicago.

In New South Wales.

The North Bulli Colliery, New South Wales, Australia, has installed an electric-generating plant and a gas producer to operate it. Electrical development is making good progress here.

Experiments have recently been made in Belgium with wireless in communicating with balloons. The latter recorded signals from the Eiffel Tower with ease.

A CONCRETE CASE OF TUNGSTEN ECONOMY.

BY W. R. BONHAM.

The Park Building, at Pittsburg, Pa., which is fifteen stories high and contains over 400 offices, was until recently lighted by carbon incandescent lamps. Due to the unsatisfactory lighting by these lamps and to the competition of newer and more up-to-date buildings, it was decided to equip the building with tungsten lamps.

The interior decorations of the building were painted a deep sea-green color, which resulted in the general illumination being exceedingly inadequate and of a gloomy, eye-fatiguing nature.

Under the direction of the engineer, the interior was repainted a light buff color, which added to the cheerfulness of the offices and to the efficiency of the lighting.

The general illumination was calculated for an average intensity of light of three foot-candles. The following table,[1] as given by the engineer, shows the lighting in detail for offices and corridors and also a summary for the entire building, both with the old system of carbon lamps and the new installation using tungsten lamps:

	Old System, Carbon Lamps.	New System, Tungsten Lamps.
OFFICES.		
Number of floors	15	15
Brackets (or ceiling outlets) per floor	117	52
Lamps per bracket	2	1
Total lamps for brackets.	3,510	780
Watts per lamp	56	100
Total watts for fixtures	196,560	78,000
Desk lights (approximate).	400	200
Watts per lamp	56	25
Total watts for desk lights.	22,400	5,000
Total watts for offices	218,960	83,000
CORRIDORS.		
Brackets per floor	9	9
Watts per bracket (32-C. P. lamp)	112	40
Total watts for brackets..	15,120	5,400
Elevator domes	15	15
Total watts for elevator domes (eight 16-C. P. lamps for each)	6,720	3,000
ENTIRE BUILDING.		
Watts for offices	218,960	83,000
Watts for corridors	21,840	8,400
Totals watts for building.	240,800	91,400
Watts saved by using tungsten lamps		240,800
		91,400
		149,400

This shows a saving when all of the lights are burning of 149.4 kilowatts. Figuring the current on the basis of two cents per kilowatt-hour and the cost of the lamps on a $1,600 contract in each case, the average life being considered to be 800 hours for both carbon and tungsten lamps, shows a saving of $2.99 per hour for the latter when all of the lamps are burning.

The net saving is shown by the following cost analysis:

COST OF CARBON LAMPS.	
Offices, 3,510 at 16 cents	$561.60
Desks, 400 at 16 cents	64.00
Corridors, 135 at 24 cents	32.40
Elevator domes, 120 at 16 cents	19.20
Total	$677.20

[1] *General Electric Review.*

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COST OF TUNGSTEN LAMPS.

Offices, 780 at $1.25	$982.80
Desks, 200 at 61 cents	122.00
Corridors, 135 at 72 cents	97.20
Elevator domes, 120 at 61 cents	73.20
Total	$1,275.20

TOTAL COST FOR 800 HOURS' BURNING.
Current Figured at 2 Cents per Kilowatt-Hour.

Carbon.	
Cost of lamps	$ 677.20
Cost of current	3,852.80
Total	$4,530.00
Tungsten.	
Cost of lamps	$1,275.20
Cost of current	1,462.40
Total	$2,737.60
Net saving in 800 hours by using tungsten instead of carbon	4,530.00 2,737.60
	$1,792.40

Should the current cost 3 cents instead of 2 cents per kilowatt-hour, the savings every 800 hours would be:

149.4 K. W. × 800 hours × 1 cent	$1,195.20 1,792.40
Total	$2,987.60

These data are believed to be conservative. They show very forcibly the economy of using tungsten lamps.

Metal-Filament Lamps in England.

S. L. Pearce, city electrical engineer of Manchester, Eng., publishes the following figures, taken at random from the books of the Manchester Corporation, Electricity Department, showing the saving in electric-light bills effected by the use of metal-filament lamps:

	Cost in 1907.	1908.
Large warehouse, Portland Street	$3,035	$1,600
Public institution, Princess Street	1,650	1,120
Shop, Victoria Street	95	55
Shop (tobacconist), Stretford Road	70	40
Shop (hosier), Stretford Road	85	50
Warehouse, Mosley Street	100	45

Dangers From Electric Shock.

It is practically impossible, says *The Engineering and Mining Journal,* to provide any rule that will determine whether an electric shock will prove of no consequence, or whether the result will be fatal. Much depends on the individual. It is advisable, therefore, to provide so far as practicable, that no shock shall be received at all. Under normal conditions, all voltages above 150 direct current or 125 alternating current, may be dangerous to life. One authority suggests that in order to provide against the failure of any insulating covering, this latter medium in turn should be enclosed in a metallic sheath which is prevented from becoming alive by being permanently and effectively connected to earth.

The first section of the electric funicular railway from Le Fayet to the summit of Mont Blanc was opened to the public on July 25 as far as the Col de Voza (5,495 feet in height). In the morning the first train carried the local French authorities and engineers to the Col, in the quick time of fifty-six minutes.

The Behavior of Litharge Exposed to Atmospheric Agents.

For some years the Siemens & Halske Company, of Berlin, has employed a special paste consisting of litharge and glycerine for fastening large porcelain insulators used in transmission lines to their iron supports. The paste has been extensively used in Italy, and it was found that after a few years many of the insulators cracked without apparent reason. Gino Galla, of the Royal Engineering School, of Rome, has investigated the phenomenon on behalf of an electric installation firm and has ascertained that under suitable conditions of humidity, litharge is capable of slowly absorbing carbonic anhydride from the air and transforming itself into basic carbonate of lead. Examinations of paste prepared at different dates showed that the proportion of carbonic anhydride increased with the lapse of time. In paste put in use three years before, forty-two per cent had been transformed into basic carbonate of lead. Further experiments showed that litharge, when transformed into basic carbonate of lead, increases considerably in volume, and in this fact the cause for the breaking of the insulators must be sought. In the process of transformation molecular forces are developed, which exert a high pressure on the rigid mass of the insulator and cause its breaking. The damage thus caused to a long transmission line may amount to thousands of lire in a year. The trouble can be prevented by protecting the exposed surface of the paste from the influence of atmospheric agents by an impermeable substance or by a suitable varnish.—*Translated and abstracted from L'Elettricista (Rome), August 1.*

Navy Department Supplies.

The Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., will open bids on the dates given below for the following electrical equipment and supplies. Bidders should without delay make application to the Bureau for copies of the schedules they are interested in, being particularly careful to give the number of each schedule. Copies of the schedules can also be obtained on application to the Navy Pay Office nearest each navy yard.

NAVAL SUPPLIES.

Date of Opening.	Material.	Quantity.	Delivery at Navy Yard.	Schedule No.
October 5, 1909	Magnet wire	1,500 pounds	Puget Sound, Wash.	1671
October 5, 1909	For constructing telephone line between navy yard, Puget Sound, and naval magazine site, Ostrich Bay.		Puget Sound, Wash.	1652
October 5, 1909	Motor-driven lathes	4	Newport, R. I.	1685
October 5, 1909	Motor-driven pumps	2	Washington, D. C.	1683
October 12, 1909	Voltmeters, etc.	Miscellaneous	Mare Island, Cal.	1692

Meeting of Central Electric Accountants' Association.

A conference was held in Indianapolis, September 17, by the members of the Central Electric Accounting Association, President M. W. Glover, of the Ohio Electric Railway, presiding.

The questions discussed at this conference were "The Advantages of Uniform Methods of Accounting" and the "Methods of Computing Car-hours and Car-mileage with Especial Reference to Passenger and Freight Trailer Cars, Non-Revenue Miles, Mileage and Terminal Cities, Blockades and Lost Running Time."

The first subject was discussed by S. C. Rogers, J. D. Maynes and C. E. Thompson. A number of new ideas were brought out and some new methods will be adopted.

The second subject brought out a lengthy discussion participated in by E. D. Gault, L. T. Hixson, E. J. Skehan, Walter Shroyer and M. W. Glover. A committee was appointed to represent the association at the Denver Convention. The next meeting will be held in Dayton, Ohio, December 11.

To Examine Power Company.

At the hearing before the Public Service Commission, Second District, on the application of the Economic Power and Construction Company for authority to continue to supply electricity for light, heat and power purposes, the commission announced that it intended to go into the financial affairs of the company and also its connection with the holding company, the New York Power Securities Company. The former company received a charter from the New York State Legislature of 1893 to enter upon any street or public place without securing the previous consent of the local authorities. Its charter powers were declared unconstitutional by the Court of Appeals in May last, but the company had entered the field at Geneva in June, 1908, and has expended approximately $10,000 on a plant. It now asks the right to proceed, as it has secured a franchise from the Geneva Common Council.

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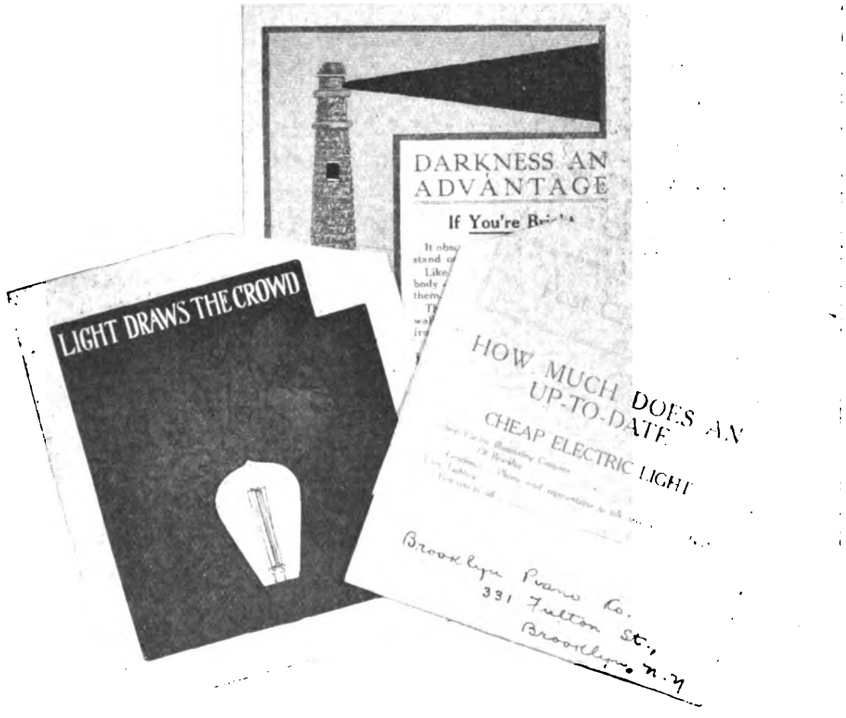
ELECTRICAL Advertising *and* Selling

Follow-Up System of Advertising.

The use of electricity has become so much of a necessity, that, in spite of the recent curtailments enforced in the many branches of business, the sales from many cities and districts were little affected. With this evidence of the stability of the industry, and with new experiments demonstrating the limitless possibilities of electricity, it is more than ever incumbent on central stations to exploit the field to the fullest extent, and this can only be done successfully by advertising.



CARDS USED BY THE BROOKLYN EDISON COMPANY IN A TUNGSTEN STORE-LIGHTING CAMPAIGN. RETURN CARDS ARE PERFORATED FOR CONVENIENCE IN DETACHING.

No one would deny that advertising of some sort is essential to every business; the question is, how to advertise.

Advertising and selling go hand in hand. Every salesman sent out by a central station is a walking advertisement. He carries the message to be delivered and spreads it by word of mouth. But the salesman should not work without the use and aid of advertising literature of some description and, to produce the best results, advertising literature should be planned and distributed with the knowledge and co-operation of the salesman in order to increase the effectiveness of both.

Perhaps the most important point in connection with advertising literature, but one which, unfortunately, is rarely given the consideration due it, is what is commonly called the follow-up system. No advertising can reach the highest degree of success unless it is followed up by something to stimulate the interest that it arouses, and turn inquiries into prospects, and prospects into customers.

The mailing of a single piece of advertising may mean a good customer, if, when the spark of interest is started, it is properly followed up.

A piece of advertising literature coming in through the mail is a good deal like a business caller. If the caller is well dressed, has a distinct individuality, and wears the air of being successful, he receives an entirely different reception from the caller who lacks personality, is slovenly in dress, and whose face wears no smile. So it is with advertising. To create the spark of interest it must first make a good impression.

As an example of the follow-up system as applied to central stations, the tungsten lamp, store-lighting campaign of the Edison Electric Illuminating Company, of Brooklyn, N. Y., may here be referred to.

The advertising matter, eight pieces in all, is distinctly impressive. The letters are written on good quality of stationery. The folders, some of which are shown in the accompanying illustration, are all designed so as to at least attract attention on account of the colors and illustrations used.

A return postal is attached in every case and so folded that all that is necessary for the recipient to do is to fill in the time he desires the salesman to call. This is accomplished by so folding that the address of the recipient is written on the back of the postal in such a position as to also serve as a signature. The least amount of trouble caused for returning the postals the more satisfactory are returns.

Testing Advertising.

One of the fairest methods of testing advertising is to assign a definite sum to cover the advertising during a definite period—then allow time, plenty of time for the results to accrue. The sum to be fixed must rest with each individual. This does not mean that he must work it out blindly or in the dark. Advertising is a definite, periodical selling expense and the sooner the retailer realizes this the sooner will his advertising be placed on a sound and proper basis. Every kind of selling expense, whether it be a salesman's wages, office rent, or advertising expenditure, must come out of the gross profit—that is, out of the difference between cost price and selling price.

When the advertiser puts himself in the reader's place, and gives the information he would want in like circumstances, the results are profitable and sure, even if not conspicuous.

It is not the dollar, but the idea behind the dollar that counts in advertising.

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CENTRAL-STATION ADVERTISING.[1]

BY J. O. LITTLE.

As time passes and electricity becomes more and more a vital force in the activities of the world, the question of how to advertise becomes a more serious one for the central station to solve. The word how is used designedly, because it is not a question of whether or not to advertise, but of how to advertise.

As advertising and selling go hand in hand, the question then resolves itself into what sort of aid and how much aid your selling force should have.

There is a kind of business known as the mail-order business, which depends entirely upon printed advertising matter and eliminates the salesman. This is the one extreme; the other extreme is to depend upon solicitors or salesmen entirely and eliminate printed advertising matter. The business of the central station is of such a nature that it cannot be conducted most advantageously on either plan to the exclusion of the other. It demands both the solicitor and the printed advertising matter, each as an auxiliary to the other.

There are several different mediums of advertising of which the central station can make advantageous use, notably, newspapers, street cars, direct-mailing, house organs, demonstrations and display rooms.

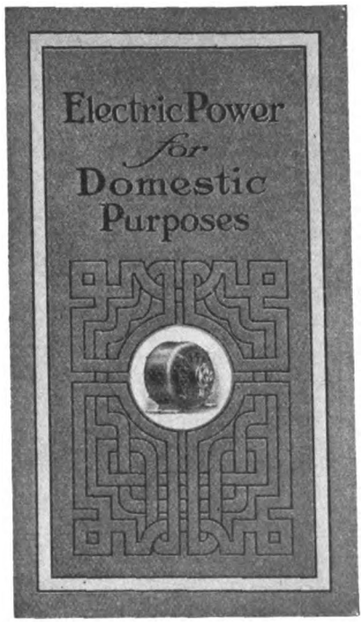
THE DISPLAY ROOM.

Let us consider the display room first. It seems to the writer to be the very foundation of central-station advertising directed toward the introduction of new methods and new apparatus, and the first requisite of the display your own thorough knowledge of what you display. Decide if it is a machine that you consider worth having in your own home, that you feel justified in recommending to your friends and customers. Become enthusiastic about it or send it back to the manufacturer. Never mind the cost. If it happens to be ten dollars more than another machine that you don't consider as good, remember that you are enthusiastic. Enthusiasm on the part of a salesman will overcome a big difference in price. Let your enthusiasm manifest itself when visitors come into the display room, instill it into the solicitors, and make it the feature of your advertising.

People want to see a new device before they buy it, and that is why the display room is important. They also want to see it in operation, therefore everything in the display room should be connected up and ready to put into operation at the turn of the switch. Not to do this is not only poor advertising, but it shows a lack of faith on your part in the economy of electric current.

After the display room is ready, advertise and invite people to come and see it. See to it that they get courteous treatment at the hands of an enthusiastic attendant. Call the visitor's attention to something that she didn't come in to see. A neat booklet to offer her to carry away with her is advertising literature well placed.

The window should by no means be overlooked, for it is exceedingly valuable advertising space. Since electric current is your specialty, you should use a little of it to make a moving display. People whose thoughts are far away from you and electricity will be attracted by a moving window display, and some of them will have their curiosity or interest aroused to the point of coming in to get a better view or to make inquiries. So simple a moving device as a belt made of toweling, covered with short sentences telling of the motor's good features, running slowly through the feed of a sewing machine, has been known to keep a crowd around the window the most of the time. The moving object catches one's eye, and he stops to look. Another stops to see what he is looking at, and the first thing you know there is a crowd.



AN EXAMPLE OF AN ATTRACTIVE BOOKLET.

It goes without saying that the window should be well lighted and the lights kept burning as long as there is anybody on the streets.

THE NEWSPAPER.

Newspaper space is practically the only space in circulating mediums that appeals strongly to the central station. The newspaper is local and so is the business of the central station. The newspaper is read by the majority of citizens that the central station desires to reach. Moreover, the local press has a great influence upon public opinion, and it is noticeable that newspapers in general, however high their ideals may be, have a tendency to deal more kindly with those who buy advertising space than with those who don't Consequently many central stations look upon it as good business to buy space without serious thought as to how they are going to use it. Whatever the motive for buying it may be, it should be made to carry the best copy procurable. To guard against the necessity of using space that you are not fully prepared to use, it is well to make a contract for so many lines or inches, to be used as desired.

Too much thought cannot be given to the preparation of copy. It should represent the best arguments you have, boiled down to the fewest possible words, and put in such simple language that he who runs may read and understand. It is always better to convey a single thought at a time than to try to say everything at once. The advertisement should be made distinctive in appearance from the other advertisements in the paper. It is a good plan, when a style is once set to adhere to it, so that people may learn to recognize your advertisement; then, if they do not stop to read, the advertisement will still have some value, for it will convey to the reader's mind the thought that you are alive and on the job. The advertisement should have a headline designed to catch the eye, or be illustrated. A strong black-and-white cut is generally more effective than a headline, while a weak cut is less effective.

A GOOD SUGGESTION FOR NEWSPAPER OR STREET-CAR ADVERTISING.

[1] Abstract of paper read before the sixth annual convention of the Michigan Electric Association, Detroit, August 19.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

AMERICAN TELEPHONE AND TELEGRAPH.

The American Telephone and Telegraph Company (Associated Operating Companies), not including the long-distance lines, reports for the month of July, 1909, and seven months ended June 30, which compares as follows:

July:	1909.	1908.
Gross earnings	$11,385,590	$10,467,923
Operation, maint. and tax.	8,048,521	7,325,111
Net	$ 3,337,069	$ 3,142,812
Interest	529,472	627,156
Available for dividends	$ 2,807,597	$ 2,515,656
January 1 to July 31:	1909.	1908.
Gross	$77,064,384	$71,804,726
Operation, maint. and tax.	56,068,128	51,649,784
Net	$20,996,256	$20,154,942
Interest	3,997,726	4,529,772
Available for dividends	$16,998,530	$15,625,170

RUTLAND RAILWAY, LIGHT AND POWER.

The report of the Rutland Railway, Light and Power Company for the twelve months ended August 31 compares as follows:

	1909.	1908.
Twelve months gross	$252,876	$254,627
Expenses	132,099	138,137
Twelve months net	$120,777	$ 11,639
Charges and taxes	81,396	.....
Twelve months surplus	$ 39,381	.....

EDISON ELECTRIC OF BOSTON.

The annual report of the Edison Electric Illuminating Company of Boston for the year ended June 30, 1909, compares with previous years as follows:

	1909.	1908.
Gross earnings	$4,111,342	$4,229,239
Expenses and taxes	2,766,029	2,690,419
Net earnings	$1,345,313	$1,538,820
Miscellaneous profits	45,360	38,441
Total net earnings	$1,390,673	$1,577,262
Miscellaneous charges	20,797	125,368
Interest	174,905	54,988
Dividends	1,424,389	1,390,796
Deficit	$ 229,418	$ 6,109
Previous surplus	247,219	241,110
Surplus June 30	$ 17,801	$ 247,219

ECONOMY LIGHT AND POWER.

The Economy Light and Power Company, of Joliet, Ill., has issued its report of coming operations for the year ended April 30, 1909, which compares as follows:

	1909.	1908.
Gross	$310,402	$276,881
Operating expenses	138,739	119,892
Net	$171,663	$156,989
Interest charges	65,324	64,145
Surplus	$106,339	$ 92,844

LONDON UNDERGROUND.

The Associated Companies of the London Underground Electric Railways Company report for the month of July, 1909, which compares as follows:

METROPOLITAN DISTRICT RAILWAY COMPANY.

	1909.	1908.
Gross receipts	£54,494	£48,774
Working expenses	26,160	27,897
Net receipts	£28,334	£20,877

BAKER STREET & WATERLOO RAILWAY COMPANY.

Gross receipts	£15,105	£13,890
Working expenses	6,979	6,971
Net receipts	£ 8,126	£ 6,919

GREAT NORTHERN, PICCADILLY & BROMPTON RAILWAY COMPANY.

Gross receipts	£25,899	£24,095
Working expenses	11,532	12,286
Net receipts	£14,367	£11,809

CHARING CROSS, EUSTON & HAMPSTEAD RAILWAY COMPANY.

Gross receipts	£17,992	£15,048
Working expenses	9,936	9,642
Net receipts	£ 8,056	£ 5,406

LONDON UNITED TRAMWAYS, LTD.

Gross receipts	£31,122	£34,689
Working expenses	20,048	19,537
Net receipts	£11,075	£15,152

JUNIATA WATER POWER.

The Juniata Water and Water Power Company has issued a report covering operations for eleven months ended June 30, 1909, as follows:

Sales of current		$ 52,515
Rents and miscellaneous		1,102
Total earnings		$ 53,617
Expense generating, distributing, etc.		35,048
Net earnings		$ 18,569
Deductions:		
Taxes	$ 4,199	
Interest on notes, mortgages, bonds, etc.	60,608	
		64,807
Deficit for 11 months		$ 46,238
Previous deficit		106,181
Deficit, June 30		$152,419

AMERICAN RAILWAYS COMPANY.

The report of the American Railways Company has been issued for the year ended June 30, 1909. The income account compares as follows:

	1909	1908
Gross income subsidiary companies	$2,865,229	$2,927,436
Income from subsidiary companies	468,662	479,029
Miscellaneous income	58,452	19,728
Total income	$ 527,114	$ 498,757
Deductions:		
General expenses	$ 840	$ 976
Interest funded debt	206,323	155,854
Taxes and miscellaneous	10,062	14,814
Total deductions	$ 216,385	$ 171,645
Net income	310,729	327,112
Dividends paid	305,706	305,706
Surplus	$ 5,023	$ 21,406
Previous surplus	499,680	478,274
Total surplus	$ 504,703	$ 499,680
Depreciation adj., etc.	.....	.....
Surplus January 30	$ 504,703	$ 499,680

President J. J. Sullivan remarks upon the operations of the company in part as follows:

"The total number of passengers carried was 67,556,901, showing a decrease of 1,195,685, or 1.74 per cent. The gross earnings of the subsidiary companies were $2,865,229, a decrease of $62,208 as compared with the previous year. After paying all fixed charges, interest and taxes, the net income was $310,729.

"There was paid in dividends to the stockholders of the company $305,706, leaving a balance of $5,023 to be added to surplus account, making a credit of $504,703 to that fund on June 30, 1909.

"During the first five months of the fiscal year, owing to the general depression in business throughout the country, the gross receipts decreased $104,000, but since December, 1908, there has been a gradual improvement in business shown.

"The fire insurance fund has increased during the year $12,426, making the net assets now on hand $181,306; the accident insurance fund has also increased $3,440, making a credit in that fund of $37,166. The average cost of accident claims during the year amounted to 2.22 per cent of gross receipts.

"Collateral trust gold 5's of 1917 amounting to $1,468,000 have been sold to bankers during the year, and out of a portion of the proceeds $865,000 was paid on account of the floating indebtedness, leaving the floating obligations of the company $250,000."

PHILADELPHIA RAPID TRANSIT COMPANY.

At the annual stockholders' meeting of the Philadelphia Rapid Transit Company, held in Philadelphia, the old board of directors was re-elected. The annual report shows gross earnings of $18,317,529, an increase of $17,449, and net earnings of $8,952,792, an increase of $447,220. There was a deficit after fixed charges of $24,270, against $92,049.

Subjoined is the income account for the year ended June 30, 1909:

	1909	1908
Gross	$18,317,529	$18,300,080
Expenses	9,364,737	9,794,508
Net	$ 8,952,792	$ 8,505,572
Other income	480,462	257,422
Total income	$ 9,433,255	$ 8,762,994
Taxes and licenses	1,464,952	1,394,127
Balance	$ 7,968,303	$ 7,368,867
Fixed charges	8,192,572	7,460,916
Deficit	$ 24,270	$ 92,049

ILLINOIS TRACTION.

The Illinois Traction System has made public its earnings for the first part of this year, showing an increase over the preceding six months. Gross income June, 1909, $341,192; June, 1908, $324,272; six months June, 1909, $2,054,218; six months, 1908, $1,913,517. Operating expenses June, 1909, $210,765; June, 1908, $188,258; six months, 1909, $1,218,242; six months, 1908, $1,138,593. Gross income less operating expenses, June, 1909, $130,427; June, 1908, $136,013; six months, 1909, $836,096; six months, 1908, $774,924. Net income, June, 1909, $126,865; June, 1908, $136,885; six months, 1909, $816,753; six months, 1908, $774,924. V.

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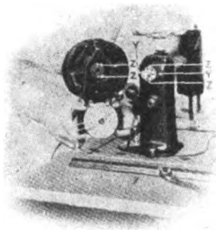
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

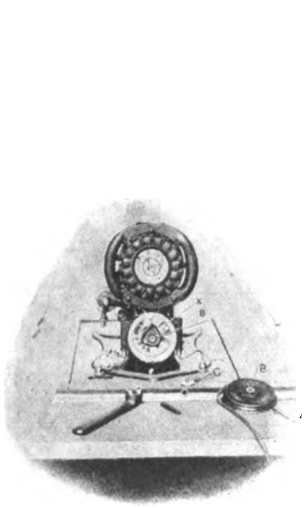
Bissell Sewing-Machine Motors.

In response to a demand for a sewing-machine motor that is adaptable to every type of sewing machine in common use, the Bissell Motor Company, 201-03 St. Clair Building, Toledo, Ohio, has developed sewing-machine motors for both direct-current and alternating-current circuits, which are meeting with general satisfaction and decided approval on the part of central-station companies, which have found it very desirable to exploit them in getting an entering wedge for miscellaneous domestic electric service.

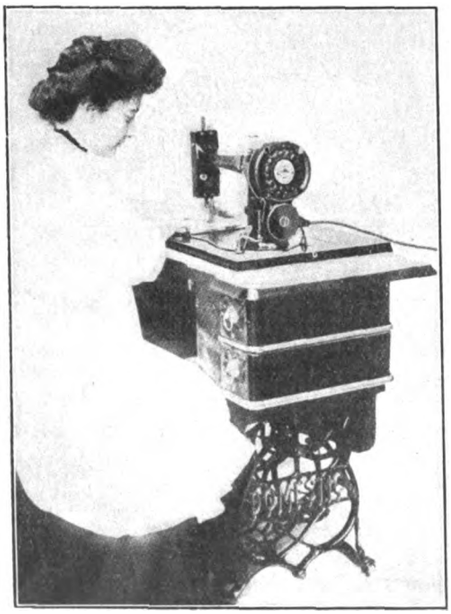
These motors are very compact and are applied directly to the machine itself by removing the hand-wheel and mounting the armature upon the main sewing-machine shaft. The operations of installing the Bissell motors upon the various types of sewing machines are very simple and can be demonstrated by a central-station solicitor quite readily, and with the aid of scarcely any tools. After the hand-wheel is removed from the machine the bobbin-winder is taken off, since each motor is equipped with a bobbin-winder that is attached to it ready for use. The motor is readily slipped into position upon the shaft, as shown in the accompanying illustration, the slots and projections Z and Y of the armature collar fitting into corresponding ones on the end of the shaft. After the motor is locked in place, a leather cord is attached to the treadle of the sewing machine; this cord leads to the rheostat of the controller and enables ready starting and speed control, as well as rapid stopping by means of a set of brakes.



BISSELL MOTOR READY TO BE PUT ON SEWING-MACHINE SHAFT.



SEWING-MACHINE MOTOR. COVER OF CONTROLLER REMOVED.



BISSELL SEWING-MACHINE MOTOR IN USE.

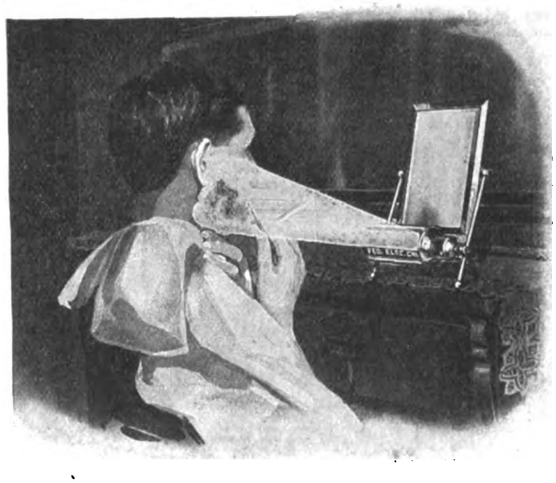
In another view is shown the motor as installed, but with the end covering of the controller removed. The controller is directly below the motor and the pulley A, fitting over its outer face, is the means by which, in connection with the leather cord above referred to, the control is effected. Very little attention is necessary in the operation of these motors, and it is claimed that any housewife can maintain them in perfect order with very little trouble.

The motor can be installed upon any sewing machine without marring it in any way. It can be removed and the machine restored to its original condition. Since the motor is adaptable to any type of machine, the machine itself can easily be changed without requiring another type or size of motor. It is said that solicitors in demonstrating these motors in the home have done so as easily as they could demonstrate the merits of the electric flatiron and in considerably less time.

Electric Shaving and Massage Mirror.

Among the new and useful electrical devices for domestic purposes may be mentioned the electric shaving and massage mirror, which is destined to become popular, particularly with men.

This handy article is a combination of a mirror, electric light and a special reflector. The mirror is six-and-three-quarter inches by nine inches and is mounted in an easel frame with a cylindrical reflector at the base. This reflector is equipped with a tubular incandescent lamp, the rays from which are reflected through a horizontal opening. The reflector is movable and can be adjusted to reflect the light at any desired angle. The mirror is manufactured by the Federal Electric Company, Chicago, Ill.



FEDERAL ELECTRIC SHAVING MIRROR.

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Examples of Individual Motor Drive.

Two good examples of individual motor-driven machinery are shown in the accompanying illustrations.

Fig. 1 shows the application of a direct-current Roth motor to a printer's saw. The saw is of the type used by printers for sawing rules and spacers, and is also sometimes used by electrotypers. For ease in removing the saw it will be noticed that there is a square on the shaft and a swinging piece in the shape of a wrench which goes over the square and locks the shaft, while the nut which holds the saw is turned to loosen it and also for tightening the nut in replacing the saw. Upon releasing the swinging piece, it automatically drops out of the way.

The motor is made in two sizes for this work, one being of one horsepower, running at about 3,500 revolutions per minute, and the other, of one-half horsepower, running at the same speed. The motor is entirely enclosed and dust and dirt-proof, and is rigidly connected through the armature shaft to the saw spindle. Both the machines are mounted on a substantial cast-iron base.

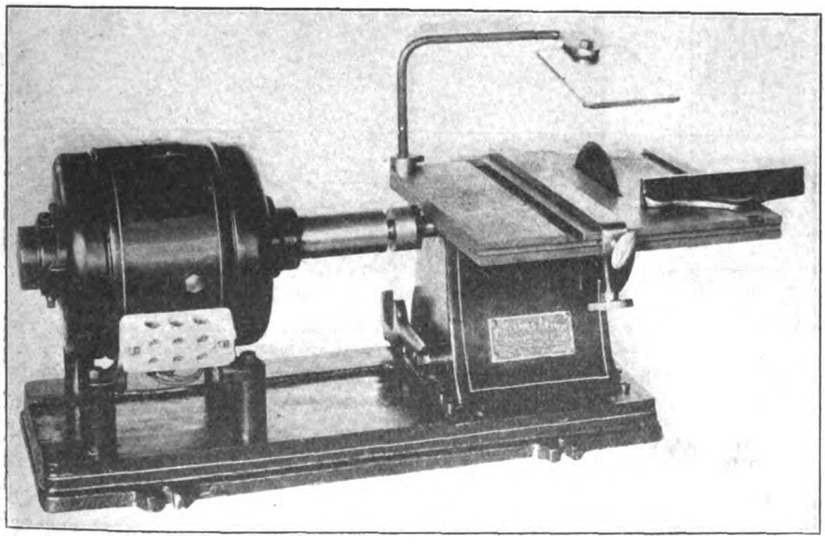

FIG. 1.—MOTOR-DRIVEN PRINTER'S SAW.

A Catlin keyseater, manufactured by the Chattanooga Machinery Company, Chattanooga, Tenn., and having directly connected a Roth adjustable-speed motor, is shown in Fig. 2. The keyseater is of the standard type, excepting that the countershaft has been removed and replaced by a gear wheel, which is driven by a pinion mounted on the motor shaft. The motor is of the interpolar type, is of one-horsepower capacity at any speed varying from about 500 revolutions per minute to 2,500 revolutions per minute, and operates sparklessly at every speed. The speed regulation is obtained through field weakening, and is controlled by a Cutler-Hammer No. 24 starting box. The motor is hung, as from the ceiling, on a bracket extending out from the column of the machine. It was found desirable for the work on which this keyseater is used, to have a device for holding the work while being operated upon. As is shown by the illustration, this holding device was incorporated as a part of and supported by the same bracket which holds the motor.

It is seen from the illustration that the connection is a very compact one, and in its operation the entire outfit has been found to be very satisfactory. The motors for these machines were furnished by Roth Brothers & Company, 1400 West Adams Street, Chicago, Ill.

Steam Turbine in the Textile Industry.

Although steam turbines have been successfully introduced in practically all lines of industry, textile mills were among the first to recognize in them a standard and thoroughly reliable type of prime mover. In New England alone, known everywhere for its many mills, one concern, the Allis-Chalmers Company, has sold thirty-eight steam turbines aggregating in total capacity 51,000 horsepower. The power house of the new Nashawena Mills in New Bedford, will contain two 3,000-kilowatt and one 500-kilowatt steam turbines of their make. The Allis-Chalmers Company has also contracted with the Whitman Mills, at New Bedford, for power-house equipment, including a 2,000-kilowatt steam turbine, and with the Byron-Weston Company, of Dalton, Mass., for one 750-kilowatt steam turbine. The Allis-Chalmers steam turbine is of the horizontal reaction, full annular-flow type.

New Line of Insulated Staples.

A new line of insulated staples has recently been put on the market by James Goldmark, general sales agent of 83 Warren Street, New York. This line should prove of considerable interest to electrical contractors and the electricians who do belt work and interior wiring, as well as telephone companies for all kinds of telephone wiring. One of the advantages the manufacturer claims for this staple is that it is absolutely waterproof and that it also has no break in the insulation beneath the head of the staple, the fiber being put on in such a manner that a double thickness of insulation is insured. Furthermore, the fiber insulation grips around the wire when the staple is driven home into the wood or plaster. These staples are so manufactured that instead of a break at the top of the fiber under the head of the staple, there is a continuous double length, due to the method of folding.

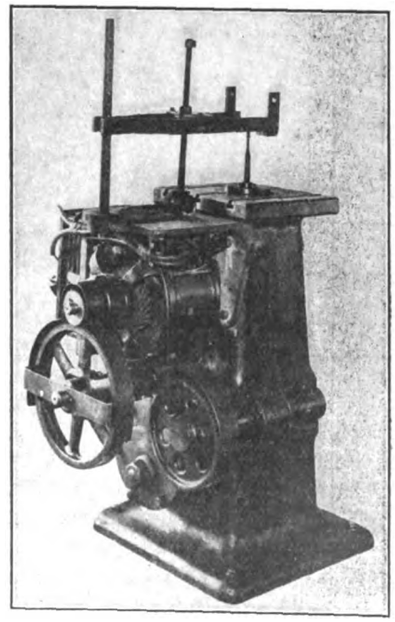

FIG. 2.—MOTOR-DRIVEN KEYSEATER.

This staple is manufactured in various sizes. The saddle of the staple is put on in such a way that it cannot come off.

In June of last year the Canadian Pacific put in operation a telephone circuit between Montreal and Farnham, Quebec, and it proved satisfactory in every way. Since then the company has strung other telephone lines, and in western Canada today it has 531 miles of telephone lines.

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The Triumph Electric Company's New Factory at Cincinnati.

About twenty years ago the Triumph Electric Company, of Cincinnati, was organized for the manufacture of electrical apparatus. Beginning in a small way, and when the electrical industry was practically in its infancy, the company has gradually increased in size and importance, until now it ranks as one of the best known of the larger electrical companies. This steady growth is due partly to the fact that it has confined its attention solely to the manufacture of generators and motors and their accessories, the entire time and skill of the engineering department being devoted to perfecting these lines of apparatus.

The move to the new factory marks an era in the history of the company. The new plant will be at least three times the size of the present quarters, and, as may be seen from the accompanying illustrations, is being built in accordance with the most up-to-date practice.

The general factory scheme consists of a main building 800 feet long with three ells at right angles, sixty feet wide, three stories high, and sixty feet apart. About 125,000 square feet of floor surface will be available as soon as the first buildings are erected.

It is the intention of the company to erect the main building, shown in Fig. 1, at the present time; the three ells at right angles to the main building will be erected at an early date. Three other separate buildings, viz., an administration building, blacksmith shop and pattern shop, will also be erected in the near future.

A very good general idea of the factory construction is given in Fig. 2, which shows the main shop nearing completion. It will be noticed that each side bay is provided with a second and a third-floor gallery, each of which is served by two freight elevators. It will be noticed further that the third-floor galleries overhang by a distance of six feet. This construction permits material to be lowered or raised to or from the main floor by the overhead traveling crane. It also allows material to be transferred direct from the third-floor east bay to the third-floor west bay, and, in addition, provides some additional 9,000 square feet of floor surface.

Each gallery is approximately forty feet wide and thirteen feet high, with the exception of the first floor, which is fourteen feet high. All four galleries are supported in the center by twelve-inch box girders in addition to the main columns at the side. The overhanging construction of the third-floor galleries is supported by brackets, as shown in Fig. 2. In addition to the four elevators previously mentioned, access is had to the various galleries by means of stairs, also shown in Fig. 2.

The main floor, between the center columns, is sixty feet wide and is concreted the entire length and width, forming a solid foundation for the heavy machine tools.

The longitudinal I-beams for providing the necessary strength for the galleries are spaced five feet eight-and-one-half inches apart and are six in number. The construction is therefore light and at the same time strong. All floors and galleries are well lighted and ventilated by means of side windows, much care having been exercised in this direction.

As is generally known, the Triumph Electric Company operates in conjunction with the Triumph Ice Machine Company. These two companies, while under one management, are separately staffed and work independently of each other, the west bay being devoted to the manufacture of refrigerating apparatus, while the remainder of the factory is devoted exclusively to electrical machines. Each unit is therefore able to work separately without interference on either side.

The site of this factory comprises some eight-and-one-half acres and is situated in a position which secures for it first-class shipping facilities. The main line of the Baltimore & Ohio Railroad passes directly in front of the property, and switches run into the various buildings, enabling the raw material and finished product to be handled with the minimum amount of labor. The Chicago division of the Pennsylvania Railroad is only half a mile to the north and the tracks of the Norfolk & Western Railroad about the same distance to the west.

The factory has been laid out so that the raw material enters at one end of the building and, after progressing in one direction through the buildings, finally leaves as a finished product at the other end. It will thus be seen that the cost of handling has been reduced to a minimum.

The new factory, as it stands today, without taking into account any future extensions, represents an outlay of approximately a quarter of a million dollars, in addition to which about $50,000 worth of new equipment has been purchased and is now being installed.

The present office building has been laid out in the front end of the east bay, but cannot be seen from accompanying

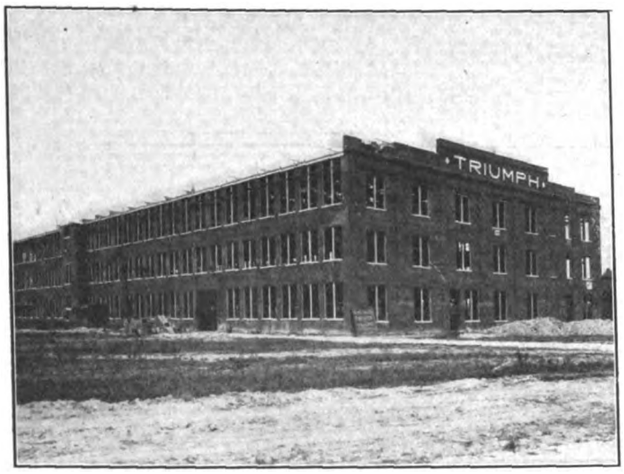

Fig. 1.—Exterior View of Main Building.

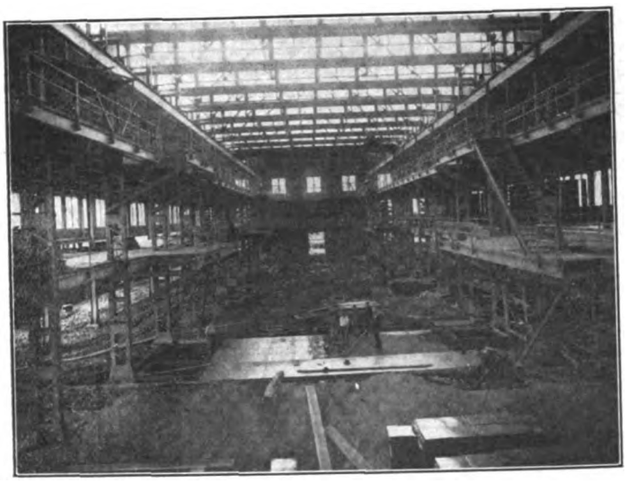

Fig. 2.—Interior View of Main Building.

THE TRIUMPH ELECTRIC COMPANY'S NEW FACTORY AT CINCINNATI.

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views. In general, this building has been designed so that each department is in juxtaposition with other departments with which it is most nearly concerned; in addition, a complete telephone system with private exchange enables all de-

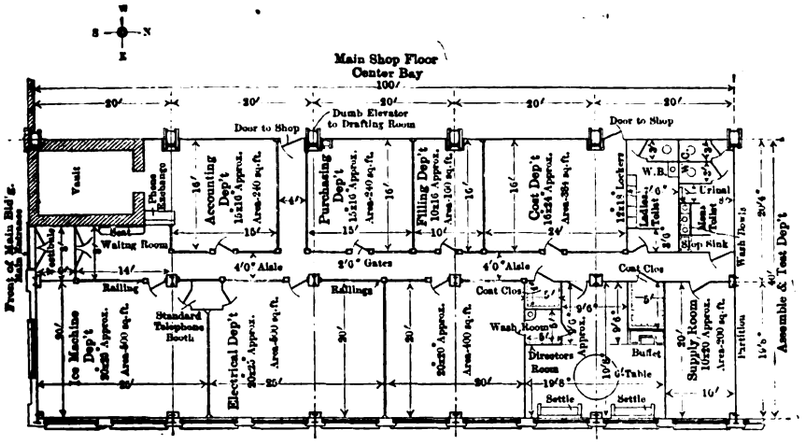

FIG. 3.—ARRANGEMENT OF OFFICES OF NEW TRIUMPH FACTORY, CINCINNATI, OHIO.

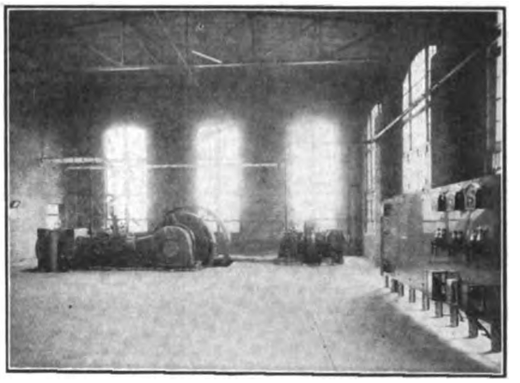

FIG. 4.—VIEW IN ENGINE ROOM OF NEW TRIUMPH FACTORY.

partments to communicate with each other readily. Fig. 3 shows the arrangement of the main offices.

In conjunction with three other companies, which are located on adjacent property, a $100,000 power plant has been erected and is now in operation. This plant will supply power, light, heat, water and compressed air to the several factories, and is equipped with Triumph generators of 300 kilowatts capacity. Fig. 4 gives an excellent view of the engine room and shows the generating sets in the background.

The power and light cables are run underground to the point of distribution, as is also the hot water for heating the various buildings, and compressed air at ninety pounds per square inch pressure for driving the pneumatic chipping tools. Every building is equipped with automatic sprinklers, water at 100 pounds pressure being supplied for this purpose.

The new factory is the outcome of twenty years' successful operation, in which quality has been the prevalent motive throughout. The company is optimistically looking forward to an exceptionally good year and, with the added facilities obtained in the new factory, will be in better position than ever to turn out high-grade work.

Fig. 5 shows the arrangement of the stores, which are located on the second-floor gallery, immediately above the punch department and directly underneath the armature-winding department, thus reducing the amount of handling to a minimum and giving the product an orderly progression through the works.

The Triumph Electric Company controls branch offices in practically all the large cities of America and Canada and has obtained an enviable reputation for turning out only high-grade machines.

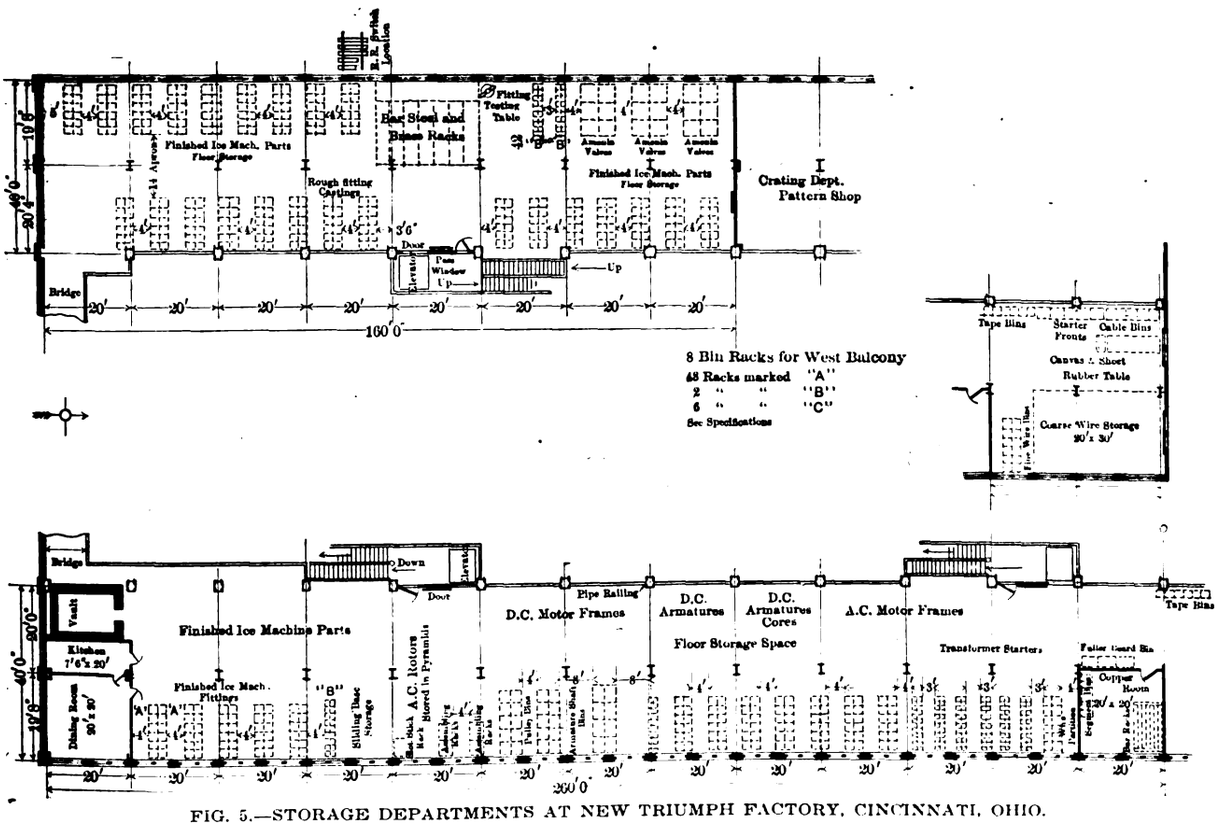

FIG. 5.—STORAGE DEPARTMENTS AT NEW TRIUMPH FACTORY, CINCINNATI, OHIO.

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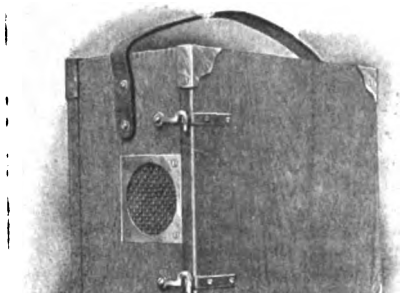
Composite Telephones Provide Additional Facilities.

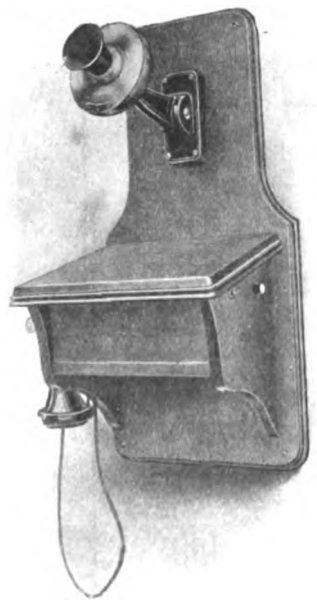
The Cleveland, Akron & Columbus Railroad Company has recently installed a composite telephone circuit on its lines between Akron and Columbus, Ohio, a distance of 130 miles. The line is constructed of No. 9 copper wire, and has three intermediate telegraph offices between the terminal telephones. There



WESTERN ELECTRIC PORTABLE COMPOSITE TELEPHONE.

are also three intermediate telephone stations connected to the line.

In connection with this service the above company has equipped its wrecking train with a portable composite telephone, which may be connected to the line at any point along the road, thus enabling it to obtain direct connection with headquarters at all times. In addition to this, an extra portable composite telephone is kept at the division headquarters, to be



WESTERN ELECTRIC COMPOSITE TELEPHONE.

used on inspection trips or in cases of emergency.

The Western Electric Company's No. 1312-A composite telephones are used in the stations, and its No. 1314-A portable set is used on the wrecking train. These sets are shown in the illustrations. It is reported that first-class service is obtained with this equipment.

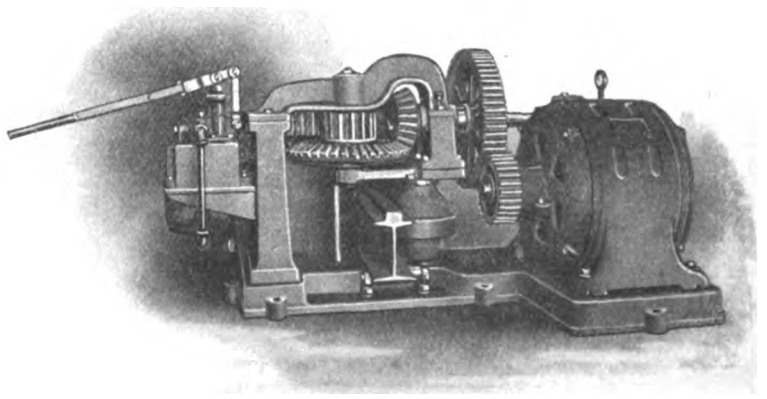
It will be readily seen that the above system enables additional service to be obtained at a very small cost, as an existing telegraph wire may be used for this service without interfering with the operation of the telegraph service.

An Electrically Driven Rail Bender.

The Smith patent motor-driven rail bender, illustrated herewith, is a convenient device, manufactured by the Watson-Stillman Company, New York, N. Y., which is a great advance on the purely hydraulic machines made by the same firm.

The framework of the machine is a heavy steel casting made in one piece, the solidity of which insures regularity of curvature and rapidity of work, which, with the small amount of manual labor required, renders the tool an almost indispensable one on construction work. The power-driven bending roll is mounted in a frame which is driven forward to give the desired curvature by a hydraulic cylinder, the power for which is a small hand pump mounted on the frame of the tool above the cylinder. The roll can be driven out under a pressure of fifty tons. The two fixed-roll centers are thirty-four inches apart. The driving roll is geared to make one turn to eight turns of the pulleys, which are twenty-four inches in diameter and have a seven-inch face. The bending rolls must be made to suit each shape of rail to be bent.

The outer bending rolls are changed



THE SMITH MOTOR-DRIVEN RAIL BENDER.

by loosening set screws and pulling out the pins. The arm holding the middle bending roll can be worked in and out by the lever shown at the left without the aid of the pump, if the release valve is open, so that the pump is necessary only when bending a rail to get the desired curvature.

The capacity of the machine is about one medium-length rail per minute when once adjusted.

Some Westinghouse Contracts for Japan.

At Yokkaichi, Japan, the electric-light company has installed a 750-kilowatt Westinghouse turbo-alternator in its Miye Ken plant. The turbine is to operate at 200 pounds steam pressure, exhausting into a vacuum of twenty-seven inches. Three-phase, sixty-cycle current at 2,200 volts, for lighting and power purposes, will be supplied by the new generators, supplanting the old reciprocating-engine-driven equipment, which is to be taken out. Three fifty-five-horsepower Westinghouse gas engines have been installed by the Furawaka Coke Works, of Tokio, to operate its coal-washing plant. These engines will use as fuel the sulphur gas derived from the coke ovens, having an average calorific value of 460 British thermal units per cubic foot. This new equipment is additional to a pair of eleven-by-twelve-inch two-cylinder Westinghouse gas engines driving a Westinghouse 125-volt direct-current generator.

Lumber Cars Run by Electricity.

Among the many excellent features of the mill plant of the Goodman Lumber Company at Goodman, Wis., is one of the finest electric-light plants ever installed in a mill plant in that part of the state. The plant not only lights the mill and mill building, but also lights the town of Goodman and will eventually furnish power for propelling the cars loaded with lumber which are hauled from the mill plant to the lumber yards, where the lumber is piled.

The lumber as cut is all loaded on cars and hauled to the yards on regular car tracks.

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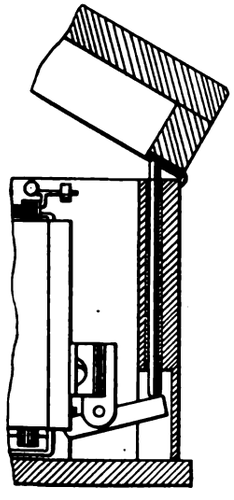
A New Galvanometer Protecting Device.

Those accustomed to the use of a portable testing instrument in which a moving system on pivoted points is an integral part, have no doubt frequently been troubled in finding the indications inaccurate or finding a great loss of sensibility through either the pivots or the jewels becoming damaged by rough handling.

With a view to entirely eliminating such trouble and maintaining the system of their instruments free and sensitive, Queen & Company, of Philadelphia, Pa., have devised an automatic clamp for their delicate suspensions whereby, when the lid of the containing case is closed, the moving element is lifted entirely free from contact with the pivot point and jewels, but as the cover is opened the system automatically returns to its initial position, thereby maintaining its initial sensibility and retaining the pivots and jewels uninjured, regardless of the mechanical treatment to which it is in the meantime subjected.



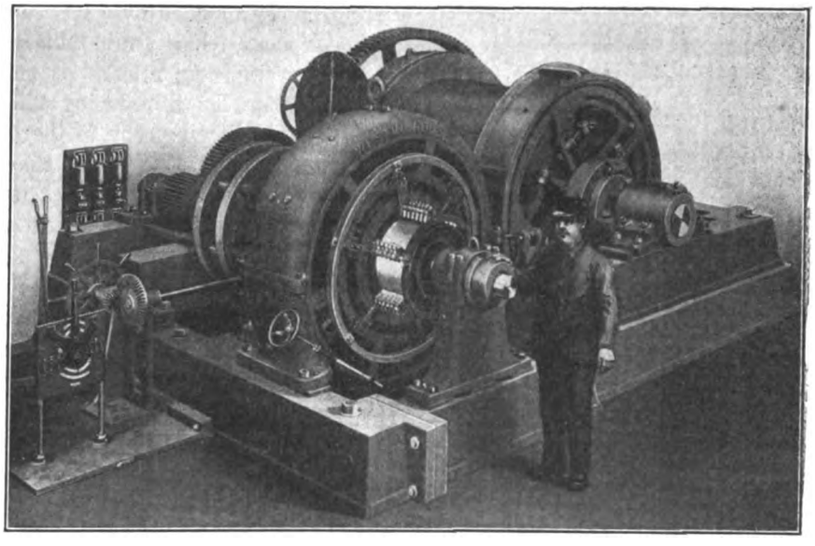
NEW GALVANOMETER PROTECTING DEVICE.

It has heretofore been the custom to clamp magnetic systems and even moving coil systems when supported by one jewel by simply lifting the systems off its one jewel, but in such instances it is comparatively a simple matter, while in the case where the moving system is supported at both ends upon a jewel and pivot the matter becomes much more complicated, as in trying to lift the coil away from one jewel more pressure would consequently be put on the other support, and it therefore becomes necessary, in order to make a satisfactory clamping device, to move either one or both jewels or pivots. This company has accomplished by an ingenious arrangement, a moving jewel-clamping lever shown in the accompanying illustration. The use of this clamp will effectually prevent any injury to the pivots or jewels of the moving system during transportation, and the user may be assured that the initial sensibility of the galvanometer is constantly retained. The mechanical arrangement is such that it can be applied to many existing types of galvanometers of Queen & Company's manufacture.

This device will be greatly appreciated by all testers who are familiar with the difficulties met with, while doing outside commercial testing, where one has to carry the instrument about continually, and where they must be ready at all times to make rapid and accurate tests.

Large Electric Mining Hoist.

There was recently installed in the mine of the Washington Coal and Coke Company, at Dawson, Pa., a large mine hoist with an electric motor which presents several features of considerable interest.



LARGE ELECTRIC MINING HOIST.

The hoist is used to haul thirty-five mine cars, averaging 3,800 pounds each when loaded, up a maximum grade of eight-and-one-half per cent, 8,000 feet long at a speed of 600 feet per minute. The loaded cars start at the bottom of the slope on a four per cent grade, which gradually increases till the maximum grade is reached near the top, where the loaded cars are pulled in on a landing on a grade of about six per cent and on a curve of 150-foot radius. The empty cars will be allowed to drift down the slope by gravity controlled by a brake on the hoist drum.

The hoisting drum is six feet in diameter and five feet wide between flanges. It is fitted with a hand brake on one end and a hand operated friction clutch on the other end. The drum is of very heavy steel construction, with a twelve-inch shaft. All the gears on the machine are cast steel with machine-cut teeth, the main spur gear being ten-inch face and the motor gears thirteen-inch face.

The frame is made in sections for convenience in installing in the mine. The drum and large gears and the friction clutch parts are also made in two pieces for the same purpose.

The hoist is driven through a flexible coupling by a 500-horsepower, direct-current, non-reversing, compound-wound Westinghouse motor. It is controlled by a standard semi-automatic Westinghouse magnetically-controlled unit switch controller. These switches are operated from the controller shown in the illustration, the controller carrying only small currents while the main motor current is handled by the magnetically-operated switches, thus doing away with the difficulties from arcing.

This controller has an accelerating relay which prevents the starting switches from closing too rapidly and thereby prevents too large starting currents. Thus the second switch cannot close until the current allowed to flow by the closing of the circuit has fallen to a predetermined value. As soon as this value is reached the second switch closes, thereby short-circuiting a resistance section and the current rises, but the third switch cannot close until the current has again fallen to the predetermined value. This not only prevents injury to the motor from careless handling during acceleration, but

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also insures the most rapid starting possible.

The controller also has a safety relay which opens the resistance switches in cases of excessive overload, and thereby protects the motor while running. If this relay operates while the motor is running, the motor does not stop, but is automatically brought up to its full speed again. This is a particularly valuable feature in an installation of this kind where the cars may strike some obstruction, as it affords perfect protection to the apparatus.

When it is remembered that this hoist is installed some 800 feet below the surface of the ground, the advantages of the electric transmission of power are evident. In no other way could this large amount of power be transmitted as economically nor as easily.

The hoist was supplied by the Connellsville Manufacturing and Mine Supply Company.

What Constitutes a Good Lubricant?

If one had to make his choice between a lubricant which kept the bearings cool and one which lasted well, the wise machinery user would select the former. The saving of a gallon or a pound a day would be dearly bought if the bearings ran so hot that they had to be constantly watched. Even the difference of a few degrees would mean appreciably greater friction, and friction cannot exist without wear.

What property of a lubricant keeps the bearing cool? Simply one thing—a low coefficient of friction. Assuming always that there is a sufficient film between the surfaces to "float" the shaft, it only remains that the characteristics tending to resist the relative movement of the surfaces (*i. e.*, reduce friction) be a minimum. If the friction is small, the heat engendered will likewise be small.

But this elementary statement of the matter assumes certain conditions and ignores others. What is to insure maintaining a sufficient film? How is the lubricant to be supplied to the bearing? When supplied in sufficient quantities, will it stay in the bearing, or does it tend to shirk its work by leaking away?

So far as the coefficient of friction is concerned, there is no better lubricant for moderate pressures than a clean oil. Its origin—animal, vegetable or mineral—does not matter much if it has the proper body and is fresh. In time, however, animal and vegetable oils tend to undergo chemical changes. In a word, they thicken, gum or turn rancid. Mineral oil is not subject to these changes, and is therefore usually preferred. But oil, however good, is useful only for moderate pressures.

The limitations of oil have led to the introduction of numerous greases. For the most part these have been made of animal fats, which are solid below blood heat, and above that temperature are equivalent to thin oil. Greases of this character have been fed semi-automatically by virtue of this property of softening under heat. It is evident that if, with a good lubricant, a certain bearing might run at eighty degrees, it suffers by being required to heat up to 100 degrees before it can receive the lubricant. Such a bearing is automatically starved and its life materially shortened. On the other hand, melted grease stays in the bearing no better than oil. It leaks away and must be constantly replaced by a fresh supply.

These characteristics are inherent in animal greases. An attempt is made to mitigate them by introducing fillers of various sorts, to give body to the grease. These substances, if solid in character, such as graphite, soapstone, etc., tend to remain in the bearing while the fatty constituents melt and run away. A further objection to animal fats is that they turn rancid and corrode the surfaces that they are supposed to lubricate. This drawback is especially serious with ball and roller bearings, the efficiency of which depends on the maintaining of the original high polish and true alinement of the bearing surfaces.

Where shall we find a lubricant which both offers a low and constant coefficient of friction and does not tend to leave the bearing before it has done its work? It is on this aspect of the problem that pure mineral grease is now receiving so much attention. Its coefficient of friction, whether it be high or low, is fairly constant, for the reason that the grease is not affected by ordinary changes in temperature. If a given grade is suitable for the lubrication of the given machinery in summer, it is also suitable in winter, and there is no tendency to turn liquid under ordinary loads.

Pure mineral grease possesses likewise the much-desired clinging quality which oil lacks. Since it does not soften, it cannot be fed like animal grease. If stiff it must be forced into the bearing under pressure, and this pressure, when properly regulated, will force out the spent grease, which otherwise would stay in the bearing indefinitely. The economy of mineral grease resolves itself, therefore, almost entirely into the question of coefficient of friction. If the coefficient of friction is small, the grease will not be spent rapidly, because the bearing will run cool.

Several different processes are used in making mineral grease, and the results obtained with them are correspondingly diverse. The purer the grease, the more nearly it approaches oil as regards coefficient of friction, while it maintains its advantage over oil in tending naturally to stay in the bearing, as well as in its ability to carry much higher loads.

In some recent tests made at Cornell University, under the direction of Prof. R. C. Carpenter, a sample of what is known as No. 1 Density Keystone Grease showed a coefficient of friction of 0.015 under loads from 150 to 300 pounds per square inch, thus equaling the coefficient of engine oil under loads of eighty pounds per square inch. Under heavy loads the oil friction rapidly rose. A slightly heavier grade, No. 1 Density, showed a coefficient of friction of 0.02 under 258 pounds, and slightly less than that under higher loads up to 500 pounds, which extraordinary pressure the sample carried during a run of one hour. These results, which were duplicated by no other lubricant (and tests were made at the same time of animal and other well-known mineral greases), are taken by the makers of Keystone Grease to justify their claims for exceptional economy and high lubricating quality.

High-Speed Monorailway Projected.

From an authoritative source comes the announcement that a monorailway will shortly be built by the American Monorail Company through Pelham Park to City Island, New York. This system was shown in operation at the recent Jamestown Exposition, and engineers of the Public Service Commission predict, it is said, a speed of 135 miles an hour under favorable conditions. The idea has also been mooted to build an upper deck over the present elevated railroads in New York city for monorail express trains, should the Pelham Park and City Island service prove acceptable to the traveling public.

Whether this would be practicable from an engineering standpoint, or whether the increased noise would be acceptable to the adjacent residents, is very much of a debatable question.

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Current Electrical News

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, SEPTEMBER 12.—Upon the new section of the Metropolitan subway which passes under the Seine near Notre Dame there has been carried out an extensive piece of work in connection with the underground shore stations and the caisson tunnel under the river, this being the congelation of the soil at the bank of the Seine. At this point there is an underground branch of the Orleans railroad running along under the embankment, and the new subway line had to cross below the railroad line. Congelation was the only method which would allow of running the subway tunnel without disturbing the railroad tracks, and an extensive freezing plant was erected near the shore at Place St. Michel. The work has now been entirely finished and the plant is at present dismounted.

At Roubaix there is to be held the international exposition of northern France, during 1911. The exposition is to be laid out on a large scale, and mechanical and electrical industries will be among the leading features. It is organized by the municipality of Roubaix, with the concourse of the Chamber of Commerce and the patronage of the government. This locality is one of the principal industrial centers of the northern region.

In Belgium there is being developed a power-distribution project, and it will cover a wide region in which the smaller industries are abundant, this being the northern Brabant region. The power lines will supply the centers of Bois-le-Duc, Ruremonde and others.

Among the new electric tramways which are to be built in Austro-Hungary I may mention the line running from Csorbato to Barlangliet. It is expected to have the line open for traffic by next year, and it will carry a large amount of tourist traffic passing in the region of the Tatra mountains. Another project is the increase of the electric traction lines of Miskolcz, and there is a new line to be run to the suburb of Heocsaba.

At Arcachon, France, there is building a large electric plant by the Gas and Electric Company. It will supply current for lighting as well as for the tramway system. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, SEPTEMBER 18.—The Ontario government will construct an electric railway from Charlton to Elk Lake, in the silver mining district, a distance of twenty-two miles. It will cost $750,000 to put a road into Elk Lake and $3,000,000 to continue it to Gow Ganda. The ground has been examined by engineers.

Manager Saunders, of the Bank of Montreal in Mexico, who is now here, makes the announcement that no rain has fallen in the Necaxa Valley and that the Mexican Light and Power Company has been paying at the rate of $10,000 (Mexican) per day for coal.

At the annual meeting of the Quebec Railway, Light & Power Company the report of the directors showed that the company had paid a dividend of two per cent on the common stock last year, which was the first dividend paid for several years. The company's service will be improved and the road outside the city will be developed.

The Ontario government has granted a charter of incorporation to the Electric Smelting and Power Company, with an authorized capital of $4,000,000. This company is incorporated with wide powers. It is empowered to own and operate mines, deal in metals, build and operate railway and steamship lines, to act as a holding company, to produce, accommodate and dispose of electrical energy or other energy, and to construct and operate telephone and telegraph lines.

A wireless telegraph system, to parallel the lines of the present telegraph companies throughout Canada, is the project planned by the Lepel Wireless Company, which has asked the city of Hamilton, Ont., and practically every municipality in Western Ontario, to install plants at a cost of $2,500 each. No money is to be paid until the system has been in operation for thirty days. The company promises a rate of one cent a word for messages of twenty-five words and half a cent per word for all words over that number.

The work on the substations of the Mines Power Company at Cobalt and Kerr Lake is making good progress. Along the right-of-way the poles are strung from Matabitchouan to Cobalt. The buildings being erected at Cobalt will be the terminus of the main transmission line and will receive two of the four compressor units, giving a capacity of 10,000 feet of free air a minute from the station. One thousand men are now working on the company's plant.

As the result of a recent meeting of the directors of the Ottawa & Morrisburg Electric Railway Company, grading on the new line will be commenced at once. A total mileage of fifty-five miles will be covered at a cost of $770,000.

The mica industry, which has been practically dead in this vicinity for some time, is now again active. Orders have been received from France, England, Germany and other European countries, as well as from many firms in the United States. The mica miners in Canada depend largely on the market offered in the United States, and as the Payne tariff bill has lowered the duty on mica, the decrease, although small, will be profitable to the Canadian producers of mica.

At the recent meeting of the Canadian Independent Telephone Association in Toronto it was shown that there were now 27,000 independent telephones in operation in the Dominion. In Alberta and Manitoba, where the Bell equipment was purchased by the provincial governments over a year ago, the mileage and number of telephones have increased very rapidly under government ownership and operation. In view of the reports to the effect that the Bell Telephone Company is making strenuous efforts to induce independent companies to enter into agreement for the interchange of service, it was resolved that in future "no member of the association shall enter into any arrangement or reversal of any agreement having for its object the interchange of service over the lines of the Bell company." As the work of the independent companies in this country is becoming more and more of a national character, the association resolved to call upon the provincial legislatures to at once introduce legislation that will bring about the provincial ownership of all long-distance telephone lines. J. B. Ware, general secretary of the International Independent Telephone Association, pointed out that, in 1895, there were only about 245,000 telephones in the United States, but as a result of competition, there were at present more than 6,000,000 telephones there. Canada, he declared, was fortunate in having a spirit of public ownership, which was frowned upon by municipal officers and governments in the United States. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

ALBANY SOUTHERN CHARTERED—The Albany Southern Railroad Company, which has been incorporated at Albany, N. Y., with the secretary of state, is a reorganization of the Albany & Hudson Railroad, the third-rail electric line between Albany and Hudson, which went into a receiver's hands some months ago and was sold under mortgage foreclosure early this month. New Yorkers are the owners of the controlling interest in the property. The new company has a capital of $3,475,000, of which $2,100,000 is preferred and $1,375,000 common stock. The company's principal office is in Rensselaer, N. Y. The directors are: W. R. Gross, R. A. C. Smith, Charles H. Werner, A. M. Young, Irvin W. Day, L. B. Grant, G. M. Congdon, of New York; C. L. Rossiter, of Brooklyn; Myron T. Herrick, of Cleveland, Ohio.

CONCENTRATION IN OREGON—The Willamette Valley Company has deeded to the Northwestern Corporation all its property in Oregon, including electric-lighting plants in Albany, Corvallis, Eugene, Springfield, Dalles, Monmouth and Independence, including also water systems at Albany, Springfield and Independence and a gas plant at Eugene. The Northwestern Corporation has in turn filed a mortgage to the Germantown Trust Company, of Philadelphia, for $5,000,000, secured by all the above-mentioned property, and, in addition, the electric street-railway system, of Walla Walla, Wash., the interurban electric line between Walla Walla and Milton, Ore., a power plant in Umatilla County, Oregon, which supplies current to Walla Walla, Wash., and Pendleton, Ore., electric light and gas plants at Walla Walla and Pendleton, and gas plants at North Yakima, Wash., and Lewiston, Idaho.

LIGHTING AND POWER.

(Special Correspondence.)

GRAND RAPIDS, MINN.—The city will call for bids on 40 4-light lamp posts. C.

TALOGA, OKLA.—This city has voted bonds to establish its own electric-light plant.

GREENE, IOWA—The local light and power company is expending $10,000 in improvements to the plant, including an addi-

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tion to the power house in which three waterwheels, aggregating 200 horsepower, will be installed. C.

WATERTOWN, S. D.—Ferris Bros. are planning to rebuild the light plant at this point.

CRESCENT, OKLA.—This city has voted bonds for $30,000 to construct its electric-light plant.

GURDON, ARK.—The Ohio Stave and Timber Company is about to put in an electric-light plant.

LIBERAL, MO.—The Liberal Rolled Feed Mill and Elevator Company will install an electric plant here.

LAGRANDE, ORE.—The electors have voted in favor of issuing bonds for the erection of an electric-lighting plant.

ANOKA, MINN.—This city is to make extensive improvements is its lighting plant. Nicholas Moberg can give information.

WESTVILLE, OKLA.—The Westville Electric Light and Power Company has been incorporated with a capital stock of $10,000.

UNION, ORE.—The special election to act on the matter of issuing electric-lighting bonds to the amount of $25,000 resulted favorably.

CENTERVILLE, IOWA—The Centerville Light and Traction Company has let the contracts for the Centerville-Mystic Interurban line.

CENTRAL CITY, NEB.—C. F. Newmyer, city clerk, will receive bids until noon, September 27, for the erection of an electric light building. C.

SHULLSBURG, WIS.—An electric light plant has been contemplated here, although a franchise for the same has not yet been granted.

OLYMPIA, WASH.—The Tonino Light, Power and Water Company of this place is preparing to put in a dam on the Skookumchuck River for power purposes.

SEATTLE, WASH.—The Stone & Webster Engineering Company is erecting a six-story reinforced concrete building, 60x120, at Seventh Avenue and Olive Street. C.

CHISHOLM, MINN.—The Range Power Company has arranged for the erection of a brick building, 26x78, and ordered a 400-horsepower, 4-cylinder Riverside engine. C.

CHIHUAHUA, MEX.—The Nazas River Power Company has announced plans for the erection of a hydroelectric power plant in the Fernandez Canyon on the Nazas River in Durango.

ABERDEEN, S. D.—The Aberdeen Light and Power Company is making additions to its engine and dynamo equipment and switchboard. The company will install twenty additional cluster lights and thirty more large arcs. C.

SAN DIEGO, CAL.—The Edwards Wave Motor Company has let contracts to the National Iron Works of this place for machinery for six power-producing units for the company's proposed wave motor plant at La Jolla, near this city.

METHOW, WASH.—The Methow Irrigation and Power Company has begun construction work on its power plant on the Methow River six miles from Winthrop. The plant will utilize the entire volume of the river at a 140-foot fall.

REDDING, CAL.—Water has been turned on at the recently-completed power plant of the Northern California Power Company at Manton. This plant has a capacity of 5,000 horsepower, bringing the company's total up to 15,500 horsepower.

FRESNO, CAL.—A. G. Wishon, of the San Joaquin Light and Power Company, states that the company will extend its power lines to Coalinga and establish a power-distributing system at that place, at a cost of approximately one million dollars.

ODESSA, WASH.—The town council has granted the Washington Water Power Company an electric-lighting franchise in this city. The line will connect with the Harrington-Sprague power line, about twenty miles from this city. About $500,000 will be spent on the work.

GRAND FORKS, N. D.—The Electric Construction Company, of St. Paul, Minn., having declined to enter into a contract to install the new lighting system of the city unless the warrants to be issued in payment for the same are guaranteed, the city will proceed with the work itself. C.

ASTORIA, ORE.—The Hammond Lumber Company is about to erect an electric power plant on its property at the Tongue to supply light, heat and power at a cost of from $75,000 to $90,000. From this plant will be derived the current to be distributed by the Astoria Electric Company.

FRESNO, CAL.—H. J. Darling, of Reno, Nev., has appropriated 40,000 inches of water for power purposes from Big Creek in this county and 20,000 inches from Pitman Creek, also in this county. It is understood that a power plant is to be erected near the junction of the two creeks.

SANTA BARBARA, CAL.—The Merchants' Mutual Light and Power Company has been incorporated here with a capital stock of $1,000,000. The incorporators are: C. H. Frink, W. R. H. Weldon, John F. Diehl, S. M. Kennedy, R. H. Ballard, William Dieterie, Herbert F. Keenan, L. J. Lee and H. J. Bauer.

MILES CITY, MONT.—The Buffalo Rapids Power Company has been incorporated here by George Burt and others with a capital stock of $300,000. The company plans to divert water from the Yellowstone River and develop electricity to supply the towns along the Yellowstone from Billings to Glendive. A dam will be put in the Yellowstone at a cost of about $25,000.

MONTEREY, CAL.—W. H. P. Hill, manager of the Monterey County Gas and Electric Company, says that his company will run a power line to Salinas for the purpose of supplying that city from the Monterey plant, where modern machinery with 3,000-horsepower capacity has just been installed. The company's plant at Salinas will be put in good condition and held in reserve.

SAN FRANCISCO, CAL.—The Pacific Gas and Electric Company has contracted with the trustees of Reclamation District No. 548 to furnish power to the district to operate pumping plants for a period of ten years for $30,000. Three 100-horsepower centrifugal pumps and two 350-kilowatt transformers will be installed. The district to be kept clear of seepage and overflow water contains 15,000 acres.

SHAMOKIN, PA.—The new hoisting apparatus at the counter slope of the Greenough colliery, which has been in course of construction for the past few months, was started last week and gives splendid satisfaction. The hoisting is all done by electricity, all the power being obtained from the colliery's own electric plant. The apparatus is able to handle four cars with two tons in each at one time. The work of installing it was done by a Scranton contractor.

LANSING, MICH.—Three more power companies, with a total capitalization of $700,000, have filed articles of incorporation here. They are the Little Muskegon Water Power Company, capital $125,000; Montcalm Electrical Company, capital $75,000, and the Western Hydro-Electrical Company, capital $500,000, all at Grand Rapids, Mich. It is the general belief that there is some connection between these three companies and the large group of power companies that filed articles last week.

ESCANABA, MICH.—All of the property of the Escanaba Street Railway Company has been taken over by the Escanaba Traction Company, in which stock is held by the leading business men of this city. The new company, in addition to conducting the two older companies, will build an interurban line connecting Escanaba and Gladstone, Mich., and two giant power dams on the Escanaba River. As soon as arrangements can be made the company will also build a huge paper pulp manufacturing plant on the river.

COLUMBIA, PA.—Francis T. Homer, treasurer of the Susquehanna Power Company, states that within six months the financing of the company will be resumed, with a view to building a dam and power plant on the Susquehanna River and selling the current in Maryland. Capital stock to the amount of $400,000 has been issued, and Mr. Homer said he was assured the substantial interests behind the enterprise would soon give it the additional financial backing to enable it to begin work on the dam and plant.

LYNNFIELD CENTRE, MASS.—At a hearing in the Town Hall at Lynnfield Centre it was announced that an agreement had been reached between the New England Telephone and Telegraph Company and the Reading Electric Light Company providing for joint ownership of all electric light and telephone poles in Lynnfield. The citizens have been opposed to marring the streets with two lines of poles. The work has been started and in the course of six weeks wires will be strung to private residences and public buildings.

JEWETT CITY, CONN.—Work is to be commenced on the new Hopeville dam for the Ashland Cotton Company. The dam will be situated on the Pachaug River, practically in the same situation as the old one, and will be seventeen feet high and have a rollway of eighty feet. An electric plant is also to be constructed at the dam, with a direct drive from the waterwheels, and is expected to furnish at least 400 horsepower, which will be used for lighting the Hopeville plant and to run electric motors to be installed in the works.

GOUVERNEUR, N. Y.—About 150 men are employed in building a massive concrete dam at South Edwards on the Oswegatchie River. This dam when completed will be one of the biggest engineering feats undertaken in St. Lawrence County since the building of the Massena Power Canal. The dam will be sixty-two feet in height. The base will be fifty-two feet in thickness, tapering to twelve feet at the top, and will be built of solid concrete. It is estimated that about 3,000 horsepower will

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be developed, which will be used to generate electricity to operate the mills of the Diana Paper Company, a few miles away. The surplus power will probably be taken to Carthage and used for operating the mills there.

ST. CATHARINES, ONT.—A new electric-power company has come into existence in this district. It is known as the Ridgeville Electric Light and Power Company, Limited, and is capitalized at $40,000. The object is to supply electric light and power to places in the townships of Thorold, Pelham and Gainsboro. A franchise has already been obtained in the two townships first named. Behind the company are Geo. Arnold, Ridgeville; Hugh A. Rose and Frank W. Houston, Welland; J. C. Stoat, Fenwick, and H. S. Arnold, Toronto.

BAKERSFIELD, CAL.—General Manager J. F. Stratton, of the West Side Electric Company, which was recently granted extensive transmission line franchises on the west side of this county, has gone to Maricopa to supervise the construction of the company's proposed steam-electric generating plant. The company's initial installation will be of 450 horsepower. The machinery for this plant was ordered some time ago from the Western Gas Engine Company. Machinery to develop 900 horsepower additional has now been ordered.

WESTFIELD, MASS.—The selectmen have awarded the contract for the enlargement of the municipal power plant to the Westinghouse Machine Company. The figures of the successful bidder were $24,322.75. The vote to enlarge the local plant was passed at the spring town meeting and since then the selectmen, with Town Clerk C. N. Oakes and George Pettibone, manager of the power plant, have been investigating the different power plants in New England to determine which will best suit the local needs. Work will be started at once.

SAN DIEGO, CAL.—The San Diego Consolidated Gas and Electric Company has just installed one of the largest engines ever brought to the Coast. It has a capacity of 1,250 kilowatts and weighs 175 tons, swinging a flywheel eighteen feet in diameter and weighing, in all, seventy-five tons. The engine is of the cross-compound condensing type. The cylinders are fifty-four inches in diameter and have a stroke of forty-eight inches. It is directly connected to a 1,250-kilowatt generator. The engine was installed by the Allis-Chalmers Company.

HUMBOLDT, TENN.—Foundations have been built at the power house for the new dynamo recently purchased, and the new machinery is expected to arrive within the next ten or fifteen days. The new dynamo is a 100-kilowatt machine, similar in type to the large dynamo recently installed. When this dynamo is put in commission Humboldt will have one of the best and most modern electric plants of any town of like size in the entire South. All the electric machinery and equipment is of the most improved and economical pattern.

WATERVILLE, ME.—The Messalonskee Electric Company, of Waterville, will soon ask for bids for the construction of a new power house, which will be erected on the Messalonskee stream at a point known as Rice's Rips. The site for the new proposed power house will be at a point where the water has a very swift current. The dam will be about twenty feet in height and will be of reinforced concrete. The power house will be of brick and located on the south side of the stream. The source of the water supply is the large Messalonskee Lake.

ROCK HILL, S. C.—The entire holdings, franchise and other properties of the Rock Hill Water, Light and Power Company were sold at auction, in pursuance to announcement following a receivership, on August 31, by P. A. Wilcox, receiver, of Florence, S. C. The price paid was $80,000 by Martin Maloney, a capitalist of Philadelphia, his being the only bid put in, he being a stockholder in the company. The liabilities of the concern are said to have been about $102,000, including bonded debt, etc. The plant will be renovated and put in up-to-date shape by the new owner of the same. L.

SAN BERNARDINO, CAL.—The San Bernardino Valley Gas Company has taken over the Lytle Creek Power Company's plant here, involving a payment of $125,000. The purchasing corporation was recently organized by Los Angeles and Pasadena capitalists and has bought up the independent gas companies here and at Redlands and Colton. The deal, while not taken to mean that the gas combine will enter the electrical field, is interpreted to point to a possible arrangement between the gas trust and the Pacific Light and Power Company for its gas works here, though local interests deny this.

STANWOOD, CAL.—It is understood in Stanwood that the Pacific Gas and Electric Company plans to begin work again upon its plant at that place. A short time ago a large block of the company's bonds running into the millions was placed with New York capital. In the neighborhood of $150,000 was spent at Stanwood before the work upon the plant was ordered stopped. The project provides for impounding the waters of French Creek, diverting these waters through a short tunnel, and turning them back into the creek again at a point much below the intake of the tunnel.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SAN DIEGO, CAL.—The City Council is advertising for sale an electric-railway line on K, R and Twenty-fifth streets.

MARSHALLTOWN, IOWA—The Iowa Electric Railroad Company proposes to build an electric road to Grundy Center and one to Ames; also to extend the street railway to the city park. C.

CENTERVILLE, IOWA—D. C. Campbell, T. P. Shonts and others have sold the Centerville Light and Traction Company to D. C. Bradley and F. S. Payne. C.

BELLINGHAM, WASH.—The Whatcom Railway and Light Company has begun work on the Happy Valley extension of its Harris Avenue line and will have it completed by October 1.

LOS ANGELES, CAL.—The Pacific Electric Company is preparing to extend its electric-railway line from La Habra eastward a distance of twelve miles. The same company is surveying for a line in the San Dimas Wash.

ALBANY, N. Y.—The Long Island Electric Railway Company has filed a certificate with the Secretary of State, announcing that the amount of its capital has been reduced from $2,100,000 to $600,000, consisting of shares of $100 each.

GETTYSBURG, PA.—The Borough Council has given the Hanover & McSherrystown Street Railway Company a franchise to enter the town at its eastern boundary and run a single track road on Hanover and York streets sixty feet into Centre Square.

NEW YORK, N. Y.—Leslie Sutherland, receiver of the Yonkers Railroad Company, says that he is about to spend $100,000 on the roadbed and tracks of the company. He is also going to install twenty pay-as-you-enter cars in a few weeks, and will take up the question later of having all the closed cars of the company equipped in this manner.

CAMBRIDGE, O.—The Cambridge Power, Light and Traction Company, owning and operating the city street car system, the interurban lines to Byesville, the street and commercial lighting system of Cambridge and a large ice manufacturing plant, has transferred its entire holdings to the Midland Power and Traction Company in consideration of $250,000.

GOSHEN, IND.—H. J. Heinze, the pickle manufacturer, has taken over the control of the Winona Interurban Railway Company, connecting Warsaw and Goshen, a distance of twenty-five miles. The reorganized company has just elected the following officers: President, H. J. Heinze; vice-president and manager, C. O. Johnson; secretary, H. C. Anderson.

TRENTON, N. J.—In the United States Circuit Court, Judge Reilstab took under advisement the appointment of Judge John G. Horner, of Mount Holly, as receiver of the Burlington County Railroad Company. Application for the receivership was made by the estate of Josiah K. Bougher, of Philadelphia, claiming that since the construction of the road in 1904 it has not paid. The company is bonded for $475,000.

NEW CASTLE, IND.—Work is progressing rapidly on the Indianapolis, New Castle & Toledo traction line and material of all kinds is being distributed along the line. The Carnegie Steel Company secured the contract for eighteen miles of sixty-pound rails, which will be laid as rapidly as it arrives. The electrical apparatus and equipment is being installed in the power house and there is little doubt of the completion of the road in a few months. S.

PORT ARTHUR, TEX.—The charter of the Port Arthur Street Railway Company has been granted and H. J. Meyers, J. H. Reeder, A. B. Davis, Joe Galrea and S. M. Krohn were elected directors. J. H. Meyers has been elected president; S. M. Krohn, vice-president; J. H. Reeder, secretary and treasurer; A. B. Davis and Joe Galrea, local counsel, and Judge Dale, general counsel. The engineer of the company, H. E. Talbott, will begin the surveys at once.

WALLA WALLA, WASH.—Articles of incorporation have been filed in the office of the county auditor by the Spokane, Walla Walla and Western Railway Company, the company capitalized at $3,000,000. Seven trustees were named to act until the second Monday in January, 1910, and they are: E. M. Symonds, Spokane; M. S. Parker, Spokane; W. L. Russell, Walla Walla; M. R. Hanger, Dayton; G. S. Hynes and E. C. Muxson, Spokane. The object of this new company is to construct and operate steam, gasoline and electric railways, connecting this city with adjacent towns, and also to construct and operate lighting plants in the states of Washington, Idaho, and Oregon.

GUTHRIE, OKLA.—Within a few weeks' time grading will begin at Dalhart on the Mountain Valley & Plains Railroad, through the Panhandle country, according to Del W. Harrington, president of the company. All profiles, surveys and estimates have been completed and work will be pushed toward Dalhart from Cimarron, N. M., a town 170 miles northwest. A construction company has been organized to do the building. There

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has never been any doubt about the road building from Cimarron, N. M., to Guthrie, according to President Harrington. The company is chartered under the laws of Texas, Oklahoma and New Mexico, and has an executive office in each of these states.

ATTICA, IND.—Articles of incorporation have been filed for a new electric road from Kankakee to Kewanee. This road connects Danville and Urbana with a large territory in Illinois and will increase the desirability of having a connecting line that will join Danville and Lafayette by way of Attica along the Wabash road. The filling of this forty-five-mile gap is becoming more probable every day and connections like the one mentioned are a great help to it.

INDIANAPOLIS, IND.—The Indiana Railroad Commission has ordered all the traction roads in the state to cut away the weeds, brush and trees at highway crossings. The Commission asserts that numerous fatal accidents are occasioned by reason of an obstructed view at highway crossings. The State Board of Tax Commissioners has issued a statement relative to the assessment value of property in the state. The grand total of the assessed value of electric roads is $21,536,041. S.

SOUTH BEND, IND.—It is persistently rumored that if experiments now being conducted prove successful, the Vandalia Railroad will be changed into an electric line between this city, Logansport and Terre Haute. A trip of inspection was made over the line recently by the officers of the line, accompanied by expert electric engineers, and it is known the officials are seriously considering electrification. Interurban competition is said to be the most potent reason for converting the line into an electric road. S.

SHEBOYGAN, WIS.—The Elkhart line, in which the Brickhausers, of Elkhart, are the heaviest stockholders, has practically completed arrangements where by the Sheboygan Light, Power and Railway Company will operate that line, giving through service from this city to the summer resort. The work of building the line through Plymouth to connect with the Sheboygan Light, Power and Railway Company is under way, and it is expected that the line will be completed so as to be utilized this year.

INDIANAPOLIS, IND.—Articles of incorporation have been filed with the secretary of state of the South Bend and Logansport Traction Company, which proposes to build a line between those points. The road is planned to pass through Lakeville, Plymouth, Rochester and Fulton, and will be seventy miles in length. The directors for the first year are Thomas P. Moredock, Virginius Nicar, Patrick J. Houlihan, Henry F. Coleman and David Pepper, Jr. The stock is $400,000, with preferred shares to the sum of $200,000.

ASHEVILLE, N. C.—The progress of the Asheville & East Tennessee Railroad Company, which recently began in a modest way, as the Asheville-Weaverville electric line, about ten miles in length, is now said to be assured of backing ample to push the line on to connect with the new Clinchfield Railway from West Virginia to the Atlantic coast, tapping the railroad probably in Yancey County. The electric railway has just received additional rolling stock enabling it to operate passenger, express and freight service to and from Weaverville, with the aforesaid promise to finally reach the Clinchfield Railroad.

SOUTH BEND, IND.—The South Bend & Logansport Traction Company, incorporated to build an electric line that will ultimately extend to Indianapolis, received a franchise to operate in Marshall County recently. The company promised to have actual construction under way by June 1, 1910, and electric trains in operation by June 1, 1911. The South Bend & Logansport is a reorganization of the old Indianapolis, Logansport & South Bend Company, formed several years ago. The new company includes Samuel R. Perly and T. P. Moreder, South Bend capitalists, but is backed by Philadelphia financiers, it is stated.

MOLINE, ILL.—At a meeting of the directors of the Davenport & Manchester Interurban Company, held last week in Davenport, Iowa, arrangements were made to call a meeting of the stockholders October 5 to reorganize the company, which practically means that the road will be commenced shortly. Fred W. Rank, of Moline, is secretary of the organization, and says that the capital stock will be increased to between $500,000 and $600,000, and that it will take approximately $2,000,000 to construct the road. The road is ninety-one miles long, but twenty-seven miles of it will be constructed first, between Manchester and Monticello.

EUREKA, CAL.—Fifteen of the wealthiest men in Humboldt County, representing $8,000,000 in capital, gathered in this city recently to discuss plans for the building of an electric railroad to connect Eureka with Redding, in the Sacramento Valley. The meeting resulted in the appointment of a committee of ten, headed by William S. Clark, president of the Humboldt Gas and Electric Company, and E. E. Skinner, a prominent lumberman, as secretary, to arrange the preliminary steps necessary for the organization of a company that will immediately undertake the construction of the line. The route of the proposed road is over 100 miles long.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

MEXIA, TEX.—The Mexia Telephone Company has been incorporated with a capital stock of $12,000.

LANGDON, N. D.—Work has been commenced on the construction of a telephone line to Waterloo. C.

HALLAM, NEB.—The Farmers' Telephone Company has been incorporated with a capital stock of $25,000.

LONG PRAIRIE, MINN.—The Northwestern Telephone Company is considering improvements to the local system. C.

ONTARIO, ORE.—J. A. Lackey will erect a two-story brick building for the Ontario Independent Telephone Company. C.

TYLERTOWN, MISS.—The Cumberland Telephone Company, main office Nashville, Tenn., is arranging to establish telephone system.

PETALUMA, CAL.—The Lakeville Telephone Company has awarded a contract for the construction of an eleven-mile line to W. D. Thomas.

DALLAS, TEX.—The Dallas Independent Telephone Company will erect telephone building; three stories and basement; fireproof, to cost $40,000.

OROVILLE, CAL.—The Pacific Telephone and Telegraph Company is planning to spend $11,000 in rewiring the city and in laying an underground cable.

CARNEGIE, OKLA.—The Spring Valley Rural Telephone Company has been incorporated by Charles Lunsford, S. A. Van Cleve, H. Kindbale and others.

RIPLEY, TENN.—The Lightfoot Telephone Company has been incorporated with $4,000 capital stock by J. H. Coughlan, W. H. Foust, W. F. Roberson and others.

DES MOINES, IOWA—The Iowa Telephone Company will erect new exchanges for handling the business of the consolidated Iowa and Mutual Companies' business. C.

ABERDEEN, S. D.—The stockholders of the Dakota Central Telephone Company authorized the expenditure of $300,000 for improvements and extensions during 1910. C.

SMITHVILLE, TENN.—The Smithville Home Telephone Company has been incorporated with $3,000 capital stock by T. W. Wade, J. H. Christian, W. H. Davis and others.

ST. LOUIS, MO.—The Home Co-Operative Telephone Company has been incorporated by John R. Gax, Truman B. Barnes, both of Maplewood, Mo.; F. A. O'Connor, St. Louis, and others.

COLEMAN, TEX.—The West Texas Telephone Company will, it is reported, expend $16,000 for improvements. It will install new cables, 800-box flashlight switchboard and make other improvements.

AMARILLO, TEX.—The Oldham Telephone and Telegraph Company, C. C. Tabor, president, 323 Taylor Street, will construct a telephone line and locate plants in and extend lines to Wildorado, Vega and Adrian, Tex.

NEW YORK, N. Y.—The Hudson Valley Telegraph Company has been incorporated to construct a telephone and telegraph line with a capital of $25,000. The incorporators are E. J. Kelly, J. Streppone and J. Foy, New York city.

REDDINGTON, IND.—The Reddington Township Mutual Telephone Company has been organized and incorporated to build and equip a telephone plant at Reddington and extend the lines throughout Jackson, Jennings and Bartholomew counties. S.

RICHMOND, VA.—The Sandy Valley Telephone Company of Grundy has been incorporated: John A. Looney, president, Grundy, Va.; Bart Belcher, vice-president, Artia, Va.; R. E. Ellswick, secretary and treasurer, Mouth Card, Ky. Capital, maximum, $4,000; minimum, $1,000.

AMARILLO, TEX.—C. C. Tabor, of this city, is promoting a telephone company to build a line connecting Amarillo and Wildorado, a distance of twenty miles. Mr. Tabor is engaged in business in Amarillo and Wildorado, and is exercising himself in this matter responsive to a popular demand for the service. With the completion of the proposed line into Wildorado it is expected people there will take it up and make an extension into Tucumcari, thus covering a long stretch of country with which no telephonic communication is had at this time.

TOLEDO, OHIO—Toledo is again the scene of a bitter telephone war for the control of the local business. Following the long-distance war between the Bell and Independents, precipitated by the announcement some time ago of sharp cuts in rates in this section, comes a second announcement of a struggle for the local business. The fight, it is claimed, was started by the Bell Telephone Company this month, when it sent its solicitors out with instructions to place Bell telephones with all exclusive Home Telephone users, absolutely free of charge. The plan is said to be to grant free Bell telephones indefinitely to all users until

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everyone is supplied who uses a telephone of any kind. The Bell company has recently expended about $500,000 in substations and other ways, adding two new exchanges with a capacity of 9,000 telephones each. It is said that the company is prepared to spend more than $100,000 to furnish its subscribers a complete list of telephone patrons. H.

TROY, ALA.—The Southern Bell Telephone and Telegraph Company, main office Atlanta, Ga., will expend about $22,000 for installation of entire new system; will install new wire, apparatus, switchboards, all appurtenances at the exchange and new telephones in dwellings and business houses; construction has been started; T. F. Powell, local manager.

FAYETTEVILLE, W. VA.—A telephone company has been organized at Clear Creek for the purpose of constructing and operating a telephone line between Clear Creek and Lawson. The line will be ten miles long and will extend through Artie and Colcord. The promoters of the enterprise are prominent business and professional men of that section of the county which the telephone is calculated to serve.

DES MOINES, IOWA—New exchanges for the handling of the consolidated Iowa and Mutual Telephone companies' business probably will be installed in Des Moines as the result of a conference between G. E. McFarland, the general manager, and C. E. Yost, president of the Iowa Telephone Company, held at Omaha recently. If the new exchanges are built, the general offices of the Bell company probably will be moved from Omaha to Des Moines.

WASHINGTON, D. C.—The complete telephone dispatching system in use on the Pittsburg & Butler Street Railway Company line from this city has proved such a success that it is being adopted by other lines elsewhere in the country. Manager W. H. Pape, of the Short Line, has stated that there have recently been several parties of operating officials from other interurban lines called to inspect the Butler Short Line dispatching system, with a view to adopting it. Many steam lines are making extensive use of the telephone system in conjunction with the telegraph.

WASHINGTON, PA.—Workmen for the National Telephone Company have completed the new line from the Canonsburg Exchange to Thomas Station, where an exchange has been opened for the convenience of the people in that section of the country. The building of the line was most bitterly contested by several farmers over whose land it was built, and during the six weeks which were required to construct the new line, three bonds had to be given by the National company. A number of injunctions were also issued against the company, and still other farmers went so far as to cut the wires after they had been strung. The line was put in operation yesterday.

DETROIT, MICH.—Extensive improvements and additions are to be made to the Michigan State Telephone Company's system, involving an immediate expenditure of $150,000 for the betterment of the service. "Our growth in business this year is outstripping the gain in subscribers of last year, which we thought was a record breaker," says President Kingsbury. "The improvements will relieve our east office district, which is congested. It will also greatly improve our service in and around Fairview and Grosse Pointe. This will allow our Grosse Pointe subscribers to have individual lines at reasonable rates, instead of party lines, as at present. The initial expenditures for this one section involve a new building, switchboard, underground conduit and cables, and will cost about $150,000, perhaps more."

NEW MANUFACTURING COMPANIES.

(Special Correspondence.)

TABLE ROCK, NEB.—The Table Rock Electric Company has been incorporated with a capital stock of $25,000.

BINGHAMTON, N. Y.—The Diamond Electric Company of this city has been incorporated to manufacture electric devices and appliances. Capital, $100,000. Incorporators: S. J. Hirschmann, J. Schwab, H. C. Price, Binghamton.

CHICAGO, ILL.—The Nohe Electric Renovator Company has been chartered to manufacture electrical devices. The capital stock is $25,000, and G. Langhenry, A. W. Nohe and J. V. Crane are the incorporators.

MUNCIE, IND.—The Warner Manufacturing Company has filed articles of incorporation with the secretary of state. The capital stock is $250,000. The object of the corporation is to build, establish, equip and operate a plant to manufacture automobiles, automobile parts, engines, motors, electrical goods and apparatus, and to do a general manufacturing business along these lines. Thomas W. Warner, N. M. Warner and E. Staunton Janney, incorporators. S.

TOLEDO, OHIO—The Ohio Electric Company has been incorporated at Toledo by Henry P. Dodge, Rathbus Fuller, Henry E. Marvin, James Brown Bell and Robert R. Lee. Capital stock, $75,000. The company will take over the business of the Ohio Electric Carriage Company, incorporated some time ago to manufacture electric automobiles. H.

ELECTRICAL SECURITIES.

Progress was made in the bull campaign last week with affairs still looking up on Monday of the present week. There was evident, however, an appearance of strain in upholding the top prices, and it is quite likely that there will be some retrogression. Industrials report continued improvement, and fruit and cereals are still announced as in a very promising condition.

The large earnings which were a feature of Philadelphia Rapid Transit's operations in the first two months of the current fiscal year have continued up to date. For first nineteen days of September gross receipts are $70,500 ahead of the corresponding period of last year.

At the annual meeting of the American Railways Company, held in New York city, the annual report was approved and directors re-elected. At a meeting of the directors the present officers were re-elected.

At the annual meeting of the stockholders of the Union Traction Company, held in Philadelphia, Pa., the annual report was read and approved and the old board of directors was re-elected.

At the annual meeting of the Tri-City Railway and Light Company, held Thursday at Hartford, Conn., Arthur Coppell, of Maitland, Coppell & Co., was elected a director to succeed Clarence McCuaig of Montreal. The other directors were re-elected. Directors of the Tri-City Railway and Light Company have re-elected the present officers for the ensuing year. An interest prominently identified with the Tri-City Railway and Light Company says that the earnings of the company, which were at the rate of $1,500,000 when the consolidation of the companies was made, have risen to $2,000,000 per annum, and the earnings for August were at the rate of $2,100,000. This company has taken a prominent share in the revival of business, as is shown by the fact that while other concerns ran behind in earnings during the depression, the Tri-City increased earnings thirty-three per cent. The company is now beginning to show results of the $4,000,000 spent in improvements since 1905.

According to an interest in the Brooklyn Rapid Transit Company, its gross returns for seventy-five days since July 1, when the new fiscal year began, have been between $5,000 and $6,000 a day in excess of earnings for the corresponding period a year ago.

DIVIDENDS.

American Cities Railway and Light Company; regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable October 1.

Bell Telephone Company, of Canada; regular quarterly dividend of two per cent, payable October 15 to stock of record September 25.

Chicago City Railway Company; regular quarterly dividend of one-and-one-half per cent; payable September 30 to stock of record September 20.

Duluth Edison Company, of Duluth, Minn.; quarterly dividend of one-and-one-half per cent on the preferred stock, payable October 1 to stock of record September 21.

Electric Boat Company; regular quarterly dividend of two per cent on the preferred stock, payable October 1 to stock of record September 20.

Germantown Passenger Railway Company; regular quarterly dividend, payable by Guarantee Trust Company, of Philadelphia, on October 5.

Houghton County Traction Company; semiannual dividend of $3 per share on preferred stock, and initial dividend of $2 per share on common stock, payable October 1.

Massachusetts Lighting Companies; regular quarterly dividend of one-and-one-half per cent, payable October 15 to stock of record October 1.

Otis Elevator Company; regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable October 15 to stock of record September 30.

Public Service Corporation of New Jersey; quarterly dividend of one-and-one-fourth per cent, putting stock on five per cent basis, an increase of one per cent in yearly rate.

Tri-City Railway and Light Company; quarterly dividend of one-and-one-half per cent on the preferred stock, payable October 1 to stock of record September 21.

Washington Water Power Company; regular quarterly dividend of one-and-three-fourths per cent; payable October 1 to stock of record September 15.

NEW YORK.

	Sept. 20.	Sept. 13.
Allis-Chalmers common	15⅜	14⅞
Allis-Chalmers preferred	52	51½
Amalgamated Copper	83¾	78⅛
American Tel. & Cable	*80	*80
American Tel. & Tel.	142¼	140¼
Brooklyn Rapid Transit	80⅝	77
General Electric	167½	165
Interborough-Metropolitan common	14⅞	14
Interborough-Metropolitan preferred	48	45½
Kings County Electric	131	130
Mackay Companies (Postal Telegraph and Cables) common	85¼	81
Mackay Companies (Postal Telegraph and Cables) preferred	74½	73¾
Manhattan Elevated	143	142
Metropolitan Street Railway	20	20
New York and New Jersey Telephone	123½	137

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NEW YORK—Continued.	Sept. 20.	Sept. 13.
U. S. Steel common	83¼	79
U. S. Steel preferred	127⅛	125½
Western Union	79½	76
Westinghouse common	86¼	84½
Westinghouse preferred	130	130

*Last price quoted.

BOSTON.	Sept. 20.	Sept. 13.
American Tel. & Tel.	142¼	140¼
Edison Elec. Illuminating	252	254
General Electric	167½	165
Massachusetts Electric common	17	16
Massachusetts Electric preferred	80	77
New England Telephone	137	134
Western Tel. & Tel. common	11	10
Western Tel. & Tel. preferred	89	88

PHILADELPHIA.	Sept. 20.	Sept. 13.
American Railways	46	46
Electric Company of America	12	12
Electric Storage Battery common	62	62½
Electric Storage Battery preferred	62	62½
Philadelphia Electric	12½	12¾
Philadelphia Rapid Transit	27¼	29⅞
Philadelphia Traction	88⅜	91
Union Traction	52½	53½

CHICAGO.	Sept. 20.	Sept. 13.
Chicago Railways, Series 1	110	110
Chicago Railways, Series 2	36	36¾
Chicago Subway	13	16
Chicago Telephone	131	130
Commonwealth Edison	121	120
Metropolitan Elevated common	15½	15⅛
Metropolitan Elevated preferred	48½	48½
National Carbon common	96¾	95
National Carbon preferred	118½	119

PERSONAL MENTION.

GEORGE A. McKINLOCK, president of the Central Electric Company, Chicago, visited New York last week, accompanied by his son Alexander, who took up his winter's studies in the East, September 22.

J. J. FOWLER, for many years identified with telephone interests in New Orleans, La., was a recent visitor to New York. Mr. Fowler is now secretary of the Board of Civil Service Commissioners of the City of New Orleans.

JULIUS BERNSTEIN, who was for many years associated with the Leeds & Northrup Company, of Philadelphia, is now connected with the department of electrical measuring instruments of Queen & Company, Inc., also of Philadelphia, Pa.

CHARLES B. PRICE, president of the Pettingell-Andrews Company, Boston, was a New York visitor last week. Mr. Price is also largely interested in the Price-McKinlock Company, of Boston, which does a large business in the manufacture of special modern lighting fixtures.

FRANK L. PERRY gave a demonstration of the utilization of wireless telegraphy in aerial navigation before the Engineer's Council of the Royal League, in the Masonic Temple, Chicago, Monday evening, September 20. Mr. Perry exhibited a perfect model of the Wright aeroplane, and, at the close of his lecture, further enlightened his audience by answering questions concerning both wireless and aviation.

J. J. MULLIN, vice-president of the Moloney Electric Company, of St. Louis, Mo., manufacturers of the well-known Moloney Transformers, recently returned from a six weeks' trip to the Pacific Coast and nearby states. Mr. Mullin found business conditions better than on any of his previous trips, and found the outlook for business very good. A great many plants which Mr. Mullin visited are enlarging their capacity or making other improvements. Mr. Mullin succeeded in adding a surprisingly large number of new customers to the Moloney company's books on his trip.

ROBERT I. TODD has been elected general manager of the Terre Haute, Indianapolis & Eastern Traction Company's system by the directors to succeed Charles C. Reynolds, who died last May. Mr. Todd was born in New Jersey in 1869, was graduated in the electrical engineering department of the John Hopkins Institute of Baltimore, and has served in the capacity of master mechanic, superintendent and vice-president with the several electric railroads with which he has been affiliated in the past. Mr. Todd came to Indianapolis six years ago to become general manager of the Indianapolis Tractional and Terminal Company and now the interurban lines have been added to his work. Mr. Todd is a successful traction man and his promotion is regarded as commendable and deserving. S.

PROPOSALS.

LIGHTING SYSTEM, FORT MYER, VA.—Sealed proposals, in triplicate, will be received at the office of the Constructing Quartermaster, October 13, 1909, for the interior electric wiring of forty-four buildings, including fixtures, and the installation of a complete outside distributing system for the post. Alternate bids are asked for underground and overhead distributing system. Certified check or surety company's guarantee for ten per cent of the amount must accompany the bid. Plans and specifications will be furnished upon application. A deposit of $10 must accompany the request to insure their safe return. Proposals should be indorsed on the envelope "Proposals for Electric Lighting System," and addressed to Capt. Warren W. Whitside, Constructing Q. M.

POST OFFICE, LEAD, S. D.—The office of Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., October 26, 1909, for the construction (complete) of the United States Post Office at Lead, S. D., in accordance with the drawings and specifications, copies of which may be had at the office of the postmaster at Lead, S. D., or at the Supervising Architect's office.

POST OFFICE, COLUMBUS, MISS.—The Supervising Architect, Washington, D. C., will receive sealed proposals October 22 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Columbus, Miss., in accordance with drawings and specification, copies of which may be had from the custodian of site at Columbus, Miss., or at the Supervising Architect's office.

POST OFFICE, PITTSFIELD, MASS.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until 3 o'clock p. m., October 25, for all the labor and materials required for the construction (complete) of the United States Post Office at Pittsfield, Mass., in accordance with the drawings and specification, copies of which may be had at the office of the postmaster at Pittsfield, Mass., or at the Supervising Architect's office.

POST OFFICE, HOBOKEN, N. J.—The Supervising Architect, Washington, D. C., will receive sealed proposals October 21 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the United States Post Office at Hoboken, N. J., in accordance with drawings and specifications, copies of which may be obtained from the custodian at Hoboken, N. J., or at the Supervising Architect's office.

POST OFFICE AND COURT HOUSE, LA CROSSE, WIS.—The Supervising Architect, Washington, D. C., will receive sealed proposals on October 18 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the United States Post Office and Court House at Lacrosse, Wis., in accordance with drawings and specifications, copies of which may be obtained from the custodian at Lacrosse, Wis., or at the Supervising Architect's office.

NEW PUBLICATIONS.

THE GENERATOR—The September number of this publication, issued by the students of the New York Electrical School, contains some interesting articles written by students and graduates of this school.

LIGHTING RATES IN OHIO—Secretary D. L. Gaskill, of the Ohio Electric Light Association, has collected and compiled a mass of data relating to the electric-lighting rates prevailing in about 120 cities and villages of Ohio. These data have been published in pamphlet form by the association as of date of August, 1909. Each central-station company is given a separate section classified alphabetically by towns and in each section the first paragraph relates to the street-lighting rates and the second to the commercial lighting rates. This pamphlet of twenty-eight pages is a very valuable one for central-station companies.

TUNGSTEN ORES IN CANADA—A report on the "Tungsten Ores of Canada," by Prof. T. L. Walker, of Toronto University, has just been issued by the Department of Mines of Canada. The report covers fifty-six pages and includes fifteen illustrations. Among the rare metals which have recently become of commercial value, tungsten is an important one, both on account of its recent application as a filament in incandescent lamps, and its use in the manufacture of tungsten steel, to which it imparts great elasticity and tensile strength. The known occurrences of tungsten ores throughout the world are comparatively few, which fact lends additional interest to some discoveries of scheelite (an ore of tungsten) which have been made within the past year or two in Nova Scotia. These, together with other occurrences of tungsten ores in Canada, have been made the subject of the present report. The several occurrences of tungsten ore in Canada are described in detail, and a general statement is given on the geological occurrence of the ores, chemical tests, concentration, the uses of the metal, producing mines in other countries, statistics of the world's production, etc., while a very useful bibliography of the literature on Canadian and United States occurrences is added.

ELECTRIC SMELTING OF IRON ORES—As a sequence to the reports on "Electric Smelting of Iron Ores," published in 1904, 1906 and 1907, the Department of Mines of Canada has just issued the results of "An Investigation of an Electric Shaft Furnace," in operation at Domnarfvet, Sweden. The investigation was made by Dr. Eugene Haanel in December, 1908, on the

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invitation of the inventors, and the results given represent some of the latest developments of the electric smelting of iron ores. The report contains thirty-eight pages and is divided into four parts. Part I deals with the Domnarfvet furnace, the trial runs and the comparative costs of production of pig iron by the furnace. The other three parts, which are more of the nature of appendices, describe: (1) a new electric furnace for the manufacture of steel, (2) the manufacture of electrodes, (3) methods of manufacturing wood charcoal, this material being used to supply the carbon which enters into the composition of pig iron manufactured by electric smelting. Three full-page plates, from photographs, and numerous drawings illustrate the descriptive matter of the book, which, taken in conjunction with the reports previously published by the Mines Branch on the subject of electric smelting, adds materially to the literature on the electrometallurgy of iron. This report and the preceding one on tungsten ores may be obtained on application to Dr. Eugene Haanel, Director of Mines, Department of Mines of Canada, Ottawa.

THE MUNICIPAL SCHOOL OF TECHNOLOGY, AND MUNICIPAL SCHOOL OF ART, MANCHESTER, ENGLAND—The calendar for the 1909-1910 session has just come to hand. This publication of 534 pages is published at the nominal price of six pence (twelve cents) and contains an account of the remarkable educational opportunities offered at surprisingly low figures to the youth of the great manufacturing district of which Manchester is the center. A partial list of some of the full-page illustrations in the book will give some idea of the scope of this great municipal technological institution, some of the departments being apparently on the scale of prosperous manufacturing concerns. The list is as follows: General view of the main building; entrance hall; plans of floors; hydraulics laboratories; materials testing laboratories; advanced physical laboratories; electro-technical laboratories; plumbing and sanitary engineering laboratories; main inorganic chemistry laboratories; department for bleaching, dyeing, printing and finishing textile goods and for paper manufacture dyeing laboratories; brew house; paper-making machine; cotton-spinning room; textile testing laboratories; photographic studio; examination and main lecture hall; applied mechanics laboratories; engineering workshop; electrical engineering laboratories; wood-working department; interior of dye-house; bakery; bread-making equipment of bakery; water-analysis laboratory; machine room, typographical department; composing room and linotype machine; bindery; main weaving shed; pattern weaving shed; the Municipal School of Art; textile court and museum: textile court of the Arts and Crafts Museum; art room; workshop for stained glass and repoussé work. There are courses both for day and evening work and the subjects of instruction cover practically the whole field of education, the arts and sciences, technology, trades and handicrafts, making the institution a polytechnic in the fullest sense of the word. As the school is affiliated with the University of Manchester (formerly the Owens College of the Victoria University), students may comrete for the technical science degrees of that university as internal students.

EDUCATIONAL NOTE.

WEST RALEIGH (N. C.) AGRICULTURAL AND MECHANICAL COLLEGE RECORD—The Department of Electrical Engineering has issued Vol. 1, No. 8, of the College Record, in which is given an account of the physical and electrical equipment, with illustrative halftones, and lists of the subjects of instruction and of the faculty.

INDUSTRIAL ITEMS.

F. W. PARDEE, Chicago, Ill., is distributing a mailing card containing a description of the Paragon ground cone, which he manufactures.

THE ELECTRICAL ALLOY COMPANY, Morristown, N. J., has recently published a circular devoted to a description of its resistance wire.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio, is distributing bulletin No. 8-A, devoted to miniature and low-voltage tungsten lamps.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., has issued a revised price list showing a reduction in the prices of the Columbia tungsten lamps.

THE GRAY TELEPHONE PAY STATION COMPANY, Hartford, Conn., has published a book of testimonials from pleased users of its pay station equipment.

THE CUTTER COMPANY, Philadelphia, Pa., is distributing an advertising calendar which announces a new era of prosperity for Cutter circuit-breakers.

GENERAL C. EDWARD MURRAY, treasurer of the Crescent Insulated Wire and Cable Company, of Trenton, N. J., was in Chicago this week and made a call upon his representative, the Metropolitan Electrical Supply Company, which carries large stocks of the Crescent wire. General Murray is well satisfied with the business outlook for the fall and winter and thinks everything looks quite favorable.

THE PHELPS MANUFACTURING COMPANY, Detroit, Mich., is distributing an attractive folder containing an illustration of the use of the "any-angle" dressing fixture.

THE COATES CLIPPER MANUFACTURING COMPANY, Worcester, Mass., is distributing bulletin No. 22, describing and illustrating the various applications of Coates Unit link, flexible shafting.

THE AMERICAN ELECTRICAL HEATER COMPANY, Detroit, Mich., is distributing a small folder-price-list describing the "Superior" six-pound electric iron, which possesses several commendable features.

THE WESCO SUPPLY COMPANY, of St. Louis, Mo., has just published the lighting number of its "Price Current and Discount Sheet," which contains some interesting suggestions on lighting material.

THE NATIONAL METAL MOLDING COMPANY, Pittsburgh, Pa., is distributing a mailing card containing a photograph of a new mammoth office building in which "Sherarduct" conduit has been installed.

THE ARROW ELECTRIC COMPANY, Hartford, Conn., announces that it has purchased the entire capital stock of the Marshall Electric Company, which corporation will be operated under the name of the first-named company.

THE CENTURY ELECTRIC COMPANY, St. Louis, Mo., manufacturers of single-phase, self-starting motors, announces that it has opened an office at 315 Hudson Terminal, 30 Church Street, New York, N. Y., in charge of H. B. Steele.

THE KEYSTONE LUBRICATING COMPANY, Philadelphia, Pa., has sent Harold D. Buzby, its secretary, on a two months' tour of the company's western branches, including Chicago, Denver and San Francisco, and other smaller sales offices.

THE AMERICAN SHIP WINDLASS COMPANY, Providence, R. I., has been favored with an order for fourteen, seven-retort stokers of the Taylor gravity underfeed pattern, to be installed in the Christian Street Station of the Philadelphia Electric Company.

THE LUCAS PUMP COMPANY, Dayton, Ohio, manufacturers of standard power pumps, announces that J. W. Good, a prominent business man, has been elected to fill the position of treasurer made vacant by the resignation of R. E. De Weese, who is taking a trip abroad.

THE REMINGTON TYPEWRITER COMPANY, owing to increase of business, has found it necessary to enlarge the capacity of its factory at Ilion, N. Y., and orders are to be placed for an additional power unit and for machine-tool equipment amounting to about $50,000.

THE WAGNER ELECTRIC COMPANY, St. Louis, Mo., has recently issued Bulletin No. 87, entitled "Generators and Synchronous Motors." This publication deals quite fully with the construction of polyphase generators and motors, and contains some interesting illustrations and data.

THE UNION SWITCH AND SIGNAL COMPANY, Swissvale, Pa., is distributing an expensively bound catalogue and price list devoted to its interlocking and signaling devices. It contains a large number of general drawings, showing the construction and applications of their product.

THE GENERAL VEHICLE COMPANY, Long Island City, N. Y., manufacturer of commercial electric vehicles, has established a branch in Chicago, Ill. P. C. Chrysler, for a long time with the Ranier Motor Company, and later with the American Locomotive Company, has been appointed western manager, with headquarters in Chicago.

THE IRON AGE—Announces that the business of the David Williams Company, publishers of "The Iron Age," has been taken over by a group of publishers, including Charles T. Root, Charles C. Phillips, I. A. Mekeel and William H. Taylor, the latter until recently the publisher of "The Engineer." No change in policy or in the important personnel of the office is contemplated.

THE BRISTOL COMPANY, Waterbury, Conn., is distributing bulletin No. 111, devoted to a description of Bristol's Class II Recording Thermometers, as especially adapted for feed-water temperature. This publication should be particularly interesting on account of three sample record charts, contained therein, showing records of actual feed-water temperatures.

DATES AHEAD.

Kansas Gas, Water, Electric Light and Street Railway Association. Next meeting, Wichita, Kan., September 23-24.

Illuminating Engineering Society. Annual convention, New York, N. Y., September 27, 28 and 29.

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Association of Car Lighting Engineers. Annual meeting, Chicago, Ill., October 4-7.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

Railway Signal Association. Annual meeting, Louisville, Ky., October 12-14.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

Alabama Light and Traction Association. Annual convention, Birmingham, Ala., November 15 and 16.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 18.

Empire State Gas and Electric Association. Annual convention, New York city, November 17 and 18.

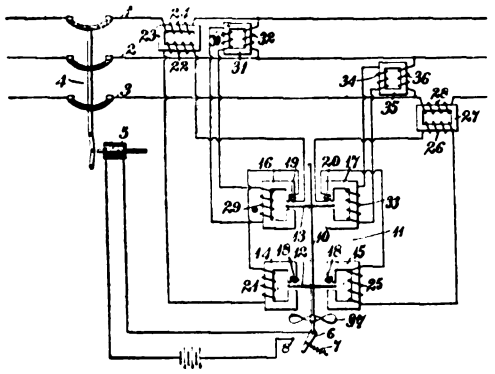
RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) September 14, 1909.

933,737. VENTILATING-PLATE AND SPACING-BLOCK FOR ELECTRIC APPARATUS. Jesse A. Baird, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed November 3, 1906. Spacing fingers dovetail into holes in a plate and are locked to the latter by a displaceable device.

933,746. OVERLOAD AND REVERSE CURRENT RELAY DEVICE. Frank Conrad, Edgewood Park, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 8, 1905. A movable member is provided with means for applying to it forces respectively proportional to (1) the product of the current, voltage and power factor of a circuit; (2) the square of the current; (3) the square of the voltage.

933,747. OVERHEAD-LINE MATERIAL FOR ELECTRICAL RAILWAYS. Harry P. Davis, Pittsburg, Pa., assignor, by mesne arrangements, to Westinghouse Electric and Manufac turing Company. Filed November 8, 1907. A section-break device for trolley conductors comprises an insulating bar, end brackets or clamping members, an intermediate member of conducting material, and a number of switch blades independently supported by the intermediate member.



933,746.—OVERLOAD AND REVERSE CURRENT RELAY DEVICE.

933,756. ELECTRIC SIGNAL. Winthrop K. Howe, Rochester N. Y., assignor to General Railway Signal Company, Gates, N. Y. Filed March 18, 1908. An oscillating motor-driven disk covers and uncovers apertures in the cover plate of the main casing of the apparatus.

933,765. WINDING FOR ARMATURES OF DYNAMO-ELECTRIC MACHINES. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed November 3, 1906. A dynamo-electric machine having a field-magnet winding in which the number of poles may be changed, has a winding for the armature, which has a number of coils, the pitch of which is intermediate the polar pitches for the respective different numbers of poles.

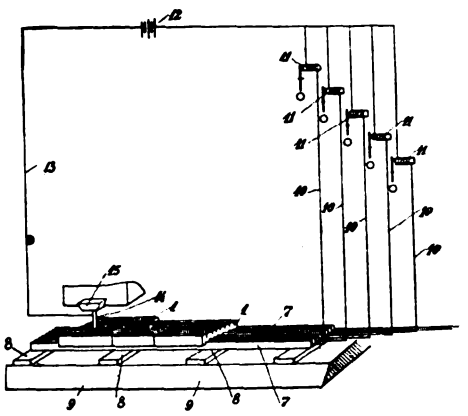
933,767. ALTERNATING-CURRENT-TRANSFORMER REGULATOR. Albert C. Lasher, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed November 26, 1906. Comprises a core member, a supporting frame therefor and a pair of movable coils, a pair of adjustably mounted rocking beams, cords for suspending the coils from the ends of the beams, and means for adjusting the connections between the cords and the coils.

933,769. ARC LAMP HAVING MAGNETIZABLE ELECTRODES. George M. Little, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 10, 1906. In combination with an arc-lamp electrode that contains mag netizable material, are means for neutralizing magnetism that may be produced therein by external means comprising an electromagnet winding that surrounds the electrode.

933,770. ARC LAMP. George M. Little, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 10, 1906. In combination with the electrodes and an inclosing casing therefor, are means for causing the drafts that enter the casing to revolve about an approximately vertical axis adjacent to the inner surface of the casing.

933,787. FUSE RECEPTACLE. Bertrand P. Rowe, Wilkinsburg, and Samuel M. Kintner, Pittsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed September 20, 1906. An insulating receptacle containing insulating fluid has a cover provided with a vent opening and a shield for the opening, separable circuit terminals within the receptacle, and an inclosed fuse device connected between the terminals.

933,792. COIL-WINDING APPARATUS. Harold B. Smith, Worcester, Mass., assignor to Westinghouse Electric and Manufacturing Company. Filed May 9, 1907. A horizontally rotatable drum has an end flange and is provided with an insulating sleeve or spool, a ring having a diagonal slot in its inner surface fits loosely over the sleeve or spool, and means are provided for exerting a constant force upon the ring to move it toward the flange.



933,805.—ELECTRICAL PATTERN FOR THE MANUFACTURE OF JACQUARD CARDS.

933,800. SECTION-BREAK INSULATOR. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed June 4, 1906. Describes a supply-line section-break device for sliding trolleys.

933,805. ELECTRICAL PATTERN FOR THE MANUFACTURE OF JACQUARD CARDS. Paul Weissenborn, Barmen, Germany, assignor to the firm of Kruse et Breying, Barmen, Germany. Filed January 9, 1908. The formation of the holes in the cards is electrically controlled.

933,815. ELECTRIC FURNACE. Thaddeus F. Baily, Alliance, Ohio. Filed October 13, 1908. Describes a form of electrode furnace.

933,824. TELEPHONE STAND. Charles S. Coom, Rockledge, Pa. Filed April 8, 1909. A normally horizontal switch-controlling arm attached to the telephone stand supports at right angles an arm adjustably grasping the receiver.

933,826. INTERMITTENT LINE SWITCH. Elmer E. F. Creighton, Schenectady, N. Y., assignor to General Electric Company. Filed October 31, 1907. An electrolytic lightning arrester has a spark-gap in series therewith, and a switch for closing the spark-gap at will.

933,827. ADJUNCT FOR ALUMINUM-CELL LIGHTNING ARRESTERS. Elmer E. F. Creighton, Schenectady, N. Y., assignor to General Electric Company. Filed August 7, 1907. In combination with line conductors of a transmission system, are an electrolytic lightning arrester, a resistance, a low inductance path in parallel with the resistance, and switching means for including the resistance in circuit with the arrester between line and line.

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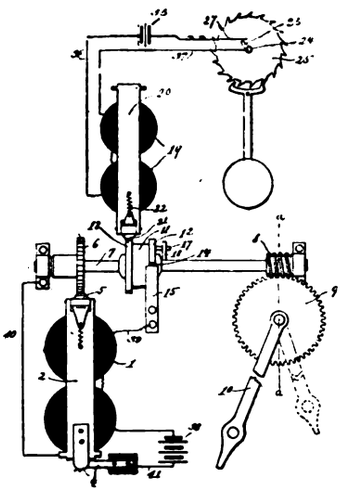
933,838. DEVICE FOR FASTENING TELEPHONES TO WALLS. Jonathan B. Horton, Elkin, N. C. Filed November 13, 1906. A single piece of wire is formed into a pointed screw at one end and bent over on itself to resemble the wing of a butterfly nut, at the other end.

933,845. ARRANGEMENT FOR INDICATING AND RECORDING PERMANENTLY THE MAXIMUM DEMAND FOR ELECTRICAL ENERGY ON ANY CIRCUIT. William W. Lackie and David J. Steele, Glasgow, Scotland. Filed January 31, 1908. In combination with an electric meter, are a solenoid, a beam pivotally mounted adjacent to the solenoid and carrying a magnetic plunger projecting into the solenoid, a wheel rotatably mounted upon the beam and adapted to be brought into driven relation with the meter, and means for exerting a gradually augmented pull upon the wheel tending to pull the wheel out of engagement with the meter.

933,854. SECTIONAL POLE. Oliver O. M. Sciple, Minneapolis, Minn. Filed April 10, 1908. A built-up steel pole has means for lowering the electric-light bracket to make the lamp accessible from the ground.

933,887. CLUSTER FIXTURE FOR ELECTRIC LIGHTS. John H. Caldwell, Philadelphia, Pa. Filed October 21, 1908. Comprises a hanger with a base secured to it, lamp sockets on the upper face of the base, lamps in the sockets, a switch on the lower face of the base, a bail secured to the base, and a lamp shade supported by the bail and surrounding the base.



933,899.—ELECTRICALLY-OPERATED CLOCK.

933,899. ELECTRICALLY-OPERATED CLOCK. Harleigh Gillette, Chicago, Ill. Filed March 11, 1908. A secondary clock has a motor for actuating it, an electric circuit controlling the motor, a rotating circuit closer controlling the circuit, electrically actuated means controlled by a master clock and imparting movement to the circuit closer to close the circuit, and means actuated by the motor imparting secondary movement to the circuit closer to open the circuit.

933,930. ELECTROMAGNETIC SEPARATOR FOR GRAIN CHUTES. Bird M. Sypher, Toledo, Ohio. Filed June 22, 1908. An electromagnet, with a non-magnetic wiper plate extending over and engaging with it, is arranged transversely in the bottom of the chute.

933,956. ELECTRICAL SWITCH. Frank H. Buffehr, Millers, Nev. Filed May 3, 1909. Describes a reversing switch for three-phase motors.

933,989. ELECTRIC HEATER. Carl E. Johnson, Los Angeles, Cal., assignor of one-half to Wm. W. Piddington, Los Angeles, Cal. Filed January 22, 1909. In combination with an electric fan motor is an electric heating element secured thereto, the element and motor being connected in parallel, and means are provided to automatically adjust the heating element while a current is passing therethrough.

934,024. INCANDESCENT LAMP. Edward H. Smith, Aberdeen, Wash., assignor of one-half to Thomas Mitchell, Aberdeen, Wash. Filed November 30, 1908. A switch lever for multiple-filament lamps comprises a single piece of sheet metal provided with a flattened offset head adapted for pivotal connection with a lamp, this lever being provided with a narrow elongated body, the central portion of which is depressed and contracted to form a contact surface, the free end of the body being rolled upon itself to form a string-receiving eye.

934,063. SAFETY DEVICE FOR POLYPHASE-CURRENTS MACHINERY. Juan M. S. Fontecha, Mexico, Mex. Filed November 27, 1908. A safety device for triphase current machinery comprises a safety fuse in each phase, and means in each circuit, controlled and operated by the current of said circuit, for automatically short-circuiting the two other circuits upon failure of current in one circuit.

934,097. CONTROLLER FOR ELECTRIC MOTORS. Frank L. Sessions, Columbus, Ohio, assignor to The Jeffrey Manufacturing Company, a corporation of Ohio. Filed December 2, 1903. Renewed January 31, 1908. Comprises a series of pairs of movable contacts, series of co-operating pairs of stationary contacts, means for normally separating the contacts of each of the pairs, and manually controlled devices for causing the contacts of each of the pairs to become electrically connected and also for positively disconnecting them.

934,104. CONTROLLING MEANS FOR ELECTRICAL CLUTCH DRIVING MECHANISM. Abram P. Steckel, Buffalo, N. Y. Filed December 11, 1908. Two electric clutches have driving members which rotate in one direction and driven members arranged to drive machinery in opposite directions; means are provided for exciting either clutch, also means operated by the motion of the machinery when the current is cut off from the driving clutch for exciting the other clutch, whereby the latter clutch acts to retard the motion of the machinery.

934,108. ELECTRIC BURGLAR-ALARM. Max Trautmann, Dresden, Germany, assignor to Bertha Trautmann, Dresden, Germany. Filed November 21, 1908. Electrical contacts are established by a double winding roller curtain.

934,119. CIGAR-LIGHTER. Francis J. Wildemann, Newark, N. J. Filed February 10, 1909. Comprises a base forming a receptacle having a lid, a lamp mounted on the lid and adapted to form an electric conductor, an arm, means for swinging the arm, a contact to engage the lamp when the rod is swung, and means for adjusting the lamp vertically.

934,122. INITIATION-STEP. Ernest L. Woodman, Chicago, Ill. Filed May 4, 1909. Each of a flight of glass-treaded stairs contains under it an electric lamp which is put in circuit and lighted when a person treads on the stair.

934,210. DYNAMO-ELECTRIC MACHINE. William D. Pomeroy, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Filed March 6, 1905. Comprises a frame, a laminated core, a dovetail connection between core and frame, clamping bolts for holding the laminas of the core together, each bolt lying in a passageway formed between the dovetail projection and dovetail groove of the connection.

934,212. KNOCKDOWN ARMATURE. Eugene W. Presbrey, New York, N. Y. Filed May 19, 1908. Comprises shells of conducting material, a generating coil arranged intermediate the shells and revoluble relatively thereto, metallic faceplates in fixed relation to the coil and connected to the terminals thereof, and carbon rings in contact with the faceplates and shells.

934,232. CONTROLLER-HANDLE. Emmett W. Stull, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Filed June 22, 1905. The handle carries a pawl which engages with a notched member rotatably mounted on the controller shaft.

934,233. CONTROLLER-HANDLE. Emmett W. Stull, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Filed June 22, 1905. A pawl carried by the handle normally engages with a relatively fixed notched member. A slight backward movement of the handle releases the pawl and means are provided for preventing the pawl from again engaging the same notch after having been released from it.

934,236. PULL-SOCKET. George B. Thomas, Bridgeport, Conn., assignor to the Bryant Electric Company. Filed May 15, 1909. Comprises a rotary insulating block, a switch member moving therewith mounted on one side of the same, a spindle extending only to the other side of the block and means mounted on the spindle for rotating the block.

934,256. DYNAMO-ELECTRIC MACHINE. Alfred H. Wouters, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed March 1, 1907. Has a stator core, with a stator winding in it, and arc-shaped straps or bars (connecting different parts of the winding) arranged circularly end to end and supported on the end of the stator core.

934,263. ELECTROMAGNETIC PULSATOR FOR MILKING-MACHINES. Lee W. Badger and Edwin J. Badger, Bellefontaine, Ohio. Filed January 6, 1908. The plunger valve of a vacuum tube is operated by a soft-iron core arranged in the tubular core of an electromagnet.

934,284. ELECTRIC SIGNALING DEVICE. Robert V. Cheatham, St. Matthews, Ky. Filed March 31, 1908. An automatic electric signaling system comprises a signaling device having an electromagnet and a signal operable thereby, a signal-operating circuit adapted to be closed through this magnet, and a pair of controlling circuits also adapted to be closed success-

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ively through the magnet and serving to operate the latter to establish the operating circuit therethrough.

934,296. TUNER FOR WIRELESS TELEGRAPHY. Halsey Dunwoody, U. S. Army. Filed July 5, 1907. Comprises an outer coil provided with a frame having a channel; an inner coil slidingly fitted in this channel and provided with terminals, and fitting the channel; and a reversing plug in circuit between the coils.

934,298. OUTLET-BOX. Thomas J. Fagen and Samuel C. Thomason, Baltimore, Md. Filed September 25, 1908. The casing is formed of sections and has a centrally disposed collar contained wholly within it for securing the casing in position; openings are provided in the walls of the casing, and means for closing these openings.

934,301. CONTROLLING DEVICE FOR ELECTRIC MOTORS. Ernst H. Geist, Cologne, Germany. Filed November 16, 1908. The motor to be regulated has its armature winding in series with the armature of a generator which has a field winding in series with its armature and also a shunt field winding. Resistances and a switching device are provided so that the field and armature circuits of the generator may be closed through the switch and the resistances inserted into and removed from the circuit of the second field winding.

934,340. SWITCH. Ole P. Noisom and Carl J. Lindewald, South Bend, Ind.; said Lindewald assignor of one-fourth of the entire right to said Noisom. Filed September 19, 1908. An electric time switch comprises clock mechanism, a switch-operating power spring, a movable switch element, means including a trip for locking and unlocking the power spring, a bearing interposed between the power spring and switch and embodying a train of gears, a movable support on which said gears are mounted, and means for fastening this support when adjusted.

934,352. LINE-WIRE CONNECTOR. John S. Pratt, U. S. Army. Filed November 24, 1908. Has terminal hooks and a central portion of a width exceeding the width of the curved portion forming the hooks, the central portion being formed to provide a lateral offset rib arranged on the inner surface of the curve.

934,369. VENTILATING PLATE AND SPACER FOR ELECTRICAL APPARATUS. Harry D. Summers, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed October 24, 1906. The plate has oblong holes and strips or figures, each of which consists of two end portions disposed in approximately parallel planes and an intermediate portion having a lateral projection that fits into the corresponding oblong hole and is upset against the back of the plate, all of the finger portions being in planes which are substantially perpendicular to the face of the plate.

934,385. APPARATUS FOR THE ELECTROLYSIS OF ALKALI CHLORIDS. Jean Billitzer, Vienna, Austria-Hungary. Original application filed January 22, 1907. Divided and this application filed June 17, 1908. Comprises a trough, a bell within the trough adapted to contain the electrolyte and the anode, a cathode net suitably disposed across the lower opening of the bell and a diaphragm upon the net comprising a layer of asbestos cloth and a mixture of sulphate of barium with asbestos wool disposed upon the cloth to form a layer.

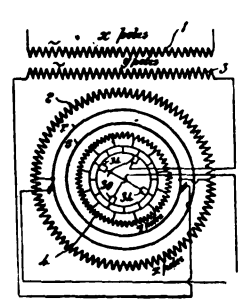
934,390. OVERLOAD AND REVERSE CURRENT RELAY DEVICE. Frank Conrad, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company. Original application filed May 8, 1905. Divided and this application filed October 24, 1906. Renewed January 25, 1909. Includes a movable conducting member and a magnetizable core comprising a yoke and pole-pieces adjacent to the conducting member, a magnetizing winding located on the yoke of the core, a second winding located on the yoke of the core, a winding connected in closed circuit with the second winding and located on the pole-pieces, and a third winding located on the yoke of the core in proximity to the second winding.

934,391. OVERLOAD AND REVERSE CURRENT RELAY DEVICE. Frank Conrad, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company. Original application filed May 8, 1905. Divided and this application filed March 15, 1909. Similar to the preceding.

934,396. SIGNAL-BELL. Harold W. Eden, Detroit, Mich., assignor to P R Manufacturing Company, Detroit, Mich. Filed December 7, 1908. Describes an electric bell.

934,405. DYNAMOELECTRIC MACHINE. Louis J. Hunt, Sandycroft, near Chester, England. Original application filed June 22, 1906. Divided and this application filed May 20, 1907. Comprises a stationary part and a rotary part, a winding on the stationary part adapted to be connected to a source of electric supply, a winding on the rotary part, a second winding on the stationary part, a commutator on the rotary part, brushes on the commutator, connections joining the brushes, the winding on the rotary part, and the second winding on the stationary part in series, and a second winding on the rotary part joined to the commutator.

934,420. AUTOMATIC WEIGHING-MACHINE. Thomas R. Weyant, New York, N. Y. Filed September 25, 1906. Comprises a scale, a hopper having a main delivery spout and a drip spout for discharging into the scalepan, an automatically closing valve for controlling the flow of material through the main spout, an electric motor for opening the valve, a valve for controlling the flow of material through the drip spout, an electric motor for controlling the last-named valve positively to open and close the drip spout, and circuits controlled by the movement of the scalepan for operating the electric motor.



934,405.—DYNAMO-ELECTRIC MACHINE.

934,421. INDICATOR FOR SWITCHES. Charles A. Clark, Hartford, Conn., assignor to Trumbull Electric Manufacturing Company, Plainville, Conn. Filed September 21, 1908. The indicator comprises a disk having a central and two diametrically opposed perforations bearing, on its upper face, a plate of distinctive color differing from the disk and extending across the plate, the indicator plate having perforations registering with the perforations of the disk, a plate on the lower face of the disk having registering perforations and means for securing the disk and plates together with the perforations in registering position.

REISSUE.

13,020. APPARATUS FOR REFINING COPPER. Frank L. Antisell, New York, N. Y., assignor of one-fourth to William S. Higgins, Perth Amboy, N. J. Filed April 3, 1908. Original No. 875,641, dated December 31, 1907. A device for electrolytically refining copper comprises a tank adapted to contain an electrolyte, an anode and a cathode suspended in the electrolyte, a frame suspended in the electrolyte between the anode and the cathode, and a removable porous non-conducting diaphragm carried by the frame.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired September 20, 1909:

482,719. CONDUIT FOR ELECTRIC RAILWAYS. Francis O. Blackwell, Boston, Mass.

482,724. ELECTROLYTIC APPARATUS. Thomas Craney, Bay City, Mich.

482,753. INSULATED ELECTRIC WIRE. Thomas L. Reed, Providence, R. I.

482,778. ELECTRIC SIGNALING DEVICE FOR FIREMEN. George L. Barnard, Milwaukee, Wis.

482,780. SIGNAL TELEGRAPH. Claudius V. Boughton, Buffalo, N. Y.

482,825. ARMATURE WINDING FOR DYNAMO-ELECTRIC MACHINES. Rudolf Eickemeyer, Yonkers, N. Y.

482,863. ELECTRIC LOCOMOTIVE. Conrad M. Conradson, Madison, Wis.

482,936. ELECTRIC SWITCH AND CASE. Augustus Wright, Providence, R. I.

482,964. ELECTRIC-RAILWAY CONDUIT. Rudolph M. Hunter, Philadelphia, Pa.

482,986. ELECTRIC ARC LAMP. James A. Stuart, Philadelphia, Pa.

482,993. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. Levi P. Bunce, Minneapolis, Minn.

483,061. TROLLEY STAND FOR ELECTRIC RAILWAYS. John C. Hough, Pittsburg, Pa.

483,074. JOINT FOR ELECTRIC CONDUCTORS. Joseph W. Marsh, Pittsburg, Pa.

483,108. ELECTRICAL STOP VALVE. Adolf Franke, Berlin, Germany.

483,123. CIRCUIT SWITCH. George W. Russell, Jr., and Daniel B. Minor, Denver, Colo.

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CONTENTS.

EDITORIAL:
Electrification of Railroad Terminals in Chicago..... 619
Units of Central-Station Investment..... 620
Cost of Power in a 3,000-Kilowatt Turbine Plant..... 621
The Value of Central-Station Statistics..... 621
Programme for a Series of Joint Electrical Meetings in Chicago..... 622
Boston Electrical Show..... 622
Chicago Electric Club..... 622
Meeting of Kansas Gas, Water, Electric Light and Street Railway Association..... 623
Monmouth, Ill., Public Service Consolidation..... 623
American Exposition in Berlin..... 623
Railroad Terminal Electrification Made Mandatory in Chicago..... 624
Vermont Electrical Association..... 625
ELECTRIC TRACTION:
Catenary Trolley-Line Construction..... 626
What Is a Crowded Car?..... 630
Vibration in Motor Traction..... 631
American Street and Interurban Railway Association..... 632
Wireless on Trains..... 633
Proposed Reorganization Plans of the Chicago Consolidated Traction Company..... 633
The Transportation Problem in New York City..... 634
New York Telephone Company Deal..... 634
Storage-Battery Meeting in Chicago..... 634
Convention of the Society for the Promotion of Industrial Education.. 634
Electrical Exports for July..... 635
Westinghouse Electric Company..... 635
Live Wires..... 636
Annual Outing for Commonwealth Edison Company Lady Employes.... 635
Boosting New Orleans..... 635
The Federation of Trade Press Associations..... 635
Details of New York Telephone Merger..... 635
Explosions in Switch Boxes..... 637
X-Rays in Dentistry..... 637
INDUSTRIAL POWER:
Extended Uses of Electricity on Board Ship.—II..... 638
Electricity in the Coal Mining Industry..... 641
One Way to Improve the Load Factor..... 642
High-Pressure Pumping System in New York..... 642
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
New Methods and Specifications for Street Lighting..... 643
The Hudson-Fulton Celebration..... 646
Convention of Car-Lighting Engineers..... 646
Magnetic Storm Ties Up Wires..... 647
QUESTIONS AND ANSWERS..... 648
FINANCIAL REPORTS OF ELECTRICAL COMPANIES..... 649
INDUSTRIAL SECTION:
The Flexibility of a Telephone System for Electric Railways..... 650
Robert Switchboard Instruments..... 651
Vac—M Lightning Arrester..... 651
Western Electric Exhibit at Denver..... 651
Geared Freight Locomotive for New York, New Haven & Hartford Railroad..... 652
New Benjamin Tungsten Fixtures with Hooded Enamel Steel Reflector..... 653
A Sign of the Times..... 653
Atchison, Topeka & Santa Fe Extends Telephone Train Dispatching..... 653
Central Laboratory Supply Company Changes Name..... 654
Westinghouse Exhibit at Denver..... 654
A New Patent Sand Box..... 655
Machinery Exhibition Warehouse for Chicago..... 655
Thordarson Toy Transformers..... 656
Hobson's Class..... 656
CURRENT ELECTRICAL NEWS..... 657
RECORD OF ELECTRICAL PATENTS..... 664

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ELECTRIFICATION OF RAILROAD TERMINALS IN CHICAGO.

The City of Chicago is about to take a most important step looking to the electrification of the terminals of all the steam railroads within a radius of eight miles of the center of the city. The draft of a preliminary municipal ordinance aiming to accomplish this laudable object is given elsewhere in this issue. Chicago is the greatest railroad center in the world. It has suffered patiently from all the smoke, soot and other nuisances attendant upon the use of soft-coal-consuming locomotives, while New York city has demonstrated that electrification not only eliminates these troubles but is highly successful from considerations of operation and economy as well. If the railroads had been in earnest in their efforts to minimize the smoke evil, they would have found successful means of substituting coke, oil, anthracite coal, or other less objectionable fuel, even if it required special locomotives to do so. In this way they might have put off the electrification movement for a great many years. By their negligence of the sentiment of the better part of the public they have hastened the day when temporizing is no longer tolerated and the public demands are more exacting than they would be if consideration had been given to them earlier.

It is often said that it is easy for political demagogues to stir up public clamor on matters relative to great corporation interests, and in recent years there have been several illustrations of this fact in this country. For this reason public-utility corporations in particular are now making greater efforts to keep in touch with public sentiment, following its desires where these are reasonable and educating the public where its demands are unreasonable or unjust. The railroads entering Chicago have done neither. One of their number has been particularly contemptuous of the growing desire to beautify the city and has continued to set up the old arguments that the cost of electrification is prohibitive and its practicability doubtful.

On the latter score the results in New York city and elsewhere have by this time fully demonstrated that both the two electrical systems in use are not only feasible but entirely satisfactory and can be made to work admirably together. As to the matter of cost, the conditions in Chicago are more favorable than on Manhattan Island. No expensive tunnel installations are required, the tracks being already mostly elevated.

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The electrification of the freight yards will be costly on account of their great extent; this problem is not an intricate one from the engineering standpoint, however. A source of material economy in Chicago should be that it has a central-station company equipped with the most modern power plants that are ready, even with the present generating apparatus, to supply all the power that may be needed by the railroads for many years to come. Practically all the Chicago traction systems have availed themselves of central-station power at an exceptionally low energy cost as well as reduced fixed charges on power-plant investment. By the same plan the present steam railroads can electrify their Chicago terminals on a very extensive scale without any investment in power-house equipment. Besides the central-station power available in the city, hydroelectric power is also available from Lockport and Joliet, Illinois.

That which advances and benefits a community in general invariably benefits its public utilities to a still greater degree. Terminal electrification will be a great civic improvement to Chicago. It will benefit Chicago's railroads still more markedly, both in a direct and indirect manner. Operating expenses on the present traffic will be reduced and a very profitable suburban passenger traffic can be built up to the proportions that should make it such an element of the local transportation facilities that it deserves to be. There should be little trouble in raising the capital required to carry the project through, as the amount required is greatly overestimated. Therefore the public demands for railroad electrification in Chicago are both reasonable and just, and the railroads that Chicago has made prosperous should lose no time in taking up the work.

UNITS OF CENTRAL-STATION INVESTMENT.

It is interesting and suggestive to subdivide large quantities occurring in the operation and administration of engineering systems. In this way one obtains a much better idea of the relations of the items which make up the property and its service than by trying to conceive the magnitude of totals. Comparisons between different properties must inevitably proceed upon the unit basis when a comprehensive insight is desired into differing conditions and their effects.

The distribution of the investment in a large central-station system serving a community of 100,000 persons, for example, affords food for thought. The total valuation of the property at the present time, expressed in terms of the money put into it, is about $1,000,000, or $10.74 per capita. The items of the plant are as follows: Land and buildings, $2.11; steam plant, 5,000 kilowatts, $2.92; electrical equipment of power plant, $1.19; overhead lines, $1.48; underground lines, $2.16; transformers, $0.40; meters, $0.34; and arc lamps, $0.14, all per capita. The income per capita for the past year was $3.10, or about thirty-five per cent of the investment. The community served is a university city, with a large residential population, and in one section has an extensive manufacturing development. The city is shaped like a rectangle, approximately 5.5 miles long by 1.25 miles wide, with an area of about 4,180 acres. The high cost of the steam plant in proportion to the other items of the company's investment is noteworthy. The station is of the condensing type, equipped with vertical cross-compound engines, water-tube boilers and a well-designed pumping layout, also having good coal-handling facilities, without mechanical stoking, however. The high cost of the underground investment is interesting, although this company has less than one per cent of its total length of wire underground.

The investment of this system per kilowatt of station capacity represents a total of $314.80. Of this, the items are: Land and buildings, $42.20; steam plant, $58.40; electrical equipment in plant, $23.80; overhead lines, $29.60; underground lines, $43.20; transformers, $8; meters, $6.80; and arc lamps. $2.80. There are four direct-connected generating sets in the station. The company's income this year per kilowatt of station capacity was $62.

Exclusive of real estate and building, the station represents an investment of $82 per kilowatt, which is a moderate figure for an installation of such excellent composition. The total distribution-system investment, exclusive of transformers, meters and arc lamps, reaches about the same sum as the station proper, the difference being only about $10 per kilowatt of capacity. The total length of the company's wire is not at hand, but in the previous year it was about 2,650,000 feet. The figures indicate that such a company should exercise great care in undertaking any comprehensive installation of underground service. Such an investment is almost impregnable protection against competition or municipal enterprises set in motion by politicians to rival a long-established installation, but the cost needs to be figured pretty carefully here before one is justified in embarking upon an elaborate system of underground service. In the larger cities, it is out of the question to maintain overhead lines in the more settled business districts, and there is no room for dispute in regard to the excellence of a well-designed underground system from the operating point of view; but when such figures as these indicate that the cost of an underground service of only a few miles extent overbalances all but one of the single items of the plant investment, it is plain that a company so situated should pay particular attention to extending such a system under first-class engineering advice, and should not be required by law to extend it at a rapid rate per year, provided that the overhead lines are kept in good condition.

It will cost the street railways of Chicago nearly a million and a half for increased wages for the three-year period. A strike has been averted. Public opinion is entirely on the side of the public's partner—the street railway company. Every cent expended in this wise is an asset; an investment for the benefit of the patron.

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COST OF POWER IN A 3,000-KILOWATT TURBINE PLANT.

Studies of the cost of producing electricity in power plants of the latest design are always suggestive. Established combinations of equipment afford valuable data as to possible economies, when viewed in their relations to the prevailing conditions of operation. In the central-station industry reduction of generating cost is constantly the goal of progressive managements, and records from new stations are useful in showing what methods of production may be counted upon to realize a high plant efficiency.

Some figures of this kind have just come to hand covering the first year's operation of a 3,000-kilowatt steam-turbine station designed by a prominent engineering organization of wide experience in power-plant construction. The station was built outside a manufacturing city about two years ago and superseded an old plant of the belted and shafting type, with relatively inefficient engines scattered over a large area. The old plant was situated on valuable real estate near the center of distribution of the city and has since been superseded by a substation of somewhat greater capacity covering much less ground. The power house is now about six miles from the old station, but it is located in close touch with an industrial district of large possibilities, and is rapidly displacing the service of the scattered small and inefficient stations previously supplying electricity to the territory. The first year's records show that in spite of the high coal cost of $4.45 per ton, the plant bids fair to assume a commanding position in its district.

The station is at present equipped with three 525-horsepower boilers of the Babcock & Wilcox type, built for operation at 175 pounds steam pressure. There are two 1,500-kilowatt Curtis-General Electric turbo-alternators running at 900 revolutions per minute, the turbines being of the four-stage type and operated in connection with barometric jet condensers. At present the station is hand fired, with natural draft, coal being delivered to the boiler room by a motor-driven car hoist in connection with an out-of-door pocket receiving fuel from hopper-bottom cars on a sidetrack and trestle built for station service. The total operating force consists of four engineers, four oilers, four firemen, three coal passers and three substation men.

In the first year of service this plant generated 5,858,255 kilowatt-hours and sold 4,605,811 kilowatt-hours, giving a customer-to-station efficiency of 78.5 per cent, including transmission from the generating plant to the substation at 13,200 volts and local distribution at 2,300 volts. Such a result shows that the location of a new plant outside a congested district may have decided economic advantages, and that the loss in transmission over a few miles of country may frequently be a small matter in comparison with the advantages of low real estate cost, good coal handling and cheap condensing-water facilities and ample room for expansion to meet future demands for service. The total energy sales of the company during the year for power service were 1,247,979 kilowatt-hours, giving twenty-seven per cent of the output for motor applications. The plant burned 8,120 tons of bituminous coal during the year, giving a rate, including auxiliaries, of 3.1 pounds per kilowatt-hour delivered at the switchboard.

The total cost of manufacture for the year was $62,089, or 1.06 cents per kilowatt-hour at the switchboard. The most important items were fuel, $36,255, or 0.62 cent per kilowatt-hour, and station wages, $16,674, or 0.29 cent per kilowatt-hour. Repairs to steam equipment came to $2,996, while the electrical apparatus required only $136 for maintenance, a frequent experience with new plants. It is probable that the substation labor cost is included in the above figures.

These results show that if the plant had not been handicapped by a high fuel price per ton it would have been feasible to generate electricity at considerably less than one cent per kilowatt-hour. The load factor of the station for the year was 26.6 per cent, assuming the usual definition of the ratio of the average load to the maximum. The ratio of the average load to the plant capacity for the year was 22.3 per cent. As the maximum load upon the station in the first year was only 2,516 kilowatts, it is apparent that considerable new business could be handled to advantage. The company is energetically seeking for new customers and larger opportunities for service, and with the increase of its day load expected during the next year or two ought to be able to reduce the cost of generating to at least 0.9 cent per kilowatt-hour—a figure reached none too often by medium-sized plants, but clearly possible under favorable conditions with modern equipment.

THE VALUE OF CENTRAL-STATION STATISTICS.

It is natural for the practical operating man to question the value of statistics which do not immediately concern his own company. The proceedings of the engineering societies and the pages of reputable technical journals, however, are constantly bearing witness to the demands of the times for numerical statements of conditions and results encountered in designing, constructing and operating work, and it sometimes seems to the busy executive that much effort is wasted in the preparation of such data, for it is absolutely impossible to memorize even a moderate fraction of it, and admittedly difficult in not a few cases to draw useful lessons from the masses of figures published in this or that cause.

The modern passion for scientific exactness is not likely to abate, no matter how little use some of our friends may have for statistical data. It is worth while realizing that the results of operation in one company cannot be properly compared with those in another city without recourse to unit figures, and when such data are presented in a straightforward fashion, with pointed interpretative comments, they stand a good chance of being highly useful. We must come down to units, however, before the best results can be obtained, stating the quantities per kilowatt-hour and per capita as well as the totals.

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Programme for a Series of Joint Electrical Meetings in Chicago.

The very successful joint meetings of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers that were held in the early part of this year in the Western Society's rooms in the Monadnock Block, Chicago, will be continued during the coming season. It has been decided by the managing committees of both these sections that co-operation is preferable to separate efforts, since the aims of the two bodies are identical.

The joint meetings as scheduled below are to be held regularly on the third Friday evening of each month. Special meetings will be arranged from time to time. The tentative programme of papers and authors is as follows:

October 15, 1909—"Central-Station Operating," by W. L. Abbott, chief operating engineer, Commonwealth Edison Company.

November 19, 1909—Address (subject to be announced later) by Dr. C. P. Steinmetz, Schenectady, N. Y.

December 17, 1909—"Low-Tension Street-Railway Feeder Systems," by R. H. Rice, Board of Supervising Engineers, Chicago Traction.

January 21, 1910—"Recent Developments in the Automatic Telephone," by Lee Campbell, of the Automatic Electric Company, Chicago.

February 18, 1910—"Special Motor Controls," by C. A. Dresser, superintendent, Kohler Brothers, Chicago.

March 18, 1910—"Electrical Features of the Reclamation Service," by O. H. Ensign, chief electrical engineer, United States Reclamation Service, Los Angeles.

April 15, 1910—"Some Proposed Improvements in Underground Conduit Construction," by E. N. Lake, Board of Supervising Engineers, Chicago Traction.

May 20, 1910—"Depreciation and Reserve Funds for Electrical Properties," by Wm. B. Jackson, of D. C. and Wm. B. Jackson, consulting engineers, Boston and Chicago.

June 17, 1910—"Induction-Motor Phenomena," by Prof. John D. Nies, of Lewis Institute, Chicago.

The lecture by Dr. Steinmetz will be the third one delivered by him before the Chicago Section of the American Institute of Electrical Engineers at the opening of the season. As in the past two years, it is probable that a larger audience room will be engaged for this occasion.

Chicago Electric Club.

At the weekly midday meeting of the Chicago Electric Club on Wednesday, September 22, George H. Lukes, general superintendent of the North Shore Electric Company, gave a brief history of the development of that company from its origin to the present time.

Good suburban transportation facilities, in addition to the congested condition of the residence districts of Chicago, has caused a surprisingly large number of people to leave the city for the more congenial conditions of suburban life, asserted Mr. Lukes. Naturally these people, accustomed to city conveniences, would demand them in the suburbs. This demand led to the formation of the electric company, by Samuel Insull, known as the North Shore Electric Company.

Twelve pieces of property were bought in various suburbs, so that the company would be equipped, by erecting stations and substations, to furnish current to all important districts surrounding Chicago. In the northern district the company erected three substations and a main station at Waukegan, Ill.; in the western district, one substation and one main station at Maywood; and in the southern district, two substations and a main station at Blue Island. The equipment of these plants, Mr. Lukes said, represents machines and appliances of all stages of advancement, from the oldest to the most modern types.

To guarantee continuous service to its customers, the substations of the North Shore Electric Company are equipped to receive current from two sources; in the northern district, from the station at Waukegan, and from the auxiliary station at Evanston, also from the Evanston substation that is supplied by the Commonwealth Edison Company; in the other districts the substations are equipped with generating units so that in the case of a breakdown at any of the supplying stations the service would still be uninterrupted.

Mr. Lukes referred to the contracts made with the electric traction systems in the northern and southern districts for supplying power, saying that the increased output resulting from supplying these systems resulted in economy in the cost of operation.

A few interesting comparisons between the North Shore Electric Company and the Commonwealth Edison Company of Chicago were made, showing the former to be serving one person in every ten of the people in its territory, as against one in every twenty served by the Commonwealth Edison Company in Chicago.

Following the address of Mr. Lukes the club indorsed, by a unanimous vote, the resolution made by the Board of Managers at its meeting Friday, September 17, tendering to C. A. S. Howlett, the retiring president, a life membership in the Chicago Electric Club.

Boston Electrical Show.

As already announced in our issue of September 4, the first electrical show to be given in Boston will be held in the Mechanics' Building November 15 to 25. Considerable headway has been made in the arrangements. Already hundreds of electrical novelties have been submitted to General Manager Chester I. Campbell, and from present indications the highest attainments and most modern electrical achievements will be represented. The space is being rapidly spoken for by the largest electrical interests in the country, and, as the members of the association giving the exposition are composed principally of the exhibitors, unusual interest is being manifested on the part of the trade in general.

Manager Campbell has evolved an entirely new scheme for decoration and illumination, which will give the exhibition floor, and, in fact, the whole interior, not only a uniform, but extremely harmonious and beautiful aspect. Approximately 100,000 incandescent lamps will be used to carry out this remarkable lighting scheme.

Particular attention is being given the industrial exhibits which will represent manufacturing processes of all kinds in actual operation, and show the great strides that have been made by the manufacturers since the electric motor came into use.

Motor Infringement Decision.

Judge Hough, in a decision rendered at Philadelphia, Pa., in the United States Circuit Court in the suit of infringement of patent claims brought by the Electric Vehicle Company and George B. Selden against the Ford Motor Company, Panhard & Levassor, John Wanamaker, and a number of other dealers and manufacturers, holds that the Panhard machine infringes claims one to five, mentioned in the complaint, and that the Ford machine infringes claims one, two and five, also mentioned in the complaint, and orders a decree entered to that effect.

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MEETING OF KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION.

WICHITA, KAN., SEPTEMBER 23, 24.

The twelfth annual convention of the Kansas Gas, Water, Electric Light and Street Railway Association was held at Wichita, Kan., September 23 and 24.

The first session of the convention was held on Thursday morning in the parlors of the Edison Electric Company. The address of welcome was given by Mayor Davidson, W. A. Scothorn responding.

The second meeting was held on Thursday afternoon. This meeting was given over wholly to the reading of papers and to discussion. The discussion on gas engines occupied much of the afternoon.

On Thursday evening an elaborate banquet was held at St. Paul's Church. Toasts were responded to by Mayor Davidson, Henry Allen and Victor Murdoch. The banquet was over by 7:30, and the banqueters were brought back to the city in time to witness the electric pageant of the Peerless Prophets.

After the parade most of them made the Hamilton Hotel their rendezvous, as it was in the parlors of that hotel that the Sons of Jove held an organization meeting.

The election of officers was held on Friday, the following being chosen to lead the association for the session of 1909-1910:

President—M. T. Flynn, Kansas City, Kan.

First vice-president—M. J. Rathort, Junction City.

Second vice-president—Charles D. Bell, Independence.

Third vice-president—W. R. Murrow, Independence.

Secretary and treasurer—J. D. Nicholson, Newton.

Executive committee—W. B. Forshay, chairman, Wichita; T. T. Cole, Pittsburg; B. F. Eyer, Manhattan.

The next meeting will be held at Kansas City, Kan. The date will be fixed later.

Following adjournment on Friday, the delegates took lunch at the Hamilton Hotel and were afterward escorted in automobiles and street cars to the power houses and water plants of the city. In the afternoon they attended the races at the fair grounds and on Friday night concluded the programme by attending the Humbug Circus.

Monmouth, Ill., Public Service Consolidation.

The capital stock and property of the Monmouth (Ill.) Gas and Electric Company, of which William Mainland, of Oshkosh, Wis., was president, and W. J. Ferris, of La Crosse, Wis., was vice-president, has been purchased by the Monmouth Public Service Company, of Monmouth, Ill. The new organization has the following officers: W. H. Schott, Chicago, president; F. W. Harding, Monmouth, vice-president; J. W. Clendening, Monmouth, secretary; W. D. Brereton, Monmouth, treasurer. W. Fred E. Harding. These officers compose the board of directors.

The old company had a capital stock of $200,000 and a bonded indebtedness of $200,000. The new company has a capital stock of $600,000 and a bond issue of $400,000. The company takes over the lighting and heating plants of the Searles Company as well as those of the Mainland interests. An ice plant is now controlled by these interests, and a district steam-heating plant will be installed. It is expected that the latter will be in operation by the early part of November.

It is understood that several large factories will take power and heat from the company, and extensive improvements will be made to the electric-light plant and to the gas works.

The engineering will be carried out by the Schott Engineering Company, of Chicago.

Two More Pennsylvania Tubes Through.

With the joining of tubes B and C on September 22, three tubes in the tunnel system of the Pennsylvania Railroad, stretching from Long Island City under the East River to the big railroad station in Manhattan, are now ready for the installation of roadbeds, tracks, and operating equipment. Several weeks ago tube D was joined, and equipment cars are now at work in this tube, getting it in readiness for traffic.

Of the two latest completed tubes, tube B ends on the south side of the new Hunter's Point Avenue viaduct, that crosses the new Sunnyside railroad yard, while tube C is continued far into the yard. It will take more than a month to finish tube A, the last of the series.

Taking advantage of the recent good weather, night and day shifts have been employed on the work, and it is predicted that all four tubes will be completed before many months.

American Exposition in Berlin.

On page 431 of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 4 appeared a short article describing some of the arrangements being made for an American Exposition, to be held in Berlin, Germany, from May to July, 1910. The Hon. Chas. Nagel, Secretary of Commerce and Labor, Washington, D. C., has heartily approved the project. The following are extracts from his letter referring to it:

At the head of this Exposition is a committee consisting of representative business men of the United States. A committee has also been formed in Berlin, whose honorary president is Prince Henry of Prussia. The conditions governing the exposition have been examined by the Bureau of Manufactures and appear to offer a great opportunity to American enterprise.

The central location of the city of Berlin, not only as the capital of the German Empire, but also with respect to a great part of northern, central, and eastern Europe, assures a rare opportunity for showing American products abroad and for promoting the export trade of the United States. As the Exposition is to be confined strictly to American products, it becomes a matter of national interest to have the exhibits thoroughly comprehensive and of exceptional merit, so that the Exposition may serve to strengthen the prestige of American industries abroad.

The committee[1] is no doubt prepared to answer all inquiries, but John M. Carson, chief of the Bureau of Manufactures, will be glad to give further information whenever it is within his power.

Fewer Accidents on New York City Railways.

The report of the New York Public Service Commission on accidents on New York city's surface traction lines for August shows a further diminution as compared with August a year ago before the Commission's requirements regarding safety devices on surface cars were complied with. There is a decrease in the total number of accidents reported from 5,314 to 5,049.

The total number of persons injured showed 3,327 for this August as compared with 3,339 in August a year ago, and serious injuries were reduced from 236 to 204. It is hoped the number of accidents will continue to decrease.

[1] 50 Church Street, New York.

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Railroad Terminal Electrification Made Mandatory in Chicago.

The popular agitation in favor of the electrification of the steam railroads entering the city of Chicago, which has been actively carried on for about a year and a half, culminated in a decisive move on the part of the city authorities at the meeting of the City Council on the evening of September 27. At this meeting Alderman Bernard W. Snow introduced an ordinance making it mandatory for all railroads operating in the city within eight miles of the City Hall to propel all cars and trains by electric power. The ordinance was immediately referred to the committee on local transportation, from which it is expected to be reported back with little alteration. There is extremely small doubt of the final passage of the ordinance, as it embodies the views of the municipal authorities, practically all of the aldermen, all of the press and the great mass of the Chicago public.

This ordinance, as submitted, is as follows:

Be it ordained by the City Council of the City of Chicago:

Section 1. That after January 1, 1912, every railroad company shall operate and propel any and all cars or trains within a radius of eight miles of the City Hall in the City of Chicago by electrical power.

Section 2. Every railroad company now operating or propelling cars or trains of cars in the City of Chicago, or now authorized by ordinance so to do, shall within one year after the passage, approval, and publication of this ordinance, submit to the Commissioner of Public Works of the City of Chicago plans and specifications for operating and propelling all of its cars or trains of cars in the City of Chicago by means of electrical power, as in Section 2 of this ordinance provided. If the manner in which any railroad proposes to operate its cars by means of electricity, as indicated by said plans and specifications, is one which, in the judgment of the Commissioner of Public Works is reasonably safe, the Commissioner of Public Works shall approve said plans and specifications, and thereafter the railroad company presenting plans and specifications so approved shall proceed within six months to electrify its line of road as in, and by, plans and specifications provided, and shall continue said work with reasonable diligence.

Section 3. No railroad company shall propel or operate any car or train of cars within a radius of eight miles of the City Hall, in the City of Chicago, by means of any power other than that of electricity any time after one year from and after the passage, approval, and publication of this ordinance, unless at the time of so doing it shall have submitted plans and specifications to the Commissioner of Public Works, as by Section 2 of this ordinance provided, and such plans and specifications shall have been approved by the Commissioner of Public Works.

Section 4. Any railroad company which shall violate any of the provisions of this ordinance shall be fined in a sum not exceeding $200, and every day that any railroad company shall continue to violate any of the provisions of this ordinance shall be regarded as a separate offense and punished by a fine of not exceeding $200.

Section 5. This ordinance shall be in force and effect from and after its passage, approval, and publication.

It will be observed that the ordinance has been carefully worded and is the result of much deliberation by the city officials, who consider its legality as unquestionable. An almost-forgotten provision of the city charter of 1863 has been found which, among other things, specifically authorizes the city "to regulate and prohibit the use of locomotive engines within the city and require railroad cars to be propelled by other power than that of steam." The city's legal counsel claims that this authority has never been repealed or curtailed by subsequent legislation. On the other hand, last spring an effort to secure enabling legislation specifically along these lines failed in the Illinois State Legislature, on account of a powerful railroad lobby that was much in evidence. From present indications most of the steam railroads will combat the city's plans with the best legal talent in possibly long-drawn-out contests in the courts.

As has been pointed out in this journal from time to time, the agitation for the abatement of the smoke and cinder nuisance, for which the steam locomotives in Chicago are so largely responsible, has been gaining strength steadily as the plans for the beautifying of the city have been developed. The early completion of Grant Park at the lake front, adjoining the heart of the city, directed particular attention to the Illinois Central Railroad, which runs through this park and along several miles of fine residences on the southern lake shore. The electrification movement was taken up by these residents, who are mostly patrons of this railroad, and became so strong that at the last annual meeting of the stockholders the Illinois Central Railroad Company was pledged to the electrification of its Chicago terminal. This important action was described at length in the WESTERN ELECTRICIAN of October 31, 1908.

It has been felt, however, that the officials of this railroad have not shown a friendly attitude toward the electrification project. In fact, it has been openly asserted that they were following a policy of procrastination, in spite of the expressed wishes of the stockholders, the patrons and the public in general. Considerable work has been done on a series of tentative plans, but there were still recurrent assertions that the expense of the project was prohibitive and its feasibility conjectural. As the city was becoming dissatisfied with the progress shown, it was felt that a broad mandatory ordinance covering all the railroads was needed to show them that the community would not stand for dilatory tactics or trifling.

It will be recalled that about fifteen years ago a similar agitation was developed in Chicago, in regard to the elimination of grade crossings by means of track elevation. The railroads used the same arguments in trying to defeat that movement. A general mandatory ordinance was passed, compelling track elevation throughout the city. It has been used from time to time to force certain railroads to take up the work. As soon as they have shown a willingness to do so, special contract ordinances were passed for each railroad. A similar plan of procedure will in all likelihood be carried out in the electrification work. Under the track-elevation ordinances practically all the worst grade crossings have been eliminated at an expense to the railroads estimated at about $50,000,000.

Among the more astute railroad officials there has been a feeling that electrification of the Chicago terminals was sure to come and a number of the railroads have studied the problem with much interest.

Chicago & Northwestern Railway officials are now gathering electrification data. Meantime the Illinois Central's management has submitted charts to the Chicago officials, including plans to separate the passenger and freight tracks by tunnels, and these plans will be either accepted or rejected by the directors at their next meeting.

The general plan for the Illinois Central contemplates the electrification in six sections, in order to prevent delays in the entire service during the progress of the work. The first section to be electrified, according to the plans, will be the suburban tracks from Randolph Street to Sixty-third Street. The protected third-rail direct-current system will, in all likelihood, be used.

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Vermont Electrical Association.

The annual convention of the Vermont Electrical Association was held at Burlington, Vt., on September 15 and 16. The headquarters of the association were at the Van Ness House, but the meetings were held at the Armory. There was a very good attendance at this convention, both of central-station men and of manufacturers' representatives and supply men. The programme was not adhered to very closely, but nevertheless the meeting was one of exceptional interest, as one outcome thereof was the decision to affiliate the association with the recently organized New England Section of the National Electric Light Association.

The first session was called on Wednesday afternoon by President F. H. Parker, of the Burlington Light and Power Company. The first matter of importance on the programme was an address by V. R. Lansingh, of the Holophane Company, New York city. Mr. Lansingh made a very good address on the subject, "The Need of Educational Work in Illumination." This address was concerned mostly with the necessity for the application of the now well-established principles of illuminating engineering, particularly in residence lighting. In ordinary house lighting, Mr. Lansingh said, almost contempt for the principles of scientific illumination had been exercised in all aspects of the lighting installations. Moreover, the greatest carelessness is very prevalent in the maintenance of the lamps. Ordinary carbon incandescent lamps are allowed to burn until they are almost black, small regard is taken of the selection of the proper glassware, and inefficient lamps are generally placed in incorrect positions. The lack of convenience of switching is also sadly evident. Mr. Lansingh took up in turn the various rooms of a dwelling and pointed out in detail what he regarded as the proper lighting in each. He asserted that it is the duty of central-station interests to inaugurate a campaign of education on matters relating to illumination, not only for the public in general, but more particularly for their own solicitors, who frequently are grossly ignorant of the advanced methods now available in the art of illumination.

In discussing this topic Walter Jones, of New Haven, Conn., spoke of his experience in inaugurating a movement for better education on matters in regard to illumination. A series of free lectures was given, which had excellent results in bringing a large amount of new business to the central station.

C. H. Scott, of the General Electric Company, read a paper on "The Extension of Power Business for Central Stations." In this paper Mr. Scott dwelt particularly upon the undeveloped opportunities for more power business and of a more varied character than is now common for central stations. He advocated the extension of electric power to the farm and dairy communities, and pointed out the excellent opportunities that there were in the lumber and stone-quarrying industries. Mr. Scott said that a day service is practically imperative in these times and is easily developed among the small consumers, both in small stores and in residences.

T. Commerford Martin then addressed the association in regard to the relations of the National Electric Light Association with state electrical associations, and the desirability of the latter co-operating with the national organization. He made a forcible appeal to the Vermont association and advised it to become affiliated with the New England Section. He showed that it was not necessary for the association to lose its identity by this plan; in fact, on the contrary, the advantages were almost entirely in favor of the local organization. He discussed at length the work that the national association is conducting on questions of public policy as relating to the central-station industry, and pointed out its attitude on many of these questions. He also showed in detail how the national association aids its sections in a great many ways.

At 8 o'clock in the evening the second session of the convention was held. At this meeting Mr. Martin again appeared before the association, at this time reading a paper on "Some Conditions of Electrical Development." In this paper Mr. Martin showed that it was imperative that a central station should reach every possible consumer within its territory, if it is anxious to get the highest returns on its investment. In order to develop the service to its utmost capabilities it is necessary that as great a variety of consumers be connected with the system as possible. By the overlapping of their diverse demands the peak load is spread out. In arguing this point, Mr. Martin showed that there has been a steady falling off in the average income obtained from the various lighting units. To overcome this tendency it is necessary that the service be extended in every way.

Following Mr. Martin, F. W. Willcox, of the General Electric Company, read an excellent paper on "Tungsten Lamps." G. C. Osborne, of the General Electric Company, was to have read this paper, but in his absence Mr. Willcox presented it in an admirable manner. He showed that the tungsten lamp had been compelled to overcome much adverse criticism when first introduced, just as practically every great invention for the benefit of humanity has been compelled to pass through a threatening period in its early exploitation. However, the tungsten lamp has passed through all the period of criticism and doubt, and has firmly established itself as of the highest value in the art of illumination. He gave some figures showing the enormous sales of these lamps within the last half year. Over one-and-a-half million lamps have been sold by his company alone in this period. He stated that in those cities where the central-station company handled the tungsten lamp itself the lamps sold were of larger size than those disposed of where supply dealers or contractors handled them.

After a general discussion of the tungsten lamp, the election of officers for the following year was held. It resulted as follows:

J. E. Davidson, Montpelier, president.

C. E. Parker, Vergennes, first vice-president.

Frank Barney, Jr., Springfield, second vice-president.

A. B. Marsden, Manchester, secretary and treasurer.

The entertainment features in connection with the association's convention were well carried out and began on Wednesday morning with a review of the parade of the police and fire departments of Burlington and of a troop of United States cavalry. Late on Wednesday afternoon quite a number of the members and guests enjoyed a trolley ride to Fort Ethan Allen and Queen City Park. Practically all of Thursday was given to an excursion on Lake Champlain to Bluff Point. A luncheon was given at the Hotel Champlain and the return was late in the afternoon. During the return on the steamer Ticonderoga an adjourned session of the convention was held, at which, after a short discussion, a resolution was formally adopted through which the Vermont Electrical Association decides to affiliate itself with the New England Section of the National Electric Light Association. This action was taken with much enthusiasm.

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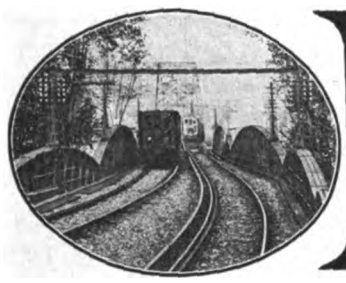

ELECTRIC TRACTION

CATENARY TROLLEY-LINE CONSTRUCTION.

BY GEO. W. CRAVENS.

It is only a little more than twenty years ago that the first electric railway was put into commercially successful operation. During this time the development of electric railroading has been very rapid, and yet if a seer or a prophet had predicted even as recently as ten years ago that the time would come when current would be collected from an overhead system, "built like a suspension bridge," he would have been laughed at.

For service through city streets and other places where high speeds are not possible, the plain trolley line is the simplest, cheapest and most satisfactory system yet devised. For high-speed interurban and trunk-line service, however, the necessity for something better than a plain trolley wire is apparent.

The construction of plain trolley systems is undergoing changes for two reasons. Electric-railway owners have learned that to supply uninterrupted service the overhead system must be both substantial and properly maintained, and center-pole bracket construction has given way to cross-span construction, because of keeping the streets clear, giving a more flexible and longer-lived structure and being cheaper to maintain. It is advisable, economically, however, to make the original installation as good as possible, not alone because upkeep will be reduced, but because interruptions to the service will be less common. The public does not care why the cars stop running, but it is vitally interested in when and how often. As power-house troubles are less to be feared than line troubles, greater expenditures for both engineering and construction work on overhead systems will pay.

The higher speeds now maintained on interurban lines have shown the limitations of the plain trolley system. The pounding of the trolley wheel against the wire at the hangers, the kinking and subsequent breaking of the wire at the same points, the great sagging and side swing of the spans at the center, and the burning of the wire, due to arcing every time the wheel rebounds from it, soon showed the necessity of providing a smooth and stable contact surface for the current collector. This led to the development of the catenary system of construction.

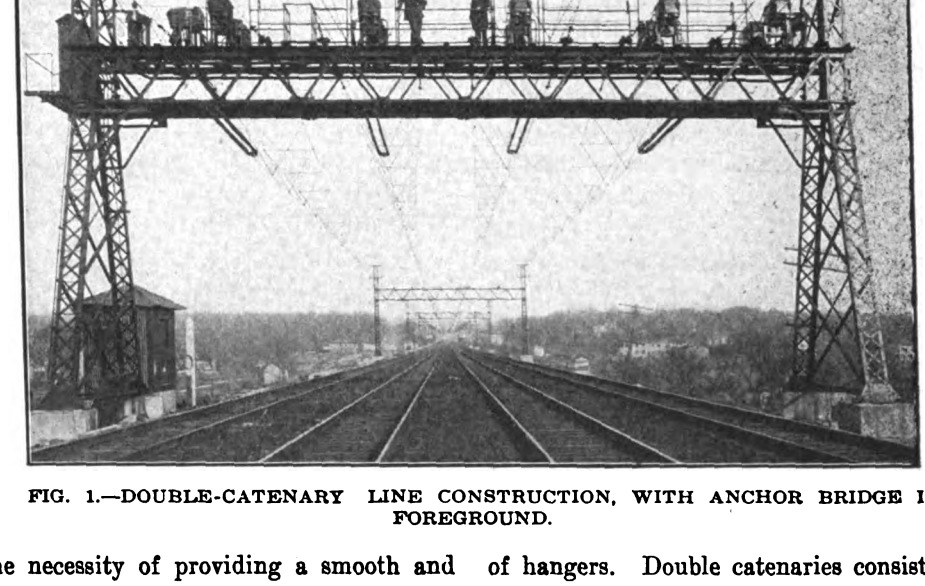

FIG. 1.—DOUBLE-CATENARY LINE CONSTRUCTION, WITH ANCHOR BRIDGE IN FOREGROUND.

Several forms of the catenary type of trolley system have been developed, but up to date they fall in one or the other of two classes, single and double. Single catenaries consist of one messenger cable strung over insulating supports and carrying the trolley wire or wires by means of hangers. Double catenaries consist of two messenger cables similarly supported and carrying the trolley wire or wires through the use of triangular hangers. Both of these systems allow of proper lateral bracing with freedom for vertical movement, although the original double catenary has been found too rigid and has

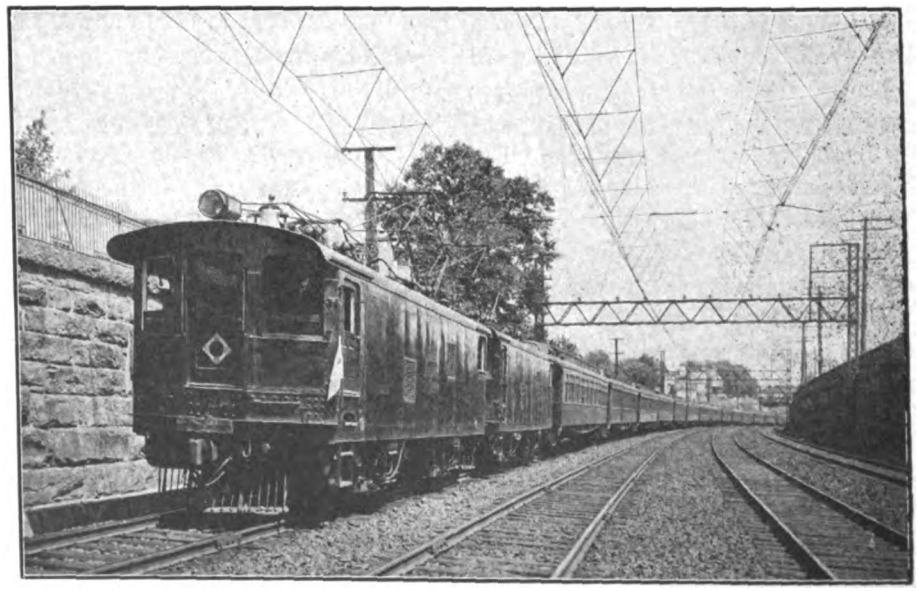

FIG. 2.—AN EXAMPLE OF HEAVY PASSENGER SERVICE FOR WHICH CATENARY TROLLEY CONSTRUCTION IS IMPERATIVE.

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been modified recently by the addition of an auxiliary working conductor.

To prevent destructive arcing, both the conductor and the collector of current should respond promptly to any variation of their relative positions. In city service with plain trolleys the pressure of the collector against the conductor is from fifteen to twenty pounds, but for high-speed interurban service the pressures range as high as thirty-five or forty pounds, so a flexible but substantial overhead system is absolutely necessary.

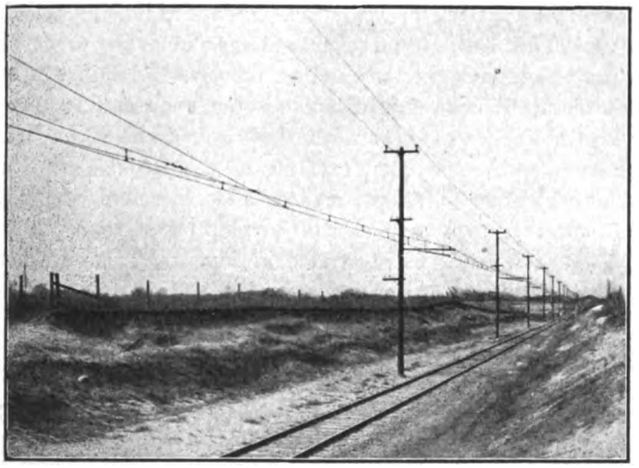

FIG. 3.—SINGLE-CATENARY LINE, SHOWING SPLICE IN MESSENGER CABLE.

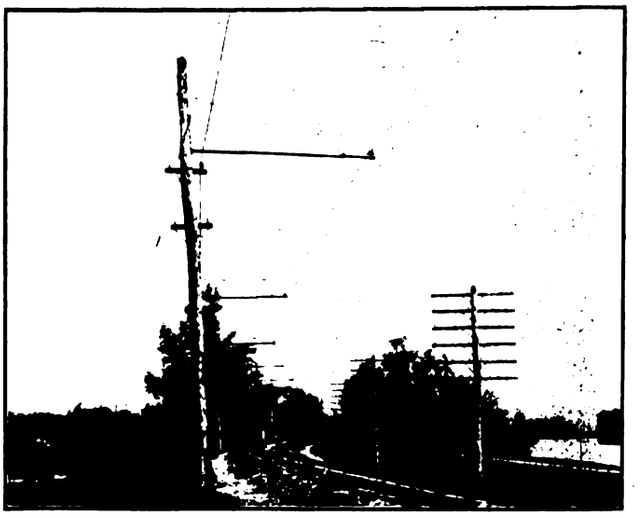

FIG. 4.—USE OF PULL-OFFS ON CURVE, SINGLE-CATENARY LINE.

Any overhead system, regardless of how satisfactory it might be as a whole, has its disadvantages as well as its advantages, and the catenary system is no exception to the rule. The advantages of this system are as follows:

1. The conductor can be maintained practically horizontal, as it is supported at frequent intervals, and its weight is carried by the messenger cable. There will be a slight variation in the level of the conductor, due to temperature changes affecting the tension and consequently the sag of the catenary. But a horizontal position at ordinary temperatures can be provided for by proper adjustment of the tensions when installing.

2. The conductor is free to rise with the current collector, as it is not supported directly by the bracket arms or cross-span wires. This is also true to a lesser degree of plain trolley systems with cross-spans, but the weight of the entire span must be lifted. With catenaries only a small portion of the conductor alone is lifted as the collector passes underneath.

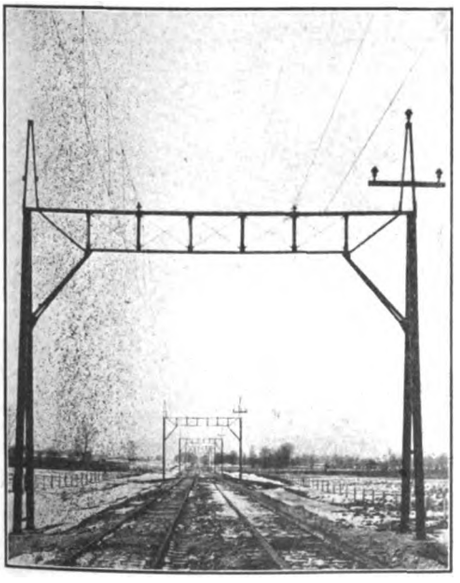

FIG. 5.—LIGHT BRIDGE CONSTRUCTION FOR CATENARY LINES.

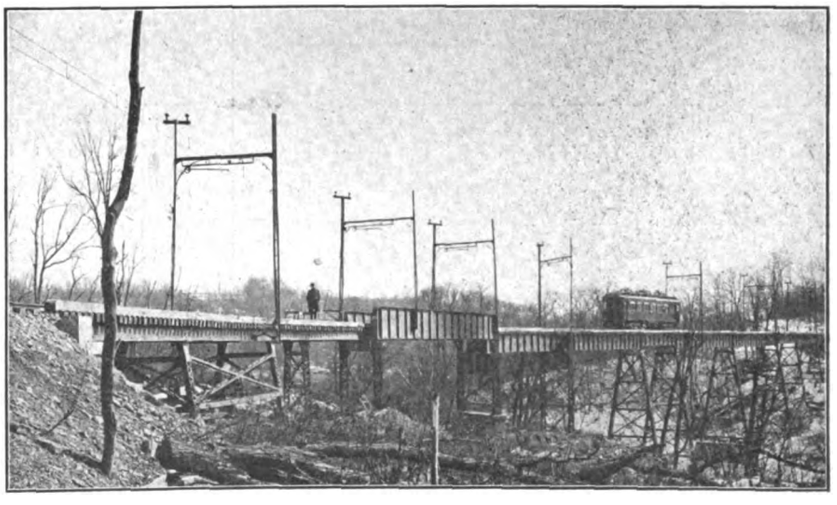

FIG. 6.—LIGHT CATENARY BRIDGE CONSTRUCTION FOR USE ON VIADUCTS, TRESTLES, ETC.

3. The lengths of the spans of the messenger cable may be as great as economical considerations will allow. The standard length for most installations is 150 feet, but spans of 300 feet have been used. The longer spans present the advantage of reducing the number of supports and possible leakage of current, but are too flexible for single catenaries.

4. There is a small amount of lateral flexibility, due to the suspension of the conductor from a cable, and this allows the wire to swing horizontally if necessary to follow the wheel. On curves and at other places where the conductor is braced this does not hold true, but the increasing use of pantographs with sliding shoes instead of poles with trolley wheels for collectors reduces this objection.

The disadvantages of catenary systems are not serious and can be met by proper designing in nearly every case. They are:

1. Systems designed for bow or pantograph collectors are not satisfactory for wheel collectors, as the hangers are too closely spaced for flexibility.

2. If spans of very great length are used, longer poles are required to com-

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pensate for the great sag in the messenger cable. Longer spans also offer more surface to the wind than short ones and require lateral bracing in many cases to prevent side sway.

3. Where pantograph collectors are used

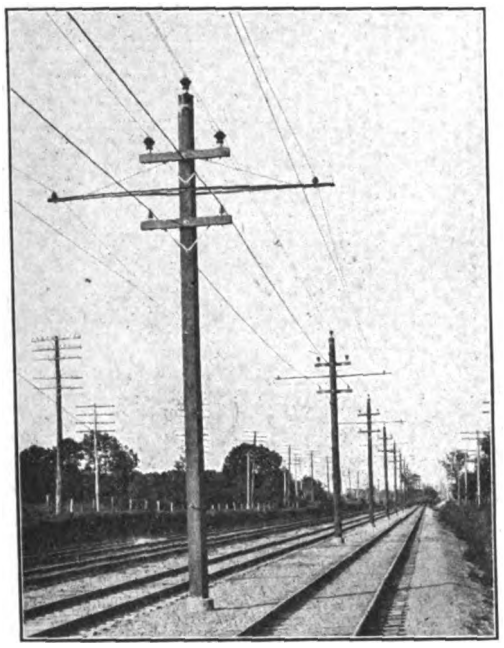

FIG. 7.—CENTER-POLE CONSTRUCTION FOR CATENARY, FEEDER AND TRANSMISSION LINES.

it is necessary to stagger the conductor from side to side of the center line of track to prevent wearing a groove in the roller or shoe of the collector. This distance off center should not exceed eight to eight-and-one-half inches for collectors four feet long, on account of the swaying of the cars, which localizes the wear of the collector to a space of about two feet near the center. Sliding-shoe collectors also wear away the conductor very rapidly.

The foregoing are some of the principal advantages and disadvantages of catenary systems, and much more might be said on either side, but these will suffice here.

The class of catenary used, single or double, has depended upon circumstances in each individual case, but the single system is most prevalent up to date. The double-catenary system installed by the Westinghouse Electric and Manufacturing Company for the New York, New Haven & Hartford Railroad is typical of both American and European practice, and is illustrated by Fig. 1. This picture shows one of the anchor bridges with line-protective devices, section insulators and tension regulators. The type of bridges used quite generally for lines of more than two tracks is also shown.

Recent experience indicates the double catenary to be almost too rigid for a single conductor, so both in the United States and abroad an extra or auxiliary wire has been strung. This hangs from and below the wire which is supported directly by the hangers, and is so arranged as to be very flexible vertically. In some cases abroad the lower or working conductor is of copper, with the steel wire above, but in the United States the steel wire hangs below and is the working conductor. The large number of points of contact with the copper wire above insures a plentiful current supply, and the steel wire does not wear away so rapidly as the copper. Records made by the New York, New Haven & Hartford Railroad Company show that its steel wire wore away but 0.0005 inch in six months, and that much at the worst places only.

Supports or hangers for the lower wire are placed midway between the hangers for the upper wire and are usually made to slide freely vertically, thus adding to the flexibility. The extra wire or working conductor has also been applied to single catenaries with very satisfactory results.

Another development has been the use of twin conductors placed side by side, so that the pantograph collector or shoe bears against both of them. This reduces the pressure necessary for collecting the current, enables larger amounts of current to be handled, reduces the liability of arcing, distributes the wear and has many other advantages over a single conductor.

An example of the large loads sometimes hauled and therefore the great amounts of current taken from the line is illustrated in Fig. 2. There are fourteen passenger cars in this train, and two locomotives with pantograph and sliding-shoe collectors were used to haul them.

Typical single-catenary construction is illustrated in Figs. 3 and 4. It will be noticed in Fig. 3 that the messenger cable has a joint in it made with Crosby clips. High-strength steel cable is very hard to splice safely, so experience dictates clamped joints. This is a view along the line of the Chicago, Lake Shore & South Bend Railway Company, and shows the use of steady braces at every bracket, also the method of attaching guy wires to the catenary and conductor. Fig. 4 shows the method of pulling the catenary over to keep it above the center of the track on curves. This is part of the Ohio Brass Company's equipment on the Middletown Division of the New York, New Haven & Hartford Railroad, and shows insulated pull-offs running to both top and bottom of hangers, to insure a vertical position of the catenary and prevent side sway.

The tendency is toward larger sized

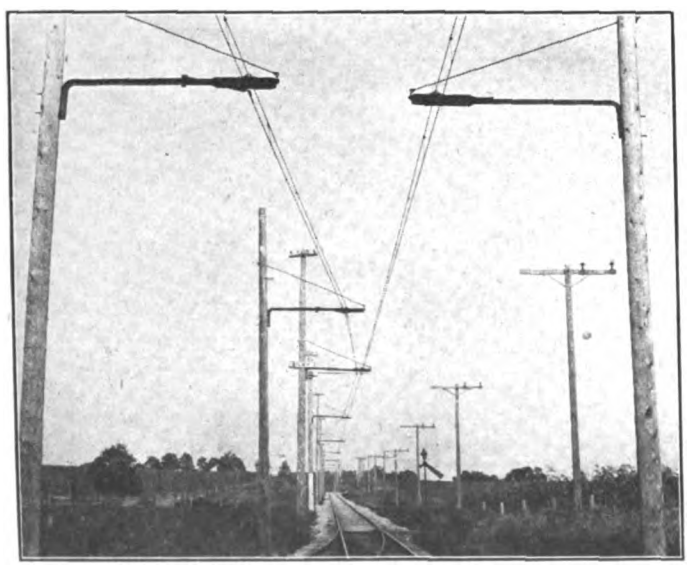

FIG. 8.—BRACKET CONSTRUCTION AT TURNOUT.

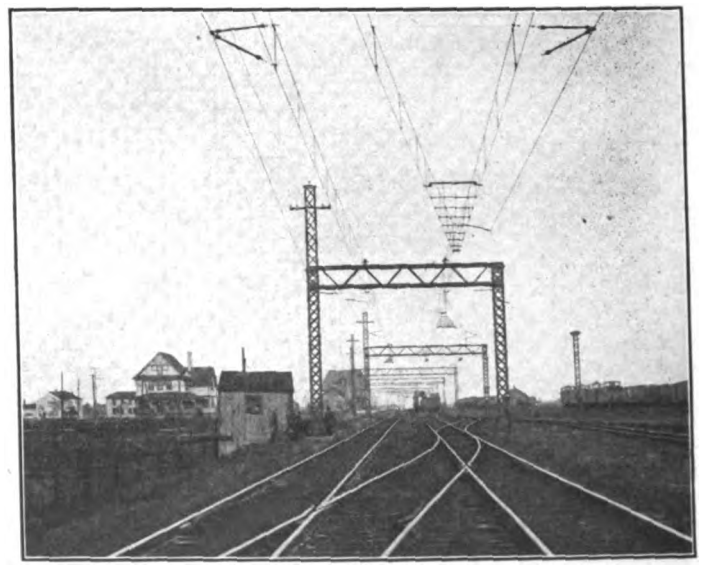

FIG. 9.—TURNOUTS ON SINGLE-CATENARY LINES.

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trolley wires, and No. 0000 is used now on a majority of the lines, although quite a number still use No. 000 wire. Grooved wire is generally used, and mechanical clips or ears have been developed to the point where they are considered reliable. These possess many advantages over the older forms, not the least of which is ease of adjustment. All of the leading concerns make them.

For pantograph collectors, the spacing of the hangers and ears or clips ranges from ten to thirty feet, thus presenting a comparatively level surface for the shoe. For wheel collectors the spacing runs from thirty to fifty feet, in order to provide a more flexible conductor and allow lower pressure to be used between the collector and conductor. Experience seems to indicate that a rigid hanger, for suspending the conductor from the messenger cable, is better than a flexible one, but there are a good many dissenting opinions, and some good results have been obtained by using hangers which allow free vertical movement of the conductor. The rigid hangers allow of greater contact pressures, however, by making the collector lift the weight of the messenger and hangers as well as the conductor.

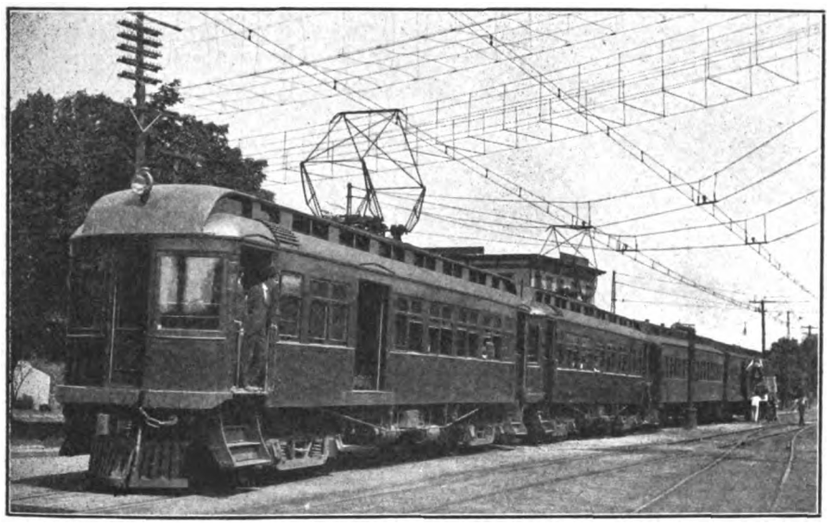

FIG. 10.—SPECIAL SUSPENSION FOR SINGLE-CATENARY LINES AND PROTECTIVE GUARDS AGAINST FALLING CROSS WIRES.

Certainty of uninterrupted service has caused the adoption of the highest strength steel cables for the messengers. These range from three-eighths to five-eighths inch in size, the majority being seven-sixteenths inch in diameter. The costs of the various cables range in almost exact proportion to the strength, regardless of kind of steel. Experience also shows that the most satisfactory cables are those that have been double galvanized with zinc. The weights of single catenaries average close to two pounds per foot with No. 0000 wire.

Many kinds of insulators have been tried for the messengers, but porcelain has been found to be the most satisfactory. For the lower voltages standard three-and-one-half-inch diameter by three-inch high double-skirted insulators are used, but for higher voltages the sizes run up to nine inches diameter by five inches high. Brown enamel finish is gaining in popularity because the white insulators offer a tempting target for small boys and amateur marksmen. For the strain insulators wood is still used for low voltages, but porcelain has been quite generally adopted for the higher voltages. Where the same tracks are used for both steam and electric service, it has been found necessary to use insulators designed for higher potentials than that used on the line, because the soot deposited reduces the insulating qualities. In all cases an excess of insulating value has been found to pay.

Brackets, bridges and cross-spans are all used, but there is an increasing tendency to use bridges for interurban service on double-track roads. The cost of these averages but about $800 per mile more than either cross-span or bracket construction with wooden poles, and the deterioration is considerably less. Fig. 5 shows a very light but substantial bridge, as developed by the Archbold-Brady Company for the Syracuse, Lake Shore & Northern Railway and others. Fig. 6 shows a very light bridge for use on viaducts, trestles and open bridges, as used by the Pittsburg & Butler Railway Company.

Center-pole bracket construction is preferred by many, especially for narrow rights-of-way. An unusually good example of this construction is that of the General Electric installation, shown in Fig. 7. Three-point suspension with short spans, continuous angle-bar brackets for both arms, high-tension three-phase transmission lines and feeder cables are all shown here to good advantage. The use of sawed and shaped poles, instead of plain stripped rough ones, has been found to pay, and is also illustrated in this view.

Brackets made of tubing are still in use, but the tendency is toward steel angles or I-beams, and provision is made for adjusting the location of the insulator to give proper alinement of the catenary. Fig. 8 shows a bracket made from a single angle bar, with the end bent to form a slot for lateral adjustment of the line.

On tangents the spans run from 120 to 150 feet for brackets and cross-spans and up to 300 feet for bridges. There is also an increased tendency to guy every pole, instead of limiting this to curves and turnouts.

Practice regarding sectionalizing the line varies from one-and-one-half to ten miles. In Europe the preference is for the shorter sections. Lightning protection also varies, some lines having nothing and others using arresters as close as every 500 feet. For low-potential systems, opinion is also divided regarding the insulation of brackets. Where they are grounded there is less chance of linemen receiving shocks, but more liability of shutting down the system if a messenger insulator fails. Where they are not grounded, the employes run more risk, and the poles, if of wood, may become charred or burned in case of leakage, but there is less likelihood of interrupting the service. Above 6,600 volts the most common practice is to ground the brackets, as the circuit-breakers will open in the power house in case of contact between line and bracket.

Overhead construction for systems using pantograph collectors has been greatly simplified. Section insulators are much plainer, lighter and cheaper, and turnouts are also much improved. Fig. 9 shows three turnouts on the single catenary line of the Grand Trunk Railway near the St. Clair tunnel. Additional wires are located in the angle formed by the branch line to insure the transition of the pantograph shoe from one line to the other without catching. Fig. 8 shows a still

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simpler method of accomplishing the same result. In this case the branch line catenary simply parallels the main line for a short distance.

Where wheel collectors are used there has been a notable increase in the diameter of the wheel and in both the depth and width of the slot. Ball-bearing wheels are used on some lines, and graphite bushings are also used, but plain bushed wheels with self-oiling hubs are still popular. Pantographs with sliding-shoe collectors have been adopted by many lines. Rollers have not been found satisfactory for high speeds. Some shoes are made with a groove lengthwise of the face which is filled with graphite for lubrication.

Tests in both Europe and the United States have shown that a pantograph with a light-weight extension will operate with less sparking than a plain pantograph, as

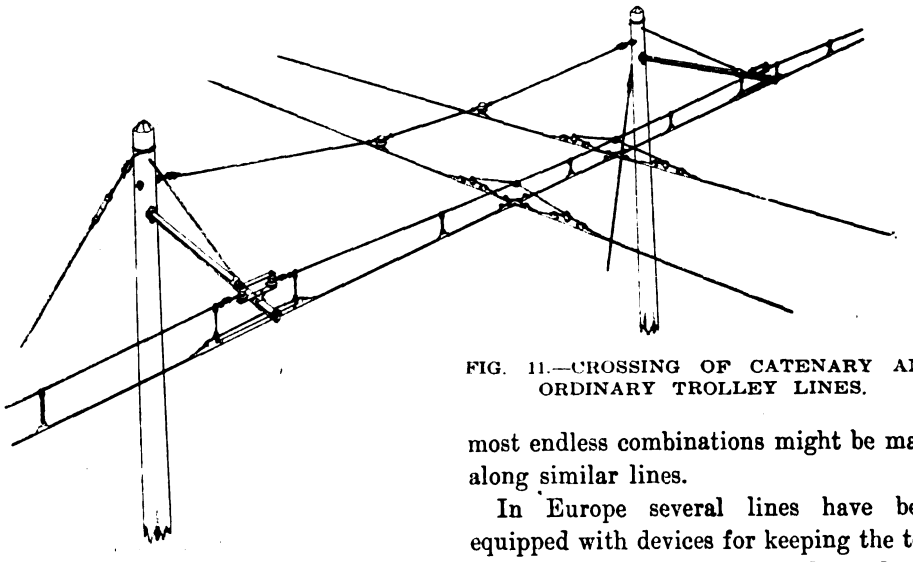

FIG. 11.—CROSSING OF CATENARY AND ORDINARY TROLLEY LINES.

it follows small inequalities in the conductor better. In all cases it has been found to pay to make the sliding shoe of softer metal than the conductor, as it is cheaper to replace shoes than the wires, and aluminum gave very long mileage under several tests. Experience also showed in many cases that the life of the shoe was only about one-tenth as great where steam locomotives traveled along under the catenaries as when the conductors were kept free from soot and corrosion.

The electrification of steam roads is continually advancing, not only at terminals but also for trunk-line service. Most roads try it out on branch lines first for several reasons. An example of such service is shown in Fig. 10, which is a view on the Rochester Division of the Erie Railroad. Multiple-unit train-control equipment is used on the motor cars, which also carry passengers and other loads, and trains of various kinds can be made up. The method of suspending the catenary is worthy of note, as are also the protective devices built about the cross lines overhead. The pantograph collectors here illustrated are typical of good practice everywhere.

Special combinations of parts have frequently been made to suit circumstances which arise in every installation, as it is obviously impossible to predetermine every demand. Fig. 11 shows an overhead crossing, developed by the writer for the Electric Service Supplies Company, for use when necessary to cross a plain trolley system with a catenary line. Standard parts have been used throughout, with a consequent saving in the cost of construction. The illustration has been made especially to show typical catenary construction in clearer detail than the photographs do. It will readily be seen that almost endless combinations might be made along similar lines.

In Europe several lines have been equipped with devices for keeping the tension of both messenger and conductor practically constant. In some cases springs have been used at the ends of each section, and on the Midland Railway in England a weight is attached to one end of each section through a pulley arrangement. In this case the trains always enter the section at the fixed end of the line and push the slack toward the weighted end. In this country springs have been tried but do not seem to meet with very great favor. With long sections, such as are used here, the amount of creepage with any sort of take-up device would tend to derange the whole catenary structure. Periodical readjustment is the more common and preferred practice.

The number of lines equipped with catenary systems has increased greatly and several which had low-voltage systems originally have changed to higher voltages. There is practically no limit to the voltage possible on the catenary itself, but the limit is set by the car equipment. Even here the limit is being raised at frequent intervals, so the future cannot safely be predicted.

What Is a Crowded Car?

It has usually been held that the average Chicagoan could, especially during the heyday of the Yerkes administration of the city's old cable systems, give a proper and complete definition of a crowded car, but elsewhere it is different, and the substance of a decision handed down recently by Judge Mullowny, of the United States Division of the Police Court, Washington, D. C., is that the Interstate Commerce Commission must promulgate a regulation specifying what constitutes a "crowded street car" before the act of Congress, approved May 23, 1908, giving the Commission jurisdiction over street-car lines in the District of Columbia, can be enforced. The judge sustained the motion of attorneys for the street railroads of the District to quash the information based on evidence as to the overcrowding of street cars, but declined to rule that the act was unconstitutional.

Judge Mullowny took the ground that Congress laid down general principles as to the overcrowding of street cars, depending upon the Interstate Commerce Commission to adopt rules and regulations which would specify what constitutes overcrowding.

Second Avenue Railroad to Borrow $500,000.

Justice O'Gorman, in Special Term of the Supreme Court at New York, has authorized George W. Linch, as receiver of the Second Avenue Railroad Company, New York city, to borrow $500,000 and issue therefor certificates at par with six per cent interest, to mature in one year.

The money is to be used to improve the condition of the road and its properties. The receiver set forth in his petition for the money that he had entered into contracts for the reconstruction of the car barn at Ninety-sixth Street and Second Avenue, which was virtually destroyed by fire some months ago. He said that part of the loss was covered by insurance, but that he needed $139,000 in addition to the insurance money.

Receiver Linch also advised the court that the tracks and roadway were in a very poor condition and in many places were so worn as to be dangerous for the operation of cars, and that he needed money to make the repairs.

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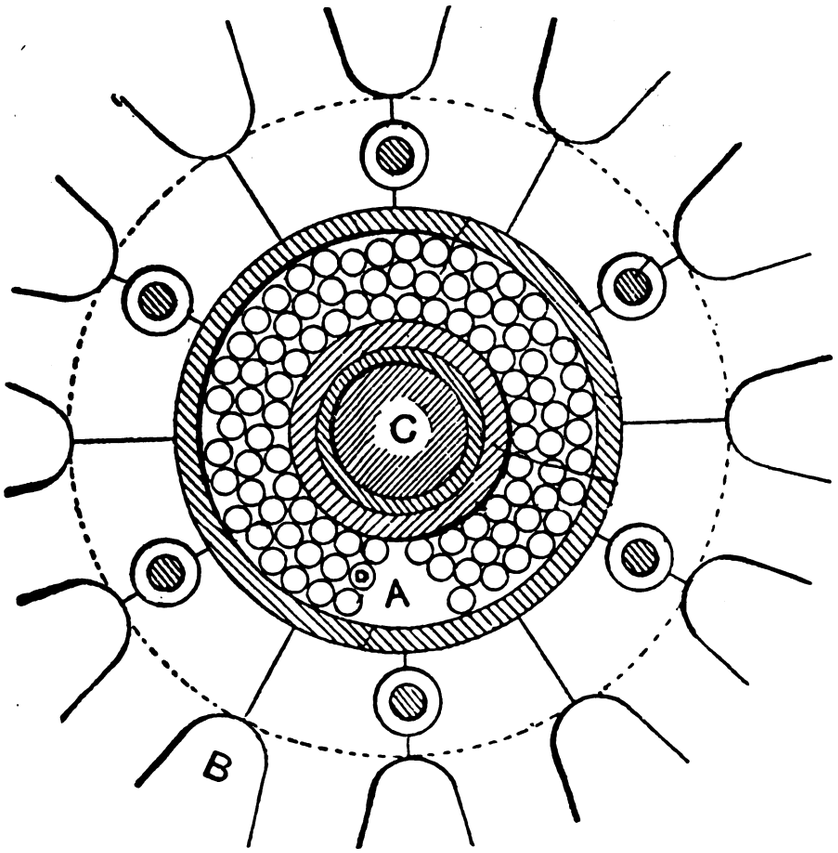
Vibration in Motor Traction.

While the average man accepts the present and future success of motor traction as an assured fact, engineers and those responsible for the management and running of mechanically-propelled vehicles are only too well aware of practical difficulties and problems which beset almost every type of motor-carriage. Though motor-buses, for instance, have almost driven the horse-bus off the streets, the economic result of that change has been financial loss by the leading motor-bus companies in the first six months of last year. The root of this unprofitable result of motor-traction lies in the heavy cost of maintenance and upkeep of the vehicles. In turn the frequency in breakdowns, defects, and costly repairs lies in the effect of vibration. Many thousands of dollars have been sacrificed over hundreds of devices in the vain endeavor to overcome that arch enemy of profitable motor working.

There was held, in England, during the past few weeks, a public demonstration of a new device, which promises to overcome destructive effects of vibration.

This invention consists of a novel form of a hub for the wheel. It marks a truly radical departure from all hitherto accepted principles of wheel construction, yet it is scientifically sound and, most important of all, it has been proved a commercial success. The device is simple and costs little. In this new hub, for which the name "Shock-Shifter" has been adopted, the "hollow space" is filled with steel balls, loosely packed, which support the axle. As will be seen from the accompanying diagram, the weight of the axle carrying the vehicle automatically forms the vacant space A, and this space is thereby constantly maintained while the wheel is in movement.

Now, in any ordinary wheel the road-shock, as from the bump over a stone or grating, chiefly travels up the spoke situated as B is in the diagram. Through the spoke it ordinarily travels directly to the center of the axle C, which in turn diffuses it throughout the vehicle. But in the Shock-Shifter hub, owing to the very mobile condition of the steel balls resting on one another, always in angular position, ever ready to slip over each other, and revolving on their own axes, an all but liquid bearing to the axle is given. Immediately, therefore, when any road shock, however slight, takes place, the row of balls beneath the axle, and to its full width of six or eight, marked D, is immediately displaced. This row is forced across the vacant space A, followed by the other balls, thus causing the shock to pass into the ball chamber in the backward moving half of the wheel, wherein the line of its transmission must be constantly broken up. The road shock is thus absorbed and prevented from ever reaching the axle.



SECTION OF SHOCK-SHIFTER HUB.

The movement of the car is wonderfully steady, because there is no reactionary shock on this wheel at all, as must invariably be the result where springs are utilized, or rubber alone, in any form, is applied to lessen vibration.

This hub, as described, is enclosed in side plates, within which the wheel freely moves up and down as road irregularities require. In these side plates the driving bolts are rigidly fixed, but these bolts pass through all the tubes, same as E, of greater diameter in the wheel, the play of which tubes synchronizes with the continuously elastic movement round the axle created by the balls. As the crushing strain of the balls varies, according to the size used, from 6,000 pounds to 32,000 pounds each, this device is as remarkable for its strength and durability as it is for its flexibility.

After being submitted for eighteen months to the most severe tests and constant running over all sorts of roads, the working parts of the "Shock-Shifter" hub were found in perfect order, and the wheels themselves show the slightest signs of wear.

One striking result of the operation of the Shock-Shifter hub is the application to the motor-car of Sir Isaac Newton's three great laws on the use of force. As each row of balls is displaced the wheel is thrown slightly eccentric to the axle, and the center of gravity is consequently shifted toward the forward moving half of the wheel, thus constantly assisting its progress and easy movement. Road shock is converted into rotary motion because the power arising from the obstacle itself is actually harnessed to do this work, and as reactionary shock is thus avoided, vibration is successfully overcome. From this same cause an astonishing saving of about one-half of the cost of rubber tires results, and a reduction in the consumption of petrol turns out to be a complete antidote to the recent tax.

Westinghouse Electric.

The Westinghouse Electric and Manufacturing Company is booking orders in excess of shipments, which is one of the best indications of a revival in the electrical industry.

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American Street and Interurban Railway Association.

Annual Convention, Denver, Colo., October 4-8—Programme, Entertainment, Exhibits.

The annual convention of the American Street and Interurban Railway Association will be held at Denver, Colo., October 4 to 8. Each association will have individual hotel headquarters, the American and Manufacturers' associations at the Brown-Palace, the Accountants at the Savoy, the Engineers at the Adams, the Claim Agents at the Metropole, and the Transportation and Traffic Association at the Albany.

The following programme has been announced:

AMERICAN ASSOCIATION.

Tuesday, October 5—9:30 a. m. to 12:30 p. m.
Registration and badges. (Association booth, entrance to Auditorium.)
Tuesday, October 5—2:00 p. m. to 5:00 p. m.
(Open Session.)
Convention called to order.
Annual address of the president.
Annual report of the executive committee.
Reports of committees:
(a) Subjects.
(b) Active membership.
(c) Associate membership.
(d) Revision of associate membership.
(e) Welfare of employes.
(f) Associate membership pins.
(g) President Goodrich's suggestions.
Annual report of the secretary-treasurer.
Announcements.
New business.
Paper, "Organization, from the Standpoint of the Smaller Companies," by Ernest Gonzenbach, president and general manager Sheboygan Light, Power and Railway Company, Sheboygan, Wis.
Report of committee on education.
Wednesday, October 6—2:00 p. m. to 5:00 p. m.
(Executive Session.)
Appointment of nominating committee.
Reports of committees.
(a) Interstate Commerce Commission affairs.
(b) Compensation for carrying United States mail.
Thursday, October 7—2:00 p. m. to 5:00 p. m.
(Executive Session.)
Reports of committees.
(a) Insurance.
(b) Public relations.
(c) Subjects for confidential bulletins in 1910.
(d) McGraw dictionary.
(e) Brill prize.
Report of committee on nominations.
Election of officers.
Installation of officers.
Resolutions.
Unfinished business.
Adjournment.

ACCOUNTANTS' ASSOCIATION.

Tuesday, October 5—2:00 p. m. to 5:00 p. m.
Registration and badges.
Wednesday, October 6—9:30 a. m. to 12:30 p. m.
Convention called to order.
Annual address of president.
Annual report of executive committee.
Annual report of secretary-treasurer.
Paper, "Interurban Statistics," by S. C. Rogers, treasurer and secretary Mahoning & Shenango Railway and Light Company, Youngstown, O.
Report of the committee on interline accounting.
Appointment of convention committees.
Appointment of nominating committee.
New business.
Wednesday, October 6—1 p. m.
"Get-together Luncheon."
Thursday, October 7—9:30 a. m. to 12:30 p. m.
Address, "The Census and Electric Railway Statistics," by W. M. Steuart, chief statistician for manufactures, Bureau of Census, Washington, D. C.
Paper, "The Electric Railway Auditor, His Duties and Relation to the Organization," by W. B. Brockway, chief accountant Ford, Bacon & Davis, New York, N. Y.
Paper, "Payrolls and Timekeeping," by N. E. Stubbs, auditor United Railways and Electric Company of Baltimore, Baltimore, Md.
Report of the committee on standard classification of accounts and form of report.
Friday, October 8—9:30 a. m. to 12:30 p. m.
Paper, "Stores Accounting and Inventory," by E. S. Pattee, secretary and comptroller Twin City Rapid Transit Company, Minneapolis, Minn.
Report of the joint committee on shop accounting.
Reports of convention committees.
Report of nominating committee.
Election of officers.
Installation of officers.
Adjournment.

ENGINEERING ASSOCIATION.

Tuesday, October 5—9:30 a. m. to 12:30 p. m.
Registration and badges.
Tuesday, October 5—2:00 p. m. to 5:00 p. m.
Convention called to order.
Annual address of president.
Annual report of executive committee.
Annual report of secretary-treasurer.
Appointment of convention committees.
Report of committee on way matters.
Wednesday, October 6—9:30 a. m. to 12:30 p. m.
Report of committee on equipment.
Wednesday, October 6—2:00 p. m. to 5:00 p. m.
Report of committee on power generation.
Appointment of nominating committee.
Thursday, October 7—9:30 a. m. to 12:30 p. m.
Inspection of exhibits.
Thursday, October 7—2:00 p. m. to 5:00 p. m.
Inspection of exhibits.
Friday, October 8—9:30 a. m. to 12:30 p. m.
Report of committee on standards.
Report of committee on power distribution.
Friday, October 8—2:00 p. m. to 5:00 p. m.
Report of joint committee on shop accounting.
Question box.
General business.
Report of nominating committee.
Election of officers.
Installation of officers.
Adjournment.

CLAIM AGENTS' ASSOCIATION.

Monday, October 4—9:30 a. m. to 12:30 p. m.
Registration and badges.
Monday, October 4—2:00 p. m. to 5:00 p. m.
Convention called to order.
Annual address of the president.
Annual report of the executive committee.
Annual report of the secretary-treasurer.
Appointment of convention committees.
Discussions: 1. What is the best means of preventing collision of cars and of cars with vehicles and pedestrians? 2. How can boarding and alighting accidents be diminished or prevented?
Tuesday, October 5—9:30 a. m. to 12:30 p. m.
Discussions: 3. What is the best plan of having trainmen procure and report an increased number of witnesses to accidents? 4. Is it good practice, when statement of injured party is obtained of accident, to furnish him with copy of his statement? 5. Is a school of instruction for trainmen essential?
Tuesday, October 5—2:00 p. m. to 5:00 p. m.
Discussions: 6. Should information be furnished newspapers regarding the work of the claim department? 7. What should be the relationship of the medical and claim departments? How can the medical best serve the claim department in the handling of accidents? 8. The claim department and its relation to the operating department.
Appointment of nominating committee.
Wednesday, October 6—9:30 a. m. to 12:30 p. m.
Discussion: 9. The unreported accident, its evils and remedy.
General business.
Reports of convention committees.
Reports of nominating committee.
Election of officers.
Installation of officers.
Adjournment.

TRANSPORTATION AND TRAFFIC ASSOCIATION.

Monday, October 4—9:30 a. m. to 12:30 p. m.
Registration and badges.
Monday, October 4—2:00 p. m. to 5:00 p. m.
Convention called to order.
Annual address of the president.
Annual report of the executive committee.
Annual report of the secretary-treasurer.
Appointment of convention committees.
Reports of special committees.
Report of committee on passenger traffic.
Tuesday, October 5—9:30 a. m. to 12:30 p. m.
Report of committee on interurban rules.
Report of committee on express and freight traffic.
Wednesday, October 6—9:30 a. m. to 12:30 p. m.
Appointment of committee on nominations.
Report of committee on city rules.
Report of committee on transfers and transfer information.
Paper, "Chicago's Transfer Crusade," by Joseph V. Sullivan, general supervisor Chicago Railways Company, Chicago, Ill.
Paper, "Transfer Laws and Suggested Changes," by Arthur A. Ballantine, Boston, Mass.
Thursday, October 7—9:30 a. m. to 12:30 p. m.
Report of committee on training of transportation employes.
General business.
Report of nominating committee.
Election of officers.
Installation of officers.
Adjournment.

Two convention halls, located in the Auditorium, and each capable of seating approximately 200 people, will be provided for the meetings of the convention. In addition, suitable meeting rooms are available in the Savoy Hotel and in the Metropole Hotel.

All of the meetings of the American Association and of the Transportation and Traffic Association will be held in Auditorium Hall, on the second floor of the Auditorium. The Accountants will hold their Wednesday session at the Savoy Hotel, and their Thursday and Friday sessions in the Rose Parlor, on the third floor of the Auditorium. The Engineers will hold their Tuesday and Wednesday sessions in the Rose Parlor, and their Friday sessions in Auditorium Hall. The Engineers have no Thursday session, that day being set apart for the inspection of exhibits. The Claim Agents will hold all of their sessions at the Metropole Hotel.

The Manufacturers' Association has practically completed its plans for entertainment during the convention. On Monday evening the annual reception will be held at the Brown-Palace Hotel, and the amateur vaudeville performance will be given on Tuesday evening. The Denver City Tramway Company is providing for a grand barbecue on Wednesday evening, to be held at the "White City," and a theatre party is arranged for Thursday evening. Special trips up the famous "Moffat Road" are to be run on Friday and Saturday. In addition, there will be several afternoon entertainments for the ladies during the convention week.

EXHIBITION.

The exhibits will be displayed in the New Auditorium. It is located within two blocks of the business district, and covers an area 260 feet long and 168 feet wide. A notable array of apparatus will be shown, the following reservations having been made:

Adams & Westlake Company, Chicago, Ill.
Allis-Chalmers Company, Milwaukee, Wis.
Aluminum Company of America, Pittsburgh, Pa.
American Brake Shoe & Foundry Company, Mahwah, N. J.
American Mason Safety Tread Company, Boston, Mass.
American Railway Guide Company, Chicago, Ill.
American Steel & Wire Company, Chicago, Ill.
Ames, Cortland F., Chicago, Ill.
Anderson Manufacturing Company, A. & J. M., Boston, Mass.
Anglo-American Varnish Company, Newark, N. J.
Atlas Railway Supply Company, Chicago, Ill.
Automatic Car Coupler Company, Pasadena, Cal.

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Automatic Ventilator Company, New York City.
Avery Scale Company, N. Milwaukee, Wis.
Badger Fire Extinguisher Company, Boston, Mass.
Barber Car Company, York, Pa.
Bayonet Trolley Harp Company, Springfield, Ohio.
Berry Brothers, Ltd., Detroit, Mich.
Black Diamond Boring Machine Company, Monongahela, Pa.
Brown, Harold P., New York City.
Brill Company, J. G., Philadelphia, Pa.
Buckeye Electric Company, Cleveland, Ohio.
Buda Foundry & Manufacturing Company, Chicago, Ill.
Burroughs Adding Machine Company, Detroit, Mich.
C. A. Wood Preserver Company, Austin, Tex.
Carnegie Steel Company, Pittsburgh, Pa.
Chicago Car Heating Company, Chicago, Ill.
Chicago Varnish Company, Chicago, Ill.
Chisholm-Moore Manufacturing Company, Cleveland, Ohio.
Cincinnati Car Company, Cincinnati, Ohio.
Climax Railway Supply Company, Chicago, Ill.
Coin Counting Machine Company, New York City.
Coleman Fare Box Company, Buffalo, N. Y.
Colorado Cement Products Company, Denver, Colo.
Columbia Machine Works & Malleable Iron Company, Brooklyn, N. Y.
Consolidated Car Fender Company, Providence, R. I.
Consolidated Car Heating Company, Albany, N. Y.
Cooper Heater Company, Dayton, Ohio.
Coulter & Co., C. J., Hammond, Ind.
Crane & Co., Chicago, Ill.
Crouse-Hinds Company, Syracuse, N. Y.
Curtain Supply Company, Chicago, Ill.
D & W Fuse Company, Providence, R. I.
Dearborn Drug & Chemical Company, Chicago, Ill.
Duff Manufacturing Company, Pittsburg, Pa.
Duntley Manufacturing Company, Chicago, Ill.
Eclipse Railway Supply Company, Cleveland, Ohio.
Edwards Company, O. M., Syracuse, N. Y.
Electric Manufacturers' Sales Company, Denver, Colo.
Electric Railway Journal, New York City.
Electric Railway Improvement Company, Cleveland, Ohio.
Electric Railway Equipment Company, Cincinnati, Ohio.
Electric Renovator Company, Pittsburgh, Pa.
Electric Service Supplies Company, Philadelphia, Pa.
Electric Traction Supply Company, St. Louis, Mo.
Emery Pneumatic Lubricator Company, St. Louis, Mo.
Eureka Tempered Copper Works, North East, Pa.
Fertig, Charles J., Colorado Springs, Colo.
Forsyth Brothers Company, Chicago, Ill.
Forsyth Steel Tie Company, Pittsburgh, Pa.
Galena Signal Oil Company, Franklin, Pa.
General Electric Company, Schenectady, N. Y.
Gest, Guy M., New York City.
Globe Ticket Company, Philadelphia, Pa.
Goldschmidt Thermit Company, New York City.
Griffin Wheel Company, Chicago, Ill.
Gulick-Henderson Company, Pittsburgh, Pa.
Hale & Kilburn Manufacturing Company, Philadelphia, Pa.
Handlan-Buck Manufacturing Company, St. Louis, Mo.
Hess-Bright Manufacturing Company, Philadelphia, Pa.
Heywood Brothers & Wakefield Company, Wakefield, Mass.
International Register Company, Chicago, Ill.
Jeandron, W. J., New York City.
Jewett Car Company, Newark, Ohio.
Johns-Manville, H. W., Company, New York City.
Jones & Laughlin Steel Company, Pittsburgh, Pa.
Kenfield-Fairchild Publishing Company, Chicago, Ill.
Kerite Insulated Wire and Cable Campany, New York City.
Lang Retrieving Trolley Company, Oakland, Cal.
Lorain Steel Company, Philadelphia, Pa.
Massachusetts Chemical Company, Boston, Mass.
Meyer Safety Guard Company, Omaha, Neb.
Midvale Steel Company, New York City.
McConway & Torley Company, Pittsburgh, Pa.
McCord & Co., Chicago, Ill.
Nachod Signal Company, Philadelphia, Pa.
National Brake Company, Buffalo, N. Y.
National Brake & Electric Company, Milwaukee, Wis.
National Carbon Company, Cleveland, Ohio.
National Lead Company, New York City.
National Lock Washer Company, Newark, N. J.
Nichols, A. O., Omaha, Neb.
Niles-Bement-Pond Company, New York City.
Ohio Brass Company, Mansfield, Ohio.
Ohmer Fare Register Company, Dayton, Ohio.
Onderdonk Engineering Company, Denver, Colo.
Pantasote Company, New York City.
Pay-As-You-Enter Car Corporation, New York City.
Pennsylvania Steel Company, Steelton, Pa.
Peter Smith Heater Company, Detroit, Mich.
Planet Company, Chicago, Ill.
Rail Joint Company, New York City.
Roebling's Sons Company, John A., Trenton, N. J.
Rubberset Brush Company, Newark, N. J.
Sherwin-Williams Company, Cleveland, Ohio.
Speer Carbon Company, St. Marys, Pa.
St. Louis Malleable Castings Company, St. Louis, Mo.
Standard Paint Company, New York City.
Standard Steel Works Company, Philadelphia, Pa.
Standard Motor Truck Company, Pittsburgh, Pa.
Standard Varnish Works, Chicago, Ill.
Standard Brake Shoe Company, Chicago, Ill.
Star Brass Works, Kalamazoo, Mich.
Sterling Varnish Company, Pittsburgh, Pa.
Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.
T. H. Symington Company, Baltimore, Md.
Taylor Electric Truck Company, Troy, N. Y.
Tool Steel Motor Gear & Pinion Company, Cincinnati, Ohio.
Traction Lubricating Company, Chicago, Ill.
Transfer Issuing Machine Company, Boston, Mass.
Transportation Equipment Company, New York.
Trolley Supply Company, Canton, Ohio.
U. S. Wood Preserving Company, New York City.
Under-Feed Stoker Company, Chicago, Ill.
Van Dorn Co., W. T., Chicago, Ill.
Wallace Supply Company, New York City.
Wagner Electric Manufacturing Company, St. Louis, Mo.
Western Electric Company, New York City.
Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.
Wharton, Jr. & Co., William, Philadelphia, Pa.
Wheel Truing Brake Shoe Co., Detroit, Mich.
Whitmore Manufacturing Company, Cleveland, Ohio.
Wilson, George, Pasadena, Cal.
Wonham, Magor & Sanger Company, New York City.

Wireless on Trains.

The Union Pacific Railroad at Omaha will be the western pioneer in experiments to show the applicability of wireless telephones to railroad trains. One of the largest and most powerful wireless electrical stations in the world will be erected at the Omaha shops within the next two months.

Dr. Frederick H. Millener, electrical expert, has been given carte blanche in the construction of this big wireless station, from which he will conduct expensive experiments.

Experiments will be conducted in wireless telegraphy and telephony and in remote control of machinery by wireless. Most important to the railroad will be the work in telephony.

Doctor Millener believes it will not be long before it will be possible to talk with a passenger on a train moving sixty miles an hour hundreds of miles from Omaha. This will permit railroad officials to keep in constant and close touch with all their trains and be able to communicate with them at any minute. The doctor expects to have a wireless telephonic model working within the next six months.

Wireless telephony for trains will necessitate the placing of a copper wire along the track, this wire liberating wireless waves which are taken up only by instruments set for a particular wave.—*Abstracted from Telephone Engineer (Chicago), for September.*

Successful British Municipal Tramway.

Vice-Consul John W. Thomas writes that the municipal railways of Manchester, England, earned a gross revenue for the year ended March 31, 1909, of $1,345,507, of which $734,066 was net, an increase in profit of $19,186 over the previous year. From the returns $340,655 was paid in for the relief of city rates, against $267,657 the previous twelve months. Of the 155,011,884 passengers carried, sixty-seven per cent paid two cents as their fare. The railways also deliver parcels, which can be handed in at any depot or to car conductors for delivery at any place within a half mile from a tram route. The rates vary from four cents upward for each parcel, and local tradesmen find it very convenient. The net profit from the parcel-delivery system was $8,352, against $5,936 for the previous year.

Proposed Reorganization Plans of Consolidated Traction Company.

Plans are being formulated, it is claimed, to reorganize the Consolidated Traction Company, of Chicago. The company, according to the plans, will be taken out of the hands of the receivers, and the City Council will be petitioned for a franchise of the sort granted to the City Railway Company and the Chicago Railways Company. A completely rehabilitated surface transportation system is also planed.

These plans would effect the suburbs of Chicago, as the present system extends through several of them.

Manila Traction Report.

The Manila Electric Railroad and Light Company during the past fiscal year carried 10,701,859 passengers at an average rate of 4.9 cents and an average cost of 2.6 cents per passenger. The total revenue was $530,000, while the total operating expenses amounted to $284,600.

Criticizes Cleveland's Subway Project.

The Cleveland subway project received severe criticism from Rev. Frederick L. Odenbach, of St. Ignatius College, in an address before the Cleveland Engineering Society last week. He declared that Cleveland would be shaken from stem to stern if subways were built.

"The underground system in New York was built in rocks," said Father Odenbach. "This helps to absorb the tremors.

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The Transportation Problem in New York City.

A recent publication by the Public Service Commission of the First District of New York gives some interesting data in regard to the enormity of the transportation problem of New York city. The data are based partly upon the annual returns for the year 1907 and partly upon those for 1908. The population of New York city is given as 4,278,526, which is equal to approximately five per cent of the total population of the United States. The length of single track of street and electric railways (including surface, elevated and subway lines) is given as 1,538, or about 4.5 per cent of the total mileage of electric railways in the country. The cash-fare passengers carried by the local transportation systems in New York city totaled 1,323,326,655, or 17.8 per cent of the total fare passengers on all the similar lines throughout the country. The New York transit systems carry fifty per cent more passengers than are carried by all of the steam railroads of the entire country. The average number of fare passengers carried each day during 1908 was 3,711,076, which is equal to about eighty-four per cent of the entire population of the city. The commission's statistics show that the passengers carried by all the transit lines are increasing at the rate of about 55,000,000 a year.

The subway system built by the city of New York was designed to carry a maximum of 400,000 passengers a day. It is now transporting close to 800,000 passengers a day during the busiest season. By further improvements in the stations and the car equipments it is expected to increase the capacity about twenty-five per cent further. The subway, as it is now constructed, is about twenty-five miles long and cost the city $50,000,000, while the Interborough Rapid Transit Company, the lessee, has expended about $35,000,000 for the rolling stock and other equipment. At the present rate of income the subway is paying about eight per cent per annum on the total investment, or about fourteen per cent upon the investment made by the lessee. The commission has plans under way and proposes to advertise at once for the construction of new extensions of the subway system to cost $100,000,000.

It is probable that the commission will ask for alternative bids for the construction of this new system, either by municipal funds or by private capital.

New York Telephone Company Deal.

The American Telephone and Telegraph Company has acquired the nearly $16,000,000 New York Telephone stock owned by the Western Union. Papers covering the purchase have now been signed.

The New York Telephone Company is the largest, and, in some respects, the most important of the Bell subsidiaries. Of its $50,000,000, sixty-four per cent, or $32,000,000, is owned by the American Telephone Company.

Of the $18,000,000 minority stock, about $10,000,000 has for many years been the property of the Western Union, and it is this stock which President Vail's diplomacy has at last landed in the Telephone camp.

No official statement as to price and methods by which the transaction will be financed will be made at this time.

Of the $16,000,000 New York Telephone stock which Western Union has sold, $9,733,100 is pledged as collateral behind an issue of $10,000,000 four per cent collateral and convertible bonds. These bonds will now be called for redemption by Western Union at 105 and interest at the earliest available date, March, 1912.

Practically speaking, therefore, it will be fully two-and-one-half years before American Telephone comes into actual possession of the entire $16,000,000 New York Telephone stock.

Somewhat contrary to the general impression, the transaction just concluded does not involve any settlement of the long-pending suit between the American Telephone and Western Union, judgment in which was recently returned in favor of Western Union in the sum of approximately $5,000,000.

The importance of the new move is that it insures in the near future the consolidation into a single huge telephone company of all the Bell subsidiaries operating in New York state.

The companies involved include New York Telephone, Hudson River Telephone, Empire State, New York and Pennsylvania, Central New York, Bell of Buffalo, New York and New Jersey, with the New York Telephone Company as the medium of the merger.

Regarding the sale of the New York Telephone stock owned by the Western Union to the American Telephone and Telegraph Company, General Clowry, president of the Western Union Telegraph Company, said:

"The matter of sale has been pending for some time, and the negotiations proved mutually agreeable, each side considering it of an advantage to make the transaction in question. As you know, the Western Union owned a little less than one-third of the New York Telephone stock, amounting to about $60,000,000. We formerly held stock in other telephone companies and gradually disposed of it, as we wish to confine ourselves to the telegraph business."

Storage Battery Meeting in Chicago.

At the invitation of the Electric Storage Battery Company, the manufacturers of the Chloride Accumulator and the Exide Storage Battery, about 150 railroad employes, mostly connected with the signal, car-lighting and telegraph departments, gathered at the rooms of the Western Society of Engineers in the Monadnock Block, Chicago, on Thursday evening, September 23, to listen to an illustrated lecture by H. M. Beck, one of the engineers connected with the company, on the "Care and Operation of Storage Batteries." The paper was listened to with much interest and a good deal of other information elicited during the discussion. G. H. Atkin, manager of the Chicago office of the company, who presided, said in introducing the lecturer, that it is the aim of the Electric Storage Battery Company to get in touch with all the users of its batteries through its operating department. On account of their constant traveling the railroad men were particularly hard to meet, and for that reason they had been called to this assemblage. An abstract of Mr. Beck's paper will be printed in a later issue.

Convention of the Society for the Promotion of Industrial Education.

December 1, 2 and 3 have been selected by the National Society for the Promotion of Industrial Education as the days upon which to hold its next annual convention. The place selected is Milwaukee, Wis., which has lately made very rapid strides as a manufacturing and industrial center.

Every effort is being made to secure some of the most distinguished leaders in the industrial, legislative and educational world for addresses and papers to be delivered at the convention. An exhibition of trade school work from all over the United States will be one of the features of the convention, which will undoubtedly attract much attention.

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Electrical Exports for July.

The electrical exports from the United States for the month of July, a summary of which has just been completed by the Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., show a very slight improvement over the corresponding month last year, but a marked falling off compared with the preceding month, June, 1909. This decrease was almost entirely in electrical machinery, which alone suffered a slump of over forty per cent.

The figures for the three months referred to are as follows:

	July, 1909.	July, 1908.	June, 1909.
Electrical appliances.	$567,795	$429,080	$ 595,044
Electrical machinery.	391,195	523,355	667,453
Total	$958,990	$952,435	$1,262,497

Totals for the first seven months ending with July of each of the years 1907, 1908 and 1909 show that the exports of electrical appliances have slightly recovered this year from the severe setback in 1908, but the exports of electrical machinery have steadily continued to recede.

A list of the principal countries to which American electrical products were sent in July, 1909, and the value of these exports is given below:

Exported to—	—Electrical— Appliances.	Machinery.
United Kingdom	$ 32,282	$ 39,065
Belgium	5,455	.....
France	2,285	125,918
Germany	10,909	270
Other Europe	2,378	8,689
British North America	176,619	86,199
Central American States and British Honduras	19,138	7,480
Mexico	65,072	48,486
Cuba	30,290	1,935
Other West Indies and Bermuda	6,306	1,393
Argentina	11,780	19,351
Brazil	134,517	7,181
Other South America	18,883	15,053
Chinese Empire	.....	1,998
British East Indies	.....	2,286
Japan	10,170	1,132
British Australasia	29,662	10,075
Philippine Islands	8,387	6,000
British Africa	1,823	5,843

Electrical Progress in Europe.

Edwin W. Rice, Jr., vice-president of the General Electric Company, who returned from Europe last week, declares that "Progress in business and in the application of electrical appliances is not so great in European countries as in this country. They are slow about the adoption of new appliances, and are too conservative in the matter of old forms and means. I expected to find railroad terminals, especially in the large cities, applying electricity, as is being done in this country, but such is not the case. The application of electricity for terminal purposes must come sooner or later in such cities as London, Manchester, Birmingham, Glasgow and other large cities.

Westinghouse Electric Company.

Westinghouse Electric and Manufacturing for the five months ended August 31 showed a surplus after fixed charges of between $700,000 and $800,000, or at the rate of $150,000 a month.

It is understood that the surplus for August was close to $220,000, which was at the rate of $2,640,000 a year, a sum equal to over seven per cent on the common or assenting stock. The business of the company is growing at a rate to warrant the statement that before the close of the year the surplus over fixed charges will be running at the rate of $250,000 a month, or $3,000,000 a year, which would be equivalent to nearly eight per cent on the assenting stock.

The directors are scheduled to meet in the near future, and it is possible that the dividends in arrears on the preferred stock, amounting to fourteen per cent, or approximately $550,000, will be paid off. The matter is now under consideration, but no definite action has yet been taken.

The increased earnings of the company would warrant the payment of back dividends, but this is a question that will have to be decided by the entire board.

Shipments of the Pittsburg plants are running at the rate of $30,000,000 a year, and orders continue in excess of shipments. The better showing in the matter of earnings is due to numerous reasons, the principal one being the departmentization or rearrangement of the great shops of the company. This, together with the introduction of new economies in general, has resulted in a sharp decrease in operating costs. Then, again, it must be taken into consideration that as a result of the reorganization of the company it is in much better position from a financial point of view.

The reorganization provided for $17,000,000 of new capital, and the company now has close to $11,000,000 cash on hand.

Live Wires.

The Order of Rejuvenated Sons of Jove will hold its seventh annual meeting at the Stollenden Hotel, Cleveland, O., October 14 and 15, and a good old hot-time reunion is expected. The Jovians are boosters, and they make things hum in an electrical way wherever they may be. E. D. Strickland, national organizer, urges all good Jovians to be present, and promises a "live meeting of live wires in a live-wire town."

Annual Outing for Commonwealth Edison Company Lady Employes.

On last Saturday, September 25, the Commonwealth Edison Company, Chicago, gave to its lady employes an outing at Ravinia Park, on the "North Shore," which had been specially reserved for the occasion. About seventy-five young ladies and their escorts, together with a number of heads of departments and their wives, left the North Water Street spur of the Northwestern Elevated road at 12 o'clock, connecting with the Chicago-Milwaukee electric road, running direct to the Park. Luncheon was served under the trees upon the arrival of the party at the Park, after which numerous games were entered into and enjoyed by all, prizes being offered to the young ladies who were most skillful in the different sports, such as archery, bowling, driving, etc. Two lively baseball games were played by the gentlemen, but the score must not be printed. When the afternoon's sports had been completed, a course dinner was served in the ballroom of the Casino, and prizes awarded to the different prize winners in the afternoon contests. An orchestra of eight pieces, especially engaged, accompanied the picnickers and discoursed good music during the afternoon and evening. The day was perfect, and a thoroughly enjoyable time was had by everybody.

"Boosting" New Orleans.

The New Orleans Railway and Light Company believes in the plan followed by many progressive public utility corporations of "boosting" the cities in which they operate. A very effective way it has found to do this is to have published a large number of complimentary copies of the pictorial guide to New Orleans, compiled by the New Orleans Progressive Union. This sixty-eight-page booklet describes and illustrates the most important attractions of civic, industrial and entertaining interest, and states in detail what to see and how to see it.

Rio Tramway Light and Power Decision.

According to the decision of Brazilian Court the Rio de Janeiro Tramway Light and Power Company, Limited, has established its exclusive right to distribute electric power throughout the municipality of Rio de Janeiro until the year 1915. After that date, according to the decision, the municipality is free to concede the same right to others if it should decide to do so.

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The Federation of Trade Press Associations.

The fourth annual convention of the Federation of Trade Press Associations of the United States was held in New York city at the Hotel Astor, September 27 and 28. The meeting was called to order on Monday morning by President Williams, who introduced Mr. Franklin Webster, president of the American Trade Press Association, who delivered the address of welcome. The response was made by Mr. Chas. V. Anderson, of St. Louis, vice-president of the Federation. The balance of session was taken up with the presidential address and the reports of officers and committees. The following topics elicited a lively discussion:

"The Changing View of the Trade Paper Advertiser and the Publisher's Duty in Consequence." Discussion led by John A. Hill, publisher of the *American Machinist, The Engineering and Mining Journal, Power and the Engineer.*

"How to Inspire the Staff—Something About Conventions of Officers and Employes." Discussion led by Chas. T. Root, president of the Root Newspaper Association, embracing *The Dry Goods Economist,* etc.

"How to Create Favor for the Trade Paper." Discussion led by J. Newton Nind, of *The Furniture Journal, The Embalmer's Monthly.*

"Some Problems in Circulation." Discussion led by H. M. Swetland, publisher of *The Automobile, The Motor Age, The American Architect, The Municipal Journal.*

"The Larger Service of the Trade Paper to Its Advertisers." Discussion led by Chas. G. Phillips, president Textile Publishing Company.

"The Printing Situation." John Clyde Oswald, publisher of *The American Printer.*

"The Paper Situation." Arthur C. Hastings, president American Paper and Pulp Association.

"The Trade Press Outlook." Emerson P. Harris, of *Advertising and Selling.*

"The Relation of the Business and Editorial Departments." Discussion led by Robert I. Clegg, of *Castings, Wood Craft,* etc.

"Developing a New Field." Discussion led by Henry S. Bunting, publisher of *The Novelty News.*

On Monday evening there was a well-attended theatre party at the Belasco Theatre.

Tuesday was devoted to a further topical discussion, and on Tuesday evening the annual banquet was held.

The speakers were Hon. Edward M. Morgan, postmaster of New York city; Hon. Chas. W. Moore and the Rev. D. N. Waters, of Brooklyn.

The following officers were elected for the ensuing year:

President, Charles V. Anderson, St. Louis.

Vice-president, Henry G. Lord, Boston.

Secretary-treasurer, P. N. Litchfield, St. Louis.

Details of New York Telephone Merger.

At a meeting held in Brooklyn the stockholders of the New York & New Jersey Telephone Company ratified the terms of the agreement whereby the New York Telephone Company, as the operating corporation of the American Telephone and Telegraph Company, becomes the owner of its properties and franchises. Under the plan, the American Telephone and Telegraph Company exchanges its stock, share for share, for the stock of the New York & New Jersey. The New York Telephone Company takes the New York & New Jersey at the fixed price of $140 a share, or, if the stock is deposited before October 15, for $142 a share, the two dollars being on account of interest. If the stock is deposited after October 15 and before December 31, interest from October 1 to the day of turning in will be allowed.

This action by the stockholders of the New York & New Jersey company practically marks the completion of plans that have been under consideration for several years to merge all the Bell subsidiaries in New York state, the northern part of New Jersey and the northern tier of counties in Pennsylvania. Because of the merger the American Telephone and Telegraph Company now controls, and through its ownership of the New York Telephone Company operates over 700,000 telephones; and if to this total be added the 300,000 telephones of the so-called "Southern group" of companies which is the merger of the Bell subsidiaries in the territory north of the Potomac, east of the Alleghanies and south of New York, the number of telephones operated by one interest aggregates more than a million. There seems to be warrant for a belief that this so-called "Southern group," which now is connected with the "Northern group" through the American Telephone and Telegraph's ownership of a large percentage of its stock and through the fact that U. N. Bethel, who is president of the New York & New Jersey and vice-president of the New York Telephone Company, is also president of the Bell of Philadelphia, and was the moving spirit in each of the mergers—this "Southern group" may in time be merged with the "Northern group."

As it stands now in the "Northern group" the New York Telephone Company has bought all, or arranged to buy all, of the properties of the companies entering into the merger. To effect this purpose it took formal steps to increase its capitalization from $50,000,000 to $100,000,000. Of this amount $35,000,000 or $30,000,000 will be used to complete deals already arranged, and the remaining $14,000,000 or $15,000,000 will be held in the company's treasury for use on occasion, as further consolidations may be arranged.

The history of the merger, which is now practically accomplished, shows one circumstance remarkable in corporation financing, in that so far from the total capitalization of the merged companies being larger than the aggregate capitalization before the merger it is actually eight per cent less. The consolidation will be capitalized between $85,000,000 and $86,000,000.

Public Service Commission Rejects Reorganization Plan.

The New York Public Service Commission has denied the application of the committee of bondholders for the reorganization of the Third Avenue Railroad Company, New York city.

The following are some of the points upon which the denial of the application is based:

The applicants do not have a vested right to capitalize franchises or to reorganize irrespective of the provisions of the Public Service Commissions law.

The applicants have failed to prove that there are assets or property of sufficient value to justify a capitalization of $73,000,000. In the absence of proof, the Commission will not approve, for no reorganization can be sound or permanent unless capitalization has some relation to value.

There are strong indications that the present company is overcapitalized and that the outstanding stock and bonds—$58,560,000—are not represented by actual property, and that the net earnings will probably be less than estimated.

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Explosions in Switch Boxes.[1]

James Ashworth has raised an important point in connection with the recent explosion at the West Stanley colliery. He suggests that the explosion of the hydrocarbon gases and coal dust in the mine was caused initially by an explosion which took place in a switch box in a pump house, in the neighborhood of the spot where it is agreed the explosion commenced. In the collieries of the United Kingdom, it has been decreed by the Home Office that switches in-bye and at distributing connecting points should be enclosed in gas-tight boxes; notwithstanding this, more than one explosion is stated to have been caused by the ignition of gas inside the supposed gas-tight box.

There are two possibilities here. In the first place, it is an exceedingly difficult matter to construct a gas-tight box, and still more difficult to insure that it shall remain so. As mining engineers know only too well, gas will creep through the very smallest capillary aperture, and the provision for opening the box when necessary, also the provision for carrying the cables through to the working parts of the switch and for the handle of the switch are all points where it is only too easy to leave capillary spaces and sometimes spaces of even greater size.

One requirement for getting over this part of the difficulty is careful fitting. The boxes are nearly always of cast-iron and a warped casting is exceedingly difficult to make into a gas-tight box. India-rubber washers are resorted to largely to make good the failings in the fittings. But india rubber perishes and sometimes the men who go to attend to a switch are in a hurry and cannot stop to make sure that they have left everything quite gas-tight. Further than this, they have no means of knowing if the box is gas-tight. They can only use the means at their disposal, the closely fitting box and the rubber washers when provided, and follow the instructions as closely as they can, and hope that the box is gas-tight, each time they leave it.

But, outside of all this, there is another point, that with reference to sparking, which I think Mr. Ashworth intended to suggest. When sparking or arcing takes place inside a switch, or distributing box, gas may be generated from the material of which the insulating envelope of the cables, or the insulating substance employed to mount the parts of the switch, are composed. Under certain conditions, it may easily happen that a spark will pass between two parts of a switch, or between two conductors in a distributing box. And it may also happen, under favorable conditions, that the spark may be pulled out into an arc. We have then the enormous temperature of the arc, within the confined space of the iron box, and we have the insulating substances, which are composed of hydrocarbons, and if sufficient heat is present, they are converted into gas, and again if the necessary quantity of air is also present, as it would be in the ordinary condition of the box, an explosion would follow, followed by flame, and again followed by ignition of coal dust, or the gases of the mine if present.

The same thing has been met with in connection with street cables, and has led to some very serious accidents. My attention was called to the question by the gas engineer of a large city in the north of England, whose service had been blamed for an explosion, which it was pretty clear from the evidence, was caused by the gasification of the insulating envelope of the cables, and ignition of the explosive mixture so called. The Manchester (Eng.) Corporation had also to foot a rather heavy bill, which arose in something the same way. Gas was formed from the insulating envelope of a pair of cables in the street, a short-circuit having occurred between the cables, followed by an arc, which converted the hydrocarbon into gas. The gas so formed found its way into a house, and, becoming mixed with air, was ignited, an explosion following. Other cases have occurred in some of the streets of London. It appears to me, therefore, perfectly possible that some of the hitherto unexplained explosions have been caused in this way.

[1] Abstract of an article by Sydney F. Walker, M. I. E. E., A. M. I. C. E., of Bath, England, in *The Engineering and Mining Journal*, July 24, 1909.

The Copper Situation.

An authority on copper in the United States who has lately returned from a six weeks' trip through the copper-producing districts in the North, is conservatively optimistic regarding the market situation. He expresses himself as surprised at the considerable increase in activity and stated that he looks for a gradual advance in the amount of business done in the future.

In all probability there will be a slow increase in consumption during the next few months; at present consumers are buying in small lots, but larger orders should be placed as the year advances. It is doubtful, however, if the consumption of copper will overtake production until the railroads enter the field again to secure metal for purposes of electrification. With the increase in funds available for betterments and extensions resulting from increased operations, it is logical to expect that the roads which postponed the electrification of their lines until a more favorable time will take the matter up in the near future. Under this stimulus a perceptible increase will be seen in production as well.

X-Rays in Dentistry.

G. E. Pfahler, according to the *Medical Record*, advises more extensive use of the X-rays by dentists. Every chronic, obscure case should be tested in this way, which is clean, aseptic, painless and absolutely safe in the hands of an expert. The rays should be confined to the area examined and directed to the point of greatest interest. When the symptoms of disease are confined to a few teeth or roots the best results are obtained by the use of a small film directly in the mouth, but the use of the plate is necessary when the bone, accessory sinuses or large dental areas are to be studied, and it is also convenient when searching for missing or unerupted teeth. The interpretation and study of the plate is more difficult than the making of it. The degrees of density as measured by the rays are as follows: The greatest density is shown by metallic fillings, then by root fillings; next in density is the enamel, then the dentine, and finally the cancellous tissue of the maxilla and the alveolar process. A uniform white light is needed in reading the negative to bring out the details properly.

He describes the pathologic conditions as they appear on the film or plate. Points of decay or abscess are indicated by a light area in the otherwise uniform density of the dentine. Incomplete filling of the root canal may be shown. A pericementitis is shown by a light space between the root surface and the mottled cancellous alveolus, and the root surface is rough instead of smooth. Abscesses about the tip of the root or in the alveolus also show light areas in which no cancellous structure can be seen. The use of the ray relieves the dentist from probing and the consequent risk of spreading infection. They also show exostoses and whorls or dense areas of bone, and pulp stones which may be the cause of neuralgias.

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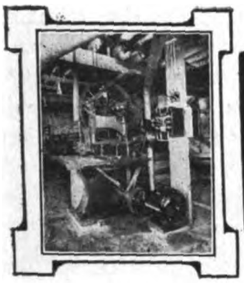
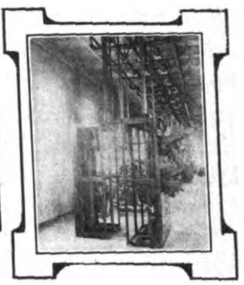


Industrial Power



EXTENDED USES OF ELECTRICITY ON BOARD SHIP.[1]—II.

BY JOHN MCLAREN.

For the more powerful motors, owing to the heavy rush of current required for starting purposes, it might perhaps be necessary to use a slightly different type of rotor, wound somewhat similar to the stator winding, so that resistances could be inserted for starting purposes. The methods that are usually employed in use with polyphase alternating-current power transmission, in which the current is generated at constant periodicity and voltage, result in abnormal starting currents, showing that it is necessary to employ induction motors fitted with slip rings, or auto-transformers, either for getting speed regulation, or for reducing the voltage at starting, etc.

There is no question about the fact that if it were possible to use the simple squirrel-cage induction motor, with polyphase alternating current, that we should have a most ideal condition of affairs, as this motor, consisting as it does of only two parts, the stator and the rotor, with no moving contacts whatever, is the most simple motor yet made. The main reason as to why this most interesting motor has not been much more used, not only on shipboard, but also on land, is because of its natural and inherent faults, which, if they can by some means be overcome, means that the field for this interesting and valuable motor is vastly extended, and its use on shipboard for driving machinery for all purposes will inevitably follow.

It is the motor that has not only the acme of simplicity, but also is combined with great mechanical strength of structure; the absence of commutators is an immense advantage, and what is not an inconsiderable item when thinking out an electrical power transmission system on a ship, is the fact that in this design of motor there is no sparking limit to allow for, as in continuous-current motors, therefore it can stand the roughest of use, and it has the greatest of output per unit of weight as compared with a direct-current machine, and without sacrifice of efficiency. A squirrel-cage polyphase induction motor will run on a given load, quite cool, when compared with direct-current motors of the same weight. This is partly due to the large section which can be given to the conductors, and also to the laminated character of the iron, which facilitates ventilation. It is not too much to say that while continuous-current motors and dynamos will always be a class of electrical machinery that requires more or less skilled attention, the polyphase motors and generators are self-oiling, self-alining, without commutators, etc., can practically be termed (especially the motor) a piece of mechanical machinery, requiring no skilled and very little unskilled attention; consequently, the maintenance is reduced to the minimum, and, further, in the squirrel-cage motor the main working current passes only through stationary windings, while in direct-current machines the main working current has of necessity to pass through rubbing contacts such as commutators, which always has been, and always will be, a continuous source of trouble.

A further (and which may prove eventually) very valuable feature in connection with the squirrel-cage induction motor is the fact, that should the rotor by any outside means be driven above the synchronous speed of its revolving magnetic field, the rotor bar winding cut lines of magnetic force, and the machine immediately becomes an asynchronous polyphase generator, and will return current to the supply mains. It will thus be seen that should such a motor be driving, say, a crane, the fact that on lowering a heavy load into the ship will not only steady the lowering of the load, but that a valuable portion of the energy that is represented by the falling weight could thus be returned to the mains, and possibly utilized for supplying other motors on the ship doing other work; and in a vessel that may be eventually fitted with this class of motor, some surprising results will no doubt be noted, as where a lot of cranes and other machinery may be at work, such as in docks, etc., the work of the main engine and generator will not be so much as that represented by the actual work done in the aggregate of dock machines at work, so that in that case there will be a not uninteresting reduction in the working costs per ton lifted.

The use of this motor is to be made, if possible, though it has some defects which, up to quite recently, have debarred its general use on board ship. For driving cranes, winches, hydraulic pumps working against head, refrigerating machinery, and in many other cases, on shipboard, great turning effect or starting torque is absolutely necessary; the squirrel-cage induction motor has little starting torque when supplied in the ordinary way, *i. e.*, with current that is at a constant periodicity and voltage. This is because the time limit in the rotor and the stator is not in satisfactory relation. The heavy current in the motor when standing, with the current turned on in the stator, does not allow the magnetic field in the rotor to rise and die down with the same rapidity as that in the stator, consequently there is not such a powerful couple between the stator and the rotor as when the rotor is running at, say, top speed, when the periodicity in the motor is reduced to almost zero, the slip being about two to four per cent then, but at starting the slip is, of course, 100 per cent. Therefore, before the simple squirrel-cage motor is used with real satisfaction for general purposes on ships, it is evident that some means must be produced so that the periodicity of the supply current to the motor at starting can be reduced, and gradually brought up to that required, to run it at the full speed, so allowing the motor to do the full work.

It is also of immense importance to have very reliable means of speed variation for such motors as will be used on cargo boats, etc., and means must be

[1] Abstract of paper read on September 4, in the Congress Hall, Imperial Exhibition, Shepherd's Bush, London.

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procured that the speed of the motor can be varied with economy.

The only way to vary the speed of the simple induction squirrel-cage motor is by varying the periodicity of the supply current to same, and up to now there have been no efficient means available for so doing, and the general application of this motor is thus limited to driving machines, that either require very little starting torque, and where no speed variation is required.

There is a system of speed variation applied to induction motors without the use of slip rings or auto-transformers, been put on the market by one of our members, Mr. Durtnall, which, in my opinion, will be the way to employ the above very simple and most desirable motor for auxiliary driving on ships. Mr. Durtnall's "Paragon" system will meet all the requirements, and by means of the generation of variable periodicity current, will overcome the defect of bad starting against load, and also will secure the variation of speed that will be required, in the simplest and most efficient of ways.

The system is best explained by reference to an actual case which Mr. Durtnall has now in hand—the design of the plant for operating the machinery for a large dredger now being built, in which it is proposed to use as the prime mover a 200 brake-horsepower Diesel engine, running at 300 revolutions per minute, this to run at constant speed irrespective of the speed or direction of rotation of the squirrel-cage induction motors, which are to be direct-coupled to the bucket chain, main winch, rotary pumps, ladder winch, revolving screen, and belt conveyor. These will be driven by three-phase current at variable speed as desired, through special controllers situated at the motor, by which means reversing of the machine at any speed can take place. The voltage is to be 350 (between phases); the periodicity will be generated at ten, twenty, thirty, forty, fifty and sixty periods per second, or with 1,200, 2,400, 3,600, 4,800, 6,000 and 7,200 alternations per minute, which means that (with, say, three per cent slip) the eight-pole motors that are to be used in this connection will run at either of the following speeds when connected with the above periodicity current through the controller —146, 290, 437, 582, 730, and with a top speed of 874 revolutions per minute.

The generator in this instance will consist of six small machines, mechanically coupled together in line and on one baseplate. These will be driven at constant speed by the Diesel engine at 300 revolutions per minute; they will consist of four-pole machines, constructed as follows: The first machine will be a synchronous three-phase alternating-current generator; this will give the ten-period current, the field of which will be separately excited (either from the continuous-current lighting circuit, or from a small exciter that can be driven by, and mounted on, the end of the prime-mover crankshaft); the other machines will be five transformer-generators.

The primary of the first transformer will be excited by means of the ten-period current, and this primary being mounted on the same shaft as the ten-period generator, and being of the same polarity, means that the periodicity of the current in the secondary or the transformer (which is a stator) is double that of the three-phase generator, namely, twenty. For this reason the revolving magnetic flux in the primary revolves once, ahead of one mechanical turn of the prime-mover shaft, tappings from the stator secondary winding being taken off to provide the twenty-period current. In the next transformer the opposite is provided, that is, the twenty-period current is taken to the primary stator, and it is so connected that the magnetic flux revolves in the opposite direction in the air gap that its mechanically driven secondary turns in; the consequence is that as the polarity of the machine is the same as the twenty-period transformer, that the periodicity in the revolving secondary is raised to thirty periods for this reason, that for one mechanical turn of the secondary the magnetic flux in the stator primary turns twice in the opposite direction (which makes the relative speed of the magnetic poles or flux, equal to a twelve-pole machine driven at 300 revolutions per minute). Tappings are taken by means of slip rings from the windings of the revolving secondary to provide the thirty-period current; this thirty-period current also forms the exciting current for the mechanical driven primary of the third transformer, in which the magnetic flux revolves three times, ahead, for one mechanical turn of same. The result is that the periodicity in the stator secondary is raised to forty periods, with tappings taken off, etc. This forms the exciting current for the stator primary of the fourth transformer, and is sent in such a direction that the magnetic flux in same revolves in the counter-direction to that of its mechanically driven secondary, the periodicity in which is raised to fifty periods because the magnetic flux revolves four times against one mechanical turn of the prime-mover shaft. Slip rings are now provided to take off the consequent fifty-period current. This current also forms the exciting current for the mechanically driven primary of the final transformer, and is so connected that the magnetic flux revolves in the same direction as the mechanical rotation; the consequence is that the periodicity in the stator secondary of this transformer-generator is raised to sixty per second, because the magnetic flux revolves, ahead, of the mechanically driven primary five times per mechanical turn; so tappings are taken off the secondary winding to provide the sixty-period current.

The whole combination is an efficient machine as a generator of variable periodicity polyphase alternating current for power transmission. Each machine is mechanically driven, supplies its part of the total work done. It is self-regulating, according to the number of motors that may be at any time coupled to it, or at any periodicity connection. It is interesting to note what will take place in the event of stopping a motor that, we will say, is running at the top speed, and to note the effect on the plant as regards momentary reduction of prime-mover power. Assume such a motor is connected with the sixty-period current, and that the machine and heavy moving masses are running at high speed. We want to stop, so we turn the controller to the fifty-period position; the consequence is the machine does not drop in speed as quick as the change of connections are made, so that momentarily the squirrel-cage rotor is running above the synchronous speed of the then fifty-period magnetic flux in its stator (the motor running at, say, 874 revolutions per minute, while the flux revolves in the stator at only 750 revolutions per minute); the consequence is that the heavy moving mass of not only the rotor of the motor, but also the machine that it may be driving, is very quickly brought down in speed by this means, and, what is also of the greatest interest, is the fact that this moving mass provides momentarily the total power, and eases the prime mover of same, which power may be used for the driving of other machines working off the same generator. This

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process is carried down to the ten-period point, so that the return of mechanical energy is a very considerable item in very large work, and should meet with considerable success.

The distribution of the electrical energy is to be carried out by means of bare copper bars, led to a trunk set of mains running the distance each side of the engine room where the motors will work, where tappings are to be taken off by means of suitable cables to the controller, or periodicity selector, as it can also be termed. The reversing of any motor can be very easily carried out at the controller, and either of the above speeds can thus be efficiently obtained in either direction of speed rotation.

For lighting the ship, the lighting section of the switchboard would be divided into three panels, one for each phase. Advantage can be taken of the star-connected generator, previously mentioned, for reducing the voltage for lighting purposes. The voltage across any of the three phases would be 250 volts, but if the neutral point of the star connection is brought out as a fourth wire, the voltage between this wire and any of the other wires is much lower than that between any of the phase wires themselves. We can thus take advantage of this to reduce our voltage for lighting without the use of transformers. And I propose to balance the lighting of the ship between this fourth wire and each of the phase wires.

Many advantages may be claimed for the gas and electricity system, numerous and far reaching. In the first place, labor for working would be cut down to half. The consumption of fuel would be half, which means the saving of bunker space. The cargo winches and hoists would be more efficient, and would be started up without the draining and heating, etc., which take place with a steam winch.

The wiring for the ship's lighting would be as usual, of the best workmanship and material to insure success. Mains could be led to each deck, running fore and aft of the ship, with distribution boxes in the most convenient positions for distributing the current to the different winches, small motors, etc., the main cables being properly cased in iron conduit, or by some other suitable means to insure the installation being watertight.

I think that you all agree with me that the heating of the ship by steam is very unsatisfactory. Steam has to travel through long lengths of small-bore pipes to get to the radiators, and by the time it reaches them it has lost anything from fifty per cent of its heat. On the other hand, electricity can be transmitted any distance with a loss of about two per cent, thus leaving about ninety-eight per cent to be expended in heating the radiators. Again, electrical radiators can be more efficiently placed than steam radiators, and better controlled.

With regard to cooking by electricity, it has been found by actual experience that it is far more cleanly, economical and easier to apply than coal. Applied on board ship, coal and ashes could be banished from the galley altogether, and as this is usually anything but a commodious space, it would be a great advantage as well as cleaner.

Another advantage which I wish to point out to you in connection with an electrical installation is that there is no trouble from freezing; those who have been into Russian and Canadian ports, for instance, know what a great nuisance this is, where it is necessary to keep the winches running all night to prevent freezing, as when freezing does happen it causes delay and expense. With the system I propose there would not be any trouble of this sort, as all the steam pipes for operating the winches and capstans, etc., would be replaced by copper cable, which is, of course, unaffected by the cold, and all deck machinery would be operated by electric motors, which are again unaffected by the cold, except to have their efficiency raised, and can be made absolutely weatherproof.

All refrigerating machinery could be very well operated by electric motors. They would, of course, require to have a large range of speed, somewhere about forty to 120 revolutions per minute. It would enable the refrigerator to be installed in the most suitable place without regard to the means of getting steam to it, with resulting economy.

I shall now deal with the question of the efficiency of the suction gas plant as compared with the steam plant, as I propose to show the coal consumption per horsepower for both types of plants. (The author did this by giving actual tests taken on a 750-horsepower suction gas engine of the type he described previously and comparing it and a high-class Corliss steam engine working with condenser and economizer.)

The results gave 0.85 pound of coal per brake-horsepower-hour for the gas engine, as against two pounds in the case of the steam engine.

There is no reason whatever why the figures for the gas engine could not be maintained if used for the purpose of driving an alternator for supplying current for the auxiliaries on board ship; whereas the losses due to the distribution of the current, etc., would not amount to more than, say, twenty per cent for the electrical plant, the losses due to distribution of steam to the auxiliaries would be, as I mentioned before, on the most favorable conditions a minimum of seventy-five per cent. I think that these figures should convince everyone that the system I have described has a great future before it for auxiliary work on board ship.

In the earlier part of this paper I mentioned that I did not claim cheapness in first costs for the electrical suction plant power for power, but owing to the fact that only twenty per cent of the power generated in the gas engine is lost in the subsequent distribution, compared with that of seventy-five per cent in the case of the steam plant, it would only be necessary to install a gas plant of about half the power of the donkey boiler to do the same work. Now, assuming for the moment that the coal consumption per brake-horsepower-hour was the same for both boiler and producer, it follows that the bunker space required for the producer would be only half that required for the boiler; however, as I have shown above, the coal consumption per brake-horsepower-hour of the producer is less than one-half of the steam boiler, and the actual bunker space required would be only one-quarter of the space required for the donkey boiler.

In a recent paper it was stated that the ratio of breakdowns with steam engines is one in eight, while the ratio of breakdowns with gas engines is one in twelve.

The cost of upkeep of a producer plant of course varies somewhat, but from my experience it should not exceed more than $50 to $55 per annum in a well-designed and constructed plant of 300 brake-horsepower. The items which wear out are the firebrick lining of the generator and bottom fire grate. The coke in the scrubbers should only require renewing once a year, and this only if the producer has been working constantly for this period.

[To be continued.]

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Electricity in the Coal Mining Industry.[1]

I believe I can say, without fear of successful contradiction, that with the exception of some special cases, the days of animal haulage in coal mining will before long be a thing of the past.

Electricity is practically independent of distance. There is no other form of energy that is transmitted as efficiently and conveniently as electrical. The coal-cutting machine is no longer an experiment. A practical electrically-driven drill has been devised. Also a puncher, which can be operated either by direct or alternating current, has been manufactured and is now operating on a commercial basis. Fans which the mine owners were originally afraid to drive by electricity are now replacing the steam-driven kind with their long and uneconomical and expensive steam line. We also have electrically-driven tipple machinery, and the electrically-driven pump in wet mines. Some of our most satisfactory box-car loaders are electrically driven, while at many plants, the coke-drawing machines are also electrically operated.

The power house of today is rapidly evolving itself into an alternating-current proposition, becoming the central source of power for a number of mines. The difficulties that attended the initial introduction of alternating current have been largely eliminated, with the result that the polyphase system, which means either a two-phase or a three-phase system, of alternating-current transmission—with its adaptability to large units and long distances—has proved itself a commercial success.

The modern switchboard will be equipped with its oil circuit-breakers and oil switches, its various safety devices, together with meters, including voltmeters, ammeters, frequency meters, power-factor meters, etc. We must not forget our exciter set, consisting of a direct-current compound-wound generator, usually wound for 125 volts and used for excitation of the generating units. This exciter set may be either engine or motor-driven. We also have transformers, which are used to raise the original generator voltage to the proper transmission voltage. In addition, there are installed lightning arresters, choke coils, disconnecting switches with their details, for protective apparatus, so that we now have our alternating-current power house most complete.

Among the principal advantages of a central power station there is the great saving in copper, and also the maintenance of a steady-working voltage—especially where the workings are located considerable distances from the power house. The saving in copper more than balances in many instances the entire cost of the substation during the life of the equipment. In transmitting the power, alternating current is used. The main power house generally furnishes current at approximately 2,400 or 6,600 volts, although 3,300, 13,000 and other voltages are used. This current being for power service, should be a twenty-five-cycle, 3,000-alternation, polyphase circuit, preferably three-phase. The current is transmitted from the power house to substations, where it is transformed to a lower voltage, and then in turn by means of a rotary converter or a motor generator is transformed from alternating into direct current.

The lowering transformers are generally arranged to transform from 2,400 or 6,600 volts high-tension to approximately 440 volts low-tension. The approximate ratio of the alternating current to the direct-current voltage is about seven to ten. If the alternating-current voltage on the rotary converter is approximately 160 volts, then the direct-current voltage will be around 250 to 275 volts. Generally speaking, it is considered advisable to put in lowering transformers, even with motor-generator sets, as that makes it safer for the operator. A further advantage is that the lowering transformers act as additional protective apparatus—having the high-tension and low-tension sides separated. This arrangement also has the additional feature that taps may be taken from the transformers to operate independent alternating-current circuits. The substation equipment requires practically no attention and is almost automatic, easily adjusting itself to the various loads and conditions. Substation equipment requires no special foundation and no anchorings. It is also true that the floor space required is considerably less than an engine and generator unit.

It is feasible to operate two circuits at a mine. Both alternating and direct current are used. The alternating current will operate the fans, crushers, tipple machinery and pumps. Alternating currents have the additional advantage that any number of alternating-current voltages may be obtained from the same generator, it being only necessary to use the proper transformer taps. The direct current will operate the locomotive and the direct-current cutting machine. By this means, the operations are independent of each other. The substation, therefore, feeds both kinds of current simultaneously to the same mine.

As to mine locomotives, it is a better practice to have two ten-ton or two thirteen-ton or even two fifteen-ton locomotives, which can be operated either separately or together in what is known as a "tandem arrangement," than to have a locomotive of twenty-ton capacity or more. Too heavy a locomotive means heavy iron for the track, and such an engine is often unwieldy and inefficient.

There are also the reel and the gathering locomotives. This latter type, known as the "traction reel" or "crab type," does not go into the room at all, but a wire cable of from three-eighths of an inch to five-eighths of an inch thick and about 500 feet long, is easily pulled in the room and fastened to the loaded car, which is then pulled out by means of a separate motor with its equipment of controller, resistances, hose and wire and other details. Both of the gathering types of locomotives are now being built so as to use one of the main hauling motors of the locomotive for gathering also.

As regards the cost of operating with electric haulage, it is obviously difficult to give exact figures which will apply in all cases, but it has already been pointed out that electrical haulage is cheaper than animal haulage. The life of the locomotive in the first place is longer than that of the mule, there being locomotives today in actual service which were installed ten or twelve years ago. Against this, two or three years is the average life of a mule. The lengths of the haul and speeds required are also in favor of the locomotive.

The motors used for the operation of fans must be perfectly reliable, as on the successful operation of these depend the lives and efficiency of the men underground.

As regards the form of drive for fans, that is, whether the fan should be geared or belted or chain-driven, that should be carefully studied in each instance. Where there is a great fluctuation in voltage, either a belted or chain drive is desirable If floor space is an item, then between these two the chain drive is the proper one. If the voltage is constant and good

[1] Abstract of paper by F. C. Albrecht, electrical engineer, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., read before the summer meeting of West Virginia Coal Mining Institute, Elkins, W. Va., June 1, 1909.

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regulation secured, then a geared fan is proper. Coupled fans can also be seriously considered, and these are in actual operation. Variations in speed can be obtained by either variable-speed motors, or, in the case of belted machines, different pulley combinations can be used.

As regards the direct-current voltage in the mine itself, there has been and still is considerable discussion. Many are of the opinion that the voltage should not exceed 275 or 300 volts. On the other hand, there are just as many, if not more, who consider 550 to 600 volts not excessive. Certainly there is no getting away from the fact that with the higher voltage, there is a great saving in copper, and also that in most cases a better working voltage will be maintained. Looking at the question from the standpoint of safety, it is true the higher voltage is more likely to kill a man than the lower. But the point is to keep away from the wire. Especially in high coal this should easily be arranged. In many instances the trolley wire can be placed from five to seven feet above the rail and should always be placed from four to eight inches to the outside of the rail. With ordinary precaution this should be entirely safe. Where the coal is low, it might then be considered proper to put in the lower voltage, although it is by no means considered absolutely necessary.

It has been pointed out at various times by some operators that they consider the higher voltage safer than the lower. Their argument is that with the lower voltage the men get familiar and careless. On the other hand, they have considerable respect for the higher voltage and are more careful and have fewer accidents. Local conditions will largely determine what voltage should be installed.

No matter whether 250, 275 or 550 volts is used, the conductor should be bare, uninsulated wire. Insulated wires in a mine are treacherous. The insulation will not last in a mine more than six months or a year at most. It deteriorates rapidly and becomes a menace instead of an additional safeguard.

A system of wiring that meets with much favor where conditions will permit is the three-wire system. By this means 550 volts can be taken from the generator or rotary converter and divided in half, using two circuits of 275 volts each.

The three-wire system was originally introduced in order that a saving in copper might be obtained. The system has become in general use for both lighting and power distribution. It permits of a saving of twenty-five per cent in copper in the feeder, when figured on a basis of current capacity; or a saving of sixty-two per cent when figured on a basis of drop of potential, when the neutral wire is considered as equal in size to one of the outside wires.

Three-wire generators may be operated in parallel with each other, or in parallel with two-wire generators if required. By means of the three-wire system, it is possible to use the higher voltage, that is, 550 volts, for the stationary motors, such as pump motors, and 275 volts for the locomotives, considering the track as the neutral and return.

The sooner mining and electrical men get together and adopt a system of standards mutually agreeable and understood, the better it will be for all concerned. I am glad to say that some steps in this direction have already been taken. At the last meeting of the American Mining Congress in Pittsburg, a resolution was passed which authorized the appointment of a standing committee for the purpose of standardizing mining practice and making necessary recommendations for electrical work in the mines.

This standardization can apply not only to the voltages employed in the mine, but can be followed out further, in, for instance, the gauges of the tracks in the mines. Likewise, a certain standard for horsepower per ton and speed in miles per hour for locomotives might be at least approximately arrived at.

Will Lecture on Sanitary and Safety Appliances for Mechanics.

Dr. W. H. Tolman, director of the New York Museum of Safety and Sanitation, has returned from a three months' tour of Europe in the interests of that institution and to gather material for a lecture tour in the interests of safety appliances for all sorts of mechanics' tools and machinery. Dr. Tolman attended the International Medical Congress at Budapest, where in the Section of Hygiene and Prevention he presented a paper on the New York Museum of Safety.

Dr. Tolman is interested in having a public institution established where all sorts of devices to prevent injuries from saws, planes, adzes, and tools of every kind, and the most approved systems of sanitation may be exhibited.

One Way to Improve the Load Factor.

The Montreal Light, Heat and Power Company has announced that it will engage in the ice business, obtaining water from artesian wells and freezing it by electric power into blocks of any desired shape and size, so as to avoid cutting. This is an example, says the *Scientific American,* which might with advantage be followed by many a smaller plant. Every lighting plant must be capable of carrying a certain maximum load at the time of night when most lights are in use, but for at least eighteen hours out of the twenty-four the load is from half as much in large cities to almost nothing in small country places, where there is little industrial use of electrical power, so that during the greater part of the day much of the capital invested is earning no dividends. The surplus power might just as well be used in making ice and providing another source of revenue, particularly as the time when the peak load is of shortest duration coincides naturally with that of the largest consumption of ice.

High-Pressure Pumping System in New York.

At the first monthly meeting for the session 1909-10, of the American Society of Mechanical Engineers, to be held in the Engineering Societies Building, New York, October 12, at 8. p. m., a paper will be presented by Prof. R. C. Carpenter, of Cornell University, upon the high-pressure pumping system of New York city. There are two pumping stations comprised in this system which receive power transmitted electrically from several of the electric generating plants of the city. There are five pumping units in each station, consisting of five-stage centrifugal pumps driven by induction motors. Each pump has a capacity of 3,000 gallons per minute and delivers against a pressure of 300 pounds per square inch in the mains.

The first high-pressure pumping system for fire protection was one with steam-driven pumps completed at Detroit in 1888. Besides the New York system, there have recently been completed, or there are under construction, similar plants at Philadelphia, Brooklyn, Boston and Baltimore.

It is expected that the discussion following the paper will not only bring out information upon these systems, but will also lead to a general presentation of the subject of centrifugal pumps.

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ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

NEW METHODS AND SPECIFICATIONS FOR STREET LIGHTING.[1]

BY J. H. PERKINS.

New Methods.—It is quite remarkable that we should have witnessed such marked improvements in street-lighting efficiencies, with both arc and incandescent lamps at practically the same time, and after a period of several years during which there was practically no change of type, efficiency or utility.

To adjust ourselves to these new conditions with regard to municipalities and our investments has not only been a difficult task, but one requiring a great deal of diplomacy.

It is not the purpose of this paper to go into the details of each form of lamp or system, or to advise you as to the system you should adopt, but rather to point out the present and possible future trend in street illumination.

Europe no doubt has led us in some of the newer forms of street illumination, but on a basis, however, which would not be commercial in America. With the development of some of these newer types, along lines conforming to American practice, considerable, if not equal, advancement has been shown, and the next few years will no doubt show marked improvements.

The general change from the open direct-current arcs to enclosed arcs as the first important step, following improvements in arc lamps, was made by reason of decreased maintenance and greater reliability in service rather than by decreased energy required or greater illumination furnished.

With the development of the flame arc and luminous arc as the next step in advancement, we obtained far greater illumination for the same amount of energy, but until this efficiency counterbalanced in cost, additional maintenance and investment charges, these systems were not freely installed, except where it was possible to obtain greater revenue for the larger amount of illumination furnished.

Street illumination, with the use of series carbon incandescent lamps for suburban districts, or where the smaller unit of illumination is almost necessary, was indeed expensive for the amount of illumination really obtained. The development of the tungsten lamp has been an effective betterment in this almost necessary form of street illumination.

The present trend is, and the writer believes the future trend in street illumination will be, along the following lines:

First—Larger illuminating values.

Second—The selection of such types and arrangements of lamps, either arc or incandescent, as will give greater decorative effects.

Third—The selection of the system or systems most suited to the particular section of the municipality to be lighted.

The old saying, "You cannot obtain something for nothing," is true even in electric illumination, and we believe municipalities are fast coming to this conclusion. Where this prevails, or where larger prices are obtained, it is believed that larger values in illumination will prevail, to either meet municipal requirements or given in lieu of a reduction in prices. As an example of this trend in lighting affairs, the city of Boston may be cited, where 6.6-ampere luminous arc lamps have recently been installed, giving the largest value of street illumination at present in use in America. Where lighting companies are not prevented, through municipal economy or other adverse conditions, it is believed that the efforts of lighting companies to make higher values of illumination a standard will be rewarded by the satisfaction of the public and a harmonious relationship, which we can all covet to advantage.

As examples of arrangements and design, looking to the decorative, we may cite the following: Single and double ornamental arc-lamp posts recently adopted in New York and Boston; tungsten incandescent clusters and special fixtures recently installed in Philadelphia, Boston and other places, and the tungsten arch scheme of illumination for downtown streets, adopted in the city of Grand Rapids, Mich.

While it is true, that in the past, suburban districts have been lighted by series carbon incandescents, at best a most inefficient method, electric street illumination in general has been accomplished by one standard—the arc lamp, and in nearly every case by one size or unit. Attempts have been made at uniform illumination of greater downtown areas by the use of a number of arc lamps located at a considerable height on towers. Although unique, this was inefficient, and in the main unsatisfactory. In the development of the flame arc lamp, with its high candlepower, peculiar color and distribution, we have a practical and efficient method of uniformly lighting large street areas from such heights as to completely remove the source of light from the line of vision. The series tungsten lamp furnishes an efficient and highly satisfactory illumination for suburban districts and streets overhung with trees.

As an example of the selection of the character of illumination to suit the condition, we again refer, as perhaps the best example, to the city of Boston, where 6.6-ampere luminous arc lamps have been installed for general street work; flame arc lamps, located at considerable heights for large downtown areas, such as corners and squares, and series tungsten incandescents with ornamental brackets for suburban districts and streets overhung with trees, representing, as the writer believes, the latest and best practice in street illumination.

With future possibilities of the flame arc in the regenerative form for street illumination, and the present general use of the luminous arc lamp and tungsten incandescent lamp, we have betterments in street illumination which the writer believes are bound to prevail either through the efforts and requirements of the public or through education by the lighting companies.

Specifications.—Contracts in general have always been a most prolific source of trouble, controversy and litigation, and no

[1] Abstract of a paper read before the second annual convention of the Pennsylvania Electric Association at Eagles Mere, Pa., September 10.

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doubt contracts for street lighting have occupied the front rank of troublemakers. There are many reasons for this condition. They have been the football of politics and the vehicle for over-enthusiastic city officials "looking after the rights of the people." There have also been cases in which companies furnishing street lighting have taken advantage of the situation, have not acted fairly. Last, but not least, the specification or designation of just what is to be furnished under such contracts has been so erroneous, misleading and unfair to both parties that we can little wonder at the trouble they have caused.

With the advent of the arc lamp came the opinion from some professor that the arc lamp was producing 2,000 candlepower. Even after more accurate methods of testing had shown this to be a fallacy, at least in the sense of street illumination, this rating still clung to the arc lamp, and is even today an unqualified part of many contracts.

Efforts on the part of illuminating companies to get away from this rating were unjustly construed by municipal authorities, and in many cases induced them to insist the more that it should remain a part of the contract under consideration. Continued effort did modify the term to "nominal 2,000 candlepower," "standard 2,000 candlepower," "commercial 2,000 candlepower," or "full arc."

The National Electric Light Association came to at least a partial realization of the difficulty in 1894, when it passed a resolution defining a 2,000-candlepower lamp as one requiring not less than 450 watts at the arc for its maintenance.

As long as there were no particular changes or improvements in the arc lamps, this specification did fairly well, but even with this definition such a specification was misleading, because it did not represent that which the municipality was really paying for and that by which it really judged the service, and unfair because by certain changes in operation, one party or the other could benefit without harm to the other, yet both were bound by the specification or its definition.

Directly on the heels of this definition by the National Electric Light Association, came the development of the enclosed arc lamp, to further complicate the situation, with its entirely different character of light and distribution, steadier operation, greater reliability in service and even less expenditure of energy for a given result.

The standard by which the layman and public official had really been judging the service was upset, and the position of the lighting companies was anything but clear even among themselves. As a matter of fact, the service was really being judged by one standard and specified by another. Both were illogical, misleading and incorrect.

Within the past few years, we have again witnessed important changes in street-lighting apparatus and possibilities with the development of the luminous arc, the flame arc and tungsten incandescent lamps.

With these developments, we have as many different characters of illumination as we have characters of lamps, with wide variation of efficiencies, and until recently we have been governed by a specification meaningless and unsuited to all systems.

The necessity for some logical, fair and practical specification as a basis for street-lighting contracts, under the various possible systems, was so apparent that a committee was appointed by the National Electric Light Association to consider specifications for street lighting. This committee made a preliminary report to the 1907 convention, and its final report to the 1908 convention.

The committee did not, as many supposed, contemplate or endeavor to draw a full set of specifications, but rather to establish, first, a unit of illumination as a basis for contracts, and, second, the relative values, on this basis, of the various forms of lamps in use.

Candlepower as the unit, and as used in the past, meant very little unless considered with the important elements of distance and direction. Wattage consumption, as a measure of illumination, was out of the question, because unfair, and, in the language of the committee: "No reason can be given why a contractor should be penalized for giving more light than contracted for, after having made considerable investment for that purpose, simply because the number of watts consumed is less, notwithstanding that other items of expense and renewals may be considerably increased." In other words, neither candlepower nor wattage is a measure of street illumination; that which the municipality really wants and that which the company should be paid for.

The foot-candle was decided upon as the unit. With present improved measuring instruments and a large number of readings we have a sufficient method of determining street illumination.

The features suggested by the committee to govern such a test of street illumination, with this unit as a standard, are briefly as follows:

Arc lights should be measured at the height of the observer's eye, perpendicular to the rays, and at a point between 200 and 300 feet distant along a level street. Smaller units to be tested at correspondingly shorter distances.

The lamps should give a mean normal illumination, not less than the illumination given by a stationary standard seasoned incandescent lamp of sixteen candle-power at $\frac{1}{X}$ of the distance.

A sufficient number of lamps should be tested and a sufficient number of readings made to obtain an average and to cover fluctuations.

From extensive observations made by or for this committee, the foot-candle values at several distances of the various forms of lamps were determined, and the value X established for each.

The X values for and the classification of the various forms of lamps as determined by the committee, are given in the following:

VALUES OF X.

Lamp.	Highest Lamp.	Lowest Lamp.	Average.	Proposed Value.
6.9-ampere, direct-current, series open arc.	5	3	4	3½
9.6-ampere, direct-current, series open arc.	6¼	3½	4¾	4
5.0-ampere, direct-current, series enclosed arc	4¾	3¾	4	3½
6.6-ampere, direct-current, series enclosed arc	6¼	4¼	5	4
5.5-ampere, alternating-current, series enclosed arc	4	3	3½	3
6.6-ampere, alternating-current, series enclosed arc	4½	3½	4	3½
7.5-ampere, alternating-current, series enclosed arc	5	3¾	4¼	4
4.0-ampere, direct-current, series luminous lamp	7	5	6	5½

As an example under these values, if an arc lamp at 250 feet shows 0.004 foot-candle, and a sixteen-candlepower lamp shows the same illumination at 62.5 feet, or one-quarter the distance, the value of X for that lamp would be 4.

In the above, the writer has not tried to give you anything new, but rather to review the conditions leading up to the work of the National Electric Light Association committee, and in brief to give you its conclusions in an effort to drive home the importance of this question, that we may make our almost necessary dealings with municipalities in street lighting more open, fair and mutually satisfactory.

In addition, I would like to review briefly the facts and outcome of a situation which very thoroughly illustrates the

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trouble that may result from loosely drawn street-lighting contracts under the old forms of specification, and further detail that which has been accomplished under a new contract and specifications, believed to be the first one entered into, drafted after the suggestions of the above committee. The city of Wilkesbarre is referred to.

Previous to May, 1906, the city of Wilkesbarre was lighted with series direct-current open 9.6-ampere lamps, of the Excelsior make, under a seven-year contract, dating from July, 1902, the lamps to be used being specified as "commercial 2,000 candlepower," and rather loosely referred to as either open or enclosed, a sample of each having been left with the city clerk, as required by the contract.

During 1905 it was apparent that a change of lamps and system was not only desirable for many reasons, but absolutely necessary, it being almost impossible to keep the system in operation, and impossible to get lamps or repair parts to make replacements.

Without paying much attention to the terms of the contract, but rather in an effort to work in harmony with the city, the company advised the city of the desirability of such a change, and requested its co-operation. Sample seven-and-one-half-ampere series enclosed alternating lamps were placed in operation as a comparison with the old lamps. After tedious delays and indefinable reasons for objection to such a change, covering a period of approximately one year, the City Council voted against the change. The lighting company then obtained a legal opinion as to its rights under the contract, to the effect that it could use either open or enclosed arc lamps, providing the standard of "commercial 2,000 candlepower" was maintained. There having been numerous decisions and opinions showing that such an enclosed lamp did fulfill this requirement, the company went ahead without the co-operation of the city, and changed the lamps on May 20, 1906.

The city felt itself outraged, and held up all payments for street lighting. Later on, and fortunately for both the city and company, the city obtained the services of an expert engineer to test the candlepower of the new lamps. The substance of the expert's report was that, while there was quite a difference between the candlepower of the two types of lamps, the city was receiving the equal of the old lamp in street illumination, the report being very fair and favorable to the lighting company. Nothing definite resulted from this report, however, at that particular time, although it was of great value in staying the arguments of the city and as a basis for future dealings.

Realizing that dealing with the municipality, especially Pennsylvania municipalities, with dual councils, was far more tedious and unsatisfactory than dealings with individuals or corporations, and wishing to show a desire for co-operation and fairness, the company agreed to a compromise proposition of the city. This proposition started from an idea of a certain number of free arc lamps for the city, by some of the councilmen, and from which there later on resulted a cash credit proposition. The resolution authorizing this compromise was vetoed by the mayor.

Negotiations then hung fire until approximately one year previous to the expiration of the contract, or about July, 1908, when the councils took up the consideration of a new contract. Much to their credit, the city councils again engaged the services of the expert engineer to draw up specifications for a contract. Elaborate tests were made of the lights operating in the city, on a basis of foot-candle illumination along the lines of the suggestions of the National Electric Light Association committee. The expert was so impressed with the fairness of the lighting company in having accepted the former compromise proposition of the city, which was vetoed by the mayor, and with the tests of operation of the lamps then in use, that he very freely advised the city authorities to settle the old controversy in connection with a new contract, the company being well within the specifications under the old contract. The company was the only bidder on the specifications prepared by the expert and committee of councils. The city, by resolution, accepted the proposition of the company, provided the company would accept a certain proposition for settlement of the old controversy. Through a desire for co-operation and harmony, rather than a thought that it had not been furnishing the city that which was contracted for, the company accepted this compromise proposition for settlement of the old controversy. An ordinance was drawn, based on this agreement, but was later defeated, as the company believes, through politics and newspaper interests antagonistic to it.

The company, having carried out its part of the obligation in the settlement of the old controversy, stood its ground without comment. With the reorganization of the councils, April 1, 1909, and the approach of the expiration of the old contract, there was introduced, and finally passed, an ordinance for a seven-year contract, based on specifications somewhat similar to the first specifications adopted, and very closely following the lines suggested above.

Without a further detailed review of the many ins and outs of this long-drawn-out controversy, the writer believes that it may rightly be said that, although affected by political and other indefinable conditions, this specification of candlepower in the old contract was really the backbone of the trouble.

As regards the new contract and the specification, based on the new standard, which form a part thereof, it might be said as a guide to the members of this association in future dealings with municipalities, that there was a strong tendency on the part of the committee of the councils to inject additional specification, which they termed an "additional safeguard" along the lines of the older forms of specifications.

Even with the assurance of their expert that the specification as to illumination in foot-candles was sufficient and easily checked, and with even more facilities for check on the supply than they had with former standards, the change to the new method appeared to them as a "dark horse." This "safeguard" they insisted upon in the drawing of the first specifications by the expert, and resulted in a requirement of curve-drawing instruments to show at all times the amount of energy delivered to the system, to be compared with the amount of energy as shown during normal conditions, with lamps burning according to the photometric value of illumination.

This issue was met in the form of an alternative bid by the company, which eliminated consideration of the curve-drawing instruments. In the second set of specifications, this feature was eliminated, but at the eleventh hour the committee again insisted on some additional specification, and inserted the amperage and voltage of the lamp.

If this experience is to be an indication of what we may expect in municipal contracts under the new specification, it is going to be difficult to change suddenly to the newer form unless there is confidence in the relationship between the municipality and the company, and will necessitate the education of municipalities to the new form.

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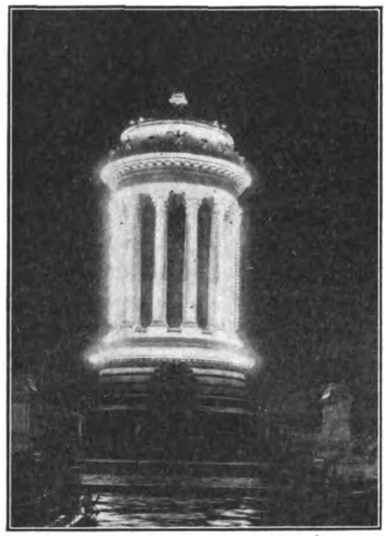
The Hudson-Fulton Celebration.

A new era in spectacular lighting dawned with the opening of the Hudson-Fulton Celebration in New York city on Saturday, September 25. New York had been in an expectant mood for a week, but it was not prepared for an electrical display which puts all other efforts, outside of exposition work, far in the shade.

During Saturday afternoon the formal naval parade was held, and the crowds, which numbered many thousands, applauded mightily; but when evening came what they saw made them gasp. Eight miles of warships outlined in light would in itself be an impressive sight, but add to this thousands of excursion steamers, private yachts, etc., all covered with shimmering lamps of many colors; batteries of searchlights, more powerful than had ever been gathered together before, sweeping the city from all directions; skyscrapers outlined in light; ocean steamers—the largest afloat—resplendent in color; and for one-hour-and-a-half the greatest display of fireworks which has ever been set off in this or any other city. Yes, it can truly be said that the thousands could only gasp, not cheer.

The Singer Building, which has been so highly praised for its exterior lighting equipment, paled before the lights of its neighbors. The new Metropolitan Tower, with its illuminated dome, and the light shining from every one of its thousand windows, was indeed a sentinel of light. The four immense bridges which span the East River were outlined in light, the Williamsburgh being shown herewith. The Waterside Station of the New York Edison Company, shown opposite, easily took the prize among the buildings on this water front.

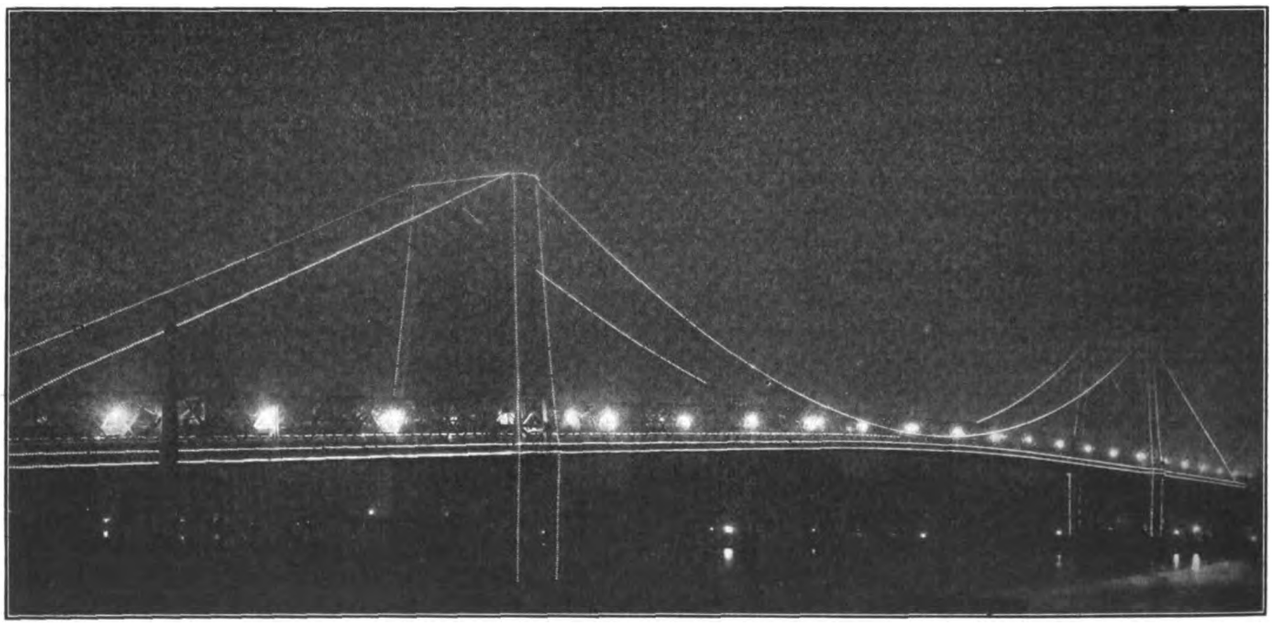


NEW YORK EDISON PHOTO.

SOLDIERS' AND SAILORS' MONUMENT, HUDSON-FULTON CELEBRATION, NEW YORK CITY.

It was along the Hudson, however, that the greatest display was made, the Soldiers' and Sailors' Monument, shown on this page, being one of the most effective features. Grant's Tomb showed up against the sky, lighted by four searchlights. Just north of the tomb is the Riverside Drive Viaduct, shown on page 647. The lights at the left of the picture are from the battery of searchlights a mile north. Some faint idea of the fireworks may be obtained from the illustration, but the noise, the color and the excitement are sadly lacking.

The photographs from which the accompanying illustrations were made were kindly furnished by the New York Edison Company.



NEW YORK EDISON PHOTO

THE HUDSON-FULTON CELEBRATION, NEW YORK CITY—THE ILLUMINATION OF THE WILLIAMSBURGH BRIDGE, BETWEEN NEW YORK AND BROOKLYN. THE THREE OTHER BRIDGES WERE SIMILARLY OUTLINED.

Convention of Car-Lighting Engineers.

As announced in last week's issue, the Association of Car Lighting Engineers will hold its next annual meeting at the new Hotel La Salle, Chicago, Ill., on October 4 to 7. As indicating the broadening scope of the association's interests and the nature of the topics to be discussed, the following programme is given:

October 4, 10:30 to 12 a. m.—Minutes previous meeting, address of president, report of secretary and treasurer, unfinished business; 2 to 5 p. m.—paper on "Application of Electricity to Railway Shops," report of standing committees.

October 5, 10:30 a. m.—Report of committee on standards; 2 p. m.—Paper on "Electrification of Steam Railroads;" evening—informal meeting with general discussion.

October 6, 10:30 a. m.—Report of special committees; 2 p. m.—Paper on "Storage Batteries as Applied to Train Lighting;" evening, banquet.

October 7, 10:30 a. m.—Unfinished and miscellaneous business; 2 p. m.—selection of place of next meeting, and election of new officers.

The secretary of the association is G. B. Colegrove, electrical department, Illinois Central Railroad, Chicago.

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Magnetic Storm Ties Up Wires.

The telegraph and cable companies suffered all day last Saturday from the interference with their wires by magnetic disturbances, coincident with the existence of special activity of the aurora borealis. The lines were not absolutely prevented from working, but there was a continual series of intermittent interruptions, which made the sending and receipt of messages a slow and tedious performance.

The disturbances were felt all throughout the United States, and the Commercial Cable Company declared that its service was affected as far East as the Irish Sea. The disturbance was noticed shortly before 7 o'clock in the morning and continued to spread during the whole day. A wire would work all right for a time and then cease to respond to the current for an indefinite period. Sun spots are also credited by scientists with being to a degree the cause of the effect.

NEW YORK EDISON PHOTO.

FLEET ILLUMINATION, SHORE LINE AND PYROTECHNICS. HUDSON-FULTON CELEBRATION, NEW YORK CITY.

NEW YORK EDISON PHOTO.

WATERSIDE STATION, NEW YORK EDISON COMPANY. HUDSON-FULTON CELEBRATION, NEW YORK CITY.

NEW YORK EDISON PHOTO.

THE GENERAL VIEW OF THE WATERFRONT ALONG THE BANKS OF THE HUDSON RIVER. HUDSON-FULTON CELEBRATION, NEW YORK CITY.

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ELECTRIC LIGHTING FOR CLEANING AND DYE WORKS.—We have a cleaning and dyeing establishment, in which we have been doing almost all of our work by day. As our business is rapidly increasing, we have intended to do some of the cleaning at nighttime as well. The process we use employs a large amount of naphtha. Is there some system of electric lighting which it is possible to use with absolute safety in a room where there is a great deal of this inflammable vapor?—R. H. T., Chicago.

For any establishment in which there is considerable inflammable vapor present in the atmosphere, no system except electric lighting is worth considering at all. Without doubt the most satisfactory electric-lighting system for this particular case is incandescent-lamp lighting. In this system, with modern wiring, there is no possibility of arcing at any point in the circuit, particularly if wall-type switches are used. The lamp filaments are in sealed glass bulbs, and no portion of the electric circuit need be exposed. With incandescent lamps any degree of inflammable vapor may be present in the air that it is safe for human beings to stay in without the slightest danger of ignition.

CHARGING AUTOMOBILE IGNITION BATTERIES.—How can I charge an ignition storage battery from my lighting circuit? I understand that the lighting company supplies direct current at 115 volts. The directions on the battery say that it can be charged from such a circuit, but that lamps must be used in connection therewith.—V. P. B., Milwaukee, Wis.

The storage battery, no doubt, is one having no more than three cells and requires, therefore, a voltage across its terminals in charging of from 6.3 to 7.5 volts. Since the lighting circuit has a pressure of 115 volts, it will be necessary to put in series with the battery an incandescent lamp to take up the bulk of the voltage. If the lamp used is a thirty-two-candlepower carbon lamp, it will pass through it about one ampere. The battery will probably require three or four amperes as its normal charging rate; therefore, it will be necessary, in order to hasten the charge, to put a group of three or four thirty-two-candlepower lamps in parallel, and this group in series with the battery. In connecting the battery to this circuit including the lamp or lamps, it is necessary that the positive pole of the battery be connected to the positive wire of the lighting circuit, in order to insure that the battery is properly charged. It is best to use a voltmeter to determine which side of the circuit is the positive side. If the battery is a very small one, a single lamp may suffice. The number of lamps actually used should be determined from the charging rate that is marked on the battery on the assumption that each ampere of charging current requires a thirty-two-candlepower lamp.

COPPER WIRE FOR A CHOKE COIL.—How much No. 20 B. & S. copper wire is required to carry six amperes at 115 volts on a laminated iron core one inch in diameter and twelve inches long? The coil is to be used for wireless telegraphy.—R. P. I., Cleveland, Ohio.

The resistance of the coil must be 19.17 ohms in order that six amperes may be passed through it on a 115-volt circuit; 1,693 feet of No. 20 copper wire has this amount of resistance under the conditions specified. The weight of this amount of copper wire is about 5.24 pounds. It will be found that the coil as wound with this size of wire and when carrying six amperes will be quite warm. Therefore, particular care must be taken in thoroughly insulating it with insulation that does not deteriorate with heat. It would have been better, perhaps, to have used a slightly larger size of wire, if this amount of current is necessary.

CHANGE OF SERIES MOTOR TO SHUNT GENERATOR.—How are the windings of a series motor changed so that it may operate as a shunt-wound generator?—H. E., Oak Park, Ill.

In changing the field connections of a series motor to those of a shunt generator it is necessary only to connect the free terminal of the field winding to the free terminal of the armature, inasmuch as one terminal of the armature is already connected to one terminal of the field. It will be found that an ordinary series-wound machine will give but a very low voltage when operated as a shunt generator, and it may be advisable to provide an auxiliary winding upon each field coil which will be connected in as part of the shunt-field circuit when operated as a generator. In this manner sufficient turns may be readily provided so as to have the necessary number of ampere turns for exciting the field to normal value. If such an auxiliary winding is provided, it would be idle while the machine was running as a series motor and would be connected in only during its service as a generator between the free terminal of the series field and the free terminal of the armature.

USE OF DOUBLE-TROLLEY SYSTEMS.—I have recently read that in order to overcome the trouble caused by the return current from ordinary trolley lines, due to electrolysis, the double-trolley system can be used. Does not current pass through the rails when such a system is used? If it eliminates the electrolysis trouble, why is it not used extensively?—C. M. K., Davenport, Ia.

The use of the double trolley effectively eliminates the possibility of trouble from electrolysis of pipes and underground cables due to the ordinary return current in electric street-car systems, since no current passes through the rails. Therefore, these do not have to be bonded. When a double trolley is used one of the conductors is the positive side of the circuit and the adjoining conductor is negative. The additional cost of the extra trolley wire is much greater than that required for bonding the rails. Double trolley systems have not been used extensively for this reason, and also because there is serious danger of frequent interruption to the line caused by possibility of the adjoining wires coming in contact with each other or with some bridging metallic material which, of course, would short-circuit the line. In a few cities, however, double trolley systems have been required and are in fairly satisfactory operation. Another difficulty that may be mentioned in connection with systems of this order is that the trolley pole of the car is not only more complicated but is more troublesome to manage properly. Still another objection to their use is that they require still more overhead conductors than are already in use, which is not very desirable.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

CHICAGO TRACTION.

The Chicago Railways and Chicago City Railway Companies have issued their statements jointly for the year ended January 31, 1908, in accordance with the ordinance of the City of Chicago. The combined income account of the two companies follows:

Gross earnings	$18,823,094
Expenses	13,176,166
Net earnings from operation	$ 5,646,928
Interest on capital invested	2,802,167
Net earnings	$ 2,844,761
Divided as follows:	
City of Chicago	$ 1,564,618
Companies	1,280,142

The combined balance sheet of the two companies as of January 31, 1908, is exhibited as follows:

Assets.

Value of property, Trac. Val. Com.	$50,000,000
Certificates issued, Board of S. Engrs.	11,641,193
Net divisible profits	2,823,670
Total	$64,464,863

Liabilities.

Capital (per city ordinance)	$61,641,193
City of Chicago profits	1,543,528
Companies' profits	1,280,142
Total	$64,464,863

The companies have also rendered individual statements as follows:

CHICAGO CITY RAILWAY.

Income account:	
Gross earnings	$ 8,215,196
Expenses	5,750,637
Net earnings from operation	$ 2,464,559
Interest on capital invested	1,236,008
Net earnings	$ 1,228,550
Division as follows:	
City of Chicago, 55 per cent.	$ 675,703
Chicago City Railway, 45 per cent.	552,847

Balance sheet, January 31, 1908:

Assets.

Value of property, Trac. Val. Com.	$21,000,000
Certificates issued, Board of S. Engrs.	8,052,146
Net divisible profits	1,225,217
Total	$30,277,363

Liabilities.

Capital (per city ordinance)	$29,052,146
City of Chicago, profits	672,369
Chicago City Railway, profits	552,848
Total	$30,277,363

CHICAGO RAILWAYS.

Income account:	
Gross earnings	$10,607,898
Expenses	7,425,528
Net earnings from operation	$ 3,182,369
Interest on capital invested	1,566,159
Net earnings	$ 1,616,210
Division as follows:	
City of Chicago, 55 per cent.	$ 888,916
Chicago Railways Co., 45 per cent.	727,294

Balance sheet, January 31, 1908:

Assets.

Value of property (as per ordinance)	$29,000,000
Addit., June 30, 1906, to Jan. 31, 1908	3,589,047
Net divisible profits	1,598,453
Total	$34,187,500

Liabilities.

Capital (as per ordinance)	$32,589,047
City of Chicago, profits	871,158
Chicago Railways, profits	727,295
Total	$34,187,500

In the following table are presented comparatively the operating statistics of the Chicago City Railway Company and the Chicago Railways Company for the year ended January 1, 1908:

	Chicago City Railway Co.	Chicago Railways Co.
Miles of track owned (single)	244.30	326.80
Miles of track operated (single)	217.13	306.44
Gross earnings per mile operated	$ 37,835	$ 34,616
Gross earnings of system.	8,215,196	10,607,898
Ratio of gross earnings to operating expenses	70%	70%
Passengers carried	268,099,953	350,200,313
Average gross earnings per passenger	3.06c	3.03c
Average expenses per passenger, including interest on valuation	2.61c	2.57c
Average profit per passenger	4.58m	4.62m

PACIFIC TELEPHONE.

The report of the Pacific Telephone and Telegraph Company for the month of July and seven months ended July 31, 1909, compares as follows:

	1909.	1908.
July gross	$1,635,518	$1,012,967
Expenses	701,122	698,746
July net	$ 334,396	$ 314,223
Charges	103,793	99,771
July surplus	$ 230,603	$ 206,508
Seven months gross	6,870,862	6,194,502
Expenses	5,475,159	5,064,727
Seven months net	$1,395,703	$1,129,775

AMERICAN TELEPHONE.

The American Telephone and Telegraph Company's report of earnings for the month of August and eight months ended August 31, compares as follows:

RECEIPTS.

August:	1909.	1908.
Dividends	$ 1,031,806	$ 971,094
Interest and other revenue	920,577	780,488
Telephone traffic (net)	370,317	254,962
Real estate	8,779	15,583
Other sources	74,171	37,003
Total earnings	$ 2,405,653	$ 2,059,133
Expenses	194,096	151,335
Net	$ 2,211,557	$1,907,798
Interest	511,464	614,253
Balance for dividends	$ 1,700,092	$ 1,293,544

Jan. 1 to Aug. 31:	1909.	1908.
Dividends	$10,826,444	$10,034,016
Interest and other revenue	7,055,447	6,506,984
Telephone traffic (net)	2,796,870	2,331,355
Real estate	64,765	87,011
Other sources	976,759	496,057
Total	$21,720,287	$19,455,425
Expenses	1,626,936	1,399,096
Net earnings	$20,093,351	$18,056,329
Interest	4,930,103	5,100,422
Balance	$15,163,247	$12,955,906
Dividends	7,631,291	6,120,092
Surplus	$ 7,531,955	$ 6,835,814

SCRANTON ELECTRIC COMPANY.

The Scranton Electric Company of Pennsylvania, a subsidiary of the American Gas and Electric Company, has increased its authorized issue of capital stock from $3,000,000, consisting of $2,500,000 common stock and $500,000 six per cent cumulative preferred, to $7,000,000, of which $5,000,000 is common and $2,000,000 preferred. The increase is made in part to finance the purchase of a number of plants which have been acquired during the past year, and, in part, for future development. Of the new preferred stock $250,000 is issuable at once.

CUMBERLAND TELEPHONE.

The report of the Cumberland Telephone and Telegraph Company for the month of August and eight months ended August 31 compares as follows:

	1909.	1908.
August gross	$ 522,544	$ 489,511
Expenses	300,979	287,636
August net	$ 321,564	$ 201,875
Charges and taxes	41,938	37,724
August surplus	$ 179,625	$ 164,151
Eight months gross	4,224,300	4,046,583
Expenses	2,419,537	2,353,317
Eight months net	$1,804,792	$1,693,266
Charges and taxes	338,926	298,081
Eight months surplus	$1,465,855	$1,395,185

Stockholders of the Cumberland Telephone and Telegraph Company have received orders from the East Tennessee Telephone Company for an amount of American Telephone and Telegraph Company's stock equivalent to two per cent of their holdings. This stock was taken from the East Tennessee company as part payment on its indebtedness to the Cumberland Telephone Company.

NASHVILLE RAILWAY AND LIGHT.

The report of the Nashville Railway and Light Company for the month of August and eight months ended August 31, 1909, compares as follows:

	1909.	1908.
August gross	$ 137,255	$ 126,946
Expenses	70,882	66,416
August net	$ 66,373	$ 60,530
Eight months gross	1,103,101	1,008,528
Expenses	553,730	527,653
Eight months net	$ 549,371	$ 480,875

AURORA, ELGIN & CHICAGO.

The report of the Aurora, Elgin & Chicago Railroad Company for the month of August and two months ended August 31 compares as follows:

	1909.	1908.
August gross	$163,698	$153,894
Expenses	76,448	71,174
August net	$ 87,250	$ 82,720
Charges and taxes	29,351	27,624
August surplus	$ 57,899	$ 55,096
Two months gross	331,312	302,642
Expenses	154,342	143,383
Two months net	$176,969	$159,259
Charges and taxes	58,250	55,402
Two months surplus	$118,719	$103,857

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways of St. Louis for the month of August and eight months ended August 31, 1909, compares as follows:

	1909.	1908.
August gross	$ 957,246	$ 911,515
Expenses	599,645	572,879
August net	$ 357,601	$ 338,636
Charges	232,420	234,551
August surplus	$ 125,181	$ 104,085
Eight months gross	7,297,061	6,973,286
Expenses	4,628,353	4,518,916
Eight months net	$2,668,708	$2,454,364
Charges	1,869,499	1,852,950
Eight months surplus	$ 799,209	$ 601,414

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Flexibility of a Telephone System for Electric Railways.

The suburban traffic on electric railways has grown to such an enormous extent that it is now necessary to maintain very fast schedules, run numerous cars under short headway and care for an increase or decrease in traffic economically and smoothly. It is, therefore, absolutely necessary to provide an efficient system of communication between headquarters and those points on different lines where the movement of cars is to be known and controlled. This is necessary, not only in order to avoid accidents, delays and the congesting of traffic, but also to take care of the other numerous phases of train dispatching. One of the best means of obtaining this service is through the medium of a telephone system.

The almost universal knowledge of the use of the telephone at the present time, coupled with the ease of imparting information to train crews through spoken words, has certainly demanded attention. Besides all this, the success of the telephone systems now in operation on steam roads has proven that the telephone is the only means of giving the electric railway the same flexibility as obtained on the steam railroad operating under a train-order system.

The methods of communicating in electric-railway work require a system which depends mainly on the character of the electric-railway system under consideration. In general, however, the system consists of a portable or stationary type of telephone set in conjunction with a properly transposed metallic-circuit telephone line extending from the dispatcher's office or from a private-exchange switchboard to the end of each operating division.

For a comparatively short railroad, possibly connecting two or more towns, the telephone lines are often strung on the same poles which carry the overhead wires. For longer and more complex electric-railway systems it has in some cases been found advisable to establish a telephone system of several lines, each similar to the above, terminating in a switchboard.

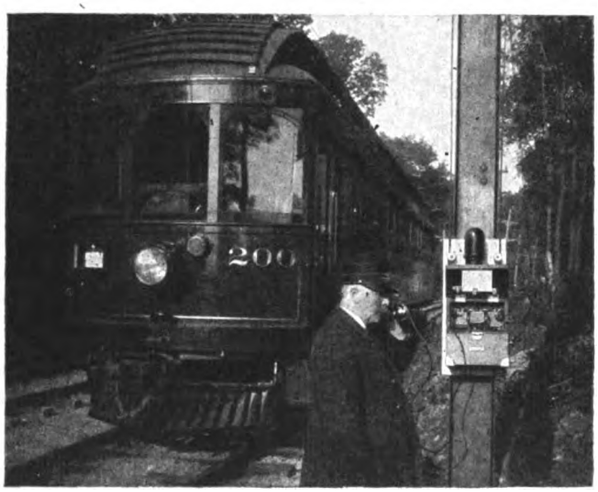

FIG. 1.—VIEW OF TELEPHONE WHEN IN SERVICE.

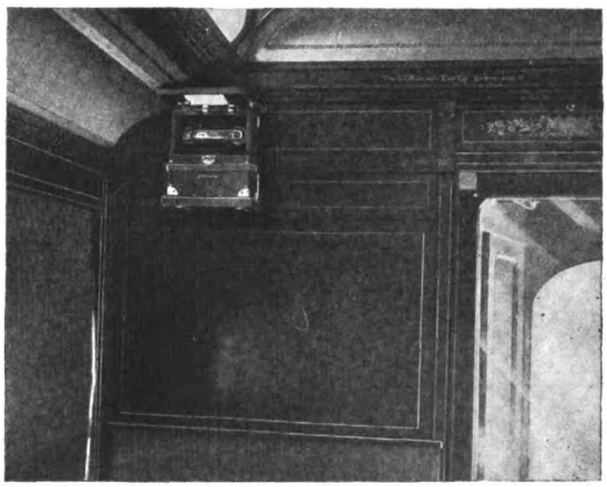

FIG. 2.—TELEPHONE MOUNTED ON RACK IN CAR.

The illustrations, Figs. 1 and 2, show an installation of telephones on the Syracuse, Lake Shore & Northern Railroad. This road operates over approximately 250 miles and has adopted a portable telephone set as its standard.

These portable telephone instruments are manufactured by the Western Electric Company, and are particularly adapted for interurban electric-railway service, being the result of an extended study into the requirements of a telephone which best meets the somewhat severe conditions usually found in this branch of railroad work. Such a telephone set must be light in weight, substantial in construction, of compact design, with the exterior surfaces flush, and all parts readily accessible. The instrument, as shown in Figs. 1 and 2, weighs sixteen pounds, is eleven-and-one-half inches high by ten-and-one-half inches wide by four-and-three-quarters inches deep.

The case is of hard maple and conveniently arranged for accessibility to the enclosed parts. The front cover is divided, one-half being hinged along the upper edge so as to form a flap, with the lower half held in place by screws. The interior of the case is divided (as seen in Fig. 1) into two horizontal compartments, the lower half containing a three-bar generator, induction coil, two cells of dry battery and a 2,500-ohm ringer. The upper half contains a hand telephone set with cord, held in place by two spring clips and also the generator crank handle and a cord and line plug for making connections at the pole jacks, which are connected to the telephone line wires. The hinges on the flap, or lid of the set, are provided with springs which tend to keep it in the closed position, also the lower edge of the flap is beveled, these features effectually excluding the rain, snow, etc., when the instrument is in use.

As shown in Fig. 2, this set when not in service is carried in a rack at the front end of the car. When a connection with the dispatcher, or other stations, is desired, the set is taken from the car and connected to the line by inserting the plug into a pole jack, as shown in Fig. 1. The stations are then called by means of the small magneto generator. The transmitter and receiver are mounted

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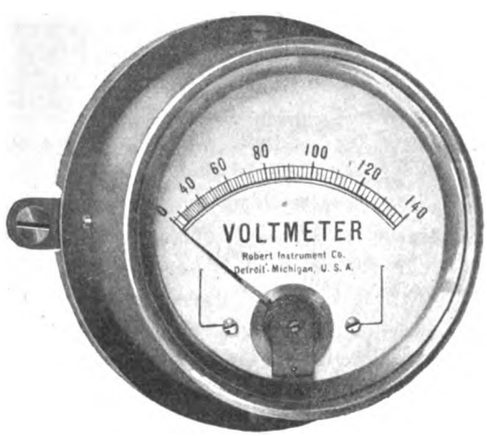
together on a yoke, so as to be conveniently operated when held in one hand. In the yoke of the hand set is a push-button, so located that it can be conveniently depressed with the thumb. This operation closes the battery circuit through the transmitter. When the button is released the battery circuit is opened, which both prevents the introduction of extraneous noises through the transmitter and economizes the battery consumption.

The fact that these telephones can be used by train crews, enables the dispatcher to get in direct communication with the conductor, and in cases of emergency obtain at first hand the conditions. By equipping each train with a portable telephone set, the dispatcher may be reached and promptly notified as to the conditions, thus enabling him to send the necessary help and arrange for such changes in the schedule as may be required.

Robert Switchboard Instruments.

The style of switchboard instrument illustrated herewith, is a most desirable form for installation where an accurate, and yet inexpensive, instrument can be used. They are accurately calibrated, and have a desirable and distinct drawn scale.



ROBERT SWITCHBOARD INSTRUMENT.

These instruments are of the electromagnetic type, and may be used on either direct or alternating current. The base is a casting, and the shell is of brushed brass with a beveled flange. The voltmeter illustrated is especially designed for use on switchboards, for storage-battery charging, electroplating equipments, small lighting plants, etc.

The Robert Instrument Company, Detroit, Mich., the manufacturers, are also the manufacturers of the Robert pocket instruments.

Vac—M Lightning Arrester.

Sand storms in the Southwest have always been annoying to telephone and telegraph companies, on account of the static electricity produced in their lines, which cripples them, sometimes for days at a time.

This condition has been overcome, it is claimed, by the use of Vac—m lightning arresters, a product of the National Electric Specialty Company, of Muskegon, Mich., and Toledo, Ohio.

The arrester consists of a hermetically sealed glass bulb, of the same type as the ordinary incandescent-lamp globe, mounted on a porcelain wall receptacle and having terminals for connections of line and ground. The air has been partially removed from the bulb, making a partial vacuum therein. The electrodes, mounted in the globe, are wired to the outside terminals, one being connected to ground

VAC—M LIGHTNING ARRESTER.

and the other to the line, in the grounded-circuit type. In the metallic-circuit type there are three electrodes and terminals, the middle electrode being for ground and the two outside ones for the line wires. A view of this arrester is shown herewith.

These arresters are thoroughly tested before being marketed, an automobile spark coil and a physician's static machine being used to furnish the spark. A competing lightning arrester is generally used in connection with these tests.

Western Electric Exhibit at Denver.

A comprehensive display of the telephone systems that have been adopted by many of the steam railroads will be shown by the Western Electric Company in its exhibit at the twenty-eighth Annual Railway Appliance and Exposition in the new Auditorium and annex of Denver, beginning October 4.

The circuits as used on the steam railroads will be shown, and the advantages of similar installations on electrical railways for governing the movements of trains will be presented.

The selectors shown will be the same as those installed on the steam roads, the principal function of these selectors being that by their installation, one at each station, it is possible to call up any one of the stations without ringing the bells at any of the other stations. This individual-selector scheme has proved itself of great value to many steam roads in the saving of time in handling of trains.

The apparatus as shown at Denver will be similar to those exhibited at the Street Railway Convention at Atlantic City last October and at the exhibition of the convention of Superintendents of Telegraph of Steam Roads at Detroit last June, along with several new features.

In addition to this exhibition, there will be a representative showing of standard Western Electric telephone apparatus.

The new "Electrose" insulation will receive an ample display in the Western Electric booths.

Aside from the show of electric insulations, there will be a line of standard Western Electric ears, clamps, section insulators, overhead frogs and crossings and armatures, field coils and Kalamazoo trolley wheels and harps.

The Western Electric booths are Nos. 114 to 126, located near the middle of the Fourteenth Street side of the annex, opposite the main entrance to the Auditorium, which is at the corner of Curtis and Fourteenth streets.

Motors for Arctic Explorers.

Lieutenant Ferdinand George Helfer, until recently connected with the German army, has applied for space at the New York Electrical Show, opening October 11, to exhibit a small and powerful motor which he thinks will be invaluable to future Arctic or Antartic explorers.

The motor is small enough to be carried on one sledge, it is said, along with a complete wireless-telegraphy outfit.

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Geared Freight Locomotive for New York, New Haven & Hartford Railroad.

The Westinghouse Electric and Manufacturing Company has contracted to build for the New York, New Haven & Hartford Railroad, an electric freight locomotive of large capacity, for use on the electrified section between Stamford and New York city. The construction of this machine is well under way, and the manufacturers expect to have it ready for service in the month of October.

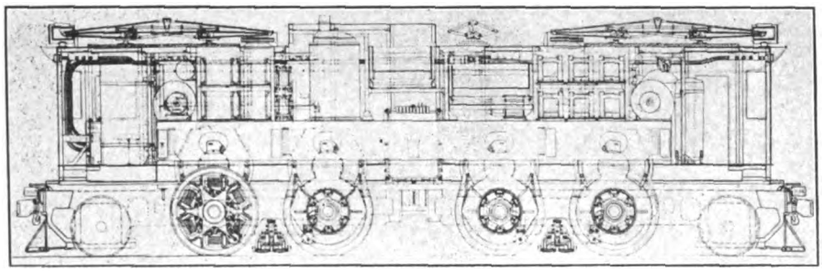
The locomotive has been designed primarily for handling fast freight service, but will also be used for hauling heavy passenger trains. The machine will be placed in regular service by the New Haven road as soon as completed, and given a thorough test in freight service with a view to handling eventually all of this class of work electrically.

The mechanical parts of this locomotive have been designed by the engineers of the Baldwin Locomotive Works and the mechanical department of the New York, New Haven & Hartford Railroad, and are being built at the Philadelphia works of the Baldwin company.

The design includes various features of special interest. The general plan of the trucks and running gear has been worked out in accordance with a patent granted to S. M. Vauclain, July 6, 1909. This patent describes an articulated locomotive in which the truck frames are connected by an intermediate drawbar. One truck has only a rotative motion about its center pin, while the other has a fore-and-aft as well as a rotative motion, in order to compensate for the angular positions of the trucks and drawbar when the locomotive is traversing curves. The tractive force is transmitted through the truck frames and drawbar, instead of through the main frame.

In the present instance, the two-four-four-two wheel arrangement has been adopted. Each truck has two pairs of driving wheels, and a single pair of leading wheels. The driving wheels are held in alinement by cast-steel bar frames, similar to those usually used in steam-locomotive practice. The frames are placed outside the wheels, and are braced transversely under the center of the locomotive by heavy steel castings provided with draw pockets in which the intermediate drawbar is seated. This bar transmits from one truck frame to the other the full tractive force developed by the motors of the leading truck. Train connections are effected by means of two radial drawbars, one of which is placed at each end of the locomotive. The drawbars are pinned to cast-steel cross-ties, which brace the truck frames between the driving and leading wheels. The wheel loads are equalized as in steam-locomotive practice, the springs of the leading wheels being connected to the driving springs by equalizing beams.

The cab is built of steel plate, and measures forty-three feet, six inches in length, covering the entire locomotive. The frame which supports the cab is composed of two twelve-inch channels, united at the ends by plates and angles. This frame is braced transversely by five cast-steel cross-ties. The cab is supported on the intermediate and end cross-ties, the weight being transferred through coiled springs which are placed in suitable pockets. The cab frame is held in alinement by the truck center-pins, while the lower spring pockets are free to slide over the truck-frame cross-ties.



LONGITUDINAL SECTION THROUGH NEW ELECTRIC FREIGHT LOCOMOTIVE FOR NEW HAVEN RAILROAD.

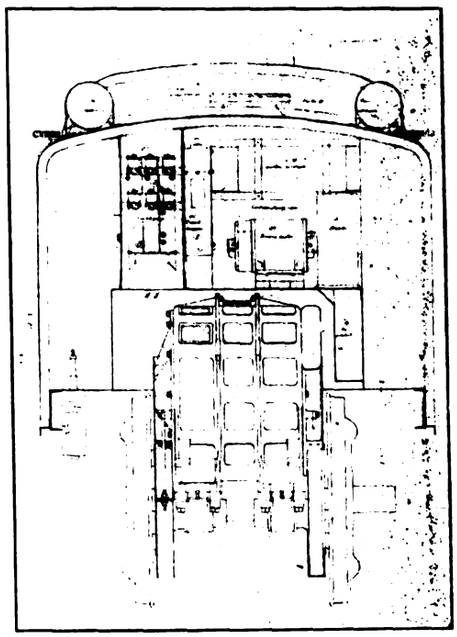
The principal dimensions of this locomotive are as follows:

Gauge	4 feet 8½ inches
Driving wheels, outside diameter	63 inches
Driving wheels, center diameter	56 inches
Driving-axle journals	8x12 inches
Truck wheels, diameter	42 inches
Wheel base, rigid	7 feet
Wheel base, total	38 feet 6 inches
Length between coupler faces	48 feet
Height over all	13 feet 9 inches
Width	10 feet
Approximate weight, total	260,000 pounds
Approximate weight on driving wheels	188,000 pounds

It is believed, from experience gained with previous locomotives, that the plan of running gear and cab support adopted for this engine will tend to avoid nosing, promote easy riding and minimize shocks on the track and roadbed.

A characteristic feature of the heavier details is the free use made of cast steel. This is particularly true of the truck-frame cross-ties, which are interesting examples of mechanical design. The tendency to follow approved steam-locomotive practice is also evident in many of the mechanical details of this locomotive.

The electrical equipment, which is being built and mounted by the Westinghouse Electric and Manufacturing Company, comprises four 350-horsepower single-phase geared motors, together with the necessary auxiliary apparatus for their operation from the 11,000-volt alternating-current or 600-volt direct-current circuits of the electrified sections which the locomotive will traverse.



CROSS SECTION THROUGH NEW ELECTRIC FREIGHT LOCOMOTIVE.

The motors are placed directly over the axles and are mounted solidly on the truck frames. Each end of the armature shaft is provided with a pinion; these mesh with gears mounted on a quill surrounding the axle and carried in bearings on the motor frame, similar to the usual axle bearings. The quills are provided with six driving arms on each end, which project into spaces provided between the spokes in the driving wheels. Each of these arms is connected to an end of a helical spring, the other ends of the spring being connected to the driving wheels.

This arrangement of drive smooths out the torque pulsations and at the same time allows for vertical movement of the axles. In addition to the spring connec-

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tion between the quills and drivers, flexibility is provided between the pinions and motor shaft, to equalize the torque on the gears. The quills are of large diameter, permitting unrestricted motion of the wheels and axles. The center of gravity of the motors, as well as that of the entire locomotive, is high, avoiding the transmission of strains and shocks from the track and roadbed to the motors.

The motors, of the standard Westinghouse type, have twelve poles built into a solid frame, and are designed for forced ventilation. When operating on twenty-five-cycle alternating current with forced ventilation, each of the four motors will carry continuously a load of 300 horsepower. An air-blast transformer is provided for lowering the trolley-line voltage to that required by the motors. The control apparatus is of the well-known Westinghouse electro-pneumatic type.

When operating on alternating current, all four motors are connected in multiple, and the control is obtained entirely by changing the connections to various voltage taps on the main transformer. On direct current the motors are first grouped all in series, and then two in series and two in parallel, in combination with various resistance steps. Provision is made for cutting out any one of the four motors singly on either alternating current or direct current.

A master controller and brake valve are located in each end of the cab, so that the locomotive can be operated from either end, and the system of control is such that two or more locomotives of this type can be coupled together and operated from one master controller.

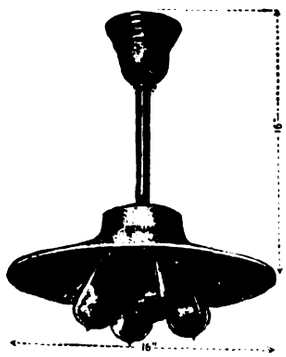
Two pneumatically operated pantograph trolleys are provided for collecting current from the 11,000-volt overhead alternating-current line. Pneumatically operated third-rail shoes are used to collect current on the third-rail section.

The locomotive will be capable of hauling a freight train having a maximum weight of 1,500 tons, at a speed of thirty-five miles per hour. When used in passenger service, 800-ton trains will be hauled at a maximum speed of forty-five miles per hour. A steam-heater outfit is provided on the locomotive for heating the cars of the trains, when used in passenger service.

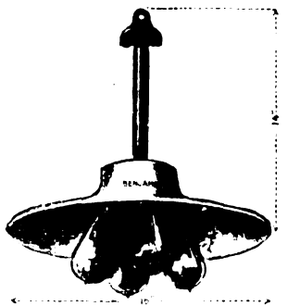
The drawings of this locomotive, herewith reproduced, show the arrangement of control apparatus, which, as will be seen, is located in the center of the cab, with a passage on each side.

New Benjamin Tungsten Fixtures With Hooded Enamel Steel Reflector.

A new line of tungsten fixtures is being placed on the market by the Benjamin Electric Manufacturing Company, of New York, Chicago and San Francisco. These fixtures are built up around the type 3-T tungsten cluster. They have a sixteen-inch white enameled steel reflector, deeply hooded, to receive the cluster in such a manner that the lamps are in proper relation to the reflecting surface. The outlets are at an angle of sixteen degrees with the vertical. This slight angle not only does not endanger the filament of the lamps but adds materially to the lighting efficiency of the fixture inasmuch as one-half of the light of each lamp is directed downward and the other half at the same angle upward to be re-directed by the reflector. Thus, very little of the light of one lamp passes through the other lamps.



BENJAMIN TUNGSTEN FIXTURE FOR INDOOR USE.



BENJAMIN TUNGSTEN FIXTURE FOR OUTDOOR USE.

The cluster body is attached to the reflector by means of a flange. A watertight joint is secured by the use of two rubber gaskets. These flanges are furnished for three-eighths or one-half-inch pipe; the former for indoor, the latter for outdoor work. Two to four-light fixtures require 100-watt lamps; five-light fixtures, forty or sixty-watt lamps.

A Sign of the Times.

Among the signs of the times are those that have become well known as representing the large industrial establishments of the country. Among these are the signs of the Western Electric Company; within a few months they will be mounted on the side boards of all trucks used by its various branch houses in the United States.

The sign is the well-known "Consult the Map" trade escutcheon of the company, but will in each location bear the address of the local house instead of the phrase, "Consult the Map."

WESTERN ELECTRIC COMPANY'S SIGN FOR DELIVERY TRUCKS.

The signs are black, the lettering being embossed and silver-leafed. The accompanying illustration, from a photograph taken in front of the thirteen-story building of the New York city house, shows the new sign mounted.

The wholesale labeling of the hauling and delivery departments of the company signalizes the rounding out of the company's very extensive advertising campaign. In this respect it is a sign of the times.

Atchison, Topeka & Santa Fe Extends Telephone Train Dispatching.

The Atchison, Topeka & Santa Fe Railway has recently installed the telephone for train dispatching between Chicago and Newton, Kan., a distance of 659 miles. This equipment is but a small portion of what is being equipped, it being the intention of the railway company to extend this service over its entire system. At the present moment there are eighteen different divisions upon which the trains are dispatched by telephone. In this way 380 stations are reached in a total distance of 1,925 miles. Western Electric telephone equipment is being used.

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Central Laboratory Supply Company Changes Name.

On account of the greatly increased scope of the business done by the Central Laboratory Supply Company, of La Fayette, Ind., the directors voted at their August meeting to change the name of the company to the Esterline Company.

The Central Laboratory Supply Company was organized in 1903 by J. W. Esterline, and began manufacturing a line of electrical, mechanical and physical laboratory apparatus. In 1906 the company was incorporated, with J. W. Esterline, W. Bent Wilson, Thomas Duncan and E. S. Ferry as the principal stockholders.

The company was prosperous from the start and has had a rapid growth, numbering among its customers nearly all the leading technical and commercial laboratories in the United States and Canada. In addition to its manufacturing work the company has continued the consulting engineering work formerly conducted by Mr. Esterline, and has been successful in the design and construction of lighting and power plants and modernizing of manufacturing establishments. On account of the increasing volume of business in this line, the directors have decided to change the name of the corporation, and also to increase the engineering staff of the company.

J. W. Esterline, president and manager, will continue at the head of the consulting engineering staff. It is the purpose of the company to enter more largely into construction work, and to this end it has secured the services of B. W. Bissell, an engineer of ability in contracting and construction work, who is now in the employ of the government at Highland Falls, New York. Mr. Bissell will take up this work October 1. A. E. Berdon, an electrical engineer and expert in switchboard and instrument design, has been appointed assistant manager. A. J. Webber is at the head of the design and drafting department. Mr. Webber was also, until recently, in the government service, and is experienced in machine and power plant design. E. L. Ogle, a graduate of Purdue University, class of 1903, engaged since graduation in electrical construction work, has also been recently engaged by the company.

With a staff of the five experienced engineers, headed by Mr. Esterline, this company is in a position to handle successfully its rapidly growing business in engineering and construction. The company has just completed a 1,000-kilowatt combined steam and waterpower plant for the city of Logansport, Ind., and a 1,000-kilowatt station for Frankfort, Ind. It has also recently closed the following contracts: Indiana Springs Company, Kramer, Ind., power plant and motor equipment; Indiana State Soldiers' Home, electric-lighting plant and motor equipment; C. H. Campbell Furniture Company, Shelbyville, Ind., electric generating plant and motor equipment; Depauw University, Greencastle, Ind., heating system and lighting plant. The company has recently been employed to design and construct a large hydroelectric plant and transmission system.

The Esterline Company will continue manufacturing the well-known line of electrical instruments, graphic meters and special apparatus which have been so successfully marketed by the Central Laboratory Supply Company.

J. W. ESTERLINE.

J. W. Esterline, president and manager of the Esterline Company, is one of the leading electrical engineers of the Middle West. He was born at Fort Wayne, Ind., and received his early training there. He prepared for university work at Fort Wayne College, and entered the School of Electrical Engineering, Purdue University, in 1893, completing the work in 1897. From 1898 to 1907, Mr. Esterline was successively instructor, assistant professor and associate professor of electrical engineering at Purdue University, and in 1905 and 1906, during the illness and absence of the late Dr. C. P. Matthews, he was in charge of the work of the department. Mr. Esterline is a member of the American Institute of Electrical Engineers, the Society for the Promotion of Engineering Education and the American Society for Testing Materials. For several years he has served as chairman of the committee of the latter society on the magnetic properties of iron and steel. Mr. Esterline has been a frequent contributor to the proceedings of engineering societies and the technical press, and is the author of several works on engineering and electrical design. Although the major portion of Mr. Esterline's time will now be given to the manufacturing and engineering work, he will continue to give a course of lectures at Purdue University on the design of electrical machinery.

Westinghouse Exhibit at Denver.

At the American Street and Interurban Railway Association's Convention, Denver, Colo., October 4 to 9, the Westinghouse companies will occupy a handsome exhibition booth in the center of the Auditorium, besides their reception rooms at the Brown Palace Hotel. Exhibits of interest to electric-railway men will include one of the sixty-ton interurban cars, built for the Denver & Interurban Railway, equipped with unit switch control and four 125-horsepower motors, and designed to operate on 11,000-volt alternating current and 600-volt direct current, and at a speed of sixty-five miles per hour; a fifteen-ton mining locomotive; a twenty-five-kilowatt turbo-exciter set, compound wound for 125 volts; a No. 5 Westinghouse-Leblanc condenser with motor-driven air and water pump; line material, such as catenary construction, trolley ears, clamps, hangers, wood strain insulators, poles, etc.; car circuit-breakers, arc headlights, multiple-unit switch control apparatus, train connectors, gears, traction brakes, etc.; lightning arresters; interpole railway motors, types CCL, DA, HF and SA motors; series, 110-volt and "W" and "V" tungsten sign lamps, etc., etc. The Westinghouse companies will be represented at the convention by W. M. McFarland, A. L. Humphrey, N. W. Storer, Thomas Cooper, E. L. Adreon, E. H. Sniffen, C. S. Cook, C. H. Davis, W. L. Conwell, C. C. Ewing, J. C. Kyle, T. J. McGill, J. C. Brett, Q. W. Hershey, C. W. Register, H. Beardsley, G. O. Noble, E. H. Heise, A. A. Miller, E. A. Craig, W. S. Bartholomew, W. V. Turner and J. C. McQuiston.

Electric Smelting.

A new process of electric smelting of iron ore in Sweden is reported by Consul-General Edward D. Winslow, of Stockholm, who says three furnaces are about to be built near Gothenburg, which will use hydroelectric power and produce pig iron cheaply.

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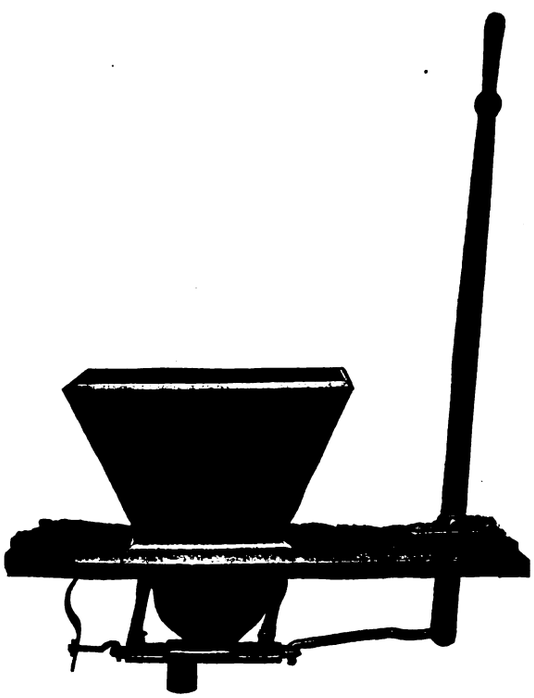
A New Patent Sand Box.

In designing the electrical equipment for an urban or suburban electric car, a factor of safety must always be allowed for the actual operating conditions and the exact frictional resistance between the rail and the driving wheel. This factor depends largely upon the conditions of the rails over which the cars are operated and the grades which must be mounted. Under the assumed condition a certain amount of frictional resistance between rail and wheel can be counted upon, which under these conditions will be sufficient for emergency stops and for starting the cars under load. There are conditions, however, when the rail, due to rain or snow, does not offer to the wheel sufficient resistance, and at these times this frictional surface is provided by an application of some material, which adds or causes an increased friction and gives the wheel a catching hold.



NEW PATENT SAND BOX.

This material is usually a fine, sharp sand, delivered to the track by means of some apparatus which can be controlled by the motorman and used by him when necessary. Such devices as these need to be so reliable and simple that their operation can be depended upon.

In fact, all the complicated and carefully worked out dispatching and signaling systems are reliable only in so far as they are supplemented by reliable equipment and efficient operation. Too often has the result of a terrible accident brought out points of weakness in the operating mechanism or the control of electric cars.

The accompanying illustration shows a new design of sand box recently placed upon the market by the Western Electric Company, which has been used on the cars operated by the Richmond Light and Railway Company for some time, with very good results.

The special features of this new sand box, which have brought about its use, are its few moving parts and its simple construction and operation.

The illustration shows the position of the feed tube when not in operation. It is readily seen that when the sand is not being fed to the track, the valve portion of this mechanism is moved and held by a spring in such a position as to allow free ventilation of the feed pipe. This prevents any accumulation of slush, snow or other dirt in this pipe. The continual and uninterrupted circulation of air through this pipe, due to its position in front of the wheel, keeps it clear and dry at all times.

Inside of the box, at the valve seat, a small mixing peg is located, which prevents the sand from collecting or banking at the edges of the opening, and breaks up any lumps in the sand, so that the moment the valve opens, a stream of fine sand flows to the rail. The valve opens by a system of levers actuated with very little effort by arrangements for operation either by hand or by foot.

Machinery Exhibition Warehouse for Chicago.

The Pfannmueller Engineering Company is erecting a fireproof reinforced concrete building and has incorporated the "Machinery Exhibition Warehouse" for a permanent exhibition of all classes in Chicago. The building is nearing completion, and is located at the southeast corner of South Ashland Avenue and Thirty-seventh Street. The building is 100 feet wide by 400 feet long, three stories high in front, two stories on the sides, and one story in the center. The front is constructed of cut stone and vitrified shale brick. The rear and side walls are also constructed of brick, while the entire interior, including main floor, balcony floors, all columns, crane girders and roof over balconies are constructed of reinforced concrete. The roof over the main space covering the traveling crane is Federal concrete tile, supported on fifty-four-foot-span steel trusses. The offices will be on the second and third floors in the front of the building and will run across the entire width. The main space in the center of the building will be unobstructed and will be spanned with a fifty-foot span, twenty-five-ton Alliance Machine Company electric traveling crane furnished with a six-ton auxiliary. In order that heavy machinery may be handled readily on the first floor under the balconies, eyebolts are set at ten-foot intervals in the brick wall to provide means of attaching block and tackle to be used in connection with the crane for easily and rapidly pulling heavy machinery to and from these spaces.

The building will be furnished with all modern conveniences, such as electricity, steam heat, ample toilet arrangements, including shower baths, telephone switchboard, with several trunk lines, etc. The building has been wired for electricity in such a manner that individual motors can be placed in any part.

The building is specially designed for exhibiting and warehousing machinery and heavy iron and steel products of every character, and while it was erected principally for the accommodation of manufacturers and dealers to exhibit their machinery, at the same time there is sufficient space and special arrangements have been made for warehousing and storing machinery.

In the rear of the building will be a paved yard, fenced in, 100 feet wide by 160 feet long, which will be used for rough machinery and metal products that do not necessarily have to be under cover, and which also allows for future extension of the building.

Entering the building in the rear is a private switchtrack from the Chicago Junction Railway.

The architect of the building was A. S. Alschuler. The general contractors were J. P. & J. W. O'Connor, who sublet the reinforced concrete work to Wm. P. McEvoy & Company. The Johnson corrugated bars were used in the concrete reinforcement and were furnished by Olney J. Dean & Company.

The building will be completed, ready for occupancy, it is stated, November 1.

It certainly marks a unique departure in industrial enterprise and one quite characteristic of Chicago.

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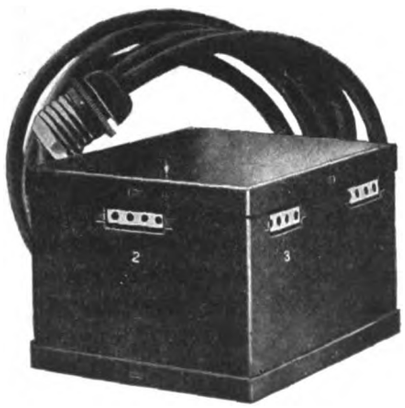
Thordarson Toy Transformers.

The Thordarson toy transformer represents a radical departure from the old method of operating toy and like apparatus. These transformers were first put on the market about a year ago and have met with unusual success.

The system of using storage or dry batteries for operating toy and miniature lights has frequently given trouble. Dry batteries are very easily short-circuited and thereby put out of commission at once, and the majority of storage cells contain acids and other compounds which are liable to spill and ruin clothes, carpets and rugs. No such troubles are experienced with the Thordarson transformers. They are designed to be connected direct to any alternating-current lamp socket, and the construction is such that they are practically indestructible.

The No. 2 toy transformer shown in the accompanying illustration generates



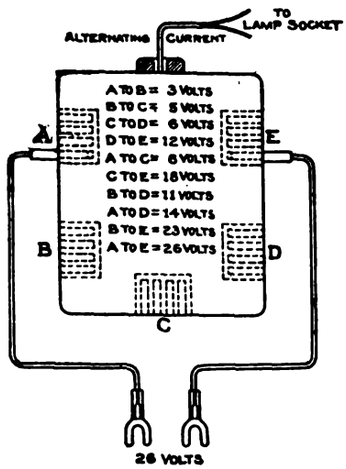
THORDARSON TOY TRANSFORMER.

ten different secondary potentials, stepping down the 110 volts to ten different voltages. These voltages may be used singly or all at one time or two or more voltages may be used at the same time. There is no danger, owing to the fact that the secondary windings are entirely separate from the primary and are thoroughly insulated. Any inexperienced boy may readily use the transformer by following instructions, becoming familiar with the different circuits in a few moments.

These transformers consume on an average less current than a sixteen-candlepower lamp and are, therefore, operated at a very slight expense. The arrangement for obtaining the different voltages is extremely flexible and simple. The plug contact makes a very safe, sure connection and may be instantly disconnected. With reasonable care the transformer should last indefinitely. The windings are so arranged that it will run on a short-circuit for some little time without any harmful effects.

The No. 2 toy transformer will operate all classes of electrical toys, such as small motors, electrical trains, bells, buzzers, electric engines, miniature lamps, etc. Another feature of this field and one that is not generally known, is that all small direct-current battery apparatus that do not require more than fifty watts may be operated with a toy transformer on an alternating current without any change in the winding or connections.

In addition to the foregoing, this company has a complete line of Christmas-tree lighting transformers of small and large capacity, six and fourteen volts. By using these transformers expensive series winding is eliminated, as the winding is arranged to cut down the 110 volts to a



CONNECTIONS OF THORDARSON TOY TRANSFORMER.

low voltage for multiple lighting, which any amateur can easily wire at a low cost. These transformers are manufactured by the Thordarson Electric Manufacturing Company, 220 Jefferson Street, Chicago, Ill.

Hobson's Class.

As is well known, there is a large number of salesmen handling electrical apparatus and supplies who have not had the benefit of a technical education, and whose knowledge of the theory and of even the practical application of the things with which they have to deal is very slight. This operates to their disadvantage and to the disadvantage of the company they represent.

One of the big supply houses with headquarters in St. Loius, Mo., is the Wesco Supply Company. Samuel A. Hobson, a brother of Harry Hobson, of Dallas, Tex., one of the famous "Hobsons of Texas," in the electrical business, and one of the founders of the Rejuvenated Sons of Jove, two or three years ago accepted the position as manager of the apparatus department of the Wesco company. Mr. Hobson has a fine technical understanding of the subjects and material which daily come under his observation.

Some months ago Mr. Hobson was waited upon by a committee of the employes of the Wesco company, whose proposition, summed up in a few words, was about as follows: "Can we prevail upon you to disseminate among us some of the technical knowledge you possess, and which we have all observed gives you advantages in the negotiations with customers and in your relations with our principals?"

Subsequent interviews and discussions resulted in Mr. Hobson's inviting those who cared to join such a "class" to meet

SAMUEL A. HOBSON.

at his home a given evening once a week for a two-hour lecture or lesson.

"Hobson's Class" has become one of the features of the Wesco company's work. The "class" includes not only city salesmen, price clerks, order clerks and claim agents, but the advertising manager and the more important officers of the organization. Mr. Hobson devotes about half of the time of the evening to elementary calculations and the other to lecture on some piece of apparatus. The motor or meter or circuit-breaker is taken apart and assembled, the function of each element being carefully explained, and where possible the calculations and theory involved is also taken up.

The meetings have proved highly successful and extremely popular. Mr. Hobson is enthusiastic about his "scholars" and they in turn regarding their "teacher" as really helpful, decided progress is being made.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, SEPTEMBER 18.—A most important tramway improvement in London was inaugurated this week by the opening of the extension of the London County Council tramways over Blackfriars Bridge. This marks not only a linking up of the tramway systems of the County Council north and south of the River Thames, but the breakdown of a prejudice to tramways within the city of London on the part of the City Corporation, which has been a prominent feature of tramway development in the county of London. Although the London County Council is the authority for working tramways in London, yet not a line can be constructed without the consent of the particular local council within whose area the lines are to be constructed. In this way the City Corporation steadfastly refused to give its sanction for the construction of tramways in the "city" for some ten years, and in each of these years a parliamentary fight saw the City Corporation victorious. At length, however, a spirit of sweet reasonableness suddenly seized the members of the City Corporation and an agreement was made with the County Council for the tramways to be extended over Blackfriars Bridge. This work necessitated the widening of the bridge, which has taken three years to accomplish, and the lines are laid within two feet of the footpath in order that the tramways may not unduly hinder the ordinary vehicular traffic. That the City Corporation is sincere in its attitude is emphasized by a project which is now under consideration for the construction of a new bridge over the Thames by the City Corporation itself, and the scheme includes the running of tramways into the center of the city. At present, however, due to the attitude of the corporation in the past, there are only two "through" tramway routes between the north and south of London.

The Illuminating Engineering Society, which has been formed in London on the lines of the American Illuminating Engineering Society, opens its first business session next month, and the first president is to be Prof. S. P. Thompson, F. R. S.

An impulse type of steam turbine is to be placed upon the market by a leading British firm of electrical manufacturers, with which a speed of 3,000 revolutions per minute will be obtainable. The largest capacity at present, with this type, will be 1,500 kilowatts.

A recent accident upon the Metropolitan Railway, in which two trains collided, has been reported upon by the Board of Trade. During the past few months a system of electric automatic signaling has been installed upon the railway known as the Johnson all-electric automatic and semi-automatic power signaling system. In this the points and signals are electrically driven through an oil transmission, and on the day of the accident in question, the release valve on one of the signals failed to act through an accumulation of dirt in the oil. Under the circumstances, no blame is attached to anyone and the makers of the system are giving attention to this point. The makers have not yet handed over the working of the system to the railway company, and in consequence of the accident, men are watching the action of the signals after the passage of the trains.

One of the London evening papers, by the aid of the electrophone, reported a lengthy and important speech on the budget by Lord Rosebery within a few minutes of its delivery. The speech was delivered in Glasgow and reported and published in London, 400 miles distant.

Several questions have again been put to the president of the Board of Trade on the House of Commons, with regard to compelling all vessels to be fitted with wireless telegraph apparatus. The Board of Trade, however, in spite of the complete disappearance of the "Waratah," still does not think that the time for such action has arrived.

The government is being urged to give consideration to an offer by Marconi's Wireless Telegraph Company to establish a penny-a-word wireless system between England and Italy. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, SEPTEMBER 18.—The fifth congress, organized by the International Union for testing of materials, was held at Copenhagen from the 7th to the 11th of September, and there were a number of interesting papers presented on this occasion.

At Coarage, in the Mediterranean region of France, there is erecting a hydraulic plant on the Paillon River for an electric-light and power supply. The plant is to have a large storage reservoir to provide for the low-water periods. The municipality of Cambrai awarded the contract to the local electric company for a considerable extension in the underground and overhead wiring in the town. At St. Michel steps are being taken to erect an electric-light plant, and the contract has been awarded to a Paris firm. Among the new companies formed at Paris may be noted the Gas Engine Company, which manufactures the "National" engine, also the firm of Roger et Cie for electrical apparatus. At Lyon the Maljournal and Bourron firm will handle electric supplies. The Boulonnaise Company, of Lille, is engaged in installing electric plants. At Bagnières de Bigorre there is formed the Société Bagneraise for electric-lighting enterprises in the region.

At a recent meeting of the Société de Physique at Paris there was read an interesting paper by a Polish engineer, M. C. de Proszynski, upon the phenomena of persistence of light impressions on the retina. He applies these principles in practice to the new moving-picture machine invented by him, in which the flickering is quite suppressed, but his results are also of interest in electric lighting and other work in the electrical field. He has also invented an electrical device for obtaining synchronism between a phonograph and a picture machine, which works on a few cells of battery.

The Municipality of Feldkirch, Austria, is now operating a hydraulic plant on the Ill stream in order to secure current for the city mains and the surrounding district. It is now running regularly and supplies about 3,000 horsepower at present, using an eight-metre head of water, with Francis turbines. The alternators are of the three-phase type and work at 6,200 volts. Some twenty-six communities are supplied and there are erected transformer posts in these for lowering the voltage to 3×500 or 3×130 volts.

The Turkish Minister of Finance is taking measures to have a telephone system installed in Constantinople and the suburbs. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, SEPTEMBER 25.—The directors of the Rio de Janeiro Tramway, Light and Power Company have declared an initial dividend of one per cent.

The town of Galt, Ont., is considering a proposition to buy the local electric-lighting plant. The price asked by the company is $67,000.

James Conmee will offer to deliver electric power from Nepigon to Port Arthur at $15 per horsepower delivered, or $8 on the wheel at Nepigon. The city needs about 30,000 horsepower, and has been looking to the Ontario Hydro-Electric Commission for a contract. The City Council will consider the Conmee offer.

The Commissioners of Queen Victoria Park, at Niagara Falls, have given permission for another immense undertaking by the Ontario Power Company, which will spend over a million dollars in laying pipe from the gate house to the power house. It is anticipated that the work will be completed in six months. Over five hundred men will be employed on the work.

The board of directors of the Western Canada Power Company has just been formed with C. H. Cahan, K. C., of Montreal, as president. Sir Edward Clouston, of Montreal, while in the West recently, was at Stave Lake, where he saw the water-power, and he expressed himself as highly pleased with the work done.

Dr. Eugene Haanel, of Ottawa, director of mines, states that arrangements are being made for the establishment of the first electric smelting plant in Canada, in connection with the Sault Ste. Marie iron and steel industries. The Lake Superior Company is arranging for the construction of a number of furnaces similar to those now in successful operation in Sweden. A second electric smelting enterprise, involving the investment of several million dollars, is also contemplated for the treatment of iron ores. It will be situated at Chats Falls, on the Ottawa River, where a splendid power site has been secured by a company headed by Louis Simpson, of Ottawa.

The Metropolitan Electric Company, of Ottawa, is asking the City Council for an extension of its franchise in the city for a twenty-five-year period. The company agrees to sell the city 3,000 horsepower at $15 per horsepower, and shows preparedness to go ahead with its enterprise by guaranteeing the completion of the plant by the end of 1911. This plant is situated at Dechesne Rapids, six miles from the city. As the new power company would be competing against the municipal electric system, as well as against the Ottawa Electric Company, the Council

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will have to decide whether it is advisable to let another rival of the municipal plant enter the field of electric lighting in the city.

The Board of Trade, of Cornwall, Ont., has unanimously endorsed the project of the St. Lawrence Power Company and the Long Sault Development Company, to dam the Long Sault Rapids and develop 500,000 horsepower. The Board also requested the Dominion government to give permission to the companies to carry out their scheme. The company will first straighten the south channel, which is all American water, and build a dam from the foot of Long Sault Island to the American mainland. This will take four years to complete and will develop from 60,000 to 100,000 horsepower, which will be sold wherever possible in Canada and the United States. At this dam will be a big lock for steamers, overcoming the rapids in one lift. The damming of the big rapids, the enlarging of the little river, or international channel, north of Barnhart's Island, and the building of power houses will occupy seven years' time and will cost upward of $12,000,000. When completed, there will be a dam 3,800 feet long and forty feet high, from Long Sault Island to Barnhart's Island, making a magnificent fall instead of the present rapids. The Long Sault Development Company has already invested $1,000,000 in the scheme.

Three companies are at present engaged in a desperate race to be the first to supply, at a greatly reduced price, compressed air and electricity to the mines in the Cobalt silver district. The Cobalt Hydraulic, a New York concern, will supply compressed air only. It will be the largest compressed air plant in the world. On the Matabitchouan River the Mines Power Company has had 700 men working for months past, completing the final dam and putting in the immense generators and turbines. This company is now building substations at Cobalt and Kerr Lake to accommodate the enormous air compressors and electric transformers. It is proposed to run the compressors with electric motors and compete for the lighting of the whole district. The Beach Bros. are generating power at Hounds Chutes, and although their undertaking to supply electric energy is not on the big scale as that of the Mines company, it is further advanced. So badly do the mines want the power at the reduced prices promised, that they will take it from the company that can first supply it. The prices for air and electricity will be cut in half. All three companies declare that they will be ready for business by the middle of November next. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, SEPTEMBER 27.—The Winnipeg Electric Company, of Winnipeg, Man., has declared a dividend of two-and-one-half per cent, payable October 1 to shareholders of record on September 30.

The British Columbia Electric Street Railway Company, with head office in Vancouver, B. C., is closing tenders for five electrical substations to supply power to rural districts. The buildings will be of concrete. R. H. Sperling, general superintendent, Vancouver, B. C.

The offer of the Hydro Electric Commission, of Toronto, to supply power to Port Arthur, Ont., fixes the rate at $17 per horsepower, which rate will be gradually reduced to $13. Address City Solicitor Kiefer, Port Arthur, Ont.

The town of Carnduff, Saskatchewan, is now completing a municipal electric-light and power plant.

The Weyburn Electric Light and Power Company, of Weyburn, Sask., has asked that town $28,000 for its entire plant and holdings. The Council is considering the matter of purchasing the plant and operating it as a municipal enterprise.

The ratepayers of Lacombe, Alta., have voted favorably on a by-law to expend $25,000 for the purchase of the plant and all other holdings of the Lacombe Electric Company, which now supplies the town with light and power. The actual price of the plant and fittings, according to the company's books, was $47,000.

A large touring party of members of the Massachusetts Street Railway Association will visit Western Canada during the beginning of October and will inspect the street-railway systems at Port Arthur and Fort William, Ont., Winnipeg, Man., Calgary and Edmonton, Alta.

Within sixteen days the Winnipeg Electric Company must file a statement of defense against the injunction obtained by the city of Winnipeg, Manitoba, on September 21, to restrain the company from erecting electric-lighting poles without a civic permit. This is the latest stage of the controversy which has been waged between the city and the company for several years past. In the injunction, which is a very lengthy document, the city states the trouble with the defendant company in detail and incidentally claims $127,000 in taxes, with several items of interest. Incidentally the city claims that the company has no status within the city limits, having broken the terms of its agreement which provide all the company's buildings must be within the city limits, by having its power plant some miles distant at Lac du Bonnet. The legal fight will be a long one, as both the city and the company are determined to take the fight to the highest court under the British flag.

The Winnipeg Electric Company, of Winnipeg, Man., has declared a regular quarterly dividend of two-and-one-half per cent, payable to shareholders on October 1, 1909.

James Kent, general manager of the Canadian Pacific Railroad Company's telegraphs, states it is the expectation of the company to be operating trains by telephone between Fort William and Brandon, Man., within a year. These towns are on the company's main line and are approximately 550 miles apart. The company claims telephones are much more satisfactory for dispatching trains than telegraphs.

The city of Fort William, Ont., has decided to extend the municipal telephone system through the township of Paipoonge. The residents along the route of the line will defray half the cost of construction and the city the other half. At Swift Current, Sask., F. W. Laidley is organizing the Saskatchewan Light, Heat and Power Company, and the company expects soon to be in a position to commence operations.

Two important power companies have been incorporated, with head office at Kamloops, B. C. They are the North Thompson Electric Power Company, Ltd., to develop power at Louis Creek, with a capitalization of $25,000, and the Kamloops Fruitland Irrigation and Power Company, with a capital of $250,000.

The branch of the British Columbia Electric Railway Company between New Westminster and Eburne, B. C., was placed in operation on September 15. R. H. Sperling, general manager, Vancouver, B. C. All grading on the Nipissing Central Railway, which will run from Cobalt to Haileybury, Ont., has been completed and the overhead contracts let. It is expected that the rails will be laid over the first six miles by November 1. It is expected the British Columbia Electric Railway Company's branch between Cloverdale and New Westminster, B. C., a distance of twelve miles, will be in operation by November 1. All along the line as far as Chilliwac, the terminus, contractors are at work grading, and the balance of the line between Cloverdale and Chilliwac will be rushed to completion. The High Falls Power Company is preparing to supply power to mines in the vicinity of Haileybury, Ont. The company is now developing power on Wabi Creek. H. S. Henessy, of Haileybury, Ont., is one of the holders of this franchise.

The joint board controlling the Fort William and Port Arthur (Ontario) electric railways intends to prohibit smoking on its cars and will do away with the smoking compartments on its closed cars. The Winnipeg Electric Street Railway Company, Winnipeg, Man., is collecting statistics with a view to do away with certain abuses of its transfer system which have led to certain prosecutions of late. The transfers are now such that it is comparatively easy to make other uses of them than those for which they were intended. Wilford Phillips is the general manager.

The Hydro-Electric Commission of Ontario has made a proposition to supply the city of Port Arthur with power at a reasonable rate. The city has been waiting for just such an offer for the past six months, and fearing it would not come was entering into negotiations with James Conmee, M. P., for the supply of power. Mr. Conmee's proposition will be held over for a few days until the offer of the commission is received and looked into.

The city of Calgary, Alta., will shortly submit a by-law to the ratepayers to authorize a by-law providing for the expenditure of an additional $40,000 for the street-railway system. The original by-law provided for an expenditure of $476,000, but this proved insufficient. Mayor Jamieson should be addressed.

The British Columbia Electric Street Railway Company, with head office at Vancouver, B. C., has applied for 30,000 miners' inches of water from Indian River and proposes to erect an auxiliary power plant there.

The Hamiota Light and Power Company, of Hamiota, Man., has completed its plant to that stage to enable it to turn on fourteen of the street lights ordered by the town. The Kaministiquia Power Company, of Fort William, Ont., which is owned by Holt and Company, of that city, is increasing its development from 14,000 to 21,000 horsepower. The city of Port Arthur, Ont., has started placing its telephone wires on Arthur Street underground. It is the intention of the municipal authorities to place all its overhead wires in conduits.

The transmission poles being erected by the British Columbia Electric Street Railway Company between New Westminster, B. C., and Chilliwac, are double the usual height in order to carry the power lines to the latter city. The overhead work is now progressing rapidly. R. H. Sperling, general manager, Vancouver.

The provincial government of Saskatchewan is installing telephone systems in the towns of Melville and Hanley.

Samuel Hooper, provincial architect, Winnipeg, Man., has prepared plans for a branch telephone exchange, to be erected by the province in Winnipeg, Man. F. C. Patterson is chairman of the provincial telephone commission.

Hon. W. H. Cushing, provincial minister of public works for the province of Alberta, stated in an interview recently that the government telephone line to Lethbridge will be extended to the Crow's Nest Pass and there connect with the lines of several independent telephone systems. R.

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IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

ARIZONA POWER PROJECT—Colonel C. E. Apponi, of El Paso, Ariz., a well-known consulting engineer, is promoting the project of establishing a great hydroelectric plant on the Colorado River at what is known as The Needles, situated about twenty-five miles south of here. Colonel Apponi secured the water rights to a strip of the river territory five miles in length at the first rapids and it is at that place the plant will be located. The initial plant will have a capacity of 30,000 horsepower. Colonel Apponi has interested a syndicate of wealthy men of Milwaukee in the project, and the early construction of the big plant is assured, he says. It is planned to build a number of transmission lines and to supply towns and industrial plants within a radius of 170 miles of the plant with power. The plans call for the expenditure of more than $2,000,000.

NORTH CAROLINA TROLLEY PROJECT—An interurban trolley system to connect all of the cities of the Piedmont section of North Carolina is contemplated in a scheme that has the backing of Eastern capitalists headed by Leslie M. Shaw, former Secretary of the Treasury, and Patrick Hirsch. A company will be formed with the present Piedmont Carolina Railway Company as a nucleus, and the trolley line being built by this company from Salisbury to Concord via China Grove and Kannapolis, will be one of the links of the big trolley system. The principal line of the system will extend from Greensboro to Charlotte, a distance of ninety-eight miles, connecting between these cities High Point, Thomasville, Lexington, Concord and Salisbury. From Greensboro or High Point a line will be extended to Winston-Salem, a distance of slightly more than twenty-five miles. From Charlotte lines will be extended to Gastonia and Monroe, each of these cities being about thirty miles distant. No definite estimate of the cost of the lines can be given until the surveys are completed, but the cost will be several million dollars. The hauling of both freight and passengers is contemplated.

LIGHTING AND POWER.

(Special Correspondence.)

RYAN, OKLA.—This city is about to begin the construction of an electric-light system.

NEVADA, IOWA—The plant of the Nevada Electric Company has been destroyed by fire.

ERICK, OKLA.—Bonds to the amount of $10,000 have been voted for an electric-light plant.

ARDMORE, OKLA.—J. T. Dickerson is about to petition this city for an electric-light franchise.

GLENDORA, CAL.—The City Trustees have opened bids for about $40,000 worth of electric lamps.

CUTHBERT, GA.—An election is to be held on October 12, to vote on waterworks and electric-light-plant bonds.

BLUFFTON, IND.—The City Council is asking for bids for the construction of twenty arches equipped with electric-light apparatus. S.

AURORA, ILL.—Work has been started on the new electric-light plant Elburn has decided it wants. The International Harvester Company has the contract.

ELKHART, IND.—The City Council is arranging with the merchants of the city to install a "goose-neck"-lighting system in the business section of the city.

LE SUEUR, MINN.—Jas. A. Morgan, city clerk, will receive bids until October 1 for a Corliss heavy duty engine, 16x36, to drive an alternating-current generator. C.

PORTLAND, ME.—The Ossipee Valley Power Company has been chartered with a capital stock of $200,000. W. J. Bodwell, of Sanford, Me., is president and treasurer.

LOS ANGELES, CAL.—An issue of $3,500,000 power bonds for use in developing the power of the Los Angeles aqueduct has been asked for by the board of public works.

LOS ANGELES, CAL.—The Board of Supervisors are asking for bids for installing and maintaining for five years a lighting plant in the East Hollywood Lighting District.

AMHERST, WIS.—B. R. Dwinell & Company are making improvements to their electric plant at Lower Amherst. A Concrete flume and new waterwheels will be installed. C.

MONTEREY, MEX.—The Mines of Mexico Company, of Denver, Colo., is preparing to erect a large hydroelectric plant on the Mayo River for furnishing its mines in Sonora with power.

COALINGA, CAL.—A. C. Whishon, general manager of the San Joaquin Light and Power Company, announces that a water, light and power plant to cost $17,000,000 will be installed in Coalinga.

NEWARK, N. J.—The Butler Electric Light and Power Company has been incorporated by Evan C. Jones, of Rutherford; John P. Lydecker, of Bloomingdale, and Harry B. Schneider, of Westwood, who is the agent in charge of the company's office at Butler. The company, the capital of which is fixed at $50,000, will generate and sell electric current.

SAN FRANCISCO, CAL.—Residents of Colma, the Hillcrest Crocker Tract and Vista Grande, south of this city, have organized a lighting district to be known as the Colma Lighting District.

IOWA FALLS, IOWA—A vote will be taken on issuing a twenty-five-year franchise for an electric-lighting plant and street railway to the Interstate Power Company. If granted, the company will erect a plant costing more than $500,000. C.

FORT WAYNE, IND.—The Fort Wayne Electric Works Company is advertising for additional help in all its departments. The activity of the works has grown to such an extent that the present large force cannot take care of the business. S.

PARADISE, ARIZ.—The Leadville property at this place has been bonded by the owner, Geo. A. Walker, to W. V. Richards, of Bisbee. Mr. Richards agrees to begin operations by December 1. Machinery, including an electric pump and hoisting plant, will be installed at once.

ASHLAND, ORE.—The Siskiyou Power and Electric Company, which is stringing wires from its plant at Falls Creek to Dunsmuir, Cal., will have its work completed within a couple of months and will be ready to supply light and power to all points between Hornbrook and Dunsmuir.

GRAND FORKS, N. D.—Owing to the Electric Construction Company, of St. Paul, declining to carry out its contract for the installation of the new lighting system unless the payment of the warrants to be given for the work was guaranteed, the City Council let the contract to the next lowest bidders, Dinnie Bros. C.

ATLANTA, GA.—The waterpower of the Tallulah Falls property has been sold by the owners, Messrs. Moss, of Athens, to the Atlanta Power Company for $100,000. The new company will develop 18,000 horsepower. It is announced that a wireline will be built from Tallulah to Gainesville to connect with the line already running from that city to Atlanta.

SOUTH BEND, IND.—A conference was held in this city September 17 in the interest of the proposed canal from Lake Michigan to Lake Erie across northern Indiana. The conference was attended by leading business men of Chicago and Indiana and it was decided to make a definite move toward the construction of the canal for shipping and power purposes. S.

TELLURIDE, COLO.—Thousands of dollars' worth of damage has been done and nearly every mine in the San Miguel district shut down because of lack of power, as the result of a cloudburst that sent a flood down the south fork of the San Miguel River, burst the dam and damaged the storage reservoir of the Telluride Power Company, which supplies power for the mines.

GREENE, IOWA—When the extensive improvements now being made by the local light and power company are completed, Greene will have one of the best equipped lighting plants of any town of its size in this part of the state. About a month ago work was begun on an addition to the power house in which three large waterwheels, aggregating 200 horsepower, will be installed.

PAWTUCKET, R. I.—The Pawtucket Valley Textile Company, River Point, is to have additional machinery. In order to provide room required it is proposed to do away with the present motive power and install electric motors. Two motors will be installed at once, and if satisfactory the boilers and engine will be discarded and the room now used for these fitted up with new machinery. The product of the plant is silk.

COLUMBIA, S. C.—Equipment to drive the machinery by electricity is being installed by the Monaghan Mill, of Greenville. It has been driving with a 2,000-horsepower engine, and the new installation will enable the company to use both electricity and steam. The Monaghan Company will also distribute electricity for lighting the streets and houses in its mill village. About $30,000 is being expended for these betterments.

SALEM, ORE.—The Portland Railway, Light and Power Company has been granted a franchise by the Marion County Court for the construction of a high power transmission line from Mt. Angel to Woodburn. The power line will be installed at a cost of over $7,000 and Manager Rollin K. Page stated yesterday that this will materially improve the power service in Salem as well as in Woodburn, Mt. Angel and other towns in that vicinity.

COLUMBUS, OHIO—The Wooster Public Service Company has been incorporated under the laws of Ohio to conduct a general electric-light and power, gas-light and power, steam-heat and power business, operate subways, lay conduits and the like in Wooster and other cities. The company, capitalized at $300,000, is incorporated by James P. Taylor, C. V. Hard, W. H. Schott, Harry E. Taylor and D. J. Hard. C. V. Hard is interested in Cleveland light and power companies with his son D. J. Hard.

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ELECTRIC RAILWAYS.

(Special Correspondence.)

DAYTON, WASH.—The Walla Walla & Columbia Traction Company has estimates for building a power house. C.

OTTUMWA, IOWA—The Ottumwa Interurban Company has surveyed three routes for the interurban road to Oskaloosa. C.

PASADENA, CAL.—An interurban electric railway will be built from Pasadena to Los Angeles by the Pasadena Rapid Transit Company.

SANTA BARBARA, CAL.—The City Council has granted an electric-railway franchise to the Santa Barbara Consolidated Railway Company.

MILWAUKEE WIS.—The Milwaukee Electric Railway and Light Company is trying to secure the right-of-way for the construction of an electric road to Beaver Dam, a distance of fifty miles. C.

DES MOINES, IOWA—M. H. Miller, general manager of the proposed interurban to Sioux City, has secured a fifty-year lease on the block at Eighth and Market streets for a Des Moines terminal. C.

GOSHEN, IND.—The Winona Interurban Traction Company has secured a franchise to build an electric belt line in this city which, when completed, will bring the electric cars to the doors of eighteen factories. S.

CEDAR RAPIDS, IOWA—The Cedar Rapids & Iowa City Railway and Light Company is planning the construction of three interurban lines the coming year. One to Muscatine by way of Iowa City; another to Monticello, and a third to Waterloo. C.

FORT WAYNE, IND.—The Board of Commissioners has granted to the Toledo & Fort Wayne Electric road a franchise to build a traction line through Allen County from Fort Wayne to Hicksville. When completed direct electric traffic will be opened between Fort Wayne and Toledo.

PLYMOUTH, IND.—The Commissioners have granted a franchise to the South Bend & Logansport Traction Company to construct an electric road through Marshall County. When this road is completed there will be a continuous traction connection between Louisville and Chicago by way of Indianapolis. S.

EVANSVILLE, IND.—President H. B. Smith, of the Evansville street-car system and the Evansville & Southern Indiana Traction Company, denies the reportetd rumor that the properties were about to be sold to the Evansville Gas and Electric Light Works. "The traction property in question is not for sale," he declares. S.

MARSHALLTOWN, IOWA—A line of interurban railway built and in operation from Marshalltown to Grundy Center within two years, and from Marshalltown to Ames within three, guaranteed under a forfeiture bond of $50,000, is the proposition made by J. H. McBride, of Philadelphia, on behalf of himself and his associates, to the City Council.

COFFEYVILLE, KAN.—Work on the extension of the Union Traction Company's line from this city to Cherryvale, by way of Independence, is being pushed as rapidly as possible and before long cars will be running through to Cherryvale. A cut-off has been made between this city and Independence and the running time has been cut down to fifty minutes.

NEW ALBANY, IND.—Charles D. Kelso and J. H. Hawcett, of this city, have obtained a franchise for the construction of an interurban road through Floyd and Orange counties, connecting New Albany, Paoli, West Baden and French Lick Springs. The franchise provides that the road shall be completed and in operation by December 1, 1910. It is said Chicago capitalists are interested in the enterprise. S.

FORT WAYNE, IND.—Master Mechanic Jaynes, of the Fort Wayne & Wabash Traction Company shops, announces that he will soon turn out the first interurban passenger car ever built in Fort Wayne. Mr. Jaynes says he will next build an electric motor locomotive similar to those built and in operation by the Indiana Union Traction Company and the Indianapolis Columbus & Southern Traction Company. S.

SALT LAKE CITY, UTAH—The electrification of the Sultaire Beach road will begin at an early date. This means the double-tracking of the road to the beach. In addition to this, it is the intention to construct a boulevard one hundred feet in width from the city to the beach. This boulevard will, of course, be devoted almost entirely to automobiles, and it will be on a level with the railroad track all the way out. This line is now part of the "Harriman" system.

PIERRE, S. D.—Articles of incorporation have been filed with the secretary of state for the Missouri & Northern Railway Company, with headquarters at Gann Valley, and a capital of a million dollars. The proposed line is to be 100 miles in length and run through the counties of Charles Mix, Brule, Buffalo, Hand and Faulk. The incorporators are: W. O. Crockett, J. B. Ingerson and J. E. Zellbach, Gann Valley; J. Q. Anderson, Chamberlain, and J. B. Ross, Miller.

FLUSHING, L. I.—As the result of efforts of men representing large real estate holdings along the north shore from Long Island City to Flushing and particularly in this place, a movement is to be started to get the speedy electrification of the lines of the Long Island Railroad along the north shore and also to get a train service that will be beneficial to the residents of this section. A conference has been held with President Ralph Peters, of the Long Island Railroad.

PHILADELPHIA, PA.—The hearing in the application for a charter of the Philadelphia & Suburban Elevated Railway Company will be heard in Harrisburg on October 26. The application will be heard by the Board to Pass Upon the Necessity for the Construction of Elevated and Underground Passenger Railways. Members of the Board are Governor Stuart, Secretary of the Commonwealth McAfee and Attorney-General Todd. Opponents to the proposed railway will be heard at the same time.

GALESBURG, ILL.—The City Council of Galesburg has extended the life of the franchise of the Peoria-Galesburg Interurban Railway from twenty-five years to thirty years. The company asked for a forty-year franchise, but the Council will not go above thirty. The proposition of the company to carry freight over the streets of the city has been rejected. The extension of the life of the franchise meets with the approval of the company, and an assurance was given that the road will be built.

WARSAW, IND.—E. S. Scott, secretary of the Winona Interurban Railroad Company, has notified the secretary of state that the company's headquarters have been moved from Winona Lake to Warsaw. Also, that the following officers have been elected by the board of directors of the Winona-Warsaw Street Car Company, operating in connection with the interurban system: President, J. E. Byer; vice-president, W. D. Frazier; secretary, Sol. C. Dickey; treasurer, C. H. Worden; superintendent, J F. Byer. S.

KOKOMO, IND.—An important question has been raised in this city as to the right of a house-moving contractor's right to move a building along Main Street, which will interfere for a time with the through operation of cars by the Kokomo, Marion & Western Traction Company. The traction company has secured a temporary restraining order against moving the building, alleging that the company is carrying the United States mail. The question will likely reach the highest court of the state. S.

NEW CASTLE, IND.—Following the announcement that Judge Carter, of the Superior Court in Indianapolis, had ordered the issuance of $460,000 in receiver's certificates for the completion of the Indianapolis, New Castle & Toledo traction line, actual work has been commenced between this city and Kennard. It is expected that the electrical equipment, which was removed from the power house west of this city just previous to the receiver being appointed for the road, will be installed at once. It is expected the road will be in operation by December 1.

CANTON, ILL.—At a meeting of the directors of the Illinois Central Electric Company, held in Canton last week, it was decided to start work on the Fairview branch of the road as soon as the necessary bonds are subscribed. The whole matter after being worked over at the meeting was brought to the conclusion that upon the action of the people of Canton will decide whether the branch will be started this fall. The people of Fairview have subscribed $40,000 worth of bonds for the new extension up to this time and $30,000 are yet to be subscribed by residents of Canton, upon which action the work will start.

MARION, OHIO—Upon the application of the Cincinnati Trust Company, John G. Webb, of the Webb Construction Company, concurring, Judge Daniel Babst, of the local Common Pleas Court, has appointed Eli West, of Columbus, and George Whysall, of this city, co-receivers for the Columbus, Marion & Bucyrus Electric Railway. The road was built from Marion to Bucyrus two years ago and has been operated by the Webb Construction Company, the property never having been turned over to the holding company, the stockholders of which were practically the same as those of the Columbus & Marion Electric Railway, which went into the hands of a receiver some weeks ago.

GUTHRIE, OKLA.—A charter has been issued to the Enid and Central Traction Company, which proposes to build a network of interurban lines in Western Oklahoma, paralleling the Rock Island lines. The capital stock is $1,000,000. The incorporators are: W. H. Stewart, R. W. Whittinghill and C. E. Burhart, of Enid, and W. T. McMahon and J. W. Smith, of Toledo, Ohio. W. T. McMahon, the promoter of the road, has been in Oklahoma six months. He was formerly superintendent of the Toledo Railways and Light Company, of Toledo, Ohio, and it is understood that he is backed by New York, Philadelphia and Minneapolis capitalists, who built the Portland, Ore., Traction line and the Bay City-Saginaw, Mich., line.

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TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

OLIVIA, MINN.—It is proposed to install an independent telephone exchange here. C.

ORANGE, TEX.—The Southwest Telegraph and Telephone Company has opened its new exchange here.

RHINELANDER, WIS.—The Wisconsin Telephone Company is enlarging the facilities of the local exchange. C.

NORTHFIELD, MINN.—A vote will be taken September 28 on granting a franchise to the Northfield Telephone Company. C.

TOWNER, N. D.—The Towner Telephone Company has been granted a franchise by the county board to construct telephone lines. C.

SERGEANT BLUFF, IOWA—The Sergeant Bluff Telephone Company has increased its capital stock from $20,000 to $40,000. C.

KEOKUK, IOWA—The Mississippi Valley Telephone Company will expend $10,000 in improvements to its system in this section. C.

INDIANAPOLIS, IND.—The assessed valuation placed on telephone property in the state of Indiana by the State Tax Board is $10,096,284. S.

LAKE PRESTON, S. D.—Farmers living southwest of here are organizing a rural telephone company to construct a line to connect with this exchange. C.

ANACONDA, MONT.—A meeting of the stockholders of the Anaconda-Big Hole Telephone Company has been held for the purpose of considering the sale of the line to the Bell Telephone Company. C.

SOUTH BEND, IND.—The Home Telephone Company, Theodore Thorwood, president, has entered upon the work of expending $150,000 in improvements and extension of the plant. Several new circuits will be constructed. S.

NORTH MADISON, IND.—A movement has been started to install a new telephone system in this place and throughout Jefferson County. F. D. Dupraz, of Vevay, Ind., will be asked to superintend the building of the new plant. S.

SOUTH BEND, IND.—The Commissioners of St. Joseph County have granted a franchise to the Citizens Mutual Telephone Company of Marshall and St. Joseph counties to erect poles and string wires in the western townships. S.

MARTINSVILLE, IND.—The Citizens' Telephone Company has purchased the Caldwell Building and has entered on the work of remodeling it into a modern exchange building. The company will install a new automatic system in the building. S.

SOUTH BEND, IND.—The City Council has refused to grant the Central Union Telephone Company the privilege of laying conduits in certain quarters of the city. The Council insists that the underground work be placed in the alleys instead of the streets. S.

TYLERTOWN, MISS.—It has been stated on good authority that the Cumberland Telephone Company has purchased of F. E. Gressett the franchise recently granted him by the Mayor and Board of Aldermen of Tylertown to construct and operate a telephone system.

LA CROSSE, WIS.—A fight will be launched on the proposed merger of the La Crosse Independent Telephone Company and the Wisconsin Bell Company. E. H. Moulton, president of the Tri-State Telephone Company, says that every legal action possible will be taken to prevent the sale. C.

SAN FRANCISCO, CAL.—Certification of the increase of the capital stock of the Sunset Telegraph and Telephone Company from $3,000,000, divided into 30,000 shares of $100 each, to $15,000,000, divided into 150,000 shares of $100 each, has been filed with the county clerk. The resolution authorizing the increase was adopted at a meeting of stockholders at Martinez August 13, 1909. It was stated in the resolution: "It is estimated that a large sum will be required for the acquisition of the necessary facilities to meet and provide for the future business and operations of this corporation."

PEORIA, ILL.—A joint meeting of the representatives of the Western Union Telegraph Company, Postal and American District Telegraph companies with the streets committee of the Peoria City Council has been held to get the companies to place their wires underground. The two telephone companies have their wires underground and within a few weeks the lighting company will have finished the work of putting its wires underground in the business district, leaving only the companies mentioned with pole line. An ordinance will be framed and passed by the Council compelling the wires to be placed underground. V.

ELECTRICAL SECURITIES.

By the middle of this week the security market showed a very strong upward trend with widespread activity. It would seem as though the interests connected with the early summer bull campaign had again taken hold of the situation. Industrials of all kinds are very strong with United States Steel as a leader making new records.

At a directors' meeting of the Metropolitan Elevated, of Chicago, only routine business was transacted. The next meeting will be October 18, when the matter of dividends is likely to be considered, but no disbursements are expected before January. The Metropolitan Elevated dividend matter has been referred to the finance and executive committees.

The directors of the Public Service Corporation of New Jersey have declared a quarterly dividend of one-and-one-fourth per cent, putting the stock on a five per cent basis. This is an increase of one per cent in the yearly rate. They also voted to issue the $5,000,000 of capital stock remaining in the treasury of an authorized issue of $25,000,000 to stockholders of record September 30. Stockholders will be allowed to buy the new stock at par in the proportion of one share of new stock for each four shares of the old issue they hold.

The New York Telephone Company has increased its capital stock from $50,000,000 to $100,000,000, a certificate having been filed with the secretary of state and a tax of $25,000 paid upon the increase. A certificate has also been filed on the merger of the Central New York Telephone and Telegraph Company, with the New York Telephone Company.

The annual meeting of the International Traction Company will be held in Jersey City, October 26. Books close October 1 and reopen October 27.

The annual meeting of the Northwestern Elevated Company, Chicago, has been adjourned to October 25.

DIVIDENDS.

American Telephone and Telegraph Company; regular quarterly dividend of two per cent, payable October 15 to stock of record September 30.

Buffalo General Electric Company; regular quarterly dividend of one-and-one-half per cent, payable October 1.

Electric Storage Battery Company; regular quarterly dividend of three-fourths of one per cent on both the common and preferred stock, payable October 1 to stock of record September 25.

New England Telephone and Telegraph Company; regular quarterly dividend of one-and-one-half per cent, payable October 15 to stock of record September 30.

Union Railway, Gas and Electric Company; initial dividend of one-and-one-half per cent on the preferred stock of the corporation, payable October 1 to stock of record September 23.

NEW YORK.	Sept. 27.	Sept. 20.
Allis-Chalmers common	15	15⅜
Allis-Chalmers preferred	52½	52
Amalgamated Copper	83	83¾
American Tel. & Cable	80	80
American Tel. & Tel.	143⅞	142¼
Brooklyn Rapid Transit	79⅞	80⅝
General Electric	166	167½
Interborough-Metropolitan common	14¾	14⅞
Interborough-Metropolitan preferred	47¾	48
Kings County Electric	131	131
Mackay Companies (Postal Telegraph and Cables) common	92½	85¼
Mackay Companies (Postal Telegraph and Cables) preferred	76¾	74½
Manhattan Elevated	142¾	143
Metropolitan Street Railway	20	20
New York & New Jersey Telephone		123½
U. S. Steel common	84⅜	83¼
U. S. Steel preferred	128¼	127⅛
Western Union	79½	79½
Westinghouse common	86	86¼
Westinghouse preferred	133	130

BOSTON.	Sept. 27.	Sept. 20.
American Tel. & Tel.	143⅞	142¼
Edison Elec. Illuminating	252	252
General Electric	166	167½
Massachusetts Electric common	15⅞	17
Massachusetts Electric preferred	79	80
New England Telephone	138½	137
Western Tel. & Tel. common	11½	11
Western Tel. & Tel. preferred	89	89

PHILADELPHIA.	Sept. 27.	Sept. 20.
American Railways	46	46
Electric Company of America	12	12
Electric Storage Battery common (ex-dividend)	59	62
Electric Storage Battery preferred (ex-dividend)	59	62
Philadelphia Electric	12⅜	12½
Philadelphia Rapid Transit	27½	27¼
Philadelphia Traction	90	88⅜
Union Traction	53	52½

CHICAGO.	Sept. 27.	Sept. 20.
Chicago Railways, Series 1	108	110
Chicago Railways, Series 2	36	36
Chicago Subway	9	13
Chicago Telephone	136¼	131
Commonwealth Edison	120½	121
Metropolitan Elevated common	15	15½
Metropolitan Elevated preferred	51	48½
National Carbon common	95	96¾
National Carbon preferred	118¾	118½

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PERSONAL MENTION.

H. C. SPAULDING, well known in electrical circles, will hereafter be identified with the Yale & Towne Company, New York city. Mr. Spaulding is one of the pioneers in the electrical field.

JAMES WHALEY, general superintendent of the electric zone of the New York Central, succeeds W. G. Bierd as general superintendent of the New York, New Haven & Hartford Railroad about October 1. Mr. Bierd is to take service with President Stevens of the Oregon Short Line.

WILLIAM MARCONI, the wireless inventor, arrived at New York last week on the Caronia, accompanied by H. J. Davis, director in the English Marconi company. Mr. Marconi is to superintend the reconstruction of the Marconi company's station at Glace Bay, Nova Scotia, which was recently destroyed by fire.

G. W. ARMSTRONG, of Chicago, western manager of the Excello Arc Lamp Company, has returned to the city after a brief vacation in Fort Frances district, Ontario. Mr. Armstrong has been carrying on a very strenuous campaign and his vacation was well earned. He reports some excellent fishing and that incidentally he could not resist the temptation of hooking a few excellent orders for "Excellos."

W. L. LOVELAND, of the Allis-Chalmers Company, with which he has been associated for the past nineteen years and, since 1904, manager of the mining machinery department, has accepted a position with the Mine and Smelter Supply Company as general manager. H. C. Holthoff, for many years identified with the mining branch of the Allis-Chalmers Company and for the past two years manager of the Mexico office, will succeed Mr. Loveland as manager of the mining machinery department of the Allis-Chalmers Company and be located in Milwaukee. Mr. Holthoff is expected to arrive in Milwaukee about October 15.

W. E. WICKENDEN has been appointed assistant professor of electrical engineering at the Massachusetts Institute of Technology, to assume the work formerly done by Prof. George C. Shaad, who has gone to the University of Kansas to take charge of the similar department at that place. Mr. Wickenden graduated from Dennison University after following a course strong in mathematics and physics. He then taught a year in Rochester, N. Y., and followed that by a year of graduate study of physics at the University of Wisconsin. He is now in the electrical engineering staff of the University of Wisconsin and has made a record for himself as a coming man in teaching and research. He is author of a book now on the press on "Photometry and Illumination."

MATTHEW C. BRUSH, who is soon to retire from the management of the Boston & Suburban Street Railway lines, was honored by his associates and other railway officials with a banquet served at the Algonquin Club, Boston, on the evening of September 22. Six hundred guests were present. Henry C. Page, general manager of the Worcester Consolidated Street Railway Company, was chairman, and ex-Congressman Samuel L. Powers, of Newton, former president of the Boston & Suburban Company, was toastmaster. The speakers were Sidney Harwood, director of the Boston & Suburban lines; J. C. Calisch, of Buffalo, present general manager of the Lake Erie Traction Company, to which Mr. Brush is going; Benjamin S. Palmer, of the Newton Board of Aldermen; Mayor George Hutchinson, of Newton; Vice-President Allen, of the Syracuse, N. Y., Street Railway, and Russell A. Sears, general solicitor of the Boston Elevated Railway Company.

F. H. BANBURY, engineer of the Acheson Oildag Company, of Niagara Falls, sailed for Europe on September 25. Mr. Banbury is an Englishman by birth. He came to America about five years ago, and was connected with the Commonwealth Edison Company, of Chicago. It is his good fortune to have won degrees as a mining, mechanical and electrical engineer. It was a little over a year ago that he became connected with the Oildag Company, and now he goes to Europe in the extended patent interests of that company. He will first go to Genoa, Italy, later visiting other countries to establish the Oildag process as demand makes necessary. Inasmuch as Dr. Edward G. Acheson is president of the Oildag Company, and it was he who gave to the world deflocculated graphite as a lubricant, Mr. Banbury's mission in Europe may be adjudged to be one that will enlighten foreign countries to a considerable extent as to the merits of this wonderful lubricant.

C. B. HUMPHREY closes a valuable service of fifteen years with the Westinghouse Electric and Manufacturing Company, during the last five years of which he was manager of the detail and supply sales department, to become vice-president and director of the White Investing Company, 43 Exchange Place, New York city, which will negotiate the financing and development of enterprises based on natural resources, and deal in bonds and securities. Among the interests of the concern are the Agucate Gold Mines in Costa Rica, which are being developed and will be in operation in the near future. W. F. White, president of the company, who is a brother of J. G. White, was formerly manager of the Cincinnati Electric Company, and later vice-president of the North American Company. For a number of years Mr. Humphrey was district manager for the Westinghouse company, with headquarters at Cincinnati. He was called to the home office in 1903 to take charge of the detail and supply department, which in recent years has grown to an important factor in the total volume of Westinghouse business. Mr. Humphrey assumes his new duties October 1.

OBITUARY.

MILO G. KELLOGG, founder and president of the Kellogg Switchboard and Supply Company, of Chicago, died on September 26 at his home in Chicago. He had been prominently identified with the telephone industry and was the inventor of many patented telephone appliances and improvements. He was a resident of Chicago since 1870. Before organizing the corporation that bears his name he had been connected with the Western Electric Company. A few years ago his name was associated with much litigation relative to the ownership of the majority stock in the Kellogg Company, that had been sold to the Bell interests during a sojourn in California. Mr. Kellogg was sixty years old and had been in poor health for several years. He was a member of several Chicago clubs. He is survived by a widow and three children. His funeral was held from his late residence, 5001 Woodlawn Avenue, Chicago, on September 28.

PROPOSALS.

POST OFFICE AND CUSTOM HOUSE, EAGLE PASS, TEX.—The Supervising Architect, Washington, D. C., will receive sealed proposals November 1 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office and Custom House building at Eagle Pass, Tex., in accordance with drawings and specifications, copies of which may be had at the office of the custodian of the site at Eagle Pass, Tex., or at the Supervising Architect's office.

POST OFFICE AND COURT HOUSE, ALBANY, GA.—The office of the Supervising Architect, Washington, D. C., September 23, 1909, will receive sealed proposals until November 3, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring and standard clock system) of the U. S. Post Office and Court House Building at Albany, Ga., in accordance with the drawings and specifications, copies of which may be obtained from the custodian of site, at Albany, Ga., or at the Supervising Architect's office.

EDUCATIONAL NOTES.

EVENING CLASSES AT LEWIS INSTITUTE—On the evenings of October 4 to 8, inclusive, and on the afternoon of October 9, Lewis Institute will be open for the registration of students for the evening classes that have in past years become such a popular and successful feature of educational work in Chicago. The instruction in these classes will be resumed on the evening of October 11. What has proven to be probably the most popular of these classes is the series devoted to electrical engineering. This branch has been developed to a four-year course, in which the first year is devoted to general electrical principles, the second to direct-current machinery, the third to alternating-current machinery and the fourth to alternating-current analysis, based on Dr. Steinmetz's methods. Aside from the electrical course there are also given courses in architectural and mechanical drawing, structural steel design, concrete construction, shop, steam, gas and chemical engineering and a large number of general studies. There have been printed a series of topical outlines, giving in detail the work of each of these courses for each evening. Copies may be obtained from Prof. P. B. Woodworth, dean of the Evening School, Lewis Institute, Madison and Robey streets, Chicago, Ill.

HIGHLAND PARK COLLEGE—The new school year at Highland Park College, Des Moines, Iowa, has opened with an increased attendance in all departments of the college, there being 120 students more at the opening of this school year than at the opening of the school one year ago. In addition to the regular courses maintained one year ago, however, two new courses have been established that have brought quite a number of students into the school. One is an evening law school, which enables pupils to do enough work during the day to earn all of their expenses, and leaves them enough time to prepare their lessons to recite in the evenings. The other is the automobile course that has been established in the engineering department. The College of Liberal Arts shows an increase of about twenty per cent. The Normal College, the College of Music, the College of Engineering, the College of Pharmacy and the College of Commerce, including the Business, Shorthand, Telegraph and Pen Art departments, are now thoroughly organized with the largest and most enthusiastic classes they have ever had. During the past year something like $15,000 was spent in general improvements, equipments and accommodations in the college buildings and on the grounds. A special fall term opens October 18. This is arranged especially for those who were unable to take up work September 7.

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INDUSTRIAL ITEMS.

THE MICA INSULATOR COMPANY, New York, N. Y., manufacturer of high-grade insulating material, is distributing Catalogue No. 25, containing descriptions and prices of its products.

EUGENE MUNSELL & COMPANY, New York, N. Y., dealers in mica, are issuing a new price-list for selected mica, also a price-list of electrical mica and a booklet descriptive of their mica specialties.

THE PETTINGELL-ANDREWS COMPANY, Boston, Mass., is distributing the September issue of its publication, entitled "Juice." This issue contains much valuable information regarding electrical material.

THE DUPLEX METALS COMPANY, of 149 Broadway, New York city, is distributing some blotters, on which it calls attention to its copper-clad steel trolley wire and gives a letter from the Dominion Power and Transmission Company, referring to its use as giving excellent satisfaction.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, of Plainville, Conn., manufacturer of electrical supplies, is increasing its plant by the erection of a brick building, fifty by fifty feet and four stories high, to be used for manufacturing and storage purposes. This addition will be completed this fall.

THE DE VEAU TELEPHONE MANUFACTURING COMPANY, Brooklyn, N. Y., is distributing its fourteenth catalogue, containing a complete list of telephone apparatus and electrical specialties. In addition, it also contains a full set of wiring diagrams and specifications for modern telephone systems. This feature makes the catalogue particularly desirable. Copies may be had upon request.

THE COURTNEY SHOE COMPANY, St. Louis, Mo., is arranging to enlarge its power plant with a view of supplying its entire requirements for light and power. Proposals for one 200-horsepower high-speed Corliss engine, one 125-kilowatt three-wire direct-current generator, and twelve 230-volt motors of various horsepowers, have been invited by William H. Bryan, the company's consulting engineer.

THE H. T. PAISTE COMPANY, Philadelphia, Pa., has issued for free distribution a wall chart of Paiste pipe tablet combinations, etc., with 130 illustrations showing at a glance some of the many different combinations that can be effected with these fittings. All electrical contractors, and others interested, would benefit by keeping one of these charts in a conspicuous place on the wall for ready reference.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, Ill., will install a complete two-section switchboard, of the latest type, for the Logan Home Telephone Company, Logan, Ohio. This includes one chief operator's desk, one wire chief's desk and complete exchange equipment. In addition, the company has received twenty-six orders for switchboards during the first half of the present month.

THE BRISTOL COMPANY, Waterbury, Conn., announces that it has opened a branch office in the Frick Building Annex, Pittsburg, Pa., which will be in charge of an expert who will co-operate with customers whose plants are in the immediate vicinity. This company has made a specialty of studying the applications of Bristol's recording instruments in the many different industries for which the Pittsburg district is noted.

THE ELECTRO-MECHANICAL ENGINEERING COMPANY, Chicago, announces that owing to an increasing business it is compelled to enlarge its facilities and has moved into larger quarters, occupying Suite 607-610, Manhattan Building, 315 Dearborn Street. The company makes a specialty of designing and drafting, physical tests, specifications and plans, chemical analysis and assaying, research and experimental work and inspection.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., announces the following among recent sales of heavy electrical machinery—a contract for two three-phase, twenty-five-cycle, 6,600-volt, alternating-current generators, with a combined capacity of 8,000 kilowatts, to be direct-coupled to gas engines in the power plant of the Carnegie Steel Company's Carrie Furnaces, at Rankin, Pa. These are the largest machines ever built for service of this character.

THE BRILLIANT ELECTRIC COMPANY, of Cleveland, Ohio, the incandescent lamp manufacturer who is everlastingly doing something new, is enlarging its offices and general force. The business which this company holds has shown such an increase and is distributed throughout the country to such an extent that it is obliged to expand the entire organization. The company has added to its quarters in the Electric Building, Cleveland, Ohio, and considerably increased its force, both on the inside and on the outside. Special departments have been created for close co-operation with the trade, and a vigorous advertising campaign is already in action. The Brilliant Electric Company has intrenched itself strongly with the electrical buying trade and it today offers "Brilliant" lamps and "Brilliant" service.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has just issued bulletin No. 4677, which consists of data relative to the Sprague-General Electric system of control, and forms a revision of similar data contained in previous bulletin on this subject. The publication contains numerous illustrations showing the various pieces of apparatus used in connection with this system, with a description of each. It also contains a table of weights of this style of equipment for various horsepower capacities. The bulletin is one of general interest to railway men.

THE PERKINS ELECTRIC SWITCH MANUFACTURING COMPANY, of Bridgeport, Conn., has won the suit it has brought against the Yost Electric Manufacturing Company, of Toledo, Ohio, for infringement of Perkins Patent No. 626,927, covering details of an incandescent lamp socket. This suit was brought in the United States Circuit Court of the Northern District of Ohio, Western Division, and the decision prepared by Judge R. W. Taylor specifically upholds the validity of claims 3, 4, 6 and 9 of the patent in question and orders an injunction and an accounting.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing several new flyers descriptive of the well-known D. & W. specialties. Particular attention is called to a new sixty-ampere entrance cut-out for National Code fuses, for which a great many advantages are claimed. The publications on fuses and service boxes describe the weatherproof type arranged for open wiring or conduit connection. A number of new Deltabeston magnet coils are also described which should prove of interest to those operating electrical apparatus under overload conditions.

THE JENNEY ELECTRIC MANUFACTURING COMPANY, Indianapolis, Ind., announces that its new works at Anderson, Ind., have been completed and that the machinery equipment is rapidly being moved into position. This increase to the Jenney establishments has been rendered necessary by the demand for Jenney electric equipments, which for some time past has exceeded the manufacturing capacity of the company. The new plant includes five fireproof buildings on a ten-acre site, and quadruples the former manufacturing capacity of the Jenney company.

THE KUHLMAN ELECTRIC COMPANY, of Elkhart, Ind., has just published a pamphlet describing its high-efficiency transformers. These are built for all standard voltages and for all frequencies. The core and copper losses have been reduced to a minimum. Standard sizes of single-phase pole-type transformers kept in stock vary from six to fifty kilowatts. The efficiencies are exceptionally high and the regulation very good. All transformers are oil-filled and constructed of high-grade materials. In conformity with the practice of this company for the past fifteen years, each transformer is guaranteed for from two to five years.

THE OSHKOSH LOGGING TOOL COMPANY, Oshkosh, Wis., reports an active demand for its construction and linemen's tools, of which it has a large variety. This company has been in business since 1850 and, as the result of its extended experience in the manufacture of the tools required in logging camps, has developed a complete line of the tools and implements used for the entire erection of electrical pole lines. Among those are various tools for digging post holes, handling poles and wires, as well as tampers, reels, guy rods, pins and brackets, blow torches and furnaces, pliers, splicers, clamps, pole seats and cable trolleys.

HUBBARD & COMPANY, of Pittsburg, Pa., the well-known makers of telephone and telegraph line-construction material, announce that they have purchased the business of the Peirce Specialty Company, of Elkhart, Ind. C. L. Peirce, Jr., formerly president of the latter company and the designer of the specialties bearing his name, will be in charge of the new department of Hubbard & Company thus created, and the Peirce policy will remain unchanged. The Peirce specialties will hereafter be produced on a larger scale, which will insure immediate shipments, and complete stocks at several convenient points. A number of new specialties of merit will be placed on the market at once. Hubbard & Company have also secured an exclusive license to the Peirce patents.

THE CROCKER-WHEELER COMPANY, of Ampere, N. J., has recently received several large orders for direct-current apparatus. Among these is one from the Southern Iron and Steel Company, of Rogers, Ga., calling for two 250-kilowatt, engine-type, 550-volt, direct-current generators and 275 horsepower in 500-volt, direct-current motors. This is in addition to a recent order for 1,450 kilowatts in engine-type generators and 1,200 horsepower in slow speed motors from the same concern. The Republic Iron and Steel Company, Youngstown, Ohio, placed an order for a 600-kilowatt, engine-type, 250-volt, direct-current generator which will be added to a plant consisting of two 300-kilowatt Crocker-Wheeler generators. Another order has been booked from the Nonquit Spinning Company, New Bedford, Mass., covering 375 kilowatt in 250-volt Crocker-Wheeler type D direct-current generators. One 250-kilowatt, 250-volt, engine-type, direct-current generator and two fifty-horsepower motors are to be

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installed in a woolen mill for the Southwark Mills Company, of Philadelphia, Pa. Two seventy-five-kilowatt, engine-type, 125-volt, direct-current generators will be installed in the factory building of Goodman, Loeb & Company, Philadelphia, Pa.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY has just published as its Circular No. 1506 a reprint of the paper on "Recent Types of Arc Lamps and Their Operation," that was read by C. E. Stephens before the National Electric Light Association at the last convention in Atlantic City, N. J. In this paper the distribution and characteristics of the common, open and enclosed arcs are first briefly discussed to show their shortcomings in comparison with the metallic luminous arc lamp, which is described at length. The author makes out a strong case for this type of lamp and shows it to be the one most deserving of central-station favor for street lighting.

THE MASCHINENFABRIK OERLIKON, of Oerlikon, near Zurich, Switzerland, has recently published a number of interesting bulletins. Of these, No. 53 deals with large transformers for electrochemical purposes, describing in particular the construction and tests of 4,450-kilovolt-ampere single-phase transformers. No. 54 treats of auto-transformers for use with polyphase motors. No. 55 describes a line of new five and six-speed polyphase induction motors. Bulletin No. 56 is devoted to the application of variable-speed motors to the drive of cloth-printing machines. A circular (No. 509) describes a portable commutator-truing device. These publications of the Oerlikon company are printed in German and also in French.

THE WHEELER CONDENSER AND ENGINEERING COMPANY, Carteret, N. J., has recently introduced several important improvements in condensing apparatus, among which are the "dry-tube surface condenser," which has shown remarkable results in high vacuum work. The company has also in hand new and improved types of rotative dry vacuum pumps, centrifugal pumps, centrifugal jet condensers and cooling towers. The plant at Carteret, N. J., is being enlarged and improved. Among these improvements is a new power house, which will be equipped with several different systems of condensers for exhibition purposes, as well as for supplying the electrical energy which will be used throughout the shop.

DATES AHEAD.

Association of Car Lighting Engineers. Annual meeting, Chicago, Ill., October 4-7.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 4-9.

Colorado Electric Light, Power and Railway Association. Annual convention, Denver, Colo., October 7, 8 and 9.

New York Electrical Show. Madison Square Garden, New York, October 11-21.

Railway Signal Association. Annual meeting, Louisville, Ky., October 12-14.

The Order of Rejuvenated Sons of Jove. Seventh annual meeting, Cleveland, Ohio, October 14 and 15.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

Illinois State Electric Association. Annual meeting at Alton, Ill., October 26, 27 and 28.

Alabama Light and Traction Association. Annual convention, Birmingham, Ala., November 15 and 16.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 18.

Empire State Gas and Electric Association. Annual convention, New York city, November 17 and 18.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) September 21, 1909.

934,427. SPARK PLUG FOR GAS ENGINES. David H. Coles, Brooklyn, N. Y. Filed March 20, 1909. Has a device for cleaning the sparking terminals.

934,462. ELECTRIC MOTOR. Arthur A. Prevost, Mount Clemens, Mich. Filed March 13, 1909. An electric motor comprising armature and field magnets has a like number of poles divided into an unlike number of different groups, and means whereby the groups of the one are successively energized alternately in series with the group of the other.

934,463. CLEAT FOR ELECTRIC WIRES. William F. Ritter, Cincinnati, Ohio. Filed May 13, 1907. Describes a supporting cleat for conductor and suspension electric wires.

934,466. STARTING DEVICE FOR ELECTRIC MOTORS. Harold M. Scheibe, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 9, 1907. An electromagnetic device opens and closes the circuit for an auxiliary starting winding, and is operated by the magnetic reaction of the secondary member of the motor on the primary member.

934,470. SYSTEM OF ELECTRIC-MOTOR CONTROL. Herbert C. Soule, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 10, 1908. A voltage regulator has a transformer with two or more windings in multiple and non-corresponding taps in each winding, which together constitute a series of substantially equal voltage steps. Means are provided for interconnecting the taps to produce voltage steps not represented by any of the independent taps.

934,473. SUSPENSION MEANS FOR RAILWAY MOTORS. Norman W. Storer, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 10, 1908. The axle carries a quill to which the motor is operatively connected. Resilient suspension means are attached to the side of the motor near the motor bearings on the quill.

934,474. ELECTRIC-CIRCUIT INTERRUPTER. Harve R. Stuart, Wheeling, W. Va., assignor to Westinghouse Electric and Manufacturing Company. Filed July 9, 1906. Has stationary contact members in fluid-containing tanks, and movable bridging contact members co-operating with the stationary ones.

934,482. CIRCUIT-BREAKER. Curtis A. Tucker, Edgewood Park, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 3, 1907. Comprises means for holding the movable member of the breaker in open position, and means tending to close it; also an electromagnet winding and devices successively actuated thereby to withdraw the holding means and to supplement the closing means.

934,498. VOTING-MACHINE. William J. Bohan, St. Paul, and Daniel D. Smith, Jr., Minneapolis, Minn. Filed June 27, 1908. The individual registers are provided with corresponding magnetically-actuated switches, each of which when actuated restores the one previously set to its inoperative position.

934,538. ELECTRICALLY-HEATED SOLDERING MACHINE. Montgomery H. Johnson, Utica, N. Y. Filed June 1, 1908. A rotary soldering iron is enclosed in part by a case carrying a heating coil, the ends of which are connected to suitable collector rings engaging with contacts.

934,539. ELECTRICALLY-HEATED SOLDERING-IRON FOR CAN-CAPPING MACHINES. Montgomery H. Johnson, Utica, N. Y. Filed August 31, 1908. The iron has a vertical cavity in which is contained a heating coil.

934,541. CLUSTER-SOCKET. Walter C. Jones, Chicago, Ill. Filed October 20, 1906. The casing when removed from the insulated base leaves the binding posts for the shells and contacts accessible.

934,542. CLUSTER LAMP-SOCKET. Walter C. Jones, Chicago, Ill. Filed October 20, 1906. Has a pair of clamps attached to opposite sides of each of the insulating blocks that support the lamp receivers and their contacts, for connecting the lamp receivers with the contacts.

934,562. SUSPENDING DEVICE FOR TROLLEY-WIRES. William A. McCallum, Cincinnati, Ohio. Filed May 14, 1908. A hanger supports a member rotatively mounted in a two-part ear, which receives and clamps the wire.

934,565. COIN-CONTROLLED ELECTRIC CIRCUIT CLOSER John B. Obermeier, Milwaukee, Wis. Filed September 14, 1908. A motor-controlling switch mechanism is actuated by the swinging of a U-shaped metallic counterweighted trough located under a vertical runway.

934,573. MAGNETIC ARC-EXTINGUISHING MEANS. Olof A. Sandborgh, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed December 4, 1905. Describes a form of controller for electric circuits.

934,596. ELECTRICAL SYSTEM. Frank Conrad, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 3, 1907. Comprises two circuits, resistances, an electrical instrument connected between intermediate points of the resistances, and means for connecting the resistances between the circuits and between conductors thereof of opposite sign.

934,600. METHOD OF RECORDING SOUND VIBRATIONS. Percy W. Fuller, Boston, Mass. Filed May 2, 1908. Sound records are produced by depositing on a body a layer of magnetizable material which varies in thickness at different points in accordance with the variations in the sound vibrations to be recorded and then subjecting the body to a uniform magnetic influence to form a permanent magnetic record.

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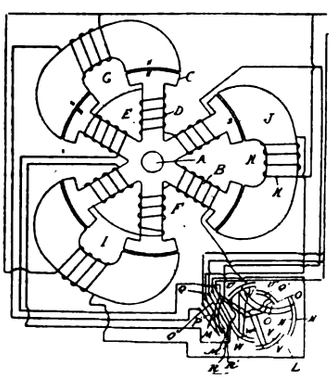
934,626. AUTOMATIC PRISON SIGNAL. J. Evron Rhoads and Henry C. Fashbaugh, Canton, Ohio. Filed May 10, 1909. Electric signaling mechanism is pneumatically operated.

934,670. JOINT FOR ELECTRICAL DEVICES. Joseph Keefe, Boston, Mass., assignor to Charles S. Knowles, New Bedford, Mass. Filed August 31, 1907. Is a coupling device for electrical conductors.

934,682. FLEXIBLE CONDUIT. George A. Lutz, New York, N. Y., assignor to American Circular Loom Company. Filed August 21, 1907. A conduit comprises a flexible tube, a spirally disposed insulating lining within the tube, and a spirally disposed winding surrounding the tube and wound in the same direction as the spiral lining, the edges of the lining and winding substantially coinciding.

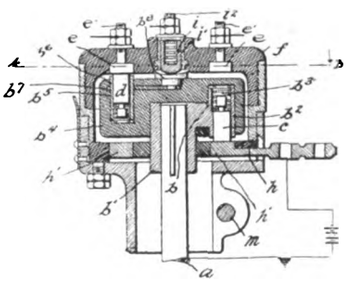
934,713. ELECTRIC INDICATOR AND SIGNAL. David G. Davies, Coeur d'Alene, Idaho. Filed November 16, 1908. The height of liquid in a tank controls the height of a connected mercury column which communicates through a series of contacts in the non-conducting pipe supporting the mercury column, with a series of resistances. The amount of resistance in circuit causes a variation in the current and thereby by means of a relay operates an indicator.

934,714. ELECTRIC CONDENSER. Edouard Deniéport, Suresnes, France. Filed May 23, 1908. Comprises a series of superimposed annular metal sheets, each alternate sheet being electrically connected at its outer edge, the remaining sheets being electrically connected at their inner edge and each sheet being insulated from contiguous sheets whereby the connected sheets are insulated from each other, and means for conducting current to each series of conducted sheets.



934,462.—ELECTRIC METER.

934,715. SPARK-DISTRIBUTER. Edouard Daniéport, Paris, France. Filed September 30, 1908. A head or block at the end of a rotating shaft carries (one at each opposite side) a primary and a secondary contact element, which co-operate respectively with a number of primary and secondary contact plugs, the former carried by an angularly shiftable plate, and the latter mounted in a stationary member adapted to form a cover for the distributor.



934,715.—SPARK-DISTRIBUTER.

934,754. REGULATOR FOR INCUBATORS. William B. Porter, Aberdeen, Miss. Filed March 5, 1908. A thermostat regulates a circuit closer in a circuit for short-circuiting the current in the main circuit through a selected coil of a series of coils.

934,760. MEANS FOR LOCKING ELECTRIC LAMPS WITHIN THEIR HOLDERS. Henry W. Roy and Arthur Weber, Wellington, New Zealand. Filed June 7, 1909. A band or collar encircles the holder, in which are formed apertures or slots adapted to pass over the pins of the lamp-socket piece, and means are provided whereby the band or collar may be caused tightly to encircle the holder.

934,781. CALORIC CIRCUIT-BREAKER. Charles C. Woodworth, Portland, Ore. Filed March 9, 1909. In combination with a line circuit of a stationary contact member and a movable contact member connected with this circuit, are means whereby these members may be placed in contact to close the circuit, means for holding the members in contact, means for separating the members, thermally actuated means controlling the separation thereof, and means for extinguishing the arc produced by separating the members.

934,796. ARC LAMP. Henry E. Davies, Weehawken Heights, N. J. Filed October 1, 1907. Has a number of downwardly pointing electrodes impregnated with a compound of a rare earth, in combination with an economizer, the inner walls of which are similarly impregnated, adapted to be rendered incandescent by the continued presence of the arc.

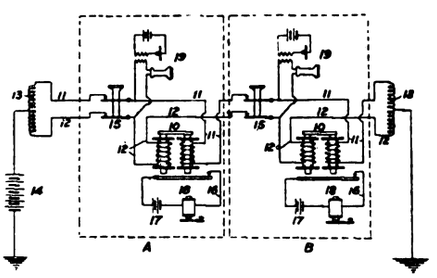
934,811. MEANS FOR REDUCING THE REACTANCE OF ELECTROMAGNETIC DEVICES FOR TELEPHONE CIRCUITS. Winthrop K. Howe, Rochester, N. Y., assignor to General Railway Signal Company. Filed April 13, 1909. In combination of a two-wire telephone circuit, are a series of telephones connected with the two wires of the circuit, a series of keys for making and breaking both lines of the circuit, an electromagnetic device having two coils, one in each of the lines and a tubular copper sheath immediately around the core of each coil, and a source of current connected with the telephone circuit for energizing the electromagnetic device.

934,816. SAFETY ATTACHMENT FOR MINE ELEVATORS. Morgan E. Jolliffe, Uniontown, Pa., and John H. Cowan, Jefferson, Ohio. Filed September 5, 1908. An electrically operated brake is provided for stopping the hoisting mechanism.

934,820. CONTROLLING APPARATUS FOR ELECTRICAL MACHINERY. Louis Krieger, Colombes, France. Filed October 16, 1907. In combination with a generator having a shunt winding and a series winding, is a demagnetizing winding opposed to and of greater power than the series winding, also a movable contact adapted to connect the ends of the demagnetizing winding to short-circuit the same.

934,839. IRON ELECTRODE. Max Roloff, Hagen, Germany. Filed October 28, 1904. Active material for negative pole plates of alkaline accumulators consists of magnetic oxide of iron magnetically derived from forge-scale and free from non-magnetic ingredients of the scale.

934,842. SPARKER MECHANISM FOR INTERNAL-COMBUSTION ENGINES. Henry Schaake and John T. Cowie, New Westminster, British Columbia, Canada. Filed July 27, 1908. Comprises a sparker plug, a movable electrode having a stem passing therethrough, a trip lever having a pivotal portion mounted on the sparker plug to operate the movable electrode, an upward projection (from the sparker plug) having bearings to support the upper ends of the pivotal portion of the trip lever and the movable electrode stem.



934,811.—MEANS FOR REDUCING THE REACTANCE OF ELECTROMAGNETIC DEVICES FOR TELEPHONE CIRCUITS.

934,843. TELEGRAPHONE. Frederic Schaefer, Wheeling, W. Va., assignor to American Telegraphone Company. Filed April 8, 1908. Comprises a record medium, a recording or reproducing device in engagement with the surface thereof; a carriage in which this device is mounted, a feed mechanism for the carriage and means for connecting and disconnecting the carriage to and from the feed mechanism without displacing the recording or reproducing device.

934,854. PROCESS OF ELECTRICALLY WELDING METALS. Charles R. Sturdevant, Worcester, Mass., assignor to American Steel and Wire Company. Filed April 1, 1909. The process consists in insulating the surfaces by fusible insulating material, placing an intermediate body of fusible material between the surfaces, and passing a current through the intermediate body until the insulating material has melted.

934,865. MICROPHONE DESK-STAND. Alfred H. Weiss, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company. Filed November 26, 1906. Has a vertically reciprocating set-supporting rod, in combination with a link carried upon the lower end of this rod, switch springs mounted in the base of the stand, and means to impart a pressure upon such springs in excess of the pressure upon the reciprocating support.

934,874. FAULT-FINDER. Theodore E. Anderson, Superior, Wis., assignor of one-fourth to Charles R. Fridley, one-fourth to Fred Speechly, and one-fourth to Solon L. Perrin, Superior, Wis. Filed November 25, 1908. Describes in detail a simple device for locating faults.

934,875. WIRELESS-TELEGRAPH TRANSMITTER. Clifford D. Babcock, New York, N. Y., assignor to United Wireless Telegraph Company. Filed June 11, 1908. Comprises a transformer, condenser, spark gap, etc.

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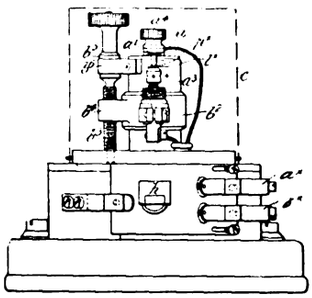
934,883. WIRELESS TELEGRAPHY. Sidney G. Brown, London, England. Filed June 3, 1904. A wireless receiver or radioscope has superposed contacts consisting of a blunt point and a plate having interposed therebetween electrically-deposited peroxide, which is obtained from the lead terminal of a storage battery.



934,883.—WIRELESS TELEGRAPHY.

934,895. RAILWAY-TRAFFIC-CONTROLLING DEVICE. Frank L. Dodgson, Rochester, N. Y., assignor to General Railway Signal Company. Filed July 21, 1903. In combination with a movable railway-traffic-controlling device are a motor therefor, a source of electric energy, operating and indicating wires, a controller, means for reversing the connections of the motor for cutting off the motor and for making the indicating circuit from the source of energy comprising an electromagnetic device in the operating circuit, a pole changing switch moved by this device, means for cutting off the source of electric energy after indication, and means for causing the breaking of the indicator circuit after the magnet has broken the operating circuit.

934,896. SAFETY-RELAY. Frank L. Dodgson, Rochester, N. Y., assignor to General Railway Signal Company. Filed October 12, 1908. The relay circuit has two contacts, one of which is movable by the relay, and automatic means are provided for producing and maintaining a break in the circuit when one of the contacts is maintained abnormally against the other.

934,902. CONTROLLING MECHANISM FOR ELECTRICITY-METERS. Evan Evans, Berlin, Germany, assignor to Bergmann Elektricitats Werke Aktiengesellschaft, Berlin, Germany, a corporation of Germany. Filed June 3, 1908. Comprises a rotary member, two cams mounted to rotate therewith yet adjustable circumferentially one relatively to the other, two levers controlled by the cams individually, and shifting mechanism carried by one of the levers and mechanically connected with the other.

934,908. SELF-ANSWERING SIGNAL SYSTEM. Edwin R. Gill, Yonkers, N. Y., assignor to United States Electric Company. Filed January 13, 1909. Includes an electromagnet having coils connected to a main line, an electromagnetic signal device, an electric circuit for the signal device including one or more coils on the first-named electromagnet, and a circuit changer for the last-named circuit, arranged to be operated by energizing said magnet.

934,920. CENTRIFUGAL SWITCH. Carlton L. Kennedy, South Braintree, Mass., assignor to the Holtzer-Cabot Electric Company. Filed June 14, 1909. Comprises a rotary support, a pair of similar centrifugal contact arms pivoted upon the same side of the center of rotation of the support, and two springs cross-connected at their ends to the arms.

934,930. INSULATOR-PRESSING MACHINE. Thomas T. McCann, East Liverpool, Ohio. Filed November 3, 1908. Describes the machine in detail.

934,950. LOCKING ATTACHMENT FOR FUSE-BOXES. Willis R. Vanaman, Atlantic City, N. J. Original application filed June 10, 1908. Divided and this application filed February 26, 1909. A cover is hinged to the box and has a slot formed upon an arc of a circle; a lever is fulcrumed at one end to the cover and carries at its free end a handle projected through the slot; lock bars are provided having pivotal relation with the fulcrumed end of the lever for engaging the bar-receiving openings of the fuse box; and a casing is arranged upon the cover for protecting the lever and lock bars.

934,973. RHEOSTAT. Henry T. Jones, Bellevue, Pa. Filed October 19, 1908. Comprises a sweep arm pivoted at one end near the center of the supporting base, an arc-shaped series of contacts mounted on one side of the base with which the other end of the arm co-operates, a column of flat conducting disks arranged near the other side of the base and held to a block, a fixed rod on which the block and disks are both freely slidable, and a connection extending between the block and the arm, whereby, as the arm is moved on its pivot, it serves to force the block upward on the rod and thus compress the column of disks.

934,977. ELECTRICAL SIGNALING AND SWITCHING APPARATUS. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company. Original application filed June 14, 1905. Divided, and this application filed September 10, 1906. An electromagnet comprises a magnetic frame, a spool carrying the magnet winding and supported in or on the frame, and a spring latch detachably securing the parts together.

934,978. SPARKING MECHANISM. Roy C. Marks, San Diego, Cal., assignor of one-eighth to R. H. Gunnis, one-eighth to Oliver J. Winston and one-eighth to W. W. Whitson, San Diego, Cal. Original application filed September 12, 1906. Divided and this application filed February 6, 1908. An internal combustion engine having a plurality of rotatable cylinders, has a spark plug on each cylinder, a brush carried directly by each spark plug, an elongated stationary contact with which each brush engages for a time period sufficient to include the limits of advance and retardation of the spark, means for charging each spark plug while its brush is in engagement with the stationary elongated contact, and means for causing the advance or retardation of the spark at will.

934,979. SELECTIVE DEVICE FOR PARTY-LINE TELEPHONES. Frank J. Mersman and Joseph Mersman, Ottawa, Ohio. Filed May 29, 1907. Includes a magnet, a pivoted armature associated therewith, a second armature, a ratchet wheel, a normally closed contact, means whereby the pivoted armature moves the ratchet wheel when the magnet is energized by a low voltage current, and means whereby the second armature breaks the contact when the magnet is energized by a high-voltage current.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired September 27, 1909:

483,124. ELECTRIC HEATER. Thomas Ahearn, Ottawa, Canada.

483,168. METHOD OF MEASURING THE STRENGTH OF MAGNETS. Charles H. Rudd, Evanston, Ill.

483,175. TEST SYSTEM FOR MULTIPLE SWITCHBOARDS. Charles E. Scribner, Chicago, Ill.

483,189. ELECTRIC METER. Addison G. Waterhouse, Hartford, Conn.

483,231. CIRCUIT-CLOSER FOR RAILROAD-CROSSING SIGNAL MECHANISMS. Irvin W. Loy and Richard O'Toole, Mechanicstown, Md.

483,235. ELECTRIC CUT-OUT AND SWITCH BOX. Llewellyn D. McMunn, Cromwell, N. D.

483,285. ELECTRIC CABLE. Theodore Guilleaume, Cologne, Germany.

483,308. WATCHMAN'S ELECTRIC TIME RECORDER. Nelson H. Raymond, Buffalo, N. Y.

483,310. ELECTRICAL ANNUNCIATOR. Nelson H. Raymond, Buffalo, N. Y.

483,316. ELECTRIC SNAP SWITCH. Seth F. Alden, New Bedford, Mass.

483,366. ELECTRIC RAILWAY SYSTEM. Andrew L. Riker, New York, N. Y.

483,388. TROLLEY-TRACK HANGER FOR ELECTRIC RAILWAYS. William Q. Prewitt, Lexington, Ky.

483,423. PROCESS OF ELECTRIC WELDING. Charles L. Coffin, Detroit, Mich.

483,424. ELECTRIC METAL-WORKING DEVICE. Charles L. Coffin, Detroit, Mich.

483,425. PROCESS OF ELECTRIC METAL WELDING. Charles L. Coffin, Detroit, Mich.

483,426. PROCESS OF ELECTRIC METAL HEATING. Charles L. Coffin, Detroit, Mich.

483,427. ELECTRIC METAL WORKING. Charles L. Coffin, Detroit, Mich.

483,428. PROCESS OF ELECTRIC METAL WORKING. Charles L. Coffin, Detroit, Mich.

483,431. ELECTRIC MOTOR. William M. Dresskell, Brainerd, Minn.

483,494. ELECTRIC RAILWAY CONDUCTOR. Rudolph M. Hunter, Philadelphia, Pa.

483,506. TEST SYSTEM FOR MULTIPLE SWITCHBOARDS. Oro A. Bell, New York, N. Y.

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CONTENTS.

EDITORIAL:
Convention of the Illuminating Engineering Society 667
Income from Tungsten Street Lamps 668
Central-Station Developments in Massachusetts 668
Meter Expenses 669
The Hudson-Fulton Celebration 669
AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION 670
Fight for Control of Worcester Electric Light 671
Rumored Consolidation of Chicago Public Utility Corporations 671
Quarry Street Plant Enlargements 671
Association of Car Lighting Engineers' Annual Convention 672
Illinois State Electric Association's Convention 673
Interesting Electrical Developments in Mexico 674
Pinchot Still Suspects a Power Trust 674
Chief Engineer of the Panama Canal Inspects the Necaxa, Mexico, Dam Break, Seeking Pointers 674
The Development of Niagara Falls 675
Pittsburg Section, American Institute of Electrical Engineers 675
Electrification Tests in France 675
The Improved Trolley Car 677
Mr. Edison and Dr. Steinmetz 677
Chicago Electric Club 677
American Institute of Electrical Engineers 677
Western Association of Electrical Inspectors 678
Westinghouse Company's Dividends 678
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
Illuminating Engineering Society's Third Annual Convention at New York 679
Illuminating Engineering Society of Great Britain 683
Hudson-Fulton Celebration—Illustrated 684-687
ELECTRO-CHEMISTRY AND METALLURGY:
Electricity and Fertilizers 688
A New Electric Transformer Furnace 689
Electrolytic Iron 690
A New Electric Furnace for Iron Extraction 690
New Electrochemical Developments in South Africa 691
TELEGRAPHY—TELEPHONY AND WIRELESS:
The Bolt Head Wireless Station 692
British Government Takes Over Lloyds and Marconi Wireless Stations 694
The Cable Controversy in Newfoundland 694
The Telephone in Europe 695
A New Machine for Constant Current 695
Navy Department Supplies 695
ELECTRICAL NOTES FROM GREAT BRITAIN 696
To Test New Recording Compass 698
Trolley Line Sleepers from Chicago to St. Louis 698
Exhibitors at the New York Electrical Show 699
BOOK REVIEWS 700
AMONG THE CONTRACTORS AND SUPPLY MEN 701
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 702-703
INDUSTRIAL SECTION:
Small Motors 704
New Wire Building for the Diamond Rubber Company 705
A New Pliable Insulating Material for Floors 705
Jewel Electric Washers 705
New Factory of the Moore Electrical Company 705
Flame Arc-Lamp Carbons 706
Allis-Chalmers Steam Turbines 708
Modern Methods in the Creamery 709
Tantalum Lamps for Railway Service 710
General Motors Company's Plans 710
General Electric Company Awards at the A. Y. P. Exposition 710
CURRENT ELECTRICAL NEWS 711
DIRECTORY OF ELECTRICAL AND ALLIED ENGINEERING AND SCIENTIFIC SOCIETIES 718
RECORD OF ELECTRICAL PATENTS 720

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CONVENTION OF THE ILLUMINATING ENGINEERING SOCIETY.

The Illuminating Engineering Society has passed a crucial point in its development in a most successful manner. The third annual convention, a full report of which is given on other pages of this issue, will be remembered for both the number and the quality of its papers and the high standing of the members who not only attended but also discussed the papers. A registration of only 244 members, less than one-quarter of the total membership, was partly due to the fact that many of the New York members were busily engaged in perfecting the lighting arrangements in connection with the Hudson-Fulton Celebration.

The convention lasted three days, and during that time there were eighteen papers and one lecture, three reports and three addresses delivered. The subjects covered work in both America and Europe and at least two of them will undoubtedly find their way to the technical press of the entire world.

Among the papers presented was an admirable one by Mr. E. L. Elliott on "The Ethics of Illuminating Engineering," which may well form the basis of the professional practice of this young branch of the engineering profession. The two papers describing the laboratories of the United Gas Improvement Company and the National Electric Lamp Association show in the former case the high standard of scientific refinement that the gas interests now recognize as being necessary in the conduct of all laboratory tests of lighting devices, and in the latter the laudable determination of a commercial body to institute researches into the exact determination of the physical, physiological and even psychological principles underlying the art of illumination; the results of these researches will doubtless prove of the utmost value to the illuminating engineer.

The paper on "The Light of the Fire-fly" that was presented by Drs. Ives and Coblentz brings out forcibly the extraordinarily high efficiency of this little creature as a light producer. Its luminous efficiency was ascertained to be 96.5 per cent, as compared with 1.3 per cent for what we are accustomed to regard as the high-efficiency tungsten lamp. This is a striking presentation of the great strides that we must make in order to achieve anywhere near the efficiency of natural light. It must be said, however, that the light of the fire-fly is of too restricted an order of radiation, being strongly green. The authors of the paper in question have estimated that a luminous efficiency

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of forty-five per cent may be regarded as the maximum theoretically attainable for pure white light. Even at this estimate there is room for increasing the efficiency of illuminants nearly thirty-five times over that of the tungsten lamp.

Dr. Louis Bell presented a simple and yet classical outline of the principles of shades and reflectors in his paper of that title, in which he also cautioned against very heavy etching of prismatic glassware. The problems involved in heterochromatic photometry were portrayed by Mr. Preston S. Millar and will doubtless stimulate further investigation of methods for reducing the errors of light comparisons with sources of different colors. The paper by Mr. L. B. Marks on "Factory Lighting" showed forcibly the wasteful and thoroughly unsatisfactory lighting conditions that are sadly too prevalent in even large shops. Messrs. Macbeth and Eustice submitted papers that draw attention to the great discrepancies found in actual commercial practice from the results theoretically estimated.

The papers referred to above are but a few of the more striking ones that were presented before the convention and show conclusively the important work that the society is carrying on and the intrinsic value of its proceedings to the betterment of the art of illumination.

INCOME FROM TUNGSTEN STREET LAMPS.

When tungsten lamps were first introduced some persons feared that they would reduce the income of central stations, but this does not appear to be the result as far as street lighting is concerned.

During the past year tungsten street lamps have been installed in large numbers, replacing the carbon incandescent, and even arcs to some extent, and yet the general result appears to have been to maintain the previous income from street lighting, and even to increase it in some cases.

This result has been attained by a division of the benefits from the higher efficiency of tungsten lamps, so that while the public has obtained more light, the rate per lamp or per substituted group of lamps has been little, if at all, decreased.

On going over a list of more than two score stations that have adopted the tungsten lamps for street lighting to the substantial exclusion of the incandescent carbon filament, and in some instances for a part or even all of the arcs, numerous examples are noted that support the above conclusions.

Thus, a small town that formerly had seventy-two incandescent street lamps of thirty-two candlepower for which it paid the electric company $25 each per year has exchanged these for seventy-four tungsten lamps of forty candles each, and pays the same rate per lamp. Another town formerly had 180 street incandescent lamps rated at twenty-five candlepower, for which $18.75 per lamp-year was paid, and now there are 190 tungsten lamps of forty candlepower in their place at the same rate per lamp. Where there were thirty-eight incandescent lamps of twenty candlepower and twenty-one arcs of 2,000 nominal candlepower in a certain town last year, which gave the central station an income of $2,154, there are now 215 tungsten lamps of forty candlepower on the streets that yield an income of $4,165 per year to the electrical supply company.

Among the larger places is a city that a little more than a year ago was paying $15 annually for each of 630 street lamps of twenty-five candlepower each, and now the equipment is 637 of forty candlepower and the rate is still $15 each. In another city 1,153 street lamps of twenty-five candlepower have given way to 1,157 tungsten lamps of forty candlepower, with no reduction of rates. Arc lamps that were lighting the streets of another city have been replaced in part by 1,500 tungsten lamps of 100 candlepower each, at a more than equivalent rate.

Besides the substitution of tungsten lamps for the carbon incandescent and the arc, there has been an important gain to the income of central stations by the selection of the tungsten lamps for streets where mantle gas burners would have been used rather than the carbon incandescent. In one instance of this sort 572 of the sixty-candlepower tungsten lamps were installed, at the rate of $23.48 each per year.

Tungsten lamps have had much to do with the extension of what may be termed display street lighting in business centers, which aims to attract people and patronage by artistic and intense lighting effects. An example of this sort is at hand where about fifty tungsten clusters of five sixty-candlepower lamps each have been located fifty feet apart in a business district, as an addition to the regular street lamps. The yearly rate for each of these clusters is $109.20, so that fifty increase the central-station income by $5,460 per year.

In another instance seventy-six arches of tungsten lamps have been erected across streets in the business center of a city, at an annual rate of $126 per arch, thus giving an income of $9,576 per year. In each of these arches there are eighteen tungsten lamps of sixty candlepower, ranged five feet apart, and the distance is 100 feet from arch to arch.

Sign lighting has been much increased by the low rates made possible with tungsten lamps, and this may be considered a special form of street illumination in many cases.

CENTRAL-STATION DEVELOPMENTS IN MASSACHUSETTS.

Centralizing tendencies are making themselves felt very strongly in Massachusetts electric light and power circles at the present time. The Edison Electric Illuminating Company of Boston is expanding along highly economic lines, taking into its efficient organization various suburban lighting properties which have previously been independently operated, and supplying its notably reliable power to several electric railways at a considerable distance from the city. These roads have for years past depended upon a none too efficient and steady self-generated service. Reductions in rates amounting to at last twenty per cent accompany the absorption of these properties in several instances, thus effectively disposing of the charge so often made that consolidation offers an excuse for an increase in prices. Waltham, Newton, Brookline, Brighton, Watertown and Chelsea are the latest Boston suburbs to benefit from the establishment of full Edison service

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at downtown rates. It is an undisputed fact that in many of these suburbs gas has held sway for so long that electric lighting has been used less extensively than in many of the towns of equal size in the West, so that the separation of the gas from the electrical business in the latest Massachusetts consolidation opens the way toward a much larger application of electricity for both lighting and power service than has before appeared feasible.

At a meeting of Massachusetts electrical men in Swampscott a few weeks ago, Mr. Everett W. Burdett predicted that the trend of development in the Bay State is to be along the lines of centralization in power supply, with the gradual elimination of small and relatively wasteful stations, the assumption of executive responsibilities by a few well-trained managements, and in general the expansion of electrical service in fields as yet little utilized. Already this movement toward larger savings and broader revenues is well under way, and under the progressive supervision of the Massachusetts Gas and Electric Light Commission there is likely to be little opportunity for even the most cordial enemies of centralization in public utilities to fear the expansion of the Boston system into the larger field of power and lighting supply westward from the New England capital.

Another important movement is the advance of the service of the Connecticut River Transmission Company into Worcester County, entrance into the city of Fitchburg now having been granted under restrictions previously reviewed in these columns. Franchises have been granted to the company for the supply of energy in the city of Worcester and the town of Clinton, and in each case the local companies have appealed to the Commission against the action of the municipal authorities. The Worcester case has been heard, and the Clinton appeal has yet to be argued. In each of these cases the same general principles of action on the part of the local companies appear, the fundamental cause of dispute being over the small power business.

As the transmission company has publicly announced its desire to be a wholesaler rather than a retailer of electrical energy, and as the Commission laid down with extreme care in the Fitchburg case the sphere of each power-producing organization's acceptable activities, it is singular that the municipal authorities continue to impose in franchise grants terms requiring the sale of hydroelectric power to consumers whose installations are of very small capacity. There is no longer any doubt that the entrance of Connecticut River power into central Massachusetts can be made a permanent benefit to the communities supplied, and without interfering with the legitimate prosperity of the older central-station organizations. While the small consumer may not at once profit in direct measurable rate reductions from the entrance of the Transmission Company's power, he cannot fail to benefit indirectly from the introduction of this service, which will probably tend to reduce the cost of operation somewhat in the local stations handling it.

METER EXPENSES.

Meter expenses make up a rather large item in the annual cost of operating an electrical supply system.

In connection with a large plant that has about 25,000 meters in use, the cost of meters that were discarded in a recent year, and the cost of rebuilding meters, and the cost of erection and removal of meters on the premises of consumers was $19,874. The number of discarded meters that went to make up this item was 509 for the year.

An additional item of expense in this same year was $21,534 for the wages of meter-repair men, and $6,830 for the material, teaming and other expense connected with this work. The wages of meter readers for the year amounted to $8,860, and incidental expenses connected with reading raised the total under this heading to $10,511.

In a hearing that involved the above matters, the following estimate was offered of the necessary annual expense per small meter of not over twenty lamps capacity.

The average first cost of these small meters was said to be about $12 each, and to this sum was added $1.50 per meter for the cost of installation. For interest and depreciation on each of these meters the annual expense was put at $2.79, on the basis of a life of seven years and interest at six per cent.

Testing and repairs on each meter were put at the average figure of seventy-seven cents per year, and for the reading of the meter the estimate was forty-two cents. Each small consumer was said to have ten lamps on an average, valued at $1.60, and twenty per cent of this sum, or thirty-two cents per meter, was taken to cover interest and depreciation.

As each meter constantly consumes a small amount of energy when connected to the circuit, whether any current is supplied through it or not, the cost of this lost energy was estimated at $4.80 per meter per year.

The above-mentioned cost to the company per meter was intended to cover interest and depreciation on its cost, and also billing, testing, postage, reading and the energy consumed.

For all meters on the system, large and small, the average cost of testing and repairs was $1.10 per meter per year, and this was based on the practice of testing meters once a year. As to the estimate of $4.80 per year for energy wasted in the meter, this figure was based on the rate of twelve cents per kilowatt-hour for this energy. The cost of reading and billing was estimated to be the same for large and small meters.

THE HUDSON-FULTON CELEBRATION.

After all the proof of the pudding is in the eating and what you see you know and realize. Most people could not see the great and glorious carnival held in New York the past two weeks. But we are now able to reproduce photographs of what is now acknowledged to be the greatest illumination in the history of the world. Particular attention is drawn to the wonders of the scintillator—every color of the rainbow directed on steam and the effect lovely beyond conception.

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American Street and Interurban Railway Association.

(*By telegraph to the* ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.)

Denver, Colo., October 5.—The 1909 convention of the American Street and Interurban Railway Association and its affiliated associations was opened auspiciously Monday morning, October 4. Before noon upward of 3,000 delegates, manufacturers' representatives and guests had been registered. The special train service that had brought this large gathering to Denver was excellent. On arrival the delegates found the hotel accommodations to be very good and the weather perfect.

The first session of the American Street and Interurban Railway Transportation and Traffic Association was called to order at the Auditorium yesterday at 2:30 p. m. An address of welcome was delivered by John A. Beeler, vice-president and general manager of the Denver City Tramway Company and vice-chairman of the local entertainment committee. Following this came the presidential address of C. Loomis Allen. In this President Allen called attention to the fact that, although the association had been organized only in January, 1908, it had held a very successful meeting at the October convention last year. This year the executive committee had determined that the programme would be devoted to the reading and discussion of the reports of standing committees and of papers forming parts thereof. The adoption of these reports will give to the transportation world the results of the best practice up to date. Future changes in operation will be made amendments, and modifications of the reports will be necessary from time to time. Therefore, the committee work must be continued.

The report of the executive committee covering the action taken at the meetings held January 28 and July 19, 1909, was read. The report of Secretary and Treasurer Bernard V. Swenson was read by him. The report of the committee on passenger traffic was read by its chairman, M. C. Brush, who took the chair during the discussion of this report. This committee made an elaborate exhibition of advertising literature in the form of timetables, illustrated and descriptive folders, posters and display advertising. The discussion was opened by E. F. Peck, who said that his own experience convinced him that high-class pictorial folders, timetables and newspaper advertising was extremely beneficial in creating passenger traffic. F. W. Coen said that he believed the liberal use of advertising devoted to some particular attraction was most beneficial. One of the best means of advertising, he had found, was the publication of a large pictorial map; a supply of 100,000 of these had been exhausted in ninety days. H. S. Page said the interest aroused by advertising, in the form of timetables, folders and posters, far surpassed his expectations. F. E. Hunt and P. P. Crafts also discussed the report, the latter describing some very effective circular-letter advertising in directing attention to pleasure parks. J. W. Brown, D. C. Cherry, J. H. Pardee, W. H. Collins, J. C. Calisch, Ernest Gonzenbach, C. L. Allen and R. P. Stevens contributed valuable features to this general discussion.

The Claim Agents' Association also held their first meeting Monday afternoon at the Hotel Metropole. Among the questions discussed were the best means of preventing collisions of cars and of cars with vehicles and pedestrians, and also how can the numerous accidents to passengers in boarding and alighting from cars be diminished or prevented?

On Monday evening there was a brilliant reception, given by the officers of the various associations to the degelates and guests. This took place at the Brown Palace Hotel. Before the reception the famous marching band, Cook's Drum Corps, of Denver, gave a very fine concert. The reception was attended by the very large number of visitors and all the social and business leaders of Denver. Vocal selections were rendered by Madam Sobrino, of London, and Clifford Wiley, of New York city. Informal dancing followed.

This morning (Tuesday) the entire session of the Transportation and Traffic Association was devoted to the discussion of the report of the committee on interurban rules. At the close of this discussion the report was adopted and the committee was instructed to confer with the rules committee of the American Railway Association, and to report back to the next annual convention.

The Claim Agents' Association during its meeting this morning discussed what is the best plan of having trainmen procure and report an increased number of witnesses to accidents. Another matter considered was whether it is good practice when a statement of the injured party is obtained to give that party a copy of the statement. The concluding topic considered was whether a school of instruction for trainmen is essential.

The first session of the parent organization, the American Street and Interurban Railway Association, was opened at 2:15 p. m. today at the Auditorium Hall, by the reading of the minutes of the previous meetings of the executive committee. The association was formally welcomed to Denver by William G. Evans, president of the Denver City Tramway Company.

The presidential address was delivered by James F. Shaw, who stated that the cities west of the Mississippi River represent twenty per cent of the association's membership and contribute twenty per cent of its resources. However, up to the present time they have been neglected as convention centers. Western companies are justly entitled to have the convention held in their territory occasionally. Everyone must concede that Denver has one of the finest street-railway systems of the country. The steady improvement of commercial conditions, making easy money possible, will permit of greater development in railway construction. The increased investment for modern systems justifies in many cases an increase in rates of fare, and a scientific charging for service tendered is an important step. The recently imposed corporation tax is unfair, as it penalizes the pioneer and imposes a burden upon the stockholder. A tax upon income in emergencies would be more equitable. Public-service commissions, to be effective, must protect the corporation and employe just as well as the traveling public. No new electrification plans of great magnitude have been announced recently, but those companies which have adopted electrification are well satisfied.

Reports were submitted from the committees on subjects, active membership, associate membership, suggestions of former President Goodrich, and education. A paper entitled "Organization, from the Standpoint of a Small Company" was then read by Ernest Gonzenbach, president and general manager of the Sheboygan (Wis.) Light, Power and Railway Company.

The Engineering Association opened its convention this afternoon in the Rose Parlor of the Auditorium by the presidential address from President Paul Winsor, the reports of the executive commit-

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tee and of the secretary and treasurer. Most of the session was taken up by a discussion of the report of the committee on way matters.

The Claim Agents' Association at its session today discussed newspaper information, the relation of the medical and claim departments, and the relation of the claim and operating departments.

This evening a grand performance by the Railway Supply Men's Amateur Theatrical Association was given at the Tabor Grand Opera House. In this effort the supply men were assisted by the Denver City Tramway Minstrel Troop and Band.

There is a magnificent exhibit of electric-railway apparatus by the members of the Manufacturers' Association. The entire floor space and gallery of the great Auditorium is filled, and an immense tent has been built in the form of an "L" flanking the Auditorium on two sides. Probably the most conspicuous exhibits are made by the Allis-Chalmers Company, the General Electric Company and the Westinghouse Electric and Manufacturing Company, the latter's exhibit of the multiple electropneumatic brake system being the most unique and comprehensive ever assembled. The Buckeye Electric Company is making a fine exhibit of tantalum street-railway lamps and has also equipped 300 of the local cars of the Denver Tramway System with tantalum lamps. The Bryan-Marsh Company is also making an extensive exhibit of tantalum railway lamps in conjunction with the exhibit of the Allis-Chalmers Company. Other notable exhibits are those of the Western Electric Company, D. & W. Fuse Company, American Steel and Wire Company, Crouse-Hinds Company, Dearborn Drug and Chemical Works, G. M. Gest, H. W. Johns-Manville Company, Massachusetts Chemical Company, National Carbon Company, Ohio Brass Company, John A. Roebling's Sons Company, Rail Joint Company, Speer Carbon Company, Stromberg-Carlson Telephone Manufacturing Company, and Wagner Electric Manufacturing Company.

A full report of the entire Denver convention will be given in the next issue.

A. A. G.

Second Avenue Railroad.

The Second Avenue Railroad Company, New York city, has issued notice to the holders of general consolidated mortgage bonds of that company, requesting them to extend the life of the bonds to November 1, 1910.

Fight for Control of Worcester Electric Light.

Stone & Webster, of Boston, have sent out, through Kinsley & Adams, to stockholders of the Worcester Electric Light Company, an offer of $300 cash for each share of the electric-light stock.

Opposed to this, the largest stockholders of the company have sent out circulars to all the stockholders, announcing the formation of a holding company to secure control of the stock to prevent it from being bought up by outside operators, and to keep the Worcester Electric Light Company a Worcester concern. The trustees of the holding company offer $100 a share cash and two shares of the stock of the holding company, par value $100, for each share of the electric-light stock, the new stock to pay five per cent dividend. The capital of the holding company is to be $2,000,000.

It is the biggest struggle for control of a Worcester corporation that has taken place since the fight for the Worcester Consolidated Street Railway Company, which resulted in the New Haven interests buying control.

By the formation of the holding company, to be known as the Worcester Electric Securities Company, stockholders of the Electric Light Company, claiming to represent $350,000 of the capital stock, propose to overthrow the present management of the Electric Light Company and put in experts to develop the field in Worcester to the advantage of both the community and the company.

The present Worcester Electric Light Company is capitalized for $800,000, and the stock is quoted at $250 a share, on a par value of $100. The company has paid ten per cent and before that eight per cent dividends for two years. It is expected that the new stock company will pay an average dividend of five per cent a year.

Gigantic Consolidation of Public Utilities Rumored in Chicago.

During the past week the frequent rumors of consolidation of public-utility corporations in Chicago have been revived. This time, however, the scheme of consolidation is said to be on a much greater scale than ever attempted heretofore. In short, it includes all of the large public-utility corporations of the city with the exception of the gas company and the telephone company; in other words, it is said that steps are being taken to merge into one gigantic corporation all of the elevated and surface traction systems of the city, as well as the Commonwealth Edison Company. The combined capitalization of the projected consolidated corporation is said to be about $300,000,000.

In newspaper interviews with several heads of the various companies involved a general statement is made that such a large corporation would be feasible and advisable from the operating standpoint, but it would require the surmounting of very much greater difficulties than the hitherto attempted consolidations of the elevated systems only. The number of subsidiary interests is very large, and in any scheme of this kind each demands to be treated most liberally; therefore, if such a merger is to go through, it will require financing by men of practically unlimited resources. No definite statements as to whether any actual steps had been taken in carrying out this project could be obtained from anyone in authority.

Quarry Street Plant Enlargements.

The Commonwealth Edison Company, of Chicago, will spend $400,000 on the east section of its new Quarry Street plant. When completed, the east and west sections will represent an investment of $1,100,000 for buildings alone. The company is steadily enlarging its plants.

Receiver for Albany & Hudson Road.

On application of counsel for the Trust Company of America, Supreme Court Justice Betts appointed John W. Searing, of New York, receiver of the Albany & Hudson Railroad Company, which formerly operated an electric railway between Albany and Hudson, which was recently sold under a mortgage foreclosure. The property recently was taken over by a reorganization committee and is now owned by the Southern Railroad Company.

Third Avenue Railway Sale Put Off.

Judge Lacombe, in the United States Circuit Court, has again postponed the sale of the Third Avenue Railroad, New York city, under foreclosure. The sale is now set for November 30, the postponement being from October 27. The uncertainty created by the rejection of the reorganization plan by the New York Public Service Commission, and the fact that none of the creditors' suits which are before the Special Masters has reached a final determination, are given as reasons for the present decision.

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ASSOCIATION OF CAR LIGHTING ENGINEERS.

SECOND ANNUAL CONVENTION AT THE HOTEL LA SALLE, CHICAGO, OCTOBER 4, 5, 6 AND 7.

The second annual convention of the Association of Car Lighting Engineers was held this week in the convention hall of the new Hotel La Salle, Chicago. In car-lighting circles this convention is the all-important event of the year, and a representative gathering of car-lighting engineers from all sections of the country was in attendance.

With this association is affiliated the Association of Car Lighting Supply Manufacturers, who contributed to the value of this meeting by their elaborate exhibits.

MONDAY MORNING SESSION.

The convention was formally opened at 10:30 a. m. Monday morning by President A. J. Farrelly. After the reading of the minutes of the previous meeting the president addressed the convention:

Mr. Farrelly said that on May 21, 1908, a little group of men met in the office of the signal engineer of the Oregon Short Line at Ogden, Utah, on the invitation of E. M. Cutting, and during the course of the meeting the formation of the association was proposed. There were only ten men present on that occasion, and the most optimistic predicted that, if nothing stood in the way, the membership of the association they were then forming would undoubtedly reach the hundred mark in a year, or in two years at the latest. The secretary's report showed the present membership to be 410, so that the prediction of the founders of this association was more than realized. Mr. Farrelly spoke of the increasing value of the association to its members and to the profession in general, showing how inquiries are being received from numerous car-lighting men in foreign countries, and stating that the association was receiving the recognition of railroad officials, which is evident by inquiries being made by officials as to what to recommend in the different problems to be decided. He spoke quite at length regarding the policy of the association, emphasizing conservatism in all matters relating to discussions, and also in the conduct of the members during the various conventions and meetings. On the subject of honorary membership Mr. Farrelly cited numerous instances where railroad officials had expressed their gratification at being elected members of the association. In conclusion the president stated the object of the association was for the betterment of the service of electrical practice on railroads, and the betterment of the individual members, and both of these objects are being realized, as is shown by the progress of the association.

Following the address of the president, C. R. Gilman, of the Chicago, Milwaukee & St. Paul Railway, proposed that the name of the association be changed from what it is at present to that of the Railroad Car Lighting and Electrical Association. Mr. Gilman stated that this change in name would broaden the sphere of work of the association and would include men who are dealing with the great variety of electrical problems to be met with at present. On account of the rapidly broadening scope of the activities of various members of the Association of Car Lighting Engineers this change in name of the association is a most important one.

A. J. Collett, of the Union Pacific Railroad, objected to the name suggested by Mr. Gilman on account of its length, and proposed instead the name of Association of Railway Electrical Engineers.

Several of the members expressed their views in favor of this change of name, agreeing that by so doing the scope of the association would be unlimited, both in membership and in work. Upon the motion of Mr. Collett, voting on the question was deferred until a later session to allow time for discussion.

MONDAY AFTERNOON SESSION.

The meeting was called to order by the president, who introduced J. Henry Klinck, of the Westinghouse Electric and Manufacturing Company, who addressed the convention on the subject, "The Application of Electricity to Railway Shops." Mr. Klinck said in part:

To deal successfully with electrical problems in connection with shop work as they occur in the motive-power department a man must have a rather wide experience. He must know what type of boilers and grates to install. He must be familiar with various kinds of fuel. He has to decide on the type of prime mover to use. The next thing before he comes to the electrical equipment proper is to make proper provision for compressed air, which is used almost universally in railroad shop work. He is next confronted with the problems involving heating and ventilation, water distribution and supply systems, and the proper type of unit for electrical generation. In regard to the electrical part of the problem we have, besides, the old familiar direct and alternating-current systems, their combination being either direct current in the main units with auxiliary alternating current, or the main units alternating current with an auxiliary direct system. From the experiences of large railroad shops the alternating-current plant is the type of plant to be installed, equipped with either rotary-converter or motor-generator sets to supply the buildings with the requisite amount of direct current. Direct current is necessary, in Mr. Klinck's opinion, for speed adjustment of motors. This speed adjustment is necessary on a great many tools. In a great many cases in connection with the shop work the question of changing of tools arises, and there has been a great deal of that done lately. It is impossible to take an old tool which was constructed so as to make a cubic inch of some material a minute with water-hardened steel, working at fifteen or less cuts per minute, and put on a motor of ten or fifteen horsepower and get three or four times the output. This method has been the cause of considerable trouble and disappointment in a number of cases. Mr. Klinck cited some results of the operations of tools under ordinary shop conditions, and illustrated the examples by means of curves which were distributed. The question of equipping railroad shops with electricity was taken up quite fully. While in only a few cases the use of electrical drive decreases the total operating expenses, yet it does materially decrease the unit cost—that is, a shop is able to turn out more work in the same time using electrical drive. The case of a railroad shop was given which had been operated very successfully with a steam plant, but when changed to electrical drive the output was increased to such an extent that the first cost of installation was soon covered. Mr. Klinck named many advantages of the electrically-driven shops, prominent among them the opportunity of increasing the power at any time in a simple way, providing the question of expansion was considered in the design of the power plant. Another important argument in favor of the use of the electric drive is the ability to use portable tools. In modern shops there is a great use for these tools, and the use of them is comparatively simple if motor-driven. There is also the advantage of the electric drive in being able to use overhead cranes freely. Those who have seen the old belt-driven cranes or air cranes can realize the importance of electrical cranes in the railroad shop of today. Another advantage is the ability to operate any particular section of any shop just when and how it is desired, without having to operate the entire shafting system, which may consist of a great many hundred feet of shafting. Mr. Klinck called attention to the classification of motors along lines of speed characteristics. This has a great many advantages and when understood will simplify the question of getting information, and also the handling of motors.

The discussion following Mr. Klinck's address was a spirited one. It was opened by F. E. Hutchinson, of the Rock Island lines, who asked Mr. Klinck what he finds with reference to variable-speed machines with multiple voltage with straight 220 and 110 volts and the free high voltage. Mr. Klinck in replying said that there have been a number of variable-voltage machines in many of the shops which work out very well, especially where there is a lighting system, but there is no need of using the two voltages for power only. If the adjustable-speed power is necessary it is advisable to use direct current.

The president then asked Mr. Klinck if it was the practice generally in railroad shops to use indicating instruments to obtain any information as to what the machines require or what the motors are doing, and if the motors are gauged accordingly. Mr. Klinck said the tendency was to use indicating instruments, but that these did not tell the whole story, as it is impossible to install them without being observed, and under these conditions an operator could do his work in accordance with his own speed views. If a recording instrument is installed on the

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circuit and left there for a considerable length of time there is no trouble in finding out just what is going on. He cited a number of cases where the recording instrument accounted for mishaps which would have been otherwise overlooked.

C. R. Gilman asked whether Mr. Klinck could tell under ordinary conditions in a railroad shop if it would be more economical to equip with alternating current entirely or preferable to use direct current. Mr. Klinck could give no definite answer, saying that shops should be equipped according to conditions, in some cases alternating current being preferable, while in others direct current is preferable; however, it is the general practice to use alternating current with the provision for direct current for use on variable-speed motors.

The question of motors was discussed, several members giving the experiences they have had in the shops of the roads which they represent.

TUESDAY MORNING SESSION.

The meeting was opened at 10 a. m., and the report of the special committee on axle generators was read by J. R. Sloan, of the Pennsylvania Railroad, chairman:

The report covers three general subjects: design and construction of the axle generator proper and the auxiliary apparatus; the operation of the battery in connection with the axle generator; and the operation of the lamps. These three points are of interest to the operators of axle generators, as they directly influence the quality, reliability and cost of service. Thus, an axle generator of poor design and construction fails in service due to these defects. The arrangement of the pulley or sprocket when facing the end of the truck on which the generator is mounted should be on the right hand. The armature shaft should be removable from the armature core and commutator without disturbance of either of these parts. The armature cores should be composed of thin, annealed, laminated steel, and keyed to the armature shaft or spider. The commutator should be built of bars drop forged from Lake copper, the ear for attaching the windings being forged as part of the bar. Methods of insulation were taken up in detail. The armature coils should be form-wound, insulated with non-inflammable material. The leads of the armature coil should be securely fastened to the bar of the commutator bar. The coils should be held in the slots in the armature core by wedges. Band wires, when used, should have a strip of thin copper laid underneath them for the full circumference. The complete armature should be interchangeable for thirty to sixty-volt generators. The field frame should be of cast steel with laminated pole pieces securely fastened together and bolted to the frame. The two field frame and castings should, if possible, be interchangeable and reversible, so that the generator may be supported either from below or above. The bearings for both commutators and pulley end of shaft should be alike and interchangeable. The field coils should be wound with wire having a non-inflammable insulation and should be well taped and mechanically protected from the pole piece and frame by fiber or other similar material. The pole changer of the mechanical type should throw out of engagement after it has performed its function. If of the rotating type, it should be massive enough to prevent warping and binding. If of the electrical type, the coils should be wound with wire having a non-inflammable insulation, and the contacts should be of ample capacity for the current they are required to handle. In this manner all of the different parts composing an axle generator were taken up by the committee, and the rules for good practice stated so that by using the suggestions offered in this report a correct lighting equipment could be constructed and installed so as to give entire satisfaction.

Following the reading of the report, W. L. Bliss, chief engineer of the United States Light and Heating Company, of Milwaukee, Wis., read a letter giving his views of the matter taken up by the committee, which was supposed to have been incorporated in the report of the committee, but was received too late for publication.

Following the reading of Mr. Bliss' letter the members entered into a lengthy discussion concerning the axle pulley. The question of standard axles was also entered into, the discussion arising as to whether the straight or tapering axle was preferable. The report of the committee was then unanimously accepted.

TUESDAY AFTERNOON SESSION.

The report of the committee on standards was read at the afternoon session after an extended discussion as to the relative number of votes entitled to the representatives of the railroad companies and the Pullman Company. It was finally decided that for each car operating over a railroad on the mileage basis, and maintained as far as the lighting equipment is concerned by the Pullman Company, should be given one-half vote:

The report of the committee on standards consisted of fourteen recommendations, principal among them being the following: The standard voltage for head-end or straight storage car lighting be made sixty-four volts (nominal); the standard voltage for axle power lighting should be made thirty-two volts (nominal); on all terminal connections on switchboards, regulators, generators, batteries, train connectors, the positive pole must be on the right, facing the same; all cars should be provided with overhead train-line connection of three wires; all wires at terminals should be marked for identification and polarity; the three-finger type of connector is recommended; a suitable vent for battery boxes must be placed in the battery-box door; an approved dustproof bushing through back or end of battery box must be provided for leading-in wires, unless a conduit system is used; an approved single-pole fuse box must be placed in the positive side of the battery circuit; battery boxes should be made of wood suitably secured by iron straps to body of car; all parts of the suspension gear or generator, when car is on a level straight track, must have at least a clearance of six inches from the top of the rail; the suspension gear should be so designed that the armature can be easily removed; the straight pulley seat should be provided for securing the axle pulley to the axle; if a bushing is used it should be secured to the axle independent of the pulley and of such length as will allow two inches lateral adjustment of the axle pulley on the bushing.

These recommendations were taken up, separately discussed and voted upon, and in nearly every instance accepted by the association.

The report of the Wednesday and Thursday sessions of the convention will be given in next week's issue.

Richmond Light and Railroad Company.

The New York Public Service Commission has issued an order approving the application of the Richmond Light and Railroad Company for authority to lay tracks on Wadsworth Avenue, Borough of Richmond, a street running from New York Avenue to Tompkins Avenue, a distance of 1,476 feet. It is the purpose of the company to substitute a private right-of-way for that section to their South Beach line, which line runs through the United States Government reservation on Staten Island, the change being made necessary by direction of the government to the company to remove its tracks on New York Avenue to Richmond Avenue, as the government contemplates very extensive improvements.

Illinois State Electric Association.

It has been decided to hold the annual meeting at Alton, Ill., on October 26, 27 and 28. H. E. Chubbuck, secretary of the association, states that all indications point to a good attendance. The meeting will be held at the Illini Hotel, and supply houses will make displays which, with the special papers by members, will make an interesting session. Mr. Chubbuck's invitation announcing the meeting says, "Come early and stay late." It is known that much interesting data on lighting rates will be submitted.

Telephones in Cuba.

The recent decree of the Cuban president, Gomez, giving the Cuban Telephone Company the right to operate local and long-distance lines in all parts of the island, is the most important concession granted by the present government and marks the end of a long struggle for the modernization of the telephone system in Havana.

The company expects within a few months to place all wires underground.

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Interesting Electrical Developments in Mexico.

The large benefits that have been accomplished through the introduction of electric power in mining operations in the districts of Guanajuato, El Oro and Pachuca, Mexico, have given a great impetus to the installation of electric power plants in different mining sections of that country. The largest of these plants is that which a Canadian syndicate, headed by Dr. F. S. Pearson, is preparing to erect on the Conchos River, near Santa Rosalia, state of Chihuahua, and which will generate power for transmission to the mining districts of Santa Eulalia and Parral. Many smaller hydroelectric projects are on foot. The Mines of Mexico Company, of Denver, Colo., which obtained a concession from the Mexican government several months ago for the installation of a large hydroelectric plant on the Mayo River, in the state of Sonora, has had the surveys made for the proposed plant and necessary dams, and the active work of construction will soon be started. The sites for three dams were located. The plant will be located near Alamos. Other projects on foot may be noted as follows:

José Enriquez Guzman will soon begin the erection of a hydroelectric plant on the Altar River, near Altar, state of Sonora. The electric power will be transmitted to towns and industrial plants in that region.

Chapala Hydro-Electric and Irrigation Company has obtained a loan of $2,200,000, which will be used to erect a new hydroelectric plant at Puente Grande, on the Santiago River, near Guadalajara, and in the construction of transmission lines to the mining districts of Etzatlan and Hostotipaquillo. The company has also obtained a loan of $3,000,000 from the federal government. The latter sum will be used to build a dike across a portion of Lake Chapala and in the construction of an extensive system of irrigation canals and ditches.

Adolfo Fartinez has obtained a concession from the federal government for the installation of a hydroelectric plant on the Quetzalpa River, state of Hidalgo. He has had surveys made for the proposed plant, and it is claimed that 10,000 horsepower can be generated.

Jose Riaz Rubin, who recently obtained a concession from the federal government for the utilization of the water in the Matamoros River for generating electric power, is preparing to build a dam across the stream and install a hydroelectric plant.

The Guanajuato Reduction and Mines Company has begun the construction of an electric railway which will run from its Las Playas mines to the yards at Tepettaya. The road will do a freight business exclusively, and will be one of a number of electric mining roads in the Guanajuato district.

Pinchot Still Suspects a Power Trust.

Gifford Pinchot, chief of the Bureau of Forestry, still asserts that a monopoly is now in progress of formation whose object is to obtain possession of the waterpower sites of the country. He declares that remedial legislation must be enacted at the coming session of Congress if this great natural resource is to be preserved to the people.

The problem of how best to prevent the nation's waterpower sites from being gobbled up by such combinations, Mr. Pinchot predicted, will be one of the biggest issues which the next session of Congress will have to thrash out. While he stated that the alleged trust is now only in the formative stage, Mr. Pinchot declared that prompt action on the part of Congress is necessary to throttle it. On the proper solution of this question the future happiness of a great many people rests, he said.

After declaring that "there is a waterpower trust certainly in process of formation," Mr. Pinchot, in a recent interview in Washington, said:

"In my judgment the tendency to consolidation which is now running through all industrial enterprises, will necessarily in the end lead to the consolidation of the waterpower interests, exactly as it has to consolidation of steel and oil interests. There has got to be legislation on this waterpower business. President Taft has indicated his intention of asking Congress for legislation governing, as I understand it, the disposal of waterpower sites on the public domain. The question is, are we going to give these power sites in perpetuity? That is a question with which Congress will have to deal."

Electrification in Australia.

The New South Wales Railway Commissioners, it is reported, have decided to electrify the remaining forty-three-and-one-half miles of suburban steam lines running out of Sydney. A total of 146 miles of single track have been electrified during the last nine years.

Chief Engineer of the Panama Canal Inspects the Necaxa, Mexico, Dam Break, Seeking Pointers.

(Special to the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.)

Mexico City, Mexico., October 2.—Colonel George W. Goethals, U. S. A., chief engineer of the Panama Canal, has arrived here for the purpose of investigating the possible causes leading up to the disaster which occurred a short time ago to the great dam at Necaxa, ninety miles from this city. This dam is being built by the Mexican Light and Power Company, a Canadian concern which has invested more than $40,000,000 gold in the erection of hydroelectric plants and power systems for supplying this city and other places within a radius of 150 miles of Necaxa with lights and power.

The visit of Colonel Goethals is of much significance, as his investigations at Necaxa may have an important bearing upon the construction of the Gatun dam. He admits this fact. He says that the two dams are being constructed along the same lines. The disaster at the Necaxa dam was caused by a slip in the clay and sand, causing damage amounting to upward of $1,500,000. Colonel Goethals says that he wants to find out what caused this slip. Since the accident occurred many eminent engineers of the world have criticized the type of construction of the Gatun dam, claiming that a similar disaster is likely to be met with there. The same engineer who planned the Necaxa dam also has charge of the work of supervising the construction of the Gatun dam, and this has added to the criticism, Colonel Goethals says.

The Necaxa dam, when finished, will be the largest dam on the North American continent. It will be 165 feet high and will contain 2,000,000 cubic yards of material. The material is carried to the dam site by means of flumes, being mixed with water. The water runs off and the clay and sand are deposited in the proper place. The clay finds its way to the center, being the heaviest, and forms a solid barrier to the pressure of the water in the reservoir which the dam forms. The dam was of insufficient strength to hold the pressure of the water and the wall of clay and sand slipped out. The repair of reconstruction of the dam is now being carried on by the method originally used. This same method is used in the construction of the Gatun dam. The engineering world is more than interested in the outcome. N.

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The Development of Niagara Falls.

It was seventeen years ago last Monday that the Cataract Construction Company broke ground for the tunnel power development in Niagara Falls. This incident occurred at the corner of Falls and Erie streets and was attended by a large crowd. It is barely possible that the development which resulted has not been so great as was then predicted by the several enthusiastic speeches of that happy time, but it is evident that the promoters were bold in their conception, even though their conclusions of those comparatively early times have been well approved and supported by practice. The tunnel development brought Dr. Edward G. Acheson, Charles M. Hall and other inventors to Niagara Falls to enjoy the electric power facilities, and this has given that locality great, busy plants, the like of which are unknown in other parts of the world. Two decades have not yet passed, and still the development has been encouraging. The two former villages have been developed into cities, and a population of a little over 11,000 has been increased until the city of Niagara Falls proudly boasts of between 30,000 and 40,000 residents, a number increased on many summer days by the tourist and excursion influx to 50,000.

And then the spirit of development has not yet ceased. Several of the great industries at Niagara are even now enlarging. The Carborundum Company has a splendid four-story structure under way adjoining its office building on Buffalo Avenue. The Aluminum Company of America has only this year placed its great No. 3 plant in operation. The International Acheson Graphite Company is completing a large addition to its plant on the New York side and increasing the output capacity and size of its Canadian works. The Development and Funding Company displays wonderful building activity, its plant now being very large. While seventeen years have rolled along, they have been years of wonderful strides for Niagara, with more and better things to come, perhaps, for many important projects are hovering about Niagara with a view of locating there. E.

Bell Telephone of Buffalo.

The stockholders of the Bell Telephone Company, of Buffalo, N. Y., have voted unanimously to sell the property of the New York Telephone Company. This is the last of the seven Bell companies of New York State to be merged.

Pittsburg Section, American Institute of Electrical Engineers.

The regular September meeting of the Pittsburg Section, American Institute of Electrical Engineers, was held in the Carnegie Institute on September 14, Chairman W. Edgar Reed presiding. Previous to the meeting the usual social dinner was held at the University Club.

The annual election of officers for the ensuing year was held, resulting as follows: Chairman, C. B. Auel; secretary, E. B. Tuttle; executive committee, W. E. Reed, W. E. Moore, H. M. Muller, Ludwig Hommel, R. A. L. Snyder and B. P. Rowe. A vote of thanks was given to the retiring officers, whose faithful and efficient service had made the past year such a successful one in the history of the Pittsburg Section.

The subject of the evening was "Industrial Motor Applications," and three original papers were presented and discussed. These were as follows: "Operation of Industrial Motors for Rolling-Mill Service," by H. C. Specht, of the Westinghouse Electric and Manufacturing Company; "The Direct-Current Motor in Industrial Work," by F. A. Rew, of the Westinghouse Electric and Manufacturing Company; "Motor Applications in the United States Navy," by W. O. Peale, of the Westinghouse Electric and Manufacturing Company.

The papers were discussed by Prof. V. Karapetoff, of Cornell University, and by C. W. Drake, B. Wylie, R. S. Feicht, W. Sykes, R. P. Jackson, C. B. Auel, and B. P. Rowe, of the Westinghouse Electric and Manufacturing Company.

The next meeting of the section will be held on October 12, when an original paper on "Electric Welding" will be presented by C. B. Auel.

Trolley Service for Queensboro Bridge.

Application has been made to the Board of Estimate by Bridge Commissioner Stevenson for permission to transfer certain appropriations for his department to enable the immediate establishment of a temporary municipal trolley line over the new Queensboro Bridge, New York city. It is proposed to rent cars from the South Shore Traction Company and to buy power from the New York Edison Company. The temporary line, which is to be operated until the franchise question is settled by the courts, is expected to yield a slight profit at the proposed fare of three cents or five cents for a round trip.

Electrification Tests in France.

Experiments are being carried out in France by the Paris-Lyon-Méditerannée Railway, with a view to converting the Cannes-Vintimille section of its line from steam to electricity. The experiments are being made on the Grasse-Mouans-Sartouse section, which is very convenient for the purpose, as it includes some of the steepest grades and sharpest curves, and is also not crowded with traffic.

The tests are being made with a trolley wire, it being suspended flexibly by means of a system which does not involve the use of separate suspension wires. Wooden poles are used at present, but these are to be replaced by metal lattice-work supports later on.

The locomotive used weighs 140 tons, and is approximately the same length as the steam locomotive in use on the road, including the tender. There are eight axles, of which the four central ones are driving axles with large wheels.

The overhead line is supplied with single-phase, alternating current at 12,500 volts, which is converted on the locomotive by means of a special permutator into a direct current at a voltage adjustable between zero and 600 volts at will.

There are four motors of the ordinary direct-current type, of 450 horsepower each, to a locomotive, geared to the driving axles.

The total draw-bar pull exerted by the locomotive is 16,400 pounds at a speed of thirty-seven miles per hour and 10,600 pounds at a speed of sixty-two miles.

Norwich & Westerley Receiver.

The appointment of United States Senator Frank B. Brandegee as receiver of the Norwich & Westerly (Conn.) Street Railway Company is intended to help facilitate the reorganization of the corporation. The company has defaulted the interest on its bonds and is trying to reorganize on a basis by which the fixed charges will be materially reduced. Holders of $500,000 of the bonds and about two-thirds of the creditors have assented to the tentative scheme of reorganization proposed by the officials of the company, and it is expected that further assents will shortly be received.

The receivership is a friendly one, and will probably be soon terminated if the readjustment plans do not encounter any serious hitch. The appointment of Senator Brandegee was made by the United States Circuit Court.

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Another Subway Route for New York City.

It is learned that the New York Public Service Commission engineers have worked out the details of a new subway route, not heretofore announced, which will provide an outlet for the new Pennsylvania station at Thirty-second Street, Manhattan Borough, New York city, and will also make use of the Queensboro Bridge and provide a rapid transit route from the Borough of Queens.

The route starts at the Battery and lies through Greenwich or Washington streets to the vicinity of Chamber Street, thence up Hudson Street to Eighth Avenue, up Eighth Avenue to Fifty-ninth Street, crossing Fifty-ninth Street to the Queensboro Bridge, over the bridge and continuing as an elevated line along Jackson Avenue in the Borough of Queens. It is also contemplated that extensions will be built in the direction of Corona and Flushing and possibly also in the direction of Astoria. The plans call for four tracks south of Fifty-ninth Street, with two tracks in Fifty-ninth Street, crossing the bridge on the elevated structure already erected on the bridge.

The engineers have reported that the route is entirely feasible from an engineering point of view, the chief difficulty being in a rather steep grade to reach the elevated tracks on the Queensboro Bridge, a grade of 5.7 per cent being provided at the western approach to the bridge. The Commission has not yet formally adopted the route, but it is expected that it will very soon take such action and send the plans to the Board of Estimate and Apportionment for approval. The method of construction, whether by public money or by private enterprise, is not yet decided and that would rest with the Board of Estimate in any event.

The proposed route of the Hudson Street, Eighth Avenue and Fifty-ninth Street subway would not conflict in any way with the proposed Broadway-Lexington Avenue subway. No announcement has been made as to the likelihood of the Interborough's bidding for this latest proposition, but the Interborough officials have repeatedly urged the importance of the extension of this West Side line downtown so as to accommodate the traffic from the Pennsylvania terminal. These suggestions have heretofore been for an extension down Seventh Avenue from Times Square, but the route now proposed would connect with the subway at Eighth Avenue and Fifty-ninth Street.

The Purchase of Coal on a Heat-Unit Basis.

A recent report to the mayor of New York by the Commissioners of Accounts contains many live facts regarding the purchase of coal on a heat-unit basis. This method of purchase would be an incentive to the dealers to furnish coal of superior quality if only on account of the obvious saving in hauling and handling charges when the price is fixed according to the number of heat units developed by the coal for a given weight. An example illustrating the purchase of coal by weight and by thermal value shows that on a bid of 80,000 tons of anthracite coal for one city department in the year 1905 there were three bidders, at prices, $6.50, $6.10 and $6 per ton, respectively. The highest priced coal had a heating value of 13,000 British thermal units per pound, and the others 11,000 and 10,500 units, in order, while the percentages of ash were twelve, eighteen and twenty-four, respectively. Assuming that the cheapest coal would do the work satisfactorily, then but 64,675 tons of the dearest coal would be equivalent in heating value to the 80,000 tons of this cheapest coal, and 76,363 tons of the intermediate quality would also give the same number of heat units. At this rate the dearest coal would cost $419,998, the next dearest $465,814, and the cheapest $480,000. Thus the coal which costs most per ton actually costs $60,002 less than the cheapest coal, on the 80,000 tons order, for the number of heat units developed, and this not taking into account the saving in transportation, handling, storage, and the disposal of the ashes, all of which would add very materially to the ultimate economy.

Telegraphy in Brazil.

Consul-General George E. Anderson, of Rio de Janeiro, reports that the Brazilian Government has made a contract with a French telegraph company for the construction of a wireless station on the island of Fernando Noronha, 200 miles east of the coast of Rio Grande do Norte, and 400 miles from Pernambuco, the nearest large Brazilian port, with auxiliary stations at Pernambuco to connect the island station with the Brazilian telegraph system, and at such other points as may be needed. The island station will have a radial activity of 1,000 miles, approximately half-way across the Atlantic from that point, and reaching as far south as Bahia and at least as far north as Maranhao.

The Improved Trolley Car.

The equipment of a train on the Cedar Rapids and Iowa City interurban line gives a good idea of the perfection of the same given on the best interurbans of the country. The latest train of this company consists of two cars each sixty feet long, one of which is exclusively a passenger coach, and the other is a combination passenger, smoker, express and mail car and also the motor car for the train. The passenger coach is attached to this car exactly as one vestibuled Pullman is coupled to another, making a vestibuled train of two cars. The passenger coach seats 118 passengers. It is a model of convenience and comfort. The interior woodwork is mahogany and the seats are of green plush much like those of the other passenger coaches of the company. But the seats are considerably wider, wide enough for two big men to sit in them comfortably, and for three to sit in case of a crowd, such, for example, as a football crowd. The windows are double like those of a Pullman car. There is a large brass rack over each seat for hats and parcels. The ventilators are of artistic design and filled with art glass. There is a row of incandescent lights down the middle of the ceiling directly over the aisle.

In addition to this there is a wall bracket and lamp for each seat, just at the height for comfortable reading. There are two toilet rooms in each car with cement floors and other equipment equal to that found in first-class Pullmans for railroad service.

In the motor car a large section is finished and equipped as above described. Forward from this is the smoking compartment which is finished in quarter-sawed oak with a mission stain and has rattan seats. In the front end of this car is a compartment built specially for the motorman, and the rest of the space is occupied by the hot-water heater and the baggage and mail facilities.

The motor is very powerful and can haul several cars if necessary. As an example, the regular interurban car was attached to the rear end of the new train, and the motor brought up the three cars with ease, taking the grades with no trouble whatever. The tendency is all for longer trains.

Dean Electric Company Absorbed.

The Kellogg Switchboard and Supply Company, of Chicago, has absorbed the Dean Electric Company, of Ohio.

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Mr. Edison and Dr. Steinmetz.

On the occasion of the convention of the Association of Edison Illuminating Companies at Briarcliff Lodge, N. Y., Tuesday, Wednesday and Thursday, August 30, September 1 and 2, one of the features of the meeting, as already mentioned in an earlier issue, was the dinner tendered Mr. and Mrs. Edison. The gathering was unique in that a large number of those who attended the banquet had their start in the laboratory of Mr. Edison. Among those felicitating Mr. Edison and the association upon this occasion was Dr. Charles Proteus Steinmetz. In many ways Dr. Steinmetz stands head and shoulders over any living exponent of electrical development,

DR. STEINMETZ AND MR. EDISON.

and it was in a peculiarly happy vein that he paid his tribute to Mr. Edison as the genius who had made possible the existence of the association.

Anyone who is at all familiar with the meetings of scientific bodies, particularly the conventions of the American Institute of Electrical Engineers and the National Electric Light Association always remembers the versatility of Dr. Steinmetz and the readiness with which he discourses upon any conceivable topic.

We are fortunate in being able to reproduce a photograph of these two great electrical men of today, in characteristic attitudes—Dr. Steinmetz talking, and Mr. Edison listening. The photograph was taken on September 2 at Briarcliff Lodge. For its use thanks are due Leavitt L. Edgar, of Boston.

Chicago Electric Club.

Dana Pierce, electrical engineer, with the Underwriters' Laboratories, Incorporated, was the speaker at the Chicago Electric Club on Wednesday, September 29, following the regular midday luncheon. Mr. Pierce gave a general review of the routine work carried on by the laboratories. He discussed their relation to insurance interests and to manufacturers and consumers. He also explained the existing methods of obtaining approvals of electrical devices and materials and the manner in which the results of the work of the laboratories are announced.

Starting with the origin of the laboratories, some sixteen years ago, Mr. Pierce outlined their rapid progress up to the present day, comparing reports made in earlier years, when both the manufacturer and the laboratories were uncertain as to the steps the other would take, with the reports in recent years which either finally approve or condemn the devices. The work of the laboratories is confined to investigations having a bearing upon the fire hazard and is undertaken as one means of securing correct solutions of many of the problems presented by the enormous and disproportionate destruction of property by fire in the United States.

The aim of the founders of the Underwriters' Laboratories was to secure the fairest and best opinion regarding the merits or demerits of every device, system, or material having a bearing upon the fire hazard, and to have the work so conducted and reviewed as to secure accuracy and uniformity in its findings, and this aim has been achieved, asserted Mr. Pierce, to such an extent that the majority of fire underwriters in the United States, many municipal authorities and a large number of architects, building owners and users either accept or require a report from the Underwriters' Laboratories incident to their recognition of devices, systems or materials having a bearing upon the fire hazard.

Summaries of the reports of the laboratories are promulgated on printed cards filed according to classifications, and copies of these cards are maintained at the offices of the principal boards of underwriters in the United States. Much of the information is also freely distributed by means of lists of approved devices.

Mr. Pierce outlined a number of interesting experiments that had recently been made at the laboratories, and also told of a number that were soon to be made.

Preceding the address of Mr. Pierce, Wm. S. Taussig, secretary of the club, made the announcement that Frederic P. Vose and Homer E. Niesz had been chosen president and vice-president, respectively, Mr. Vose to fill the position made vacant by the resignation of C. A. S. Howlett.

American Institute of Electrical Engineers.

The October meeting of the American Institute of Electrical Engineers is announced for Friday, October 8, at 8 p. m., when a paper on "Telegraph and Telephone Systems as Affected by Alternating-Current Lines" is scheduled to be presented by John B. Taylor, of the General Electric Company, Schenectady, N. Y. The report of this meeting will be given in our next issue.

The November meeting is announced for Friday, November 12, at 8 p. m., when Dr. Cary T. Hutchinson, consulting engineer, of New York city, will read a paper entitled "The Electric System of the Great Northern Railway Company at Cascade Tunnel."

The Edison Electric Illuminating Company, of Brockton, Mass., has recently moved into a new office. The building is outlined with electric lamps. There is also a mammoth electric sign installed on the roof. This display is a good example of electric advertising at home.

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Western Association of Electrical Inspectors.

A preliminary announcement of the fifth annual meeting of the Western Association of Electrical Inspectors has already appeared in these columns. The programme of reports and topics to be considered is now fairly complete, and is given herewith in condensed form. The association's sessions will be held in the Employers' Association Hall, Stevens Building, Detroit, Mich. The dates are October 26, 27 and 28. The meetings will begin promptly at 10 a. m., but it is arranged to have a series of inspection tours preceding all the sessions after the first one.

The programme is substantially as follows:

Address by President George D. Bayle, report of executive committee, report of secretary and treasurer, new business, appointment of nominating committee; reports from the following committees: Uniformity in Rulings, Grounding of Conductors for Safety, Public Safety; address by Alexander Henderson on "The Effect of Inspection on the Manufacture of Electrical Appliances;" address by J. B. McCarthy on "The Technical Press and Its Relation to Electrical Inspection Work;" discussions on the following topics: "Metal Molding," "Illuminating Engineering," "Difficulties Arising in Electrical Inspection Work;" reports from the following committees: Architects' Specifications, Instructions to the Public Concerning the Safe Operation and Maintenance of Electric Wiring, Laws and Ordinances, Installation and Operation of Induction Motors, Construction and Installation of Electric Signs, Show Window and Display Lighting, and finally a general discussion on the inspection tours.

On the evening of October 26 an informal dinner will be given to the members. At this the principal address will be made by James E. Cole, of Boston, his subject being "Municipal Control of the Electrical Hazard."

General Electric and Westinghouse Companies Patent Agreement.

It is understood that the General Electric Company is working on a new agreement with the Westinghouse Electric and Manufacturing Company, which will be substituted for the present patent agreement which became operative in 1896 and expires in 1911.

The present agreement provides for an exchange of licenses so far as patents are concerned, between the General Electric Company and the Westinghouse Electric and Manufacturing Company.

Special Census Agents for Manufactures.

Census Director E. Dana Durand announces November 3 next as the date for making a practical test of the qualifications of applicants for appointment as special agents for the collection of the thirteenth census statistics of manufactures and mines and quarries. Blank applications may be obtained now by writing the Bureau of the Census, Washington, D. C. No applications which are received after the close of business October 25 will be considered.

In a circular of instructions relative to the subject the director states that about January 1, 1910, the bureau will employ from 1,600 to 1,800 special agents. As far as possible it is desired to obtain for this work persons who have had college or university courses in statistics or economics, and persons who have had service in the accounting department of some manufacturing or other business establishment.

When an application is complete in every particular it should be mailed to the Director of the Census, Washington, D. C.

The duties of special agents will consist in obtaining, in person, from manufacturing establishments and mines and quarries, the statistics required by law, as indicated in the printed schedules with which they will be furnished. These statistics cover investment, quantity and value of products and of raw materials used, number of employes and their wages, character and quantity of power, etc.

The special agents will be divided into two classes: Class 1, chief special agents, who will collect statistics and supervise the work of assistant special agents within a given territory or district; and Class 2, assistant special agents, who will be assigned to the collection of statistics under the direction of, and subordinate to, special agents of Class 1.

Chief special agents of Class 1 will receive compensation at the rate of from $4.50 to $6 per day, including intervening Sundays. Assistant special agents of Class 2, if paid by the day, will receive from $3 to $4 for each day, including intervening Sundays; but such agents may, however, be compensated on a piece-price basis.

Copper Exports.

Exports of copper for the week ended September 30 were 7,470 tons. Since September 1 they were 20,057 tons, compared with 19,378 tons the same period last year.

New York Interborough's Passenger Traffic Makes Wonderful Record.

The New York Interborough Rapid Transit Company broke all previous traffic records Thursday of last week, when 2,157,989 persons were transported over its lines, of which 1,121,207 were elevated passengers and 1,036,782 subway. These figures eclipse last Saturday's record when 2,140,521 passengers were carried over the Interborough system.

Thirteen millions of passengers, to be exact, 12,964,716—is the record in transportation which the Interborough Rapid Transit Company has reported as having been set by its subway and elevated lines in seven days, from September 25 to October 1. This count did not include Saturday's tally of passengers, which is thought to have been greater than that of any other day of the Hudson-Fulton celebration.

The company officials think that on Saturday, October 2, 2,250,000 or more passengers paid their fares—the count has not yet been completed—thus bringing the number of passengers carried in the eight days of the big show up to 15,000,000. Besides those who paid to ride, the company had issued 10,000 passes to the officers and men of the visiting fleets and to the accredited delegates from other countries; how many took advantage of these cannot be determined.

Westinghouse Company's Dividends.

As a result of the rapid increase in business this year, dividends on the preferred stock of the Westinghouse Electric and Manufacturing Company have been resumed by the declaration of a quarterly dividend of one-and-three-fourths per cent and three-and-one-half per cent on account of the twelve-and-one-fourth per cent back dividends accumulated since the company went into the hands of a receiver during the panic of 1907.

There is $3,998,700 cumulative preferred stock outstanding, which shares equally with the "assenting" stock in all disbursements after seven per cent has been paid on the latter issue. On this basis the preferred received ten per cent annually from 1903 to October, 1907, just prior to the receivership. During the receivership, as part of the reorganization plan, the "assenting" stock was increased from $46,000,000 to $56,000,000 and $6,431,950 was issued to creditors along with $3,635,000 convertible five per cent bonds in satisfaction of the claims of the creditors.

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ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

ILLUMINATING ENGINEERING SOCIETY.

THIRD ANNUAL CONVENTION, NEW YORK CITY, SEPTEMBER 27, 28 AND 29.

Under circumstances which, to say the least, lent great aid to the subject of lighting, the third annual convention of the Illuminating Engineering Society began on Monday morning, September 27, at the Engineering Societies Building, New York city, just two days after the opening of the Hudson-Fulton Celebration. Needless to say, this celebration will long be remembered for its lighting rather than any other feature.

MONDAY MORNING SESSION.

Unfortunately, the New York members were so taken up with work on the celebration that they were not much in evidence at the first session, which the chairman of the convention committee, E. L. Elliott, opened shortly after 10:30 a. m. The visitors were made welcome by T. C. Martin, who aptly stated that while Paris was the "City of Light" in the old world, New York was the "City of Light" in the new; and Dr. Louis Bell, who responded to the welcome, said that it takes New York a good while to wake up, but when she does, it is with great enthusiasm.

The president, W. H. Gartley, in his presidential address, only an abstract of which was presented, referred chiefly to visual perception, and his remarks, when fully published in the society's *Transactions*, will bear careful consideration. Regarding the position of illuminating engineering, he said that the fact that some 250 million dollars for lighting were spent each year in this country would seem to be an answer to the query as to the need for work along the lines which the society was following. The society has brought about a higher standard of illumination in both gas and electric lighting, and is actively supported by both these industries. We need, however, the aid of the trained physicists in our colleges, and such interest as they have already taken speaks well for the future.

In presenting the report of the committee on nomenclature and standards, the chairman, Dr. A. C. Humphreys, spoke briefly of the work in hand and referred to the chairmen of the sub-committees for the detailed reports.

The report of the sub-committee on unit of light was presented by Dr. E. P. Hyde, at the request of its chairman, Dr. Louis Bell. Dr. Hyde reviewed briefly the work which has been accomplished toward the adoption of the international candle by the United States, Great Britain and France, which we have referred to in earlier issues. It seems that there has been considerable discussion, especially in Germany, concerning the adoption of an international unit, but without an international standard with which to make a comparison.

In this connection, Dr. A. H. Elliott stated that he had taken personally six carbon-filament electric lamps to the Electrical Testing Laboratories in New York city, the Bureau of Standards at Washington, the official laboratories at London and Charlottenburg, and then back to Washington, and although the final figures were not available, the results showed a much better agreement than he had anticipated.

Dr. E. B. Rosa called attention to the fact that the International Photometrical Commission would meet in Zurich next year, and as yet America had no representative, although England, Germany and France had several.

The other report referred to by Dr. Humphreys, viz., one on photometric units, was presented by Dr. C. H. Sharp, the chairman, but not in final form, as some of the minor details have not yet been decided by the committee. He said that the proposals were based upon the celebrated work of Doctor Blondel. The unit of luminous flux will undoubtedly be based on the unit solid angle or steradion $\left(\frac{1}{4\pi} \times \text{M. S. C. P.}\right)$, that is, unit mean spherical candlepower divided by 4π.

Doctors A. E. Kennelly, L. Bell and E. P. Hyde spoke in favor of the centimetre-gramme-second system of measurements being adopted, as they were already international in character. Doctor Rosa said that, if we would give up the foot and adopt the metre, the Germans would be likely to give up the hefner in favor of the candle (laughter). After further discussion by Messrs. Gartley, Marks and Bond, the subject was closed.

Secretary Preston S. Millar then announced that a number of invitations had been received, among which were those of the Consolidated Gas Company and the New York Edison Company, to visit their works; and from the American Society of Mechanical Engineers to visit its historical exhibit on the Hudson-Fulton Celebration.

After reports from the chairmen of the committees on entertainment and exhibits, Messrs. Marshall and Elliott, the meeting adjourned.

MONDAY AFTERNOON SESSION.

Although the day opened with cloudless skies by afternoon it began to rain, so that the attendance at the second session was not what it should have been.

President Gartley called the meeting to order promptly at 2:30 o'clock and introduced E. L. Elliott, who read his paper on "The Ethics of Illuminating Engineering."

In this paper Mr. Elliott outlined an admirable code of ethics for illuminating engineers. He spoke of the need of furnishing the genuine illuminating engineer with some authoritative credentials to distinguish him from the quacks. As to fees from clients he regards as self-evident that compensation must be based upon competence. The value of the services to the client must also be taken into account, but not on a contingent basis. An illuminating engineer in the employ of a lighting company or lighting appliance company should not do a general consulting business, as his judgment is biased. As regards professional relations illuminating engineers should not openly criticize the work of their competitors; in fact, they should do all in their power to advance the standing of the profession and the knowledge of the illuminating art.

In the discussion L. B. Marks stated that although a college education was desirable it was not essential, and that an engineer could accept a retainer from

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manufacturers of appliances and also do consulting work.

Mr. Campbell described the practice of basing the fee upon the saving on lighting bills and hoped that this practice would be frowned upon.

Mr. Calvert thought that the advice given by lighting companies was tending to encroach upon the work of regular practitioners, and in reply H. T. Owens stated that it was fortunate that the lighting companies took an interest in the subject, as any increase in the number of good installations would greatly aid all concerned.

Norman Macbeth said that the greatest trouble so far experienced was from salesmen who were pushing their wares under the guise of illuminating engineers.

In closing the discussion Mr. Elliott said that any advice given by an engineer interested in a certain appliance should be confined to that particular system and not include any others, as he was manifestly unable to give impartial advice in the latter case.

The second paper was presented by Geo. S. Barrows on "The Work of Dr. Carl Auer von Welsbach in the Field of Artificial Illuminants."

This paper was devoted chiefly to a description of the development of the incandescent gas mantle which rightly bears its inventor's name. About 1880, while a student at the University of Heidelberg, Dr. Auer had his attention directed to the luminescent properties of the rare earths. After several years' experimental work he announced his invention of the mantle in 1886. Commercial difficulties developed till 1890, when the mantle was perfected as the result of Dr. Auer's individual work. About 1898 he produced his first osmium incandescent lamp filament, which was the first of the metallic filaments and would have had a greater commercial future but for the invention subsequently by others of the tantalum and tungsten filaments. Lately he has made a study of pyrophoric substances for igniting gas.

Dr. A. Simonini, who had been associated with Dr. Auer, spoke briefly of the great work which the latter had accomplished.

Dr. A. H. Elliott stated that his work on pyrophoric or sparking alloys had already borne fruit as they were being used extensively in Germany for gas lighting.

Dr. Myer said that as early as 1906, some 400 tungsten lamps a day were being made in Dr. Auer's Vienna factory for commercial use.

Dr. C. H. Sharp called attention to the fact that the two great modern systems of illumination, incandescent gas and incandescent electric lighting, were one-man systems, Dr. Auer's and Mr. Edison's.

Dr. Louis Bell referred to Dr. Auer as one of the greatest and one of the least recognized of research chemists.

The paper on "The Progress of Illuminating Engineering in Europe" was then read by H. Thurston Owens.

Illuminating engineering is as new in Europe as it is here, says Mr. Owens in his paper. It has become prominent within the past two years largely because of the work of Leon Gaster in his journal, his Cantor lectures and his organization of the British Illuminating Engineering Society. Mr. Owens thinks that we are much behind Europe in the adoption of high-powered luminants. He cited many large installations of flaming arc lamps and high-pressure gas lamps. Berlin, he regards as a model for public lighting. London is brightly lighted but has a great variety of systems. Paris seems to be less deserving of its title, "City of Light," than formerly. Gas is used more extensively throughout Europe, and gas fixtures are more artistic than here. Maintenance receives greater attention, and it is seldom one sees broken mantles or dirty bulbs.

In discussing the paper Dr. A. H. Elliott agreed most heartily with the author regarding the matter of maintenance and hoped that both gas and electric companies would give the matter greater attention.

G. S. Barrows stated that he did not believe that America was so far behind Europe, especially in electric lighting, and that as far as high-pressure gas lamps were concerned the American manufacturers have been ready for some time to supply the demand, but that the field was covered by electric arc lamps.

In closing, Mr. Owens stated that he hoped Mr. Barrows would be fortunate enough to visit Berlin and see the results obtained with the latest designs of electric lamps. Regarding the high-powered electric lamps, which Mr. Barrows claimed were so good, these should be displaced by either newer types of electric or high-pressure gas lamps, as they have been abroad.

The next paper was entitled "Diffusing Mediums," by A. J. Marshall.

This paper is devoted to a strong criticism of the use of ground or roughed glass balls as a diffusing medium for high-powered luminants. These do require to be diffused, but the kind of balls so commonly used meet the hygienic requirements only partially, and the æsthetic requirements not at all. The brilliant source is very prominent in the center of such a ball. The only excuse for the use of ground or roughened glass is its cheapness and low absorption. At the slight sacrifice of each of these it is possible to use clear or slightly tinted opal globes, which Mr. Marshall regards as excellent diffusers that at the same time give a rich and beautiful effect. The author made also other excellent suggestions.

Messrs. Hopton and Marks discussed the conditions under which ground glass could be used to advantage despite the interdictions of the author to the contrary.

P. S. Millar stated the practice of manufacturers in supplying photometric data with their lighting appliances could well be amplified by including the intrinsic brilliancy and the character and amount of absorption.

The concluding paper of the session was that by F. K. Richtmyer on "Illuminating Engineering from the Educational Standpoint." It was read by E. L. Elliott in the absence of the author.

The object of the paper was to stimulate discussion of the technical education that should be given an illuminating engineer. The technical schools should provide not only instruction in the fundamental principles, but should arrange to utilize their facilities for research work. The author regarded a good course in photometry as an essential feature, and submitted an outline of eight groups of experiments in this line that are to be given at Cornell University this year. Thirty three-hour weekly periods will be devoted to this work.

President Gartley spoke of the great value of college courses in promoting the cause, and Mr. Elliott stated that it was to be hoped that architects would have the benefit of them, as like the story about the Scotchmen, if they could be caught young enough they could be taught about anything.

Prof. S. W. Ashe spoke in favor of having the regular courses in physics, which generally covered the basis of illuminating engineering, supplemented by lectures by practical men engaged in the work.

Mr. Bond suggested that recommendations as to the character and scope of the work be made by the society, as Mr. Richtmyer had requested.

TUESDAY MORNING SESSION.

The weather was kinder to the convention gathering on Tuesday than on the previous day, and the morning session opened with many new faces.

The first paper, describing "The Photometrical Laboratory of the United Gas Improvement Company," was presented by Charles O. Bond, and this was immediately followed by Dr. E. P. Hyde's paper on "The Physical Laboratory of the National Electric Lamp Association."

Mr. Bond's paper described the excellent and extensive equipment in the former laboratory, located very near to Philadelphia, which is provided with every facility for conducting photometric and life tests of all kinds of gas-lighting appliances both for indoor and outdoor use. Various kinds of gas, and at any desired pressure, are available. A storage battery and an accurate set of electrical instruments is provided for use in connection with electric incandescent lamps that are used as secondary standards.

Dr. Hyde in his paper described the er-

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ganization and objects of the Lamp Association's laboratory in Cleveland, rather than its equipment. It is planned to make it a laboratory for scientific research of the physical, physiological, and even psychological principles underlying the production and utilization of light. The laboratory will not concern itself with ordinary commercial problems. The first class of problems to be investigated will be those concerning the laws of radiation and of the radiating properties of matter. The second will embrace most of the scientific problems peculiar to illuminating engineering. The third will relate to the physiological effects of light and attendant radiations on the eye and other organisms. Connected with the laboratory are a good library and a well-equipped instrument shop. Associated with Dr. Hyde, who is director, are Drs. H. E. Ives, P. W. Cobb and F. E. Cady.

Dr. C. H. Sharp, who opened the discussion, called attention to the growing tendency among men of financial affairs to give greater consideration to matters which were far removed from any apparent direct benefits. The fact that such an elaborate and complete laboratory had been installed by a gas company marked a new era, as in former years the tendency had been toward the chemical rather than the photometrical side of the business.

W. H. Gartley stated that a few years ago the possession of a photometer gave a man a standing, but the trouble began when he had two and tried to make his results balance (laughter). The papers were also discussed by Messrs. Millar and Litle.

A paper entitled "Notes on Chemical Luminescence of Rare Earths" was read by Dr. A. Simonini. This was followed by one on "The Light of the Fire-fly," by Drs. H. E. Ives and W. W. Coblentz, this paper being read by the former.

The former paper narrated the results of a series of experiments conducted by its author while at work in the laboratory of Dr. Carl Auer von Welsbach in 1894-5. These confirmed the author's theory that the high incandescence of the Welsbach mantle is due to a recurrent oxidation and reduction of that constituent oxide which has several stages of oxidation. This is compared to the action in a mercury-vapor arc, the effects of the anode and oxidizing flame and also of the cathode and reducing flame being of a similar order.

The paper by Drs. Ives and Coblentz gave the results of their study of the characteristics of the fire-fly light. Its spectrum was photographed and, by comparison with that of a carbon glow lamp, its spectrophotometric curve and the distribution of its radiant energy determined. The light was found to consist of an unsymmetrical structureless band in the yellow-green of the spectrum. Its luminous efficiency was calculated as 96.5 per cent as compared with 0.4 per cent for the carbon glow lamp used and about four per cent for the most efficient artificial illuminant, the mercury arc. This value is obtained on the assumption that there is no infra-red radiation other than "animal heat." The light of the fire-fly would not be acceptable as an illuminant for general purposes because of its green hue and small spectral extent. The color values of objects illuminated by it would be distorted to a greater extent than by the mercury arc. The most efficient light for human use would be a light similar to the fire-fly light in containing no radiation beyond the visible spectrum, but differing from it by being white. Such a light would have a luminous efficiency of about forty-five per cent or about twenty-two candles per watt. Where color is of secondary importance it is not unreasonable to hope that we may some time approach the fire-fly efficiency.

Dr. Sharp, in discussing these two papers, referred to the fact that Dr. E. L. Nichols stated nearly twenty years ago that the efficiency of the gas mantle was due to phosphorescence or luminescence and not to temperature only. He regarded the results brought out by Drs. Ives and Coblentz as of the greatest significance in pointing out to us the possibility of great improvement in the methods of light production.

Dr. Louis Bell said he hoped that bolometer measurements would be taken by Dr. Ives in future experiments along this line as those taken by Professor Langley had received so much criticism. These investigations might be extended with profit to the study of many chemical charges that are accompanied by radiations of limited extent similar to those of the fire-fly.

As it was long past the hour for adjournment and a photographer was in attendance the discussion was interrupted at this point and the meeting adjourned to look happy.

TUESDAY EVENING SESSION.

At the evening session the society was fortunate in having among the members present Walton Clark, who is the president of the Franklin Institute, of Philadelphia, and past-president of the American Gas Institute. He addressed the meeting briefly, congratulating the illuminating engineers on their efforts to conserve our natural resources and our eyesight as well.

The only topic on the programme for the evening was the lecture that was delivered by Dr. Chas. P. Steinmetz on "The Physiological Effects of Radiation."

The speaker dwelt especially on the effects of radiation outside of the visible spectrum. He stated that in spite of the fact that daylight contained far more of the ultra-violet rays than artificial illuminants, nevertheless the latter were much more harmful, so that we must look for something besides ultra-violet light as the cause of the trouble. The troubles which our eyes are subject to he divided into three classes: Indirect, due to impairment of color distinction; direct, due to the power or quantity of radiation, and specific, due to high frequencies. Regarding the trouble due to the second phase of the question, the lecturer explained that the harm from a four-watt-per-candle lamp was greater than from a two-watt-per-candle lamp on account of the greater energy or power outside of the visible spectrum which reaches the eye.

At the conclusion of Dr. Steinmetz' lecture, the subject was discussed by Messrs. Jones, Bond and Klumpp and Drs. Cobb, Simonini, Hyde, Bell and Elliott.

WEDNESDAY MORNING SESSION.

There were no distractions in the way of parades on Wednesday, and with beautiful weather the attendance was noticeably better.

The first paper, "Allowable Amplitudes and Frequencies of Voltage Fluctuations in Incandescent Lamps," was presented by Dr. Herbert E. Ives.

This paper gave the results of an investigation to determine the frequency at which flicker due to various voltage fluctuations just vanishes in carbon and tungsten incandescent lamps. The tests were made at the Bureau of Standards and the flicker was produced by superposing an alternating electromotive force upon a direct electromotive force, or the reverse. The frequency of the former was varied from four to seventy-five cycles per second. The results were shown graphically and indicated that for slight fluctuations of voltage an excessively rapid rise of the frequency is necessary. A three per cent change in voltage with a carbon lamp means under normal conditions an eighteen per cent change in light, while with a tungsten lamp about twelve per cent change in light.

In the discussion Mr. Fisher pointed out that low frequency, such as twenty-five cycles, was permissible in street lighting where the intensity of illumination was low.

Dr. Sharp said that the sensation of flicker was stronger when we looked at an illuminated object than when we looked at the lamp. Others entering into the discussion were Messrs. Menill, Hyde and Perkins.

The next paper, by Dr. Louis Bell, was entitled "The Principles of Shades and Reflectors."

The author defined a shade as a structure which is intended chiefly to keep the direct light of the illuminant out of one's eyes, and a reflector as a structure intended chiefly to redistribute the radiation into more useful directions than are available with the unmodified source. Some devices are both shade and reflector. By decreasing the intrinsic brilliancy the visual usefulness of the light as actually applied is increased, even though the actual loss of light flux in passing through diffusing globes amounts to from about ten to as much as fifty or sixty per cent, depending on the amount of roughening, sand-blasting, or opalescence of the globe. Dr. Bell then analyzes the action of simple reflectors in re-directing the light, considering a plate directly above the light, a cone and a hemisphere. In regard to prismatic reflectors he calls attention to the fact that the tendency to etch the exterior surface of the reflector results in giving it a diffusing surface. As the etching is increased it reduces the efficacy of the prisms in refracting the light, and if very

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dense renders the device into a mere diffuser, just as if there were no prisms.

In the discussion on this paper V. R. Lansingh said that the distribution of light could only be changed materially when either mirror or prismatic glass was used.

Mr. Jones described a metal trough reflector with glass shields for the lamp which gave practically uniform illumination. The paper was also discussed by Messrs. Wohlauer and Owens.

The concluding paper of the morning session was entitled "Standard Relations of Light Distribution," by A. J. Sweet.

In this paper Mr. Sweet advocates the need of standardization of lighting units so as to adapt them to meet the requirements of the bulk of illumination problems, which he classifies into three general groups: (1) Illumination of a room from one light center located in the center of the room, such as most residence rooms and small offices; (2) illumination of large interiors on the basis of the square, such as stores and large offices; (3) illumination of long, narrow rooms by several light centers in a row along the center, such as small stores. Mr. Sweet discussed each of these problems and determined a set of typical distribution curves and constants for each group. In concluding, he asked that the work of standardization be extended as far as possible, even if his analysis should not be approved, in order that the common problems be properly solved by the laymen.

Mr. Woodwell stated that we should encourage the specialist to take up each separate problem by itself rather than use general rules as suggested by the author.

Mr. Hopton thought that the curves shown would give normal valves which would be too high for residence lighting, and H. T. Owens said that the reverse was the case with commercial lighting.

E. L. Elliott congratulated the author for bringing forward suggestions for standardization which the art was badly in need of.

WEDNESDAY AFTERNOON SESSION.

The final session opened with a paper on "The Problem of Heterochromatic Photometry," by P. S. Millar.

The photometry of an illuminant differing in color from the standard used presents great difficulties even on the part of expert observers. In commercial practice very serious discrepancies are encountered. These difficulties and discrepancies are discussed in detail with the aid of actual results of various comparisons. Mr. Millar advocates the transfer of the candlepower unit from the present color to that of, say, the tungsten lamp, which he regards as presenting no insurmountable difficulties. He recommended that the attention of the society's council or of a special committee be called to the consideration of standardization of methods in this branch of photometry.

Dr. C. P. Steinmetz, in discussing the paper, said that the matter of measuring lights of decided color could be done by three operations, as follows: By using the bolometer to determine the radiation, a photographic plate for the actinic rays, and a flicker photometer for the effects of after image. He recommended the use of an illuminometer with a reading card with black letters on white background for low intensities and white letters on a gray background for high intensities.

Dr. Louis Bell stated that with the last-named instrument the trouble would be that the result would be one of adaption rather than perception, which was agreed to by Prof. S. W. Ashe.

Mr. Sweet described a tungsten lamp which was constructed to meet with the necessary requirements of a standard.

The next matter taken up was the conclusion of the discussion on the papers of Drs. Ives and Simonini, which had been interrupted the day before.

Dr. Steinmetz was of the opinion that the spectrum of a single fire-fly would show an even narrower area than that from the large number used by Dr. Ives. He then discussed the earliest as well as the largest application of selective radiation, the Welsbach mantle showing that the greenish color was characteristic of this phenomena. Dr. Ives did not agree with Dr. Steinmetz regarding the spectrum.

The paper by Mr. Norman Macbeth on "Some Results Obtained Through Illuminometry" was then read but not discussed.

This paper gave the results of a series of illuminometer tests of incandescent gas lamps equipped with different reflectors and mounted at various distances above the test plane in a room having alternately light and dark walls. Considerable variation was found in the results actually observed at heights of four, six and eight feet from the calculated values. This was attributed to the effect of the reflectors.

L. B. Marks then read his paper on "Factory Lighting."

The author made a study of the actual lighting conditions, both by day and night, in five factories devoted to the manufacture of typewriters and kindred appliances. These factories were lighted almost entirely by individual localized incandescent lamps. The results are given in detail and their shortcomings carefully pointed out. The illumination produced was found to be confined to small very bright zones with an excessive amount of harmful reflection from the smooth surfaces of the machines; the frequent handling of the lamps by the operators to adjust their height resulted in soiling them and their reflectors, besides consuming much time; low general illumination is produced which gives a dingy effect to the whole shop; advantage is not taken of the walls and ceilings for their reflecting value. In many cases the artificial local illumination was ten to twenty times the natural illumination by day. All these features show the need for suitable general illumination, proper location of lamps, reduction of intrinsic brightness, improved diffusion, etc.

A short discussion followed by Messrs. Millar, Forest, Rowe and Macbeth.

The paper on "Operating Efficiencies of Some Commercial Installations of Lighting Systems," by A. L. Eustice, was then presented.

Mr. Eustice's paper gave the results of an extended investigation of actual illuminating efficiencies attained in twenty-one different commercial installations in which a total of sixty-six sets of tests were made by him. These tests were made with the lighting units both as actually found, i. e., more or less dirty, and after cleaning them. A series of laboratory tests was also conducted. The conclusions from the various results make it evident that the conditions under which lighting systems, employed the same type of unit, are installed, are so varied that it is almost impossible to lay down or establish definite illumination efficiency factors to be used promiscuously by one lacking a great amount of experience. In all cases it is necessary to increase any theoretical factors obtained in order to provide additional voltage to take care of depreciation, not only of the candlepower of the units, but also due to accumulation of dirt. The latter varies with different systems, since a unit that does not depend primarily upon reflecting glassware suffers least in application to commercial systems.

V. R. Lansingh said that the figures which he had given out some time ago were based upon the data available at that time and that they would have to be revised. A short discussion followed by Messrs. Macbeth and Jones.

The paper on "Tests of Moore Tube Lighting Installation, New York Post Office," by Dr. E. P. Hyde and J. E. Woodwell, was read by title only, as the authors were unable to be present. It reported the results of a number of tests made in June, 1908.

The final paper on "Tests of a Moore Tube," by Dr. C. H. Sharp and P. S. Millar, was read by the latter.

These tests were made in Assembly Room No. 2 of the Engineering Societies Building in New York city in July, 1907. The tube was 176 feet long and was operated at sixty cycles. It was found to give a mean horizontal candlepower of 8.1 per one-foot section, and to have an efficiency of 2.39 watts per mean horizontal candlepower. The total watt consumption was 3451 at 220.3 volts.

In the discussion, Dr. Ives gave some figures of a recent test as to the color value in connection with the paper he presented at the last annual convention.

Mr. Warner stated that he had made some tests for efficiency which were fifty per cent better than those given in the paper.

The convention then adjourned. The total registration was 244 members and 185 guests.

ENTERTAINMENT FEATURES.

There was no end to the entertainments that afforded relaxation to the members

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and their guests. In fact, the number of attractions of the Hudson-Fulton Celebration were so numerous that they became almost distractions to the convention. Great interest was taken in the grand illumination on all sides.

The reception committee wisely left Monday evening for less strenuous things and the members, accompanied by a host of ladies, enjoyed a delightful musicale which was followed by an informal reception, with many tempting viands to appease the inner man.

Tuesday afternoon was devoted entirely to a review of the great historical parade. After the session on Tuesday evening closed, the members journeyed in automobiles to Riverside Drive to view the Ryan scintillator, and from there down through the city and over to Brooklyn. This was a most successful feature of the convention because New York was illuminated as never before.

On the following morning some 150 guests, of the fair sex, embarked in touring cars on a long trip not only in New York but through Westchester County as well.

THE EXHIBIT.

In connection with the convention a most interesting exhibit of lighting appliances was held in a building a few doors from the convention hall. It was notable for the elaborate displays of the individual exhibits rather than the number of exhibitors.

The Leeds-Northrup Company, of Philadelphia, exhibited a number of photometric and electrical instruments.

The Electrical Testing Laboratories, New York city, had a booth with the following photometric screens in use so that they could be compared: Lummer-Brodhun contrast, Lummer-Brodhun comparison, Martens bi-prism, Bunsen and flicker.

Foote-Bierson & Company showed the Sharp-Millar photometers and a number of electrical measuring instruments.

The Welsbach Company had as fine a display of gas fixtures, and their tasteful arrangement gave an air of comfort quite unusual in such exhibits.

The Holophane Company showed an ever-increasing line of glassware for both gas and electric lamps and the inevitable comparison booth. A full line of the Holophane-D'Olier reflectors were also shown.

The General Electric Company had a generous display of arc and incandescent lamps, particularly tungsten.

The new Westinghouse-Nernst lamps, with their attractive fixtures, were shown by the Nernst Lamp Company.

Various types of Cooper-Hewitt tubes were exhibited by the company of that name.

The Westinghouse Electric and Manufacturing Company showed a complete line of tungsten lamps with both opal and Holophane reflectors.

A number of historical and educational features were also exhibited.

The Illuminating Engineering Society of Great Britain.

As is well known there has recently been organized in London an association of illuminating engineers called, like its American sister-society, The Illuminating Engineering Society. This society received its greatest impetus at an inaugural dinner given in London on February 9 last, and all who attended on this occasion became charter members. On May 25 a meeting was held at which the constitution that had been drafted was formally adopted.

The first of the technical sessions will be held in November, the exact date to be announced very soon. At the council meeting, held on June 18, it was decided that dues paid by those who join the society during the present year should cover the period up to December 31, 1910. The honorary secretary is Leon Gaster, editor of *The Illuminating Engineer,* of London, who has been most instrumental in the movement that resulted in the society's formation and who is actively soliciting scientists, engineers and architects interested in the study of the science and art of illumination to aid in this work by joining the new society. Mr. Gaster's address is 32 Victoria Street, London, S. W. He will be pleased to communicate with anyone interested in the objects of the society.

It is now understood that Prof. S. P. Thompson has kindly consented to become the first president of the society, and that influential support has been received from many distinguished authorities on matters of illumination in Great Britain, on the Continent, and in America.

In order to illustrate the representative and international nature of this support, there are given below, in alphabetical order, the names of a few of those who are expressing their sympathy with the movement by becoming vice-presidents and corresponding members:

Dr. Louis Bell, Boston, Mass.; Dr. L. Bloch, Berlin; Prof. A. Blondel, Paris; Dr. E. Budde, Berlin; Prof. H. Bunte, Karlsruhe; Sir William Crookes, London; M. Sainte Claire Deville, Paris; Prof. H. Drehschmidt, Berlin; E. L. Elliott, New York; Dr. A. H. Elliott, New York; Prof. J. A. Fleming, London; Dr. E. P. Hyde, Cleveland, Ohio; Dr. H. Kruss, Hamburg; V. R. Lansingh, New York; Prof. Vivian Lewes, London; Sir William Preece, London; Sir Boverton Redwood, London; Prof. S. Rumi, Genoa; Dr. E. Schilling, Munich; Prof. H. Strache, Vienna; Prof. K. Ulbricht, Dresden; Dr. W. Voege, Hamburg; Sir H. Trueman Wood, London.

In addition, a very representative council has now been formed. The society will therefore enter upon its opening session, next November, under excellent auspices, and has every reason to hope for a long and prosperous existence.

Chicago Publisher Seeks Lighting Franchise in Ottawa, Ill.

W. D. Boyce, of Chicago and Marseilles, Ill., and publisher of various Chicago weeklies, has two petitions, an ordinance and a communication from his legal representative before the City Council of Ottawa, Ill. He has been building a high-power transmission line along the banks of the canal from Marseilles to La Salle. The Ottawa authorities refused to let him cross the city without action by the City Council.

He asked permission to do so. This line has nothing to do with the regular franchise that he asked for. It was claimed that by permitting him to complete this line the county could buy light and power for the county farm much cheaper than had yet been offered them.

This petition was quietly received and filed.

Then came his petition for a franchise to distribute light, heat and power, by electric current, through the City of Ottawa. His petition set forth that he had secured frontage consents from a majority of the property along each proposed street to be occupied. The franchise is asked for fifty years, the matter of compensation not being stated very clearly in the petition.

Alderman Dinneen wisely suggested that the ordinance be published, that the people may see just what is asked for. The whole matter was referred to the judiciary committee and the city attorney.

Mr. Boyce left a few weeks ago for his game hunting by balloon expedition in Africa, which is attracting so much attention.

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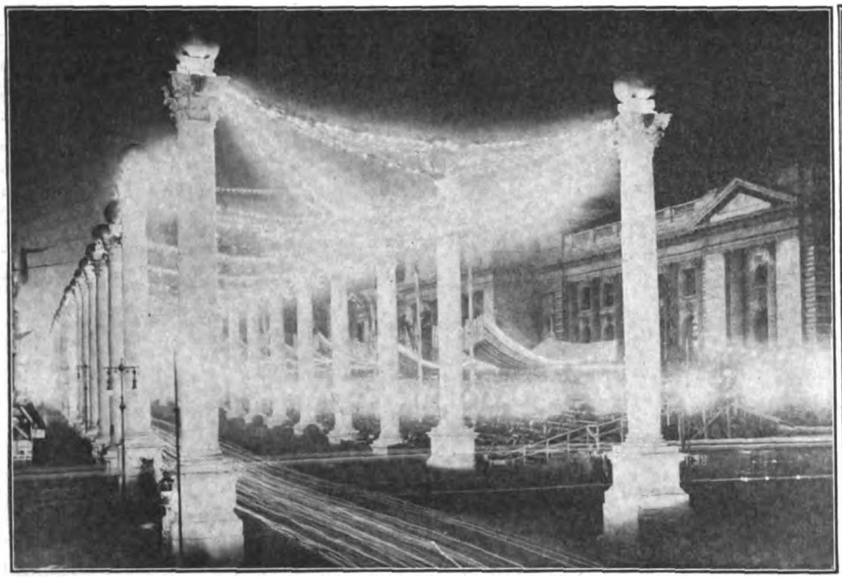
The Hudson-Fulton Celebration.

The Hudson-Fulton Celebration of 1909 has by this date nearly passed into history. It will be remembered as one of the most magnificent festivals ever held in this country. The metropolis and its sister cities along the noble Hudson certainly did their utmost to do honor to the memory of the two famous pioneers of that great river. Both on land and on water were held series of pageants whose participants were gathered from far and near. The civic display rivaled the naval display. As a climax to the events of each day there was an illumination on a scale never before witnessed. A suggestion of what this illumination was like was given in these columns last week with the aid of five views. In this article an attempt will be made to give a little better idea of these displays.

To view all these attractions there were the biggest crowds of people that New York city, much as it is used to handling crowds, ever had assembled. Every means of transit was taxed to more than its normal capacity. By the spreading out of the peak over the larger part of the day, and particularly in the evening, all traffic records were broken right on the first day of the celebration. The elevated and subway lines of the Interborough system carried a total of about fifteen million passengers during the eight days of the celebration in New York city. This massing of humanity was one of the striking features of this extraordinary week.

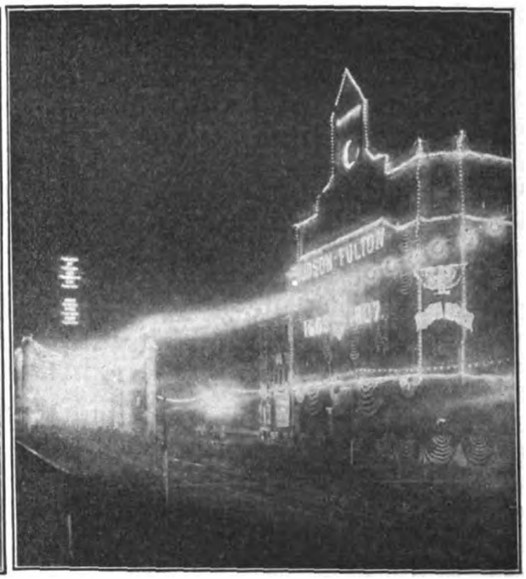
However, without question, the most successful feature of the Hudson-Fulton Celebration, in fact, the one which will make the most lasting impression, was the special illumination of the buildings, both public and private, the streets, bridges, wharves, vessels and other conspicuous objects, both on land and on water.

There were three land parades, more or less interesting. The last one, held on Saturday night, October 2, was heralded as an illuminated carnival parade,



NEW YORK EDISON PHOTO.

THE COURT OF HONOR ADJOINING THE PUBLIC LIBRARY ON FIFTH AVENUE. NEW YORK.



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UNION LEAGUE CLUB, NEAR COURT OF HONOR.

NEW YORK EDISON PHOTO.

THE HOTEL PLAZA.

NEW YORK EDISON PHOTO.

GORHAM BUILDING.

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but was entirely lacking in the features which go to make such a parade successful. Thousands of men in nightshirts, holding Roman candles, and a hundred highly decorated floats, appealed to the young and the uninitiated, but the effect was dismal and crude as compared with the avenues of light through which the parade passed.

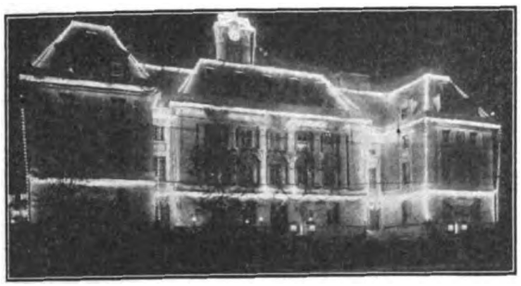
its massive columns and streamers of lights is clearly brought out. Over 7,000 lamps were used here.

The Union League Club, just south of this point, had one of the most effective displays of decorative lighting in the city. The many other clubs were also decorated and outlined.

The Plaza Hotel, at Fifty-ninth Street, as shown herewith, was illuminated in a manner in keeping with its location, reputation and size. The other famous hostelries vied in their efforts at tasteful display. Another of the striking Fifth Avenue installations was that of the Gorham Building.

The double lane of incandescent lights shown in these views extended the whole length of the parade route, a distance of over five miles. About 30,000 lamps, spaced two feet apart, were used for this purpose.

The illumination of buildings was not confined to the route of the parades, as will be seen from the accompanying illustrations. The lighting of a dry-goods store on One-hundred-and-twenty-fifth Street attracted considerable attention. The New York City Hall and the Home Life Insurance Building are shown below on this page. The Waterside Station of the New York Edison Company was outlined in a very pleasing manner. One view of this installation is shown herewith; another was shown on page 647 of last week's issue.



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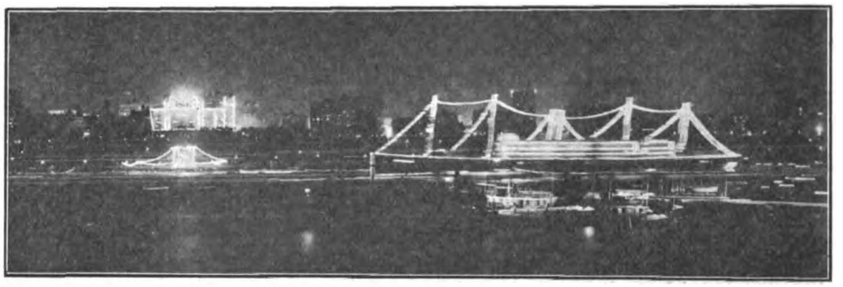
BOROUGH HALL, STATEN ISLAND.



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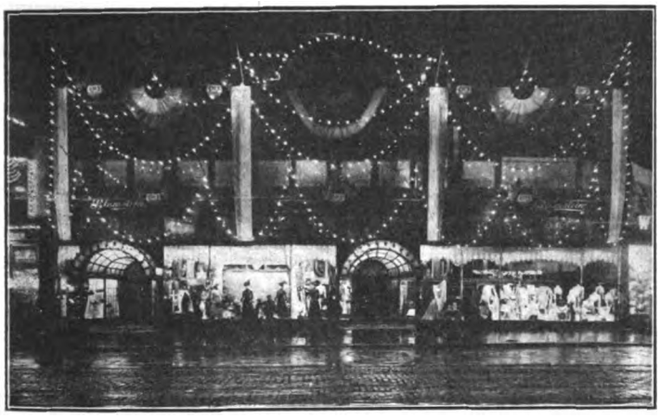
WATER GATE AND STEAMER NEW AMSTERDAM.



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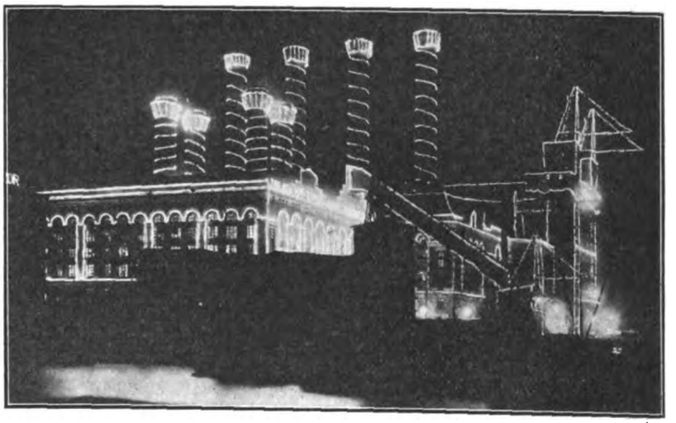
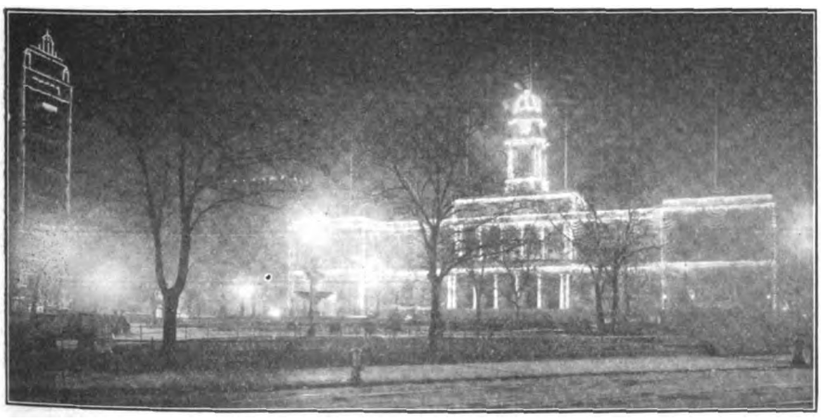
DRY GOODS STORE ON 125TH STREET, NEW YORK.



NEW YORK EDISON PHOTO.

WATERSIDE STATION, NEW YORK EDISON COMPANY.



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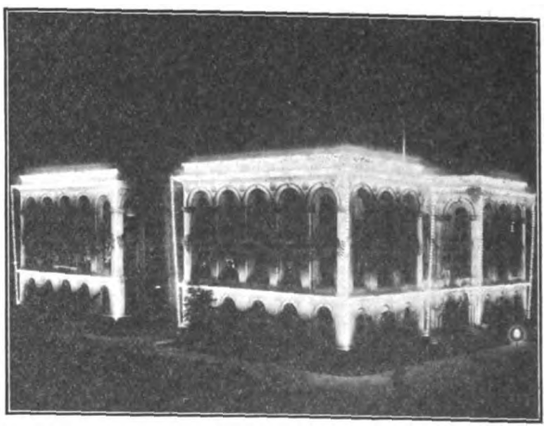
CITY HALL, NEW YORK CITY.



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BOROUGH HALL, BRONX.

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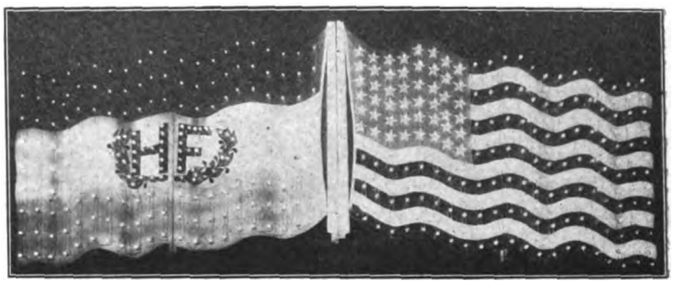
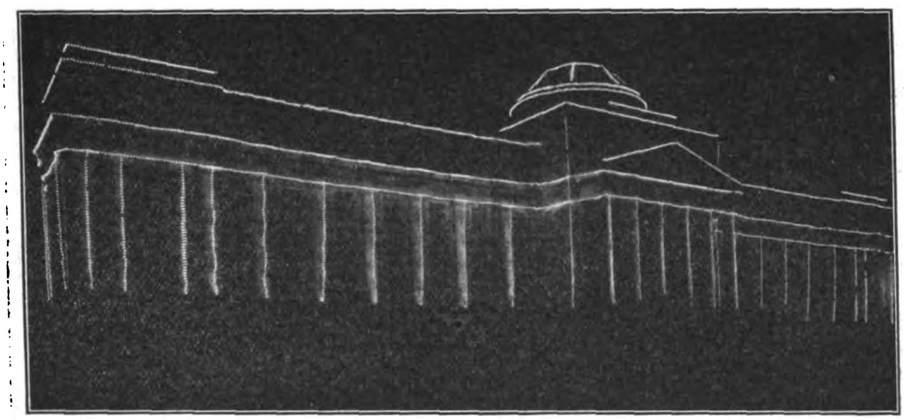
Among the electric lighting displays made by the large number of naval vessels, commercial steamers, yachts, ferries, tugs and other watercraft, one of the most pleasing was that of the great Holland steamship *New Amsterdam*. The accompanying view gives but a very meager idea of the splendor of this effect.

CUPOLA OF BROOKLYN INSTITUTE OF ARTS AND SCIENCES, WATER TOWER, SOLDIERS' AND SAILORS' ARCH.



ILLUMINATED FLAGS AT BAY RIDGE, NEAR 87TH STREET, BROOKLYN.



BROOKLYN INSTITUTE OF ARTS AND SCIENCES, EASTERN PARKWAY.

BOROUGH HALL, BROOKLYN.

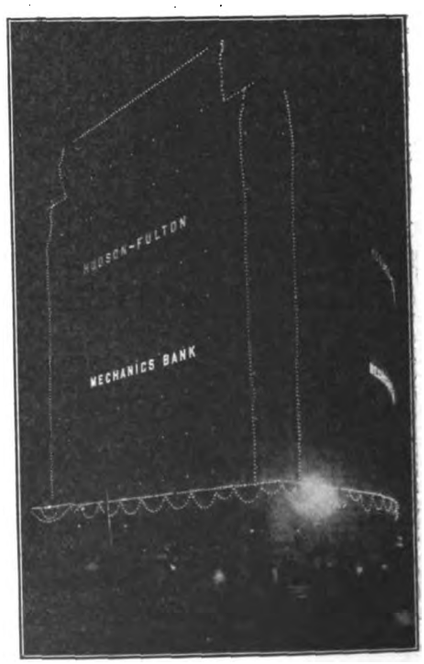
The special illumination for the Hudson-Fulton Celebration was not confined to Manhattan and the Hudson River. Each of the boroughs of the greater city strove to do its share in making the occasion a memorable one. Each of the borough halls was outlined with strings of lamps.

The Brooklyn Institute of Arts and Sciences is one of the architectural monuments of the city and stands upon a good elevation near Prospect Park. This building can be seen from many high points in Manhattan as well as from Williamsburg Bridge. Its outline lighting was admirably done, as will be seen from an accompanying view. Close by is the Soldiers' and Sailors' Monument, which presented a very beautiful appearance at night.

Among the private buildings which were effectively illuminated were the Mechanics' Bank and Dime Savings Bank.

One of the many signs erected on the shore front was the flashing flags erected by the New York Electric Carriage Call Company. It is shown on the adjoining page. The Edison Electric Illuminating Company, of Brooklyn, also had a very conspicuous though simple sign. As shown, it consisted of the words, "Brooklyn Edison" in bold, twelve-foot letters.

SIGN ALONG WATER FRONT.



MECHANICS BANK, BROOKLYN.

Probably no single feature of the celebration has elicited more attention than

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the Ryan scintillator, especially among those interested in illuminating engineering. The scintillator was installed at a prominent point on the extension of Riverside Drive at 155th Street, and its effects could be seen to advantage in every detail from a distance of nearly two miles, so that great crowds have been entertained nightly. The accompanying illustration, showing the auroral effect, was taken about half a mile away.

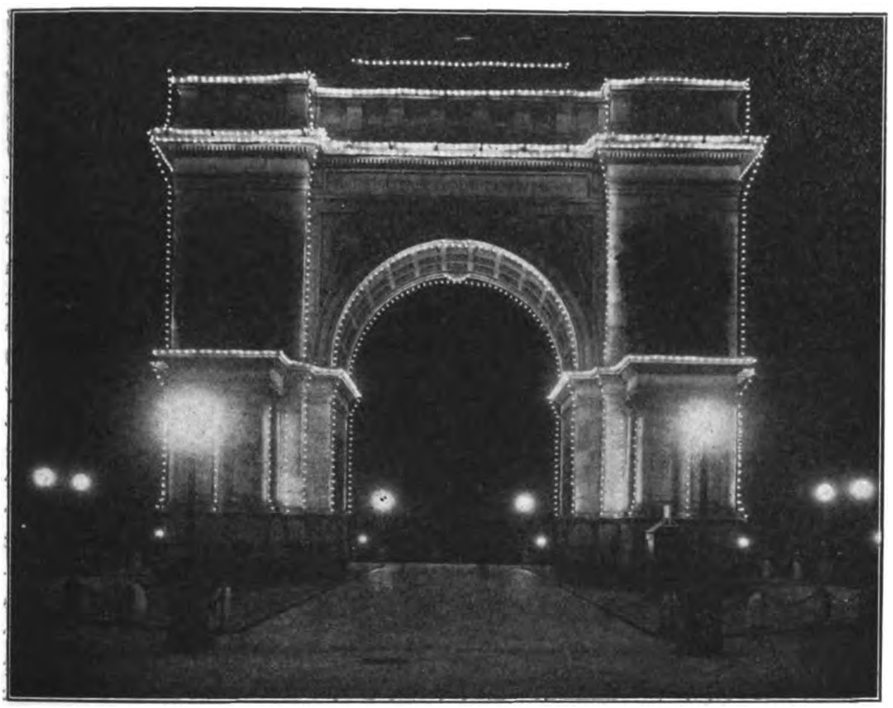
The installation consists of two groups of arc projectors with auxiliary apparatus in the shape of color screens, steam nozzles and devices for throwing bombs into the air. Steam for these nozzles was supplied by a 200-horsepower boiler. As it escaped from the nozzles it formed immense screens of mist, upon which the most exquisite colored and spectacular effects were thrown by the beams from the searchlights.

The searchlights consisted of two batteries, as shown from the rear, each including nine thirty-inch and one twenty-four-inch projectors, the whole set using up to 1,500 amperes when all are in operation. Each searchlight is equipped with six gelatine color slides, and there are six additional hand slides for each projector.

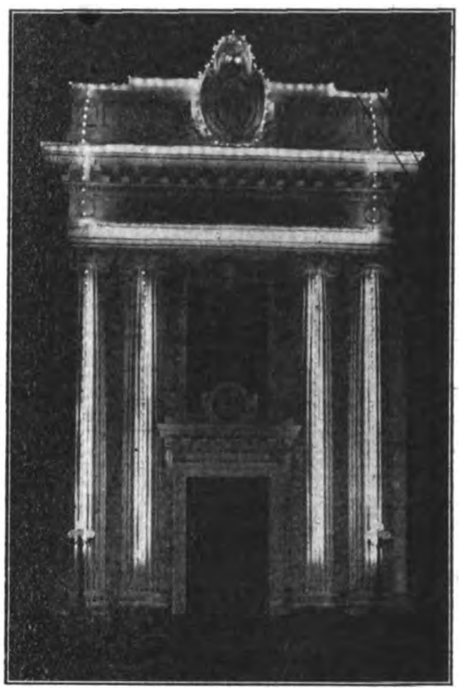
A complete programme of spectacular effects, requiring nearly an hour-and-a-half, was carried out several times each evening. It included sunbursts, auroras, peacock feathers, beam dances, plumes, fans, etc. In addition to the steam effects, bombs were exploded and the varied colors of the searchlights played upon the smoke.

The installation of the scintillator is largely due to the efforts of the New York Edison Company and to C. F. Lacombe, chief engineer of light and power for the city of New York. It is the same equipment as was designed for use at Niagara Falls and was built by the General Electric Company in accordance with the designs of W. D'A. Ryan.

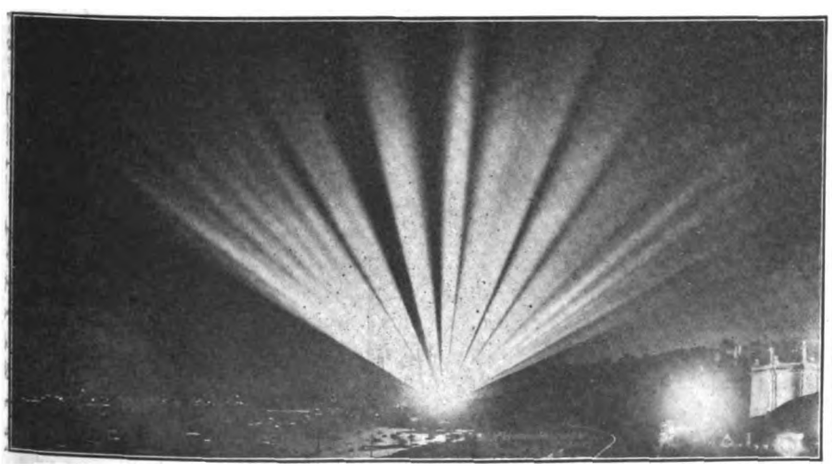
For the photographs from which all the accompanying illustrations were made we are indebted to the New York Edison Company and to the Edison Electric Illuminating Company, of Brooklyn, who supplied the current for practically all the illumination throughout New York city.



SOLDIERS' AND SAILORS' ARCH, PROSPECT PARK PLAZA, BROOKLYN.

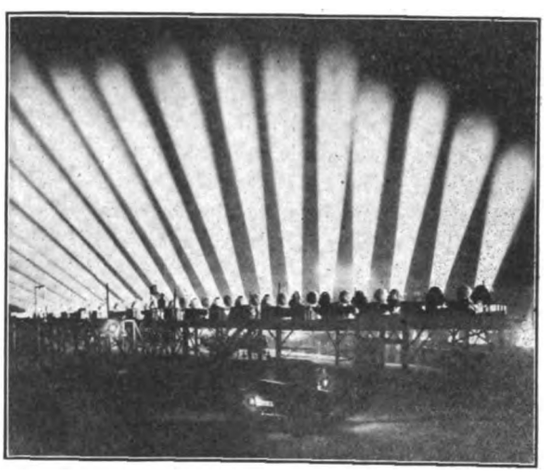


DIME SAVINGS BANK, BROOKLYN.



NEW YORK EDISON PHOTO.

THE RYAN SCINTILLATOR, FROM 145TH STREET AND RIVERSIDE DRIVE.



NEW YORK EDISON PHOTO.

RYAN SCINTILLATOR, FROM REAR.

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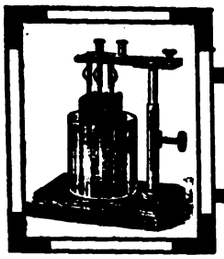

ELECTRO-CHEMISTRY and METALLURGY

Electricity and Fertilizers.[1]

The world is more indebted to the electrical engineers and chemists who have produced the manures calcium nitrate and calcium cyanamide than it at present has any idea of. For if these artificial manures had not come in the nick of time, there is no doubt that the prices of sodium nitrate from Chili and sulphate of ammonia from gas works would have gone soaring up. As it is, the prices have increased some thirty per cent within the last few years.

And the reasons are not far to seek. First, the virgin soils of the world are being rapidly used up; there was a time, not long ago, when wheat could be grown nearly all over the United States without putting in manure, but it is not so now. The natural stores of nitrogen accumulated through the ages have been taken out by repeated cropping of wheat. The second reason is that more and more people in the world are becoming, like ourselves, wheat and meat eaters.

This provision of nitrogen for the gluten in wheat and the fibrine in meat to build up the muscle and tissue of the human body was rapidly becoming the problem of this century, as Sir William Crookes pointed out in 1898, when, without any fuss, some electrical engineers and chemists, called Birkeland and Eyde, Frank and Caro, came forward with solutions.

The first step toward fixing the nitrogen of the air was made in 1773 by Dr. Priestly. He sent a series of electric sparks through air in a closed glass jar, and obtained a brownish colored gas which was nitric oxide.

The principle of the process of making calcium nitrate at Notodden is based on Dr. Priestly's experiments, the sparks he used being replaced by a disk-shaped flaming arc about five feet in diameter. Six years ago Professor Birkeland and S. Eyde built their first furnace of twenty-five horsepower. Two years later they had a plant of 2,500 horsepower, and in 1907 the 40,000-horsepower plant at Notodden, Norway, was set to work. The harnessing of the Rjukan Falls of 220,000 horsepower is now in hand, and by 1912 nearly half a million water horsepower will be used in manufacturing calcium nitrate and nitrite. The Birkeland and Eyde furnace is about eight feet in diameter and three feet through, set on edge like a wheel. It is lined with refractory bricks, and has a disk-shaped arc chamber about five feet diameter by three inches. Alternating current at 5,000 volts is fed across the two water-cooled copper electrodes, and a flaming arc is continually being struck and blown out to the limits of the arc chamber by the repulsion of a powerful electromagnet. Air is forced through the arc chamber under pressure, and is immediately burnt into nitric oxide, and this gas is then led away to two sets of five towers, taking up another atom of oxygen on the way to form nitric peroxide. The first four towers are filled with pieces of quartz over which water and the nitric acid already formed, trickle. The fifth tower is filled with ordinary bricks, with milky lime flowing over them. This quickly absorbs what nitrous gases remain, and is converted into calcium nitrate and nitrite. The first tower yields a fifty per cent nitric acid, the second twenty-five per cent, the third fifteen per cent, and the fourth five per cent. The liquids from the fourth are raised by compressed air to the top of the third, and those from the third to the second, and so on, the acid thus traveling in a counter direction to the gas.

Calcium cyanamide, or "nitroline," is made from carbide of calcium, and the inventors, Professor Frank and Mr. Caro, took the idea from Bunsen and Playfair, who obtained cyanides by passing nitrogen over a hot mass of carbon and alkalies. They first tried barium carbide, but since carbide of calcium has been produced in such great quantities for acetylene-gas lighting it has become very cheap. When carbide of calcium is raised to 1,000 degrees centigrade, it fixes nitrogen directly without the aid of alkalies. Further, if the resulting cyanamide is mixed with water under pressure the nitrogen combines with the hydrogen to form ammonia. This naturally suggested the use of the material as a manure, and it has been so successful that there are now about a dozen factories in the various countries of Europe, in the United States, and even in Japan, turning out about 150,000 tons per annum. The nitrogen content is guaranteed at eighteen per cent.

The manufacture for England is in the hands of the Northwestern Cyanamide Company, which has built a works at Odda, on the Hardanger Fiord, in Norway, capable of turning out 12,000 tons per annum. The calcium carbide made by the affiliated concern, the Ally Carbide Company, is delivered in lumps. After being broken up fine in crushers and mills, it is fed by means of special hoppers with 196 electric resistance furnaces, each capable of holding about 670 pounds. The lids are fastened down air-tight, and nitrogen gas is forced through under pressure, the process being completed in about forty-five hours. The nitrogen gas is made by the Lende process, in which air is led through white-hot copper shavings. The copper at that temperature has a great affinity for the oxygen, so it takes it all up, leaving the nitrogen to be blown forward to the furnaces.

The various reactions may be written down thus:

$CaO + C_2 = CO + CaC_2$ carbide of calcium.

$CaC_2 + 2N = C + CaCN_2$ cyanamide.

$CaCN_2 + 3H_2O = CaCo_3 + 2(NH_3)$, ammonia.

It will be noticed that when the ammonia gas is given up the lime is deposited in the soil. This also happens with the other manure, calcium nitrate, and therefore they both have this advantage over sodium nitrate from Chili. Soils short of lime are improved, whereas when sodium enters the soil it tends to make it "sad." It is not known how the nitrogen passes from the ammonia to the gluten in the wheat ear, but there is no doubt that certain bacteria in the soil play an important part.

[1] Somewhat condensed from an abstract of a lecture (by F. Kilburn Scott, at the Wye Agricultural College, Wales) in *The Electrical Engineer* (London), September 8.

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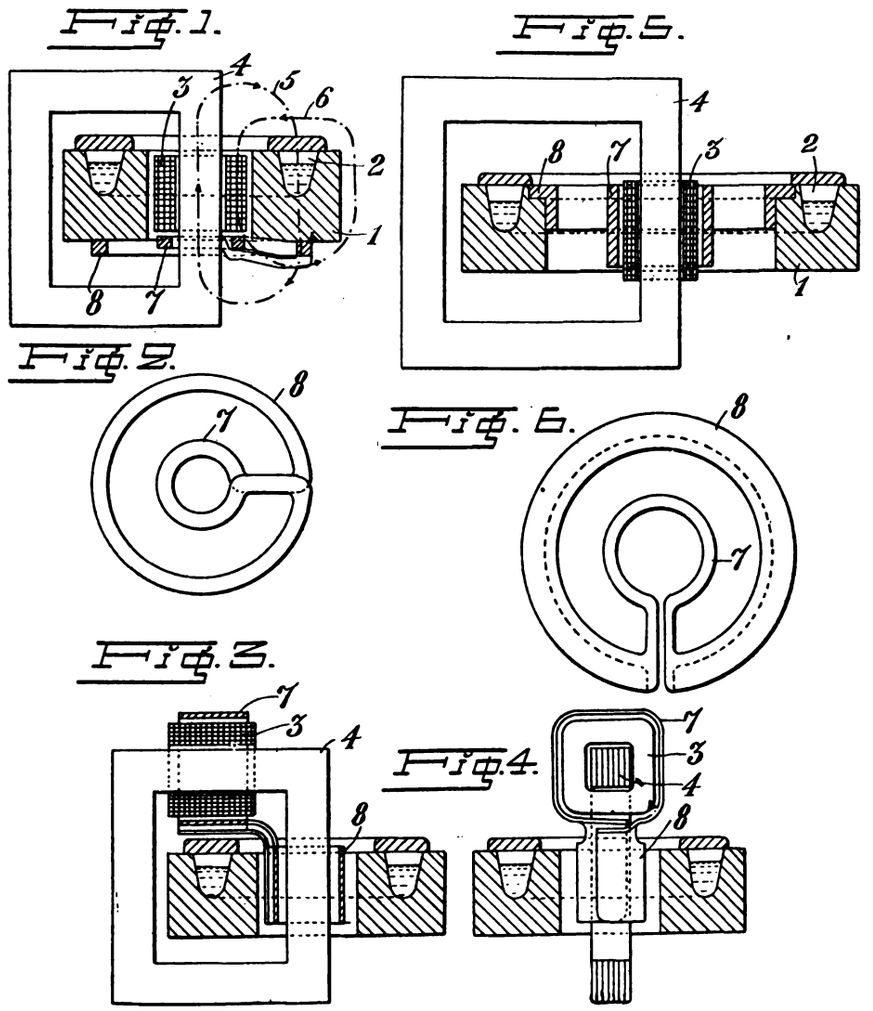
A New Electric Transformer Furnace.

The electric transformer furnace described herewith is the invention of Otto Frick, of Saltsjöbaden, Sweden (United States Patent No. 933,169, September 7, 1909), assignor to the Gröndal Kjellin Company, Limited, of London, England.

The object of the invention is to suppress, as far as possible, the leakage field, especially that around the primary coil. This is done preferably by placing, around the field core, a short-circuited conductor having two coils placed at a distance from each other and wound in opposite directions, each coil consisting, generally, of only one winding and connected in such a manner as not to be effectively induced by the main field, whereas the lines of force of the leakage field or fields pass through the closed circuit of the conductor and excite therein a current counteracting the said field. Such short-circuited conductors may suitably be termed leakage-field coils.

In the accompanying drawing some forms of embodiment of the invention are schematically illustrated.



DETAILS OF VARIOUS FORMS OF THE FRICK INDUCTION FURNACE.

Fig. 1 shows a vertical section through one form of the invention. Fig. 2 shows a plan of the short-circuit conductor employed therein. Figs. 3 and 4 show two sections, at right angles to each other, of a second form of the invention. Fig. 5 shows a vertical section through a third form of the invention. Fig. 6 shows a plan of the short-circuit conductor employed according to Fig. 5.

The furnace shown in Fig. 1 is provided, as usual, with an annular melting space 2, arranged in a suitable brickwork 1, as well as with a primary coil 3, placed around the shank of the closed iron core 4, passing through the central opening in the brickwork. In such an arrangement of the primary and secondary conductors of the furnace, leakage fields are created about the said conductors, the limits of the said leakage fields in the right half-part of the sections shown being represented by the dotted lines 5, 6, respectively. The direction of the flux of the lines of force in a given moment is indicated by the arrows.

In order to neutralize the leakage field from the primary coil, there is placed, beneath the primary coil, a short-circuited conductor or loop consisting of a central part 7, situated immediately below the primary coil 3, and an outer part 8, whose diameter is so large that it substantially encloses the leakage field of the primary coil and which is so arranged that the current in the same will run in opposite direction to that in the part 7. As may be easily understood, the main field in the closed iron core exerts the same inducing action in the parts 7 and 8, of the short-circuit loop or conductor 7, 8, and inasmuch as these parts are connected in series so that the induced currents will flow in opposite directions, the result of this induction will be zero. The leakage field of the primary coil flowing between the parts 7 and 8 excites in the short-circuit conductor a current counteracting the leakage field.

As indicated in the drawing, a part also of the leakage field of the secondary conductor passes through the space between the hoops 7 and 8, formed by the short-circuit conductor, and, inasmuch as this field has the same direction as the primary one, also, this leakage field is partly counteracted by the current produced in the short-circuit conductor. As easily seen, the possibility of counteracting the leakage field of the secondary conductor is to an essential degree dependent upon the possibility of placing the short-circuit conductor in close proximity to the secondary conductor. As the secondary conductor can here be formed by a thick cable or bar without electric insulation, it is easily understood that the said conductor can without danger be heated to a high temperature, so that it can be placed close up to or within the brickwork at an inconsiderable distance from the melting bath. It is also obvious that more than one short-circuit conductor of the kind described may be employed within the leakage fields, if desired. Obviously, the action of the said short-circuit conductors is chiefly dependent upon their cross-sectional area, which determines their capacity of conducting the short-circuit currents necessary for suppressing the leakage fields, without any higher tension being required in the short-circuit conductor.

The invention furnishes an effective means of suppressing, to an essential degree, the injurious consequences of disposing the primary coil outside the part of the iron core enclosed in the secondary conductors, for instance on any of the

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horizontal shanks of the iron core, in that by placing one winding of a conductor or loop close around or within the primary coil and connecting this winding with a winding around the central iron core, as shown in Figs. 3 and 4, the leakage fields may be employed for producing in these windings a current tending to blow away the leakage fields. Such an arrangement is schematically shown in Figs. 3 and 4. The primary coil 3 is placed around the upper horizontal shank of the iron core 4. Thus a strong leakage field will be created about the primary coil which, in case no measures were taken to prevent it, would entail unfavorable working conditions for the furnace. According to this invention, a short-circuit conductor in two sections is arranged about the iron core. The current produced therein has no action upon the main field passing through the iron core, the direction of current in one part being opposite to that in the other part in relation to the iron core. The parts of the primary and secondary leakage penetrating the space between 7 and 8 produce a current in the short-circuit conductor, which current tends, in the same manner as in the arrangement shown in Figs. 1 and 2, to counteract or blow off the leakage fields.

Fig. 5 shows a short-circuit conductor acting to suppress the chief parts of the primary as well as of the secondary leakage field. This effect is gained by extending the inner part of the short-circuit conductor along the whole primary coil and placing its outer part as near the melting bath as possible. For the rest, the arrangement is analogous to that illustrated in Figs. 1 and 2 in that the two parts 7 and 8, are connected to each other in such a manner that their windings run in opposite directions. The advantage of this arrangement is especially obvious, when the furnace is built with a melting bath of a great diameter.

In order to obtain the greatest possible effect it is advantageous to divide the primary coil, or the short-circuit conductor, respectively, into parts arranged between one another. In certain cases the leakage-field coil can be built up of solid copper plates. For instance, in Fig. 2, it might consist of a circular disk having at the middle thereof a circular opening for the central iron core and being also cut radially.

Electrolytic Iron.

The electrolytic production of iron direct from iron ores, though possible, has so far not attained practical importance. Electrical refining of iron, on the other hand, is continually extending. Electrolytic iron is unsurpassed in purity. As any kind of commercial iron of low quality may be used for its production, it is possible to convert iron of lower value into high-priced material, that is, provided cheap current is obtainable. At this year's convention of the German Bunsen Society the Langbein-Pfannhauser Works exhibited samples of electrolytic iron manufactured by the process of Prof. Franz Fischer, which possess excellent qualities and are applicable for many purposes. This iron contains at most 0.05 per cent of impurities, and is therefore nearly chemically pure. When heated its hardness falls below that of silver and gold, and it may therefore be easily worked, cold-rolled and forged. By means of hardening agents, that is, by the addition of carbon, it may be hardened entirely, or only in places, if desired. Its magnetic qualities are the highest that have been observed at the Imperial Physico-Technical Institute in Berlin. Plates of 0.01 to ten millimetres in thickness may be readily manufactured. By first depositing nickel and then iron of the desired thickness on a polished cathode, plates coated with nickel on one side and having a perfectly smooth, polished surface may be produced. There would seem to be a special field for electrolytic iron in the manufacture of electrotype plates, as the printing surface may be readily made hard and the strengthening part soft and flexible. Seamless iron tubes may also be manufactured and lead tubes may be armored with a perfectly adhering iron coating. It may be safely assumed that the possibility of manufacturing electrolytically the greatest variety of objects from this kind of iron will open for it fields of application that are presently not thought of.—*Translated and abstracted from Die Umschau (Frankfort-on-the-Main), September 4.*

A New Electric Furnace for Iron Extraction.

For several years three Swedish inventors, Messrs. Stalhane, Sindblad and Groenwall, have devoted themselves to the perfection of an electric furnace for smelting iron ores, which would meet certain conditions laid down by Doctor Haanel in a report to the Canadian Government on experiments made at Sault Ste. Marie in 1906 with the Héroult furnace. Last December Doctor Haanel visited the furnace of the Swedish inventors on behalf of his government, and the following information is given by him regarding this apparatus. In general appearance the furnace closely resembles the ordinary blast furnace. It comprises a conical chimney, surmounting a greatly enlarged fusion chamber, into which carbon electrodes are introduced obliquely and converging toward the center. The only departure from the form of the blast furnace is in the lower part of the reduction zone, immediately over the fusion zone, which contracts at a height of about 1.8 metres, so as to have the shape of an inverted cone. The object of this construction is to direct the fall of the charge so that it cannot come in contact with the lining of the arch in the neighborhood of the electrodes, in order to prevent the rapid destruction of the lining. On account of this arrangement there is always a free space around the electrodes, and in order to make the protection perfect, cooling gas jets are directed against the arch through tubes placed in proximity to the electrodes. The gases employed are taken from the upper part of the furnace and are made to return to the same by an electrically operated blower. This combination solves the problem of utilizing the reducing and heating powers of the electric furnace gases; their circulation furthermore has the advantage of insuring a more uniform distribution of the heat. The insulation of the electrodes also meets the requirements indicated by Haanel. The model visited by him at Domnarfvet is 7.5 metres high, the fusion chamber measuring 2.1, and the reduction zone 5.4 metres. It is operated by three-phase currents and has three electrodes held in water-cooled fixtures protected on the outside against oxidation. Their regulation is effected by hand. The experiments demonstrated that the furnace is capable of meeting all requirements of an apparatus intended for industrial operation. Recently the same inventors have also patented a three-phase refining furnace, in which there are only two carbon electrodes, the third phase being connected with the hearth, which is lined with a mixture of graphite and magnesia. This arrangement of the electrodes gives the fused mass a rotary motion in a vertical direction, and new material is thus continually brought in contact with the slag, which is favorable for the reactions.—*Translated and abstracted from L'Electricien (Paris), August 20.*

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The New Electrochemical Developments in South Africa.

In our issue of September 4 last, there was an account (on p. 431) of a "New Electrical Industry for South Africa." Further details of this undertaking have just been received from a London correspondent, who writes as follows:

"It is proposed that in addition to the waterpower station on the Crocodile River a steam-power station should be erected forthwith, situated in the Middleburg District, right in the heart of the coalfields, where exceptional facilities for cheap water and coal supply are available, enabling the company to produce as cheap power for electric bulk supply as in any other steam-generated station anywhere in the world.

"The principal objects for which the company will be formed are the manufacture of nitric acid and nitrate of lime from the atmosphere, the manufacture of calcium carbide and the manufacture of cyanamide. The steam station will have a capacity of about 40,000 kilowatts.

"The production of nitric acid from the atmosphere is especially suited for South Africa, more especially in the interior, as the freights on nitrate of soda, sulphur and other products necessary for this manufacture make the ordinary methods much more expensive.

"Large quantities of nitric acid are being used in the dynamite factories, so that there should be no difficulty in disposing of a considerable quantity of this acid on favorable terms. The South African colonists should also become very good customers, in the near future, of artificial manures, but as the introduction of these manures will require some time for development it is only proposed to start with an output of 5,000 tons of nitrate fertilizers per annum, the quantities being increased from time to time as this particular branch of the company's industries develops.

"As to the manufacture of calcium carbide in the country this part of the business can be made very attractive through the introduction of acetylene lamps in the mines. At present candles are mostly used, and it is estimated that by the introduction of suitable acetylene lamps, which are now most extensively used both in America and Germany, the mines would be able to save at least thirty-three per cent of their present lighting bill.

"Harper Bros. & Co., 13 St. Helen's Place, London, England, who will be consulting engineers to the new company, are at present engaged in working out the details of the scheme, and are also arranging for the finance of the new company, and it is anticipated that the putting up of the plants and the construction of the works will be commenced early in 1910."

A New Kind of Primary Cell.

In a recent number of *La Revue Electrique* appears a description of a primary cell using some of the elements of the Leclanché cell, but having entirely different characteristics. This battery, which has been patented by Aubert Frères, differs from the Leclanché cell in that chloride of manganese has been substituted as electrolyte for the sal-ammoniac solution. Zinc is used as negative electrode, a mixture having manganese dioxide for a basis as positive electrode, and a concentrated solution of chloride of manganese as electrolyte. The advantages claimed for this battery are that its tension drops only slightly during the discharge; that it is not exhausted on open circuit; and that it can be short-circuited without deterioration. Furthermore, the battery is said to have a large ampere-hour capacity and a low internal resistance. These advantages are claimed to be due to the great concentration which it is possible to attain in the chloride of manganese, which may reach 150 per cent in weight. For this reason the liquid will not freeze at the lowest temperatures to which it might be exposed. After exhaustion the battery can be regenerated like an accumulator by a charging current. There is no creeping of salts in the battery, and the fluid remains clear.

Indicating Gas Engines.

In a paper recently presented before a meeting of the (British) Institution of Mechanical Engineers, Prof. F. W. Burstall, of Birmingham (Eng.) University, gave some interesting results on the indicating of gas engines. Two indicators, one of the ordinary type, and the other of the special type (or manograph), were used, the usual cord being replaced by a phosphor-bronze stranded wire. As a result of numerous tests the discrepancy between the diagrams from the two types of indicators was less than three per cent, thus showing that at least a fairly accurate indicator card can be obtained from the gas engine as well as from the steam engine. These results would also seem to indicate the reliability of the best ordinary types of indicators for high-speed engines.

Boston Tunnel Contract Signed.

With the decree of the Massachusetts Supreme Court entered, establishing the right of the Transit Commission to select the route for the Boston end of the Cambridge subway, and its right to make that location under the Boston Common, the Boston Transit Commission will begin work. This is with knowledge of the fact that the petitioners who vainly sought to have the Massachusetts courts save the Common from further tunnel construction still have the right to appeal to the United States Supreme Court, but it is deemed unlikely that that right will be exercised. After the decree had been entered the Transit Commission held a meeting at its office on Beacon street and signed the necessary papers so that the contract may be delivered to Patrick McGovern.

May Discontinue Service for Non-Payment of Bills.

The recent decision by the Wisconsin State Railroad Commission of a question involving a feature of the public-utilities law is looked upon as important to concerns of this class. The case in question was that of Oscar J. Berend, of Milwaukee, against the Wisconsin Telephone Company. It had been the general impression that under the law a public-utility company, in order to enforce a claim for service, would have to go to the courts, and that until this had been done it could not cut off service from any consumer on account of non-payment of bills. While the law does not give the Railroad Commission the power to pass on disputed claims of corporations of this character, it does give it authority to decide as to the reasonableness of rules and regulations of such concerns. It was upon this basis that the case in question was presented to the Railroad Commission by Mr. Behrend after the telephone company had discontinued service and he had been defeated in mandamus proceedings in the courts. The Railroad Commission reviewed the question of the right of the company to demand payment in advance and to require security or deposit to insure payment of bills for past service or payment in advance. The commission held that the rule of the company is reasonable and should be enforced. M.

Over the American telegraph wires in 1907 there were flashed 368,470,509 messages, of which 5,869,317 were cablegrams.

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TELEGRAPHY—TELEPHONY, and WIRELESS.

The Bolt Head Wireless Station.

The wireless telegraph station which was opened last December by the British Post Office Service at Bolt Head, near Kingbridge, South Devon, England, is situated about 350 feet above the sea level and was the first station to be used in public service, in England at any rate, for communicating with ships at sea. We are indebted to *Electrical Engineering*, of London, for the following description and illustrations of this interesting station, the information being originally given out through the courtesy of Major W. A. J. O'Meara, engineer-in-chief to the post office.

The generating plant and apparatus for the new station are contained in a one-story brick building, fifteen feet wide by fifty-five feet long. In order to insure the utmost dispatch in starting and also to minimize noise, the three-kilowatt alternating-generator is coupled to a direct-current machine, which is normally run as a motor from a storage battery. To charge the battery the two machines are driven through a clutch by an eight-horsepower horizontal Campbell oil engine, running at 265 revolutions per minute. Current for the wireless apparatus can be taken from the alternator at the same time.

Alternating current is generated at 100 volts, fifty cycles, and is transformed up to from 15,000 to 20,000 volts, according to the length of the spark gap which is being used. The transformer is of the ordinary oil-cooled type, with a capacity of three kilowatts, and the secondary pressure is varied by means of an inductance (*A*, see Fig. 1) in the primary circuit. Besides driving the motor-generator set, the battery is used for lighting the building.

The battery consists of fifty-two cells of the D. P. Accumulator Company's pattern in glass boxes, and has a capacity of 180 ampere-hours on a nine-hour discharge rate. The signaling is done in the generator circuit by means of a Morse manipulating key, *B*, which controls a special form of magnetic key, *C*. This latter key is designed to prevent the circuit from being opened at any time except when the alternating current is passing through its zero value, thus preventing injurious sparking at the contact of the Morse key.

The secondary of the main transformer, *D*, is connected through two iron-core choking coils, *E*, and two air-core choking coils, to the battery of condensers, *F*; and the oscillatory circuit, consisting of the spark gap, *G*, high-frequency tuning inductance, *H*, and the primary coil of the high-frequency oscillation transformer, *K*, is connected across the condenser as shown. The iron-core choking coils, *E*, prevent any high-frequency oscillations from reaching the main transformer, *D*. The spark gap is of the standard Marconi pattern, the one illustrated in Fig. 2 being for one of one-and-one-half-kilowatt plant, but of the same general construction as that installed in the present station. The electrodes are of iron, mushroom-shaped, and mounted on ebonite pillars. The size of the gap can be varied from two to eight millimetres by screwing the electrodes to the right or left as desired. The normal working size of the gap is five millimetres.

The spark gap is entirely boxed in to deaden the noise of the discharge, as may be seen in the illustration. Fixed to the pillars are two guard points, which are set to limit the pressure across the gap to a certain amount, in order to protect the condensers.

There are four condenser tanks similar in design to that illustrated in Fig. 3, and consisting of a number of thin iron plates separated by glass plates, and immersed in oil. It will be noticed that the condenser illustrated has a zinc-lined box with a further internal lining of cork. When the condensers are connected in two groups (of two in parallel) in series, the total capacity is 0.07 microfarad, and the corresponding inductance in the oscillating circuit is 2.3 microhenries. The primary of the high-frequency oscillation transformer consists of one turn only, and the secondary of ten turns. Adjustable couplings have been provided in the oscillation transformers in this station, and these permit of a loose coupling being made between the oscillating circuits; in consequence a sharper and more defined wave can be obtained, with improved tuning capabilities. When it is desired to operate with a 600-metre wave, one terminal of the secondary of the oscillation transformer is connected to the aerial, and the other is earthed. As shown in the diagram of Fig. 1, however, a fur

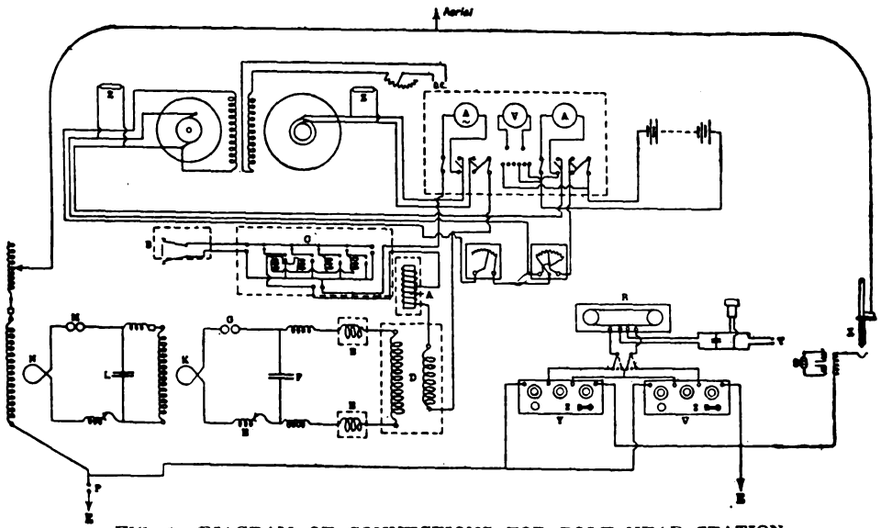

FIG. 1.—DIAGRAM OF CONNECTIONS FOR BOLT HEAD STATION.

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ther oscillating circuit can be connected in cascade with the first one for the purpose of working with a different wave length. In that case the secondary of the oscillating transformer K is connected across a second battery of condensers L, in circuit with which is a second spark gap M, a tuning inductance, and the primary of a second oscillation transformer

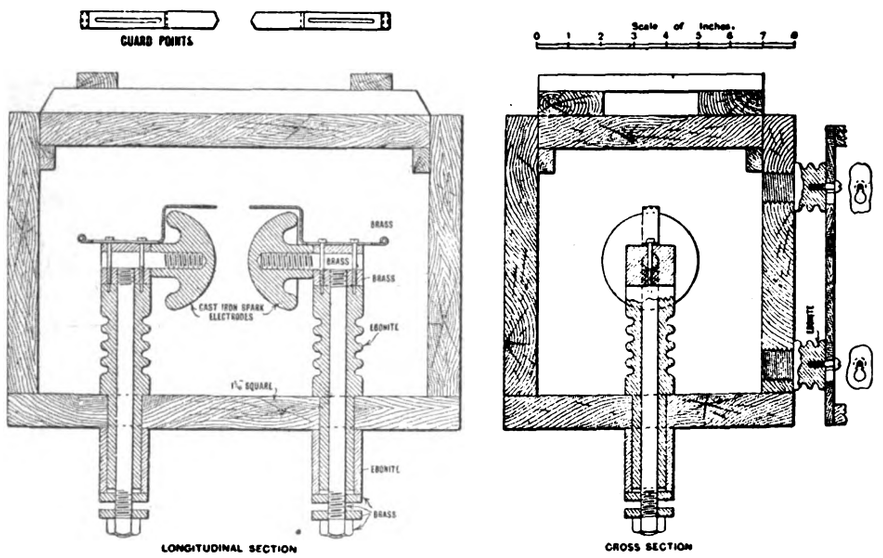
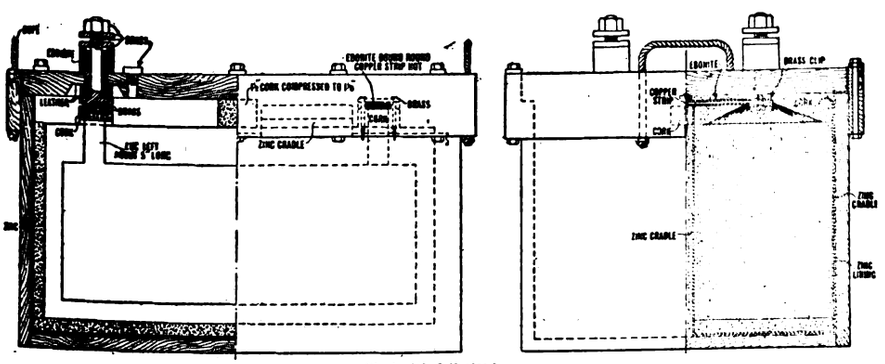


FIG. 2.—SECTIONS OF ENCLOSED SPARK GAP.

N. The secondary of the latter is then connected to the aerial and to earth, as shown in the diagram. In neither case is the aerial directly earthed through the secondary, as a small "arrester" spark gap P is interposed between the latter and the earth connection. The function of this will be explained later, but it may be mentioned here that, when transmitting, this gap is practically non-existent, as a discharge to earth occurs every time the aerial is charged.

The arrangement of the mast and aerial is shown by the sketch of Fig. 4. Four small thirty-foot poles surround the main mast, which is 160 feet high, and the aerial conductors, which consist of stranded copper wire, are supported by wire ropes and ebonite insulators, as shown. The aerial is thus of the umbrella type, with four radiating arms and two central conductors, which terminate at the instrument house. To protect the instruments from lightning, a "thunderstorm switch" is provided. This consists of a metal ring connected to the aerial, which slides on a long ebonite rod; during a thunderstorm this ring is pulled along the rod by means of a cord, extending into the instrument room, until it touches an earthed metal flange at the extreme end of the rod. The aerial is led into the instrument room through a Bradfield insulator. To provide an efficient earth connection, thirty galvanized iron plates have been buried edgewise into a circle round the station, and these are connected by sixty wires to the earth conductor in the instrument room.



(Scale $\frac{1}{4}$th full size.)

FIG. 3.—SECTIONS SHOWING CONSTRUCTION OF CONDENSERS.

The receiving apparatus is of the usual Marconi pattern, and comprises a magnetic receiver B, and a separate filing coherer receiving set S, which is connected direct to the aerial, as shown in Fig. 1, and left in circuit when the operator is not using the magnetic receiver, so that an audible bell call can be given. When transmitting, the coherer receiving set is automatically disconnected from the aerial by the switch X. The Marconi form of magnetic receiver consists of a moving band of iron wires, which passes through two concentric coils, one of which is connected to a telephone receiver, and the other between the aerial and earth. The portion of the band in the coils at any instant is under the influence of a permanent magnet, and variations in the magnetism of the band, produced by the aerial current, cause corresponding sounds in the telephone receiver. An important feature in this installation is the provision of means whereby the operator can be interrupted while dispatching a message. This is done as follows: Both the magnetic receiving instrument and the transmitting instruments are always connected to the aerial, but the telephone receiver of the former is automatically short-circuited by means of the contacts shown in the diagram of connections at T, when the manipulating key B, in the transmitting circuit, is depressed. It would not, of course, be practical to have the aerial coil of the magnetic receiver in series with the aerial, either directly or indirectly through a transformer, when transmitting, but this difficulty has been got over by placing the previously mentioned "arrester" spark gap P in the aerial circuit, and connecting the magnetic receiver R across this gap through the "tuners" V or Y. This gap, which offers little or no resistance to the current surges during transmission, compels the small induced receiving currents to pass through the receiving instruments. It is evident that were the gap not present, the receiving apparatus would be short-circuited. As the operator always has the telephone at his ear, signals received during the intervals of transmission can be heard.

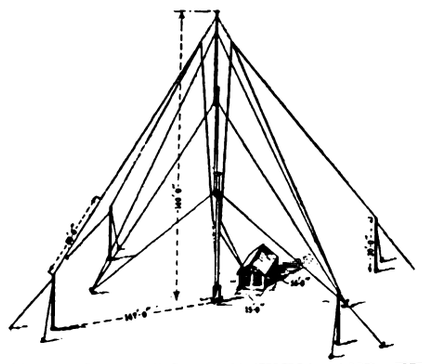


FIG. 4.—UMBRELLA ANTENNA AND EXTERNAL ARRANGEMENTS OF BOLT HEAD WIRELESS STATION.

For tuning purposes, the receiving apparatus includes two units of the latest pattern of the Marconi multiple tuner V

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and *Y*, the function of which is to tune the receiver or render it immune to interference from other stations. It may also be used for measuring the lengths of the transmitted and received waves, and under certain conditions for estimating the distance of a known station. The *V* unit is for large wave lengths, and the *Y* unit for short wave lengths. The instrument contains three separate circuits called the aerial circuit, the intermediate circuit and the detector circuit. The first consists of a tuning inductance in series with a tuning condenser and an inducing inductance, the latter in magnetic relation with an inductance in the intermediate circuit. In the latter circuit there are two inductances in magnetic relation with the other two circuits respectively, and a tuning condenser in parallel with the inductances. The third circuit consists of an inductance in series with a tuning condenser and the detector or receiver. The two inductances in the aerial circuit and the three tuning condensers are all adjustable, and by means of these adjustments all the three circuits are tuned to the received wave lengths. The oscillations in the aerial circuit then induce oscillations in the intermediate circuit, which in turn induce oscillations in the detector circuit. In addition, the coils in magnetic relation may be moved relatively to one another, so that the couplings between the three circuits may be varied. The instrument is also fitted with a micrometer spark gap and a shunt inductance of the order of 80,000 microhenries, connected between the aerial and earth terminals to prevent the accumulation of an electrostatic charge in the aerial. A change-over switch by means of which the tuned circuits can be cut out, and the receiver instantly rendered sensitive to a wide range of wave lengths, is also provided. One terminal of the aerial circuit is connected to earth, and the other is connected to the top of the "arrester" spark gap, so that connection is made through the secondary of the oscillation transformer *N* to the aerial, as shown in the diagram of Fig. 1. When receiving with this instrument, first the inductances and then the condensers are adjusted until the strongest signals are obtained. The wave length can be read off on one of the dials of the instrument. When the apparatus is left without an attendant, the aerial is connected direct to the filing coherer set *S* by the switch *X;* and this set, in conjunction with a relay and a Morse ink receiver, records all the signals received.

The station is in direct telegraphic communication with Exeter, and messages received from ships at sea are transmitted inland via that city.

Great precautions had to be taken to prevent the magnetic receiver from being affected by the telegraph circuits. The speed of signaling which has been attained with the system used in this station is that usual with key operation—namely, about thirty words per minute. A large ten-inch spark coil is included in the equipment of the station, and this could be supplied direct from the battery, and used instead of the ordinary generating plant, in case of a breakdown of the latter. Attention may also be drawn to the so-called "guard-lamps" *Z*, which are ordinary straight carbon-filament lamps connected across the machines, to prevent the high-frequency oscillations from reaching the armatures. The whole of the wireless apparatus, the mast and the aerial were supplied by Marconi's Wireless Telegraph Company, Ltd., and the generating plant was installed by the Westminster Engineering Company, Ltd., of Willesden Junction, London, N.W.

The cost of the station was about $10,000.

British Government Takes Over Lloyds and Marconi Wireless Stations.

The British government has completed arrangements to take over all the coast stations of the Marconi wireless system, excepting the long-distance stations at Poldhu and Clifton, which the company retains for its projected transatlantic service. The Government pays $75,000 for the stations taken over, and gets also the right to use all existing patents and all improvements made during the next fourteen years. Under the control of the British postoffice, the Marconi stations will be opened for communication equally with all ships, irrespective of their wireless system. The post office department is taking over also all the Lloyds wireless stations.

Wireless in Argentine.

The Radio Telephone Company of New Jersey has petitioned the ministry of the interior for a concession for ninety-nine years to establish radiographic stations in any part of the Argentine Republic, and also on ships flying the national flag. The telegraph board has been directed to report the matter.

The Cable Controversy in Newfoundland.

The Direct United States Cable Company has informed the Newfoundland government that hereafter it will operate its trans-Atlantic cable service by way of Newfoundland. The company has agreed to pay the landing tax required by the colonial statute. The premier of Newfoundland, Sir Edward Morris, declares that this latest development in the cable situation shows that he had ample warrant for his recent refusal to permit the Commercial Cable Company to establish a cable station here. The ministry of Sir Robert Bond, which immediately preceded that of Sir Edward, entered into a contract with the Commercial Cable Company permitting that company to connect its lines with this colony, but shortly afterward Sir Edward became premier and declined to ratify this contract on the ground that it gave the company undue privileges.

North Pole Discovery Helps Telegraphs.

The Great Northern Telegraph Company, Ltd., has had to cope with a great rush of press messages from Denmark since the news of Dr. Cook's arrival from his polar journey, says *The Electrical Engineer* of London. "This is proving a record time for us," the manager remarked to a correspondent. "Up to 8 p. m. Sunday (September 5) we received 50,000 words of press messages about Dr. Cook, and much more is still coming in. We have had to increase our staffs here and at Newcastle, where the Danish cable comes ashore, and we have also had to take in a second cable, which is ordinarily used only for Sweden." The company has been gratified to hear from various newspapers of the accuracy with which the messages, written in English, and transmitted by Danish operators, have been received.

Commercial Cable Company's Taxes.

The Commercial Cable Company has obtained a writ of certiorari from Justice Amend, in the Supreme Court, to review the action of the municipal tax board in assessing its cables and conduits, for the purpose of taxation, at $27,000. The company contended that the tax was excessive, and that it had been taxed on the same property by the State Board of Taxes, and that the intrinsic value of the property was small. The writ is returnable the first Monday in January.

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The Telephone in Europe.

Vice-Consul-General Richard Westacott, of London, furnishes the following information, contained in the August issue of the *National Telephone Journal*, showing the number of telephone stations in the several countries of Europe on January 1, 1908, and 1909:

Country.	1908.	1909.
Germany	768,266	851,319
Great Britain	528,763	565,854
France	178,518	194,159
Sweden	150,948	156,000
Austria	108,457	124,825
Russia	97,643	113,000
Switzerland	64,953	69,122
Denmark	60,825	67,339
Norway	49,398	53,726
Italy	44,834	53,721
Holland	43,449	48,134
Belgium	34,818	38,503
Spain	18,545	19,500

Russia has one telephone for every 1,322 persons, Spain one for every 955, Great Britain one for every seventy-seven, the German Empire one for every seventy-one, Denmark one for every thirty-eight, and Sweden one for every thirty-four. Relatively, therefore, Sweden makes more use of the telephone than any other country in Europe.

Telephone Train Dispatching.

The Atchison has recently completed the installation of telephones for train dispatching between Chicago and Newton, Kan., a distance of 659 miles. This road is among the foremost in this use of the telephone and already has eighteen different divisions thus equipped, covering a total distance of 1,925 miles.

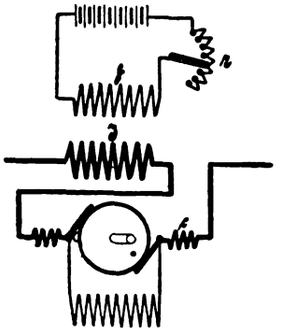
Railroad men are of the opinon that the use of the telephone will afford relief from the present serious shortage of competent telegraphers. In part the shortage is the result of the federal law limiting the hours of employment of railroad telegraphers, and it is feared that the difficulty may become still greater when the fall movement of crops and other freight is in full swing.

Telegraph and Telephone Extensions in Korea.

According to Consul-General Thomas Sammons, at Seoul, the Japanese Residency General authorities state that since taking over the telegraph and telephone lines in Korea, in July, 1905, the total length of the telegraph lines, then about 1,930 miles, of which 895 miles were used for military purposes, has been increased to approximately 7,000 miles. As for the telephone system, five years ago it existed mostly at Seoul, aside from lines on mining concessions, and the total length of the wires was less than 100 miles. Today it exists in all the principal cities with a mileage of 4,500.

A New Machine for Constant Current.

The latest type of constant-current machine of the Felten and Guilleaume-Lahmeyer Company was described by Ch. Kraemer in a paper read at the annual meeting of the Verband Deutscher Elektrotechniker. If a machine is excited by a main current field, and this is annuled by separate external excitation, then every current variation will produce a positive or negative electromotive force; that is, at every current variation there will be a corresponding change in tension. This change in tension may be utilized for inducing a self-excitation in another winding, by means of which, at constant exterior resistance, the current is reduced to a value corresponding to the separate



f—Separately excited field; j—Main field; r—Compensating poles.

CONNECTIONS OF CONSTANT-CURRENT MACHINE.

or foreign excitation, for the self-excitation will compensate the field produced originally by the current variation.

In principle, therefore, the machine is based on the sum of three fields, as shown in the accompanying diagram. The external and self-exciting circuits may be connected in series or they may have separate windings; the method of operation will be the same. The sum of the main field and the external excitation must always be equal to zero so long as the machine is working exactly under its characteristic conditions. All three windings are together on the poles of an otherwise entirely normal machine, which may be provided with compensating poles for the purpose of sparkless running. Since, as explained, the sum of the main field and external excitation must always be equal to zero, it follows that the main current will correspond to the value of the external excitation, which may be adjusted at will by a regulator *r*.

The advantage of this machine over those having similar properties resides in the fact that standard models may be employed, which will work without cross brushes and distorted fields, as well and as sparklessly as a specially constructed machine with compensating poles. This property of automatically changing its tension at constant current in correspondence with the exterior resistance makes it eminently suitable for a number of uses.—*Abstracted from Elektrotechnische Zeitschrift (Berlin), August 26.*

Clarence H. Mackay Denies Rumors.

Clarence H. Mackay, asked about the report that the Postal Company had absorbed the Western Union, says:

"Neither the Postal Company nor the Mackay companies have entered into any arrangement for the purchase or lease of the Western Union or the purchase of its stock, and neither the Postal Company nor the Mackay companies contemplate doing so. Competition will continue."

Navy Department Supplies.

The Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., will open bids on the dates given below for the following electrical equipment and supplies. Bidders should without delay make application to the Bureau for copies of the schedules they are interested in, being careful to give the number of each schedule. Copies can be obtained on application to the Navy Pay Office nearest each navy yard.

NAVAL SUPPLIES.

Date of Opening	Material.	Quantity.	Delivery at Navy Yard.	Schedule No.
October 19, 1909	Bells and buzzers	Miscellaneous	Various	1711
	Buttons, push	"	"	1711
	Cells, dry	"	"	1711
	Dynamometers	9	"	1711
	Fuses	50,000	"	1711
	Generators, testing	35	"	1711
	Insulators and hangers	Miscellaneous	"	1711
	Irons, soldering	"	"	1711
	Keyboards, night signal sets	9	"	1711
	Motors	2	Norfolk, Va.	1730
	Plugs, attachment	Miscellaneous	Various	1711
	Sets, testing	15	"	1711
	Sets, ventilating	17	"	1711
	Sockets, miscellaneous	Miscellaneous	"	1711
	Switches	"	"	1711
	Appliances, wiring	"	Mare Island, Cal.	1725
	Wire, copper, insulated	22,000 feet	" " "	1725
	Accessories, wiring	Miscellaneous	Brooklyn, N. Y.	1751
	Fixtures, etc., lighting	"	" "	1751
	Sets, night signal	2	" "	1751
	Strips, glass, searchlight	75 sets	" "	1751
	Tape, insulating, cotton	4,500 pounds	" "	1751

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Electrical Notes From Great Britain.

By Our British Correspondent.

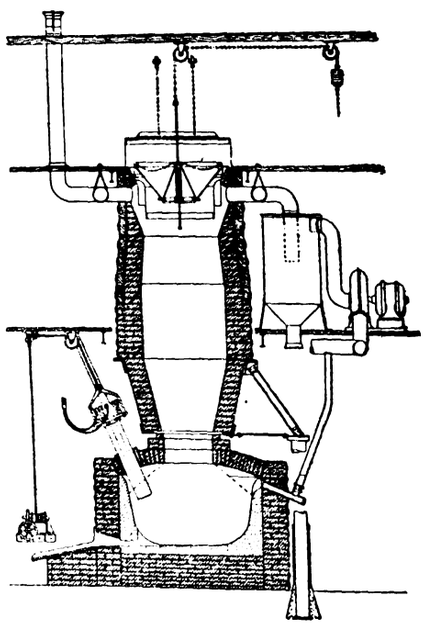
London was the meeting place in the closing week of September for two bodies of men in whose calling electricity plays an important part. The annual Conference of the Municipal Tramways Association came first, its proceedings commencing on September 22 and continuing until September 24. The autumn meeting of the Iron and Steel Institute opened on September 27 and closed on October 1. The two most important electrical communications to come before the Iron and Steel Institute were: "The Refining of Steel by Electricity," by Disponent E. J. Ljungberg (of Falun, Sweden), and "Determination of the Power Consumption of Reversing Rolling Mills," by C. A. Ablett, of London. The Institute will naturally now devote increased attention to electricity every year, as its applications are permitted to make greater headway in British iron and steel works. It is appropriate to mention here that the installation of exhaust-steam turbo-blowing and generating plant that was put down at the noted Bolckow-Vaughan works, in the north of England, has given complete satisfaction to the owners, who have announced that if the results are equally satisfactory for a further three months they will proceed with the extension of the installation throughout their entire steelworks.

Mr. Ablett said that since the last autumn meeting of the Iron and Steel Institute, five steelworks had decided to adopt electrically driven reversing rolling mills, making in all twenty firms which had come to this decision. Twelve such plants are working in different parts of the world, one at least being installed to replace an engine less than ten years old, which was in good condition. The following were given as the reason influencing this decision: (1) Greater economy in fuel consumption; (2) larger output from plant; (3) reduced running costs, *i. e.*, reduction in cost of repairs, attendance, oil, etc., the reduction in the cost of oil being very striking; (4) greater convenience and reduction of management expenses due to centralization of power supply; (5) the great economy of the electrical plant is maintained throughout the life of the plant, and does not diminish as the parts wear. Experience during the last two years had enabled them to reduce the capital cost of an electrically driven reversing mill, but further reductions were scarcely possible unless some entirely new method of reversing-mill driving were evolved in place of the Ilgner system; the present state of electrical knowledge offered little prospect of this. In many cases, however, the greater capital expenditure as compared with a steam-driven mill was justified by the economies possible with electric driving. As saving in fuel consumption appealed most strongly to the steelmakers, Mr. Ablett went on to consider the methods by which economy in fuel, power or steam consumption can be ascertained. He showed various results of tests made by indicating the steam engine, and by measuring the feed water or fuel burnt, and showed that the energy consumption of an electrically driven reversing rolling mill as expressed in kilowatt-hours per ton rolled can be determined in the simplest possible manner by inserting an ordinary integrating wattmeter in the supply system, which instrument could "always be left in circuit and requires no attention." "If a reading of this instrument before the commencement of a shift, and a second reading at the end of a shift, are taken," he said, "the difference gives the total kilowatt-hours used during the shift, and dividing this by the tonnage rolled, the total kilowatt-hours per ton is obtained." Such readings can quite easily be taken for every shift, and a continuous check on the energy consumption can be kept. Results expressed in kilowatt-hours per ton, the author said, were generally found most useful, as the cost of the kilowatt-hour varied according to the local conditions, and, knowing this cost, the total cost of power can be arrived at directly. The efficiency of the electrical plant could also be checked in the simplest manner possible, by placing a second integrating wattmeter in the armature circuit of the mill motor. The paper concluded with some figures showing characteristic values for the kilowatt-hours per ton rolled, from tests on reversing mills, as follows:

Description of Steel Pieces.	Size In Inches.	Weight in Tons of Ingots.	Output in Tons per Hour.	Kilowatt-Hours per Ton.
Billets	4.5×4.5	2.5	53	22.5
Blooms	6.0×6.0	2.5	63	17.5
Blooms	8.0×8.0	2.5	80	13.0
Blooms	12.5×9.5	7.0 (34.5×25.0 ins.)	65	11.2
Slabs	32.0×9.0	6.0 (36.0×19.5 ins.)	40	4.3
Slabs	32.0×5.0	6.0 (36.0×19.5 ins.)	40	5.8

Section Rolled.	Weight in Lbs. per Yard.	Weight in Tons of Ingots.	Output in Tons per Hour.	Kilowatt-Hours per Ton
Flange rails.	100	2.0	30	48.0
Beams	120	1.5	..	36.0
Channels	92	1.5	..	37.0

Mr. Ljungberg in his paper said that in the extensive and costly trials at Domnarfvet, Sweden, in the direct reduction of ore during the past few years, two modifications of a furnace constructed by Mr. Wallin, in Berlin, and several modifications of a furnace by Grönvall and Lindbad, Ludvika, had been tried. The latest form was described. The accompanying illustration shows a furnace similar to a common blast furnace, but with three electrodes fed by three-phase alternating current at about forty volts, sixty cycles, and 9,500 amperes, averaging 674 horsepower, instead of tuyeres. In this furnace, which has been running for 1,903 hours, there have been produced twenty-eight tons of iron, containing from 0.95 to 3.09 per cent of carbon. The furnace consists of a lower portion, or smelting chamber, corresponding to the hearth of a blast furnace, and a top section or shaft. The latter is supported on columns which prevent any weight from bearing on the arch of the smelting chamber. The latter is so proportioned as to provide a considerable amount of free space between the charge and the arched roof, through which the carbon electrodes project into the charge. The



FURNACE DESCRIBED BY LJUNBERG BEFORE THE IRON AND STEEL INSTITUTE.

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brickwork is thus protected against any very high temperature and remains a non-conductor of electricity. This, it was stated, was an important feature of this furnace, since experiment had shown that if the electrodes enter the chamber at the point where the charge touches the walls, a very high temperature is generated at this point, the brickwork is destroyed and becomes a conductor of electricity, giving rise to a more or less complete short-circuit. The brickwork may be further cooled by means of a blast of cool gas taken from the top of the furnace and blown in around the electrodes with a fan, no heat being lost by this proceeding. The ore and fuel are crushed to a suitable size, and are fed into the top of the furnace through the bell hopper in the usual way, the ore being partially reduced by the carbon monoxide rising through the charge. The latter spreads out in the smelting chamber, as shown, and the reduction is there completed. Since the electrodes project well into the charge, the highest temperature occurs in the center of the latter, and the brickwork is thus kept cool compared with the walls of an ordinary blast furnace.

Mr. Ljungberg gave figures showing that in the manufacture of the twenty-eight tons referred to there were used: Ore, 442 tons; lime, twenty-four tons; coke, forty-one tons; charcoal, fifty-eight tons; electrodes (total), 6.5 tons; electric current (kilowatt-hours), 891,623.

The author said that the figures showed that the problem of replacing a considerable part of the fuel used in making iron and steel by electric current was technically solved. As regards its commercial value, he remarked, "It is too early to make any definite statement yet, but this will be readily understood by all iron and steel makers when they reflect how many years it has taken to bring the Bessemer, the open-hearth, and the basic processes to their present state of perfection."

The subjects coming before the Municipal Tramways Association included the medical examination of tramway employes, whose fitness for safely controlling heavy high-speed electric tramcars is quite as important as is the fitness of the various brakes to respond immediately and efficiently to the driver's demands. In the interests of the community the elimination or exclusion of the physically unfit is imperative in such a department of the public service, and while medical inspection, efficiently and frequently carried out, may not always detect the man who, given certain conditions, will suddenly develop a fit of the nerves when an emergency arises requiring that all his wits shall be about him, it should go a good way in that direction. The author of the paper on this subject was Councillor Chapman, the vice-chairman of the City Tramways of Manchester, which, of course, employ a large staff of motormen and conductors. The London County Council Tramway Department has lately equipped a big central car repair depot, and an account of this was read by W. E. Ireland, the Council's rolling-stock superintendent. The depot was visited by those attending the meeting, as was also the tramway generating station at Greenwich. Mr. Fearnley, the secretary of the association, and general manager of the Sheffield municipal trolley lines, introduced some comparisons between Continental and British methods of operating tramways, and the question of "Current Consumption" was considered from the economy viewpoint by R. S. Pilcher, of Aberdeen's Tramway Department. A. L. C. Fell, the London County Council tramway manager, delivered the presidential address, and, from some points of view, the most interesting feature of the meeting was a demonstration of the trackless-trolley system in one of the suburbs of London.

Mr. Pilcher thought that no effort to prevent the systematic increases in current consumption which were taking place all over the country, ought to be spared. Track and car equipments were becoming older and top-covers were a contributing factor, and current was wasted in these ways, as well as through defective motor fields, badly worn pinions and gears, bent axles, etc. The importance of giving close attention to the motorman's method of driving the cars was the principal subject handled in the paper. On one English system the author, by instructing the motormen in the series-parallel system of controlling motors, and showing how it was possible to save current without decreasing the speed of the cars, had reduced the consumption by over seven per cent. Three years ago he started a similar system at Aberdeen, and this has been very successful. Each motorman is trained by the aid of diagrams in the best way of running the cars, and when on the road a tactful superintendent watches the progress of their economical efforts, and all drivers are informed of the reductions made. Previous to the introduction of the system at Aberdeen, there was a yearly rise of between six and twelve per cent per car-mile in current consumption, but immediately it was introduced there was a reduction. In the first year not only was the increase checked, but there was a reduction of six per cent, representing a saving of $3,200, and the consumption per car-mile has not since increased, although top-covered cars have been added at the rate of six per annum. All the cars are fitted with ampere-hour meters, and drivers become interested in watching the consumption each trip and each day. The drivers like the cars with the meters. Although several thousands of pounds' worth of current have been saved in Aberdeen during the last three years, there has not been a single motorman suspended in connection with the effort to economize consumption. Mr. Pilcher believes that any tramway having no method of checking current consumption will use at least five per cent more current per car-mile than one having a systematic check upon its drivers. In towns with many steep gradients and few level tracks there is less scope than in fairly level towns. Simultaneously with the introduction of systematic supervision of drivers, Mr. Pilcher noticed a great improvement in the timekeeping of cars and a great reduction in motor troubles.

J. A. Bell, the city electrical engineer of Aberdeen, says that his department has had a unique experience during the past year, this period being the first since the undertaking started, in which there has been an actual decrease in the number of units generated. The units sold, however, have increased, economies in distribution, etc., having been effected, and a good advance has been made in supply to power consumers. Metal-filament lamps to the number of 25,000 have superseded those of the carbon-filament type.

There are further signs that the antipathy of small municipal authorities to bulk power supply companies is on the wane. There is less reluctance to hand over provisional orders already obtained, and an increased disposition to buy energy in bulk and act as the distributing authority only. In September, the municipality of Brighouse, in Yorkshire, superseded its own old-standing generating station, and commenced to take a supply in this way from the Yorkshire Electric Power Company, whose generating station

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is at Thornhill. The transformer plant has cost some $15,000, and the Brighouse Corporation will pass on the light and power supply to its own customers. The Farnworth (Lancashire) Urban District Council also in September inaugurated a new plant which it has put down for dealing with supply purchased in bulk from the Lancashire Electric Power Company. The Lancashire company generates a 10,000-volt, three-phase, fifty-cycle supply, and this is stepped down to 500 volts in two 300-horsepower Westinghouse machines for conversion to a 500-volt, direct current by two General Electric 270-kilowatt motor-generators running at 600 revolutions. The Council has for some years had its own generating plant, but instead of putting down additional generators it has made arrangements to buy as above a minimum of 400,000 units per annum. A further step of interest at Farnworth is the inauguration of a front-feed type refuse destructor by the aid of which it is hoped to generate a further 400,000 units per annum.

ALBERT H. BRIDGE.

London, September, 1909.

Two Large Mortgages.

Two mortgages, one for $50,000,000 and the other for $75,000,000, were filed in the office of the Register of Essex County, N. J., in Newark, October 2.

The first was given by the Public Service Corporation of New Jersey and the recently formed Public Service Gas Company to the Fidelity Trust Company, of Newark. The other was given by the New York Telephone Company to the Farmers' Loan and Trust Company.

The Public Service mortgage has been recorded in eleven counties in New Jersey, owing to the fact that the properties which it covers are so widely distributed. It includes all the franchises of the big corporation and the gas companies of the Public Service Gas Company, and the capital stock of the eighty-four underlying concerns of the parent company. It puts up, in effect, as a guarantee for the $50,000,000, all the property it owns.

The mortgage is given as security for 50,000 general-mortgage, fifty-year, five-per-cent, sinking-fund, gold bonds, on which the interest is payable in April and October of each year. It is provided that $13,500,000 of the new issue of bonds will be put out in exchange for the company's present obligations, the remainder according to the needs of the company.

To Test New Recording Compass.

Maritime circles in New York are watching with considerable interest the result of a test of a new recording compass invented by Carl L. Jaeger. The test is being made on the steamship Amelia, that has sailed for the West Indies. Mr. Jaeger, who has been at work on the instrument for seventeen years, in an interview said the new compass will record the direction of the ship's course, the distance it travels and the speed.

The compass is about twenty-four inches long and six inches in diameter. It has the usual needle at the top and a chronometer at the bottom. The record is made by an electric spark perforating a chart that moves up or down within the body of the compass. A perforation is made for each knot traveled. The device makes a permanent record of all important features connected with navigation. It thus makes a check on the ship's log.

Electric power necessary for operation is secured by storage batteries or from the ship's dynamos. Mr. Jaeger will test his invention in every possible way during his four weeks' absence. On his return it is expected that plans will be made to put the compass on the market, provided it is found satisfactory.

Mr. Jaeger has about thirty patents on various instruments, among them an automatic log. He is an associate member of the American Institute of Electrical Engineers.

Waterpower Resources and Railway Electrification.

An American consul in a Latin-American country reports that the local government has engaged the services of an eminent civil engineer to make an exhaustive study of the great waterpower resources of that region, with a view to their development by the government as well as by private interests. Legislation bearing on the subject is now before Congress, and a proposition is being considered for the electrification of the government railways in the near future, as it is claimed a very large saving can be made in operating expenses by using electric power instead of steam as at present. The name of the individual under whose direction the work is being done can be obtained by interested firms by applying to File No. 3840, Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C.

New York's Street and Electric Railway Traffic.

The magnitude of the traffic on New York city's street and electric railroads was well illustrated by the exhibit of the Public Service Commission for the First District in the State Institutions Building at the recent State Fair. On the walls of the Commission's booth were charts, maps and photographs showing actual conditions in the big city, together with statistical tables comparing the transportation business of the large cities of the world.

It is shown, for instance, that the street railways in New York city carry many more passengers in a year than do those of London, which has a population of more than 7,000,000 against a little more than 4,000,000. In New York the figures for 1907 were: New York, 1,323,326,655; London, 871,171,495 passengers.

A profile chart of Manhattan and the Bronx and part of Brooklyn showed the number of tickets sold at the various stations on the subway and elevated lines and over the East River ferries and bridges for every hour of an average day. The Manhattan station of the Brooklyn Bridge showed the highest number of sales in one hour, namely, 29,411, while the Atlantic Avenue station of the subway in Brooklyn came next with 11,000 in one hour.

Trolley Line Sleepers from Chicago to St. Louis.

In a comparatively short time it will be possible to ride in a sleeping car from Chicago to St. Louis over a trolley or third-rail line. This will result from a completion of the road of the Illinois Traction Company between St. Louis and Joliet.

Sleeping cars of the new type are being constructed for this interurban service, and they will be operated between St Louis and Peoria, Springfield, Bloomington and Danville in limited trains. The company charges two cents a mile, but special rates are made for round trip and special occasions, bringing the average rate down to one-and-three-quarter cents per mile. The freight rates are based on the Illinois Railroad Commission's distance tariff for steam roads. Agents of the company say, however, that their line offers express schedules at freight rates. Another feature of the system is that it allows country merchants to use the company's telephone to order goods from St Louis, which is a saving to the retailers

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Exhibitors at New York Electrical Show.

As already announced in these columns, the third annual New York Electrical Show will be opened at the Madison Square Garden on October 11. The management confidently announces that it has completed all the arrangements to make this show eclipse everything ever attempted in this line. A number of startling innovations are to be looked for The show will close on October 21.

Following is a revised list of exhibitors with their New York city addresses in cases where New York offices are maintained:

American Electric Lamp Company, 153-9 Jefferson Street, Philadelphia.
American Metal Hose Company, 173-77 Lafayette Street.
Automatic Electric Washer Company, Newton, Iowa.
Collins Wireless Telephone Company, 54 Clinton Street, Newark.
Consolidated Telegraph and Electrical Subway Company, 66 Lafayette Street.
Dunlop Manufacturing Company, Thirty-fourth Street and Broadway.
Economical Electric Lamp Company, 25 West Broadway.
Edison Electric Illuminating Company of Brooklyn, 360 Pearl Street, Brooklyn.
Electric Cleaner Company, Monadnock Building, Chicago.
Electric Home Supply Company, 45 West Thirty-fourth Street.
ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, 13-21 Park Row.
Electric Suction Sweeper Company, 91 Wall Street.
Electric Storage Battery Company, Philadelphia.
Electrical Testing Laboratories, East End Avenue and Eightieth Street.
Electrical World, 239 West Thirty-ninth Street.
Empire Vacuum Company, 110 West Thirtieth Street.
Excello Arc Lamp Company, 30 East Twentieth Street.
Fox Brothers & Company 126 Lafayette Street.
German-American Electric Company, 110 West Fourteenth Street.
General Compressed Air and Vacuum Cleaning Machinery Company, 315 Fifth Avenue.
General Electric Company, 30 Church Street.
General Vehicle Company, Long Island City.
Goulds Manufacturing Company, 16 Murray Street.
Hurley Machine Company, 949 Broadway.
Keller Manufacturing Company, Philadelphia.
Charles L. Kiewert Company, 39 Cortlandt Street.
H. Krantz Manufacturing Company, 160 Seventh Avenue, Brooklyn.
Manhattan Electrical Supply Company, 17 Park Place.
Murphy Electricity Rectifier Company, Rochester.
National Electric Lamp Association, 4411 Hough Avenue, Cleveland.
Otis Elevator Company, 17 Battery Place.
Pelouze Electric Heater Company, 403-13 Ohio Street, Chicago.
W. P. Pressinger Company, 1 West Thirty-fourth Street.
Public Service Corporation of New Jersey, Newark.
Radio Reflector Company, 1178 Broadway.
Roger Williams (The Simplex Electric Heating Company), 25 West Forty-second Street.
Shelton Electric Company, 105 West Forty-second Street.
Southern Exchange Company, 97 Warren Street.
Stanley and Patterson, 23 Murray Street.
Sunray Electric Lamp Manufacturing Company, 109 West Forty-second Street.
Crane Company, 1200 South Canal Street, Chicago.
The Heany Company, 25 Broad Street.
The Lansden Company, Newark.
The New York Edison Company, 55 Duane Street.
The Westinghouse Electric and Manufacturing Company, 165 Broadway.
Tucker Electric Construction Company, 110 West Thirtieth Street.
United Electric Light and Power Company, 1170 Broadway.
United Shoe Repairing Machine Company, 39 Warren Street.
Watson-Stillman Company, 30 Church Street.

Advertising of the right kind in the right place at the right time cuts the salesman's work in two.

New York and New Jersey Telephone Company's Past Earnings.

In view of the obliteration, so to speak, of the New York and New Jersey Telephone Company in the New York Telephone Company, a retrospective glance at its financial status during the past ten years will illustrate the value of the property and its successful work to date, as follows:

	Outstanding Capital Stock.	Gross Earnings.	Net Earnings Applicable to Dividends.	Dividends Paid.
1908...	$25,235,000	$9,269,407	$2,400,037	$1,766,275
1907...	25,235,000	8,807,093	2,138,740	1,697,311
1906...	18,930,500	7,447,147	1,700,864	1,272,797
1905...	16,578,700	6,217,288	1,446,016	1,034,150
1904...	13,770,100	5,393,709	1,476,951	962,088
1903...	12,520,000	4,741,344	1,290,133	852,215
1902...	11,430,100	3,962,597	972,789	707,627
1901...	9,375,000	3,376,433	907,695	616,286
1900...	7,500,000	2,827,481	634,147	490,650
1899...	6,000,000	2,381,369	621,620	398,850

An interesting fact in connection with the rise and progress of the company is the increase in the number of subscribers' stations. In 1883, when the total capitalization outstanding amounted to $2,400,000, the number was 3,673. At the end of the last fiscal year 157,645 availed themselves of the telephone facilities through subscription.

The dividend rate of the New York and New Jersey company has been as follows: 1883, three per cent; 1884 and 1885, four-and-one-half per cent; from 1886 to 1894, inclusive, six per cent; and from 1894 to the present time, seven per cent.

The Wheatstone Telegraph System in Australia.

According to *The Transmitter*, the Australian government telegraph authorities have decided to install the Wheatstone telegraph system in several provinces in that commonwealth. This system is in use at present to some extent in Melbourne, and no additions are to be made to the equipment in that city. The provinces in which new apparatus is to be installed are New South Wales, Queensland, South Australia and Western Australia. Before deciding to install the Wheatstone system in the provinces mentioned, Sir John Quick, postmaster-general, received a report from F. G. Creed, of Glasgow, the inventor of the Creed perforator, which, among other things, said that the British Post Office during a recent trial handled on a single wire all traffic between London and Edinburgh, and occasionally gave Glasgow a helping hand. There are ordinarily six duplex Morse wires employed between these stations, and the traffic is sometimes very heavy; they once handled a total of 500 messages in a single hour in both directions.

Changes Its Subway Proposals.

The Interborough Rapid Transit Company, of New York, in a letter sent by President Shonts to the Public Service Commission, modifies its proposal to construct subways through Lexington and Third avenues by substituting a plan to build a four-track road along Madison Avenue, starting from Thirty-eighth Street. The company now proposes to construct a line along Madison Avenue to about 138th Street, thence across the Harlem River to 146th Street, thence dividing, with two tracks to a connection with the West Farms division of the present subway at 149th Street and Girard Avenue, and two tracks from 146th Street up River Avenue to a connection with the proposed MacComb's Dam extension of the Sixth Avenue elevated. The west side elevated line is to be modified so as to meet the projected subway at about 161st Street and River Avenue, and is to be continued up River and Jerome avenues to 194th Street as a three-track elevated road.

The modification of the plans, which is regarded as a surrender on the part of the Interborough, is the result of several conferences recently held between Chairman Willcox and President Shonts; and the last letter was a direct answer to a communication sent by the Commission on August 27. It is not known whether the Service Board will accept the Interborough's new proposition, or will insist upon the construction of the Broadway-Lexington Avenue subway planned by the old Rapid Transit Board. Mr. Shonts' former proposal did not have the approval of the Commission.

Successful Use of Telephones for Train Dispatching.

The adoption of the system of dispatching trains by telephone instead of telegraph on the Canadian Pacific Railroad has proved that fully fifty per cent more traffic can be handled by the former than by the latter.

In June of last year the company put in operation a telephone circuit between Montreal and Farnham, Quebec, and it proved satisfactory in every way. Since then the company has strung other telephone lines, and in western Canada today it has 531 miles of telephone lines.

It is the intention of the company at once to string a telephone line between Winnipeg and Brandon, 133 miles, and within a year it will have 1,000 miles of its system operated by telephone.

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BOOK REVIEWS.

"Motorman's Practical Air Brake Instructor." By George R. Denehie. Frederick J. Drake & Company, Chicago, Ill. Morocco, 280 pages (4½x6¾ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $1.50.

The days of the hand brake and mechanical friction brake for street and suburban electric cars have come and gone, and such appliances are now regarded by leading and experienced railway officials as being inadequate to meet the demands of modern electric passenger transportation. As is suggested by the title, this treatise treats of the more modern form of brake, namely, the air brake, and the author has taken considerable pains in collecting, condensing and compiling all of the latest available information bearing upon this most important subject, with the view in mind of offering to motormen and conductors the means of possessing something more than a mere knowledge of how to apply and release brakes. As is aptly stated in the opening chapter, trainmen should understand the mechanical principles represented in the brake, and should know how to detect, remedy and report any and all kinds of defects which may arise.

Beginning with a full and clearly illustrated description of the Westinghouse A. M. A. brake equipment, especially adapted to electric traction work, each of the other types of straight air, and automatic service is taken up, and its construction and operation clearly explained and plainly illustrated. This includes the National Straight Air Brake Equipment, not only for straight air, but as adapted for automatic service also. The General Electric Company's air brake in all of its details; the Christensen air brake, both straight and automatic, is fully described and illustrated, also the Westinghouse S. M. E. equipment. Considerable space is also given to electric brakes and friction brakes.

"Alternating-Current Motors." By A. S. McAllister. McGraw-Hill Book Company, New York, N. Y. Cloth, 322 pages (5¾x9 inches), illustrated. Supplied by the Electrical Review and Western Electrician for $3.00.

The third edition of this book has appeared in a revised and enlarged form. A comparison of the present edition with the second will show that the essential features of the recently developed "split-pole" variable-ratio synchronous converter are discussed in the simplest possible terms. There has been added a chapter on "Synchronous Motors" in which all of the characteristics of this machine, both as a motor and as a condenser, are fully treated, and the chapter on the "Prevention of Sparking in Single-Phase Commutator Motors" has been expanded to include the recent improvements in commutating-pole motors.

In selecting the methods of presentation, choice has been made of the treatments which serve to impart the maximum of information with the minimum of confusion. The general method of treating all methods is first to outline the theory roughly, then cover the discussion, again, adding the details. For example, in Chapter XIII the physical phenomena involved in the operation of single-phase commutator-motors are treated in the simplest possible manner without any reference to the mechanical dimensions or electrical constants. In Chapters XIV and XV, however, these motors are discussed in detail and the relations between the several parts of each machine are treated both algebraically and graphically.

The phenomena of induction motors are dealt with separately in Chapters II, VI, VIII and IX. In Chapter II the entire treatment is concentrated on the secondary circuit, the modifying influences of the primary quantities being temporarily ignored. In Chapter VI it is shown that, in its effect upon the primary quantities, the secondary circuit may be considered as composed of a constant reactance and a variable resistance. Chapter VIII gives a rigorous discussion of the operation of induction motors, and Chapter IX contains an analysis of the magnetic field in induction motors.

In addition to the enlarging and revising, the book contains all of the features which made the first and second editions a valuable work for students of alternating-current machines.

"The Protection of Railroads from Overhead Transmission Line Crossings." By Frank F. Fowle. D. Van Nostrand Company, New York, N. Y. Cloth, 70 pages (5x7½ inches), illustrated. Supplied by the Electrical Review and Western Electrician for $1.50.

The rapid progress made in the development of high-tension power transmission has given rise to a number of new problems which, though of secondary importance to that of transmission, are quite important to the electrical field as a whole. One of the most important of these is the problem of safeguarding persons and property from exposed transmission lines. It is coming to be regarded more and more that high-tension transmission lines are agencies of the most dangerous character and an increasing amount of attention is being paid to the subject of protection at all places of hazardous exposure.

This work treats of protection of railroads from these overhead high-tension power transmission lines only, the general problem of protection being a broad one.

The author does not believe it feasible to prepare a general specification which will cover all crossings of high-tension lines and steam railroads; hence in treating the subject he has indicated or outlined a form of specification which covers the general principles involved, the materials to be used, and the types of construction, without going into such details as naturally pertain to individual crossings.

Several approved types of protected high-tension crossings are taken up, together with comparisons of old types. The book contains many illustrations which help to simplify the discussion.

"Electric Power Conductors." By Wm. A. Del Mar. D. Van Nostrand Company, New York, N. Y. Cloth, 339 pages (5¼x7¼ inches), illustrated. Supplied to the Electrical Review and Western Electrician for $2.00.

To the users of power conductors, this book should prove valuable, as it gives a clear account of all of the engineering considerations which affect the purchase and use of such conductors. The book will be found practical and up-to-date, being based upon notes prepared by the author for his own use.

The arrangement of the book follows the rational order of the series of engineering considerations which affect the purchase of conductors, namely, the determination of material, insulation, and size, the specifications, test, and installation.

The text is made as brief as possible and where explanation or theoretical discussion is advisable, the text is supplemented by appendices. Diagrams, tables and formulas throughout the book supplement the discussion, and should prove beneficial to the readers.

To Rebuild Pittsburg Incline.

The Pittsburg Railways Company, of Pittsburg, Pa., closed the Knoxville incline on August 16, for ten days, to rebuild it. The incline has been materially strengthened to accommodate the heavier cars now being used. New and special safety devices were also added.

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AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing, is always interesting. "Actualities," the actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

THE WIEKS BOILER COMPANY, Saginaw, Mich., was the lowest bidder for the furnishing of three vertical 200-horsepower boilers for the city's waterworks and electric-light plant.

THE CINCINNATI ENGINEERING COMPANY, Cincinnati, Ind., has been awarded a contract to construct and equip a water and light system in Jasonville, Ind. Work will begin soon, under the supervision of Laurent Lowenberg.

THE CITY COUNCIL OF TEKOA, Wash., has awarded a five-year contract for the placing of cluster lights on First Avenue as follows: To the Olympia Foundry Company, for furnishing posts, $3,440, and to the Aguttor & Griswold Company, for supplying conduits, $24,538.

THE GREAT WESTERN POWER COMPANY'S bid for a franchise for erecting poles and stringing wires along the streets of Oakland, Cal., for light and power purposes has been accepted by the City Council.

THE WESTERN ELECTRIC COMPANY, Los Angeles, Cal., announces that on June 1 last it succeeded to the business of the California Electric Company, of Los Angeles.

J. J. AND J. M. KELLY, contractors, Winnipeg, Manitoba, have been awarded the contract for the erection of the new branch telephone exchange in that city for $43,000, while the Northern Electric Company will install the switchboard for $150,000. R.

THE CAMERON ELECTRIC COMPANY, Emporia, Pa., has secured the contract from the city of Seattle, Wash., for next year's supply of incandescent lamps for the city.

THE E. D. CROWLEY COMPANY, of San Francisco, has been awarded the contract for constructing a power plant at the Mare Island navy yard, San Francisco, Cal., at $50,894.

THE HENRY J. SPEICHER COMPANY, Toledo, Ohio, has been awarded the $100,000 contract for the Toledo plant of the General Electric Company on Friday of this week. The structure will be 300 feet long, eighty feet wide and four stories high. It will be constructed of reinforced concrete, and when completed will be utilized by the Toledo Lamp Company for the manufacture of the tungsten incandescent electric lamp. H.

THE HANDLAN-BUCK MANUFACTURING COMPANY, St. Louis, Mo., has recently closed a contract with the Waterloo Drop Forge Company, Waterloo, Iowa, for furnishing a complete drop-forge equipment, with the exception of the drop hammers, including 135 horsepower in electric motors, power presses, lathes, planers, millers, shapers, drills, and miscellaneous tools, amounting to approximately $25,000.

John R. Morris is president and general manager and F. B. Johnson, superintendent of the Waterloo company, which will engage in the general drop-forge business, making a specialty of high-grade forgings for automobiles and other kindred work, together with manufacturing of high-grade tools on which they have secured a number of patents. Strange as it may seem, this plant will at the start be the largest drop-forge works west of the Mississippi River, and will be equipped with high-grade machinery throughout.

The machine shops and forge room will be lighted with Stave "Flaming" arc lamps, for which the Handlan-Buck Manufacturing Company is the western agent.

THE W. H. OCHILTREE COMPANY, Pittsburg, Pa., reports the following contracts at the present time:

Complete electric-light and power installation in the filtration plant for the city of Pittsburg, Pa. Two of the interesting features of this contract are that all fixtures and apparatus are watertight and all conductors are insulated with thirty per cent pure Para rubber, covered with a layer of jute, which is covered with one-eighth-inch lead sheathing, and this in turn is protected by two layers of steel tape armor. Contract to be completed in May, 1910.

The Lincoln Public School, of Pittsburg, now near completion. This is an old building, which is being wired with B. X., and the installation comprises about 125 tungsten chain fixtures, and 125 250-watt frosted-bowl tungsten lamps, together with necessary switchboards, etc.

The C. L. Flaccus Building, at Pittsburg, Pa., which will be completed in a few days. The roof garden of this building is attracting considerable attention. Also the contract for a complete electrical installation in the new office building for the Brotherhood of Locomotive Engineers Building, Cleveland, Ohio, which was received some time ago, and work on which will be started about October 4.

GEORGE W. JACKSON, INC., Chicago, Ill., has secured the contract to build the main section of the Washington Street tunnel at Chicago, and excluding competitors by more than $150,000.

D. W. COOLEY, Waterbury, Conn., has been awarded the contract for building the concrete dam, gates to the penstock and foundation for the power house of plant No. 2, for the big storage basin and dam in East Montpelier. The dam will be 150 feet long and twelve-and-one-half feet high and will have a fall of thirty feet.

THE EUREKA ELECTRICAL AND CONSTRUCTION COMPANY, Eureka, Cal., has secured a contract for the erection of an electric-lighting plant at the works of the Little River Redwood Lumber Company at Little River, near Eureka.

THE ELECTRIC SUPPLY AND FIXTURE COMPANY, Ogden, Utah, has just completed the installation of a steam-turbine electric power plant for the Southern Pacific Railroad Company at Carlin, Nev. The contract discloses, among other machines, two twenty-five-kilowatt, direct-connected, 230-volt multipolars, furnished by the Westinghouse company. The plant will furnish power and light for the railroad shops and the town of Carlin. N.

BARTLETT & KLING, Cedar Rapids, Ia., announce that they are ready to let sub-contracts for plumbing, heating, electric wiring, plastering and terrazzo work for a six-story fireproof office building in Cedar Rapids, the contract for which has been awarded to them.

PERRY-MANN ELECTRIC COMPANY, INC., Columbia, S. C.—At a meeting of the stockholders of W. M. Perry Electric Company, Inc., held October 2, it was unanimously agreed to change the name of the company to that of Perry-Mann Electric Company, Inc. Application was made to the secretary of state, and the charter of the company was amended accordingly. The business will be conducted under the same management, the change in name being made in order that both stockholders should be represented in the firm name. The following officers were elected: W. M. Perry, president; M. L. Mann, secretary and treasurer.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of August and eleven months ended August 31, 1909, compares as follows:

	1909.	1908.
August gross	$ 355,229	$ 329,772
Expenses	183,582	164,262
August net	$ 171,647	$ 165,510
Charges, rent, etc.	50,026	54,112
August surplus	$ 112,620	$ 111,397
Eleven months gross	3,492,776	3,329,059
Expenses	2,078,398	1,978,659
Eleven months net	$1,414,378	$1,350,400
Charges, rent, etc.	418,801	423,021
Eleven months surplus	$ 995,576	$ 927,379

CHICAGO RAILWAYS.

The report of the Chicago Railways Company for July and six months ending July 31, 1909, compares as follows:

July:	1909.	1908.
Passenger earnings	$1,049,277	$ 939,944
Miscellaneous	28,416	22,615
Total gross	$1,077,693	$ 962,559
Operating expenses, maintenance and taxes	709,967	614,263
Balance	$ 367,725	$ 348,295
Thirty per cent of gross	323,306	288,766
Interest on property, 5 per cent	186,881	141,645
Net earnings	$ 136,426	$ 147,122
City's share, 55 per cent	75,034	80,917
Company's share, 45 per cent	61,391	66,204

Six months total gross, $6,034,488, expenses, $4,060,401, balance $1,974,087, thirty per cent of gross $1,810,346, interest on property $1,045,772, net earnings $764,574, city's share fifty-five per cent $420,515, company's share forty-five per cent $344,058.

NASSAU ELECTRIC.

The New York Public Service Commission has ordered a hearing for October 6, on the application of the Nassau Electric Railroad Company for permission to issue $730,000 in bonds. The purpose of the issue is to retire an equal amount of first consolidated mortgage bonds of the Atlantic Avenue Railroad Company, falling due October 1, 1909.

NORTHERN OHIO TRACTION.

The report of the Northern Ohio Traction and Light Company for the month of August and eight months ended August 31 compares as follows:

	1909.	1908.
August gross	$ 231,061	$ 209,741
Expenses	115,724	107,356
August net	$ 115,337	$ 102,385
Charges	43,703	43,381
August surplus	$ 71,634	$ 59,004
Eight months gross	1,432,015	1,248,875
Expenses	784,739	731,393
Eight months net	$ 647,275	$ 517,482
Charges	350,414	348,593
Eight months surplus	$ 296,861	$ 168,889

MEXICAN TELEGRAPH.

The report of the Mexican Telegraph Company for the quarter ended September 30, 1909, compares as follows:

	1909.	1908.
Traffic receipts	$ 157,000	$ 160,000
Expenses	38,000	42,000
Net	$ 119,000	$ 118,000
Other income	25,500	26,000
Total income	$ 144,500	$ 144,000
To Mexican government	7,500	7,500
Balance	$ 137,000	$ 136,500
Dividends	89,735	71,752
Surplus	$ 47,265	$ 64,747
Previous surplus	2,144,308	2,559,849
Total surplus	$2,191,573	$2,624,596

CENTRAL & SOUTH AMERICAN TELEGRAPH.

The report of the Central & South American Telegraph Company for the quarter ended September 30, 1909, compares as follows:

	1909.	1908.
Traffic receipts	$ 371,000	$ 365,000
Expenses	163,000	165,000
Net	$ 208,000	$ 200,000
Other income	2,200	4,500
Total income	$ 210,200	$ 204,500
Dividends	143,565	143,565
Surplus	$ 66,637	$ 60,935
Previous surplus	1,562,890	1,279,132
Total surplus	$1,629,525	$1,340,067

LAKE SHORE ELECTRIC.

The report of the Lake Shore Electric Railway Company for the month of August, 1909, compares as follows:

	1909.	1908.
August gross	$130,993	$119,674
Expenses and taxes	55,822	54,749
August net	$ 75,171	$ 64,925
Interest	33,852	33,749
August surplus	$ 41,318	$ 31,175

BOSTON SUBURBAN.

The combined earnings' statement of the subsidiary companies of the Boston Suburban Electric Companies, comprising the Newton & Boston, Lexington & Boston and Middlesex & Boston Street Railway companies, and excluding the operations of Norumbega Park and the Waltham Gas Company, for August last, is as follows:

	1909.	1908.	Increases.
Gross earnings	$89,970	$90,522	*$ 552
Expenses	56,535	54,926	1,608
Net earnings	33,434	35,595	*2,160
Interest	13,409	13,015	393
Surplus for dividend	20,025	22,580	*2,554

*Decrease.

AMERICAN LIGHT AND TRACTION.

The report of the American Light and Traction Company for the month of August and eight months ended August 31, 1909, compares as follows:

	1909.	1908.
August gross	$ 236,410	$ 194,872
Expenses	8,214	4,000
August net	$ 228,195	$ 190,872
Eight months gross	2,017,491	1,605,721
Expenses	71,405	32,000
Eight months net	$1,946,086	$1,573,721

PUBLIC SERVICE CORPORATION OF NEW JERSEY.

The authorization by the directors of the Public Service Corporation of New Jersey of an issue of $4,750,000 new stock, or about twenty-five per cent of its present outstanding stock, is accompanied by an increase in the rate of dividend from four to five per cent annually. The higher rate of dividend applies to the declaration for the present quarter, which is a disbursement of one-and-one-quarter per cent, payable September 30. The new stock, which brings the amount issued up to $23,750,000, out of the authorized capital of $25,000,000, will be issued pro rata at par to stockholders of record October 1.

With the increase in stock a bond issue of $8,000,000 was authorized under the new general mortgage covering $50,000,000 fifty-year five per cent bonds ratified over a year ago. The $8,000,000 now to be put out have been sold to J. P. Morgan & Company, and, according to a statement issued after the meeting by President McCarter, will be used chiefly to retire the $7,250,000 five per cent collateral trust gold notes due on November 1 of this year. The proceeds of the sale of stock are to go to finance the improvements which the company has had in contemplation for some time. In commenting on the increase in the dividend rate, President McCarter says:

"The action of the directors in putting the stock on a five per cent annual dividend basis was taken upon the recommendation of the executive committee, after a careful consideration by that committee of the favorable showing which the company is making both in the increase in its business and the economical operation of its properties."

AMERICAN TELEPHONE.

The American Telephone management made the most explicit statement when the last bonds were sold in November, 1908, that this would finance the company through 1910. It is not expected that any financial arrangement will be considered this year.

Authoritative information is that no financial plans for the future are in any way under consideration, and that nothing in the line of new issue, either stocks or bonds, are in contemplation.

BIRMINGHAM RAILWAY, LIGHT AND POWER.

The report of the Birmingham Railway, Light and Power Company for the month

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of August and eight months ended August 31, 1909, compares as follows:

	1909.	1908.
August gross	$ 181,979	$ 172,068
Expenses	100,036	105,630
August net	$ 81,943	$ 66,438
Eight months gross	1,458,461	1,404,375
Expenses	811,916	820,582
Eight months net	$ 646,535	$ 583,793

CHICAGO RAILWAYS' EARNINGS.

The Chicago Railways Company has prepared figures showing the increase in its business and earnings during the last year, as a result of the rehabilitation work that has been done and the installation of new cars. In ten months, from December 1 last year to September 30 this year, the company's gross earnings were $9,854,000, as compared with $8,668,000 in the corresponding months of 1907-08. The increase was $1,185,000, or fourteen per cent. The earnings by months in those periods compare as follows:

	1908-9.	1907-8.	Increase.	%
December	$ 949,260	$ 833,719	$ 115,541	14
January	917,357	794,388	122,969	15
February	850,200	716,023	134,177	19
March	963,655	840,743	122,912	15
April	975,440	847,220	128,220	15
May	1,032,511	884,775	147,736	17
June	1,021,582	913,594	107,988	12
July	1,049,277	939,943	109,334	12
August	1,061,364	959,167	102,197	11
September	1,033,961	939,048	94,913	10
Ten months	$9,854,607	$8,668,620	$1,185,987	14

METROPOLITAN WEST SIDE ELEVATED.

The Metropolitan West Side Elevated Railroad Company's report for the year ended June 30, 1909, compares with the years ended June 30, 1908, and the calendar year ended December 31, 1907, and 1906, as follows:

	1909.	1908.
Gross	$2,734,284	$2,809,483
Expenses	1,393,630	1,457,152
Net	$1,340,654	$1,352,341
Other income	9,795	5,016
Total income	$1,350,449	$1,357,357
Charges	1,066,626	1,070,780
Surplus	$ 283,823	$ 286,577
Dividends	.....	65,320
Surplus	.....	$ 221,257

BRONX GAS AND ELECTRIC COMPANY.

The application of the Bronx Gas and Electric Company for the approval by the New York Public Service Commission of a bond issue of $1,500,000 has been adjourned by Commissioner Maltbie pending further investigation. The company intends to issue only $740,000 of this amount, of which $550,000 is to redeem outstanding bonds. The objection that is raised by the Commission is the fact that the brokerage firm that is commissioned to underwrite this amount asks the sum of $30,000 for the work.

The Commission will continue further hearings on the matter in the near future.

Boston Street Railways Merger.

That the Boston Elevated Railway Company is planning to secure control of the Boston & Northern, the Old Colony, the Blue Hills, the Boston & Worcester, the Middlesex & Boston and the Lexington & Boston Street Railway systems has been known in a way that permits of no doubt.

The initial step to bring about enabling legislation was taken by the Boston Elevated, through its counsel, Frederic E. Snow, who appeared before a special commission in advocacy of the proposition. This commission consisting of the Massachusetts Railroad Commission and the Boston Transit Commission, gave its first public hearing at the State House on kindred subjects, and Mr. Snow named the companies referred to above and gave reasons for turning their control over to the Boston Elevated. Better transportation could be given, he said, if the Boston company were allowed to own and operate the lines with which it has physical connection.

The law of the state permits of consolidation of connecting street railways, but the Boston Elevated cannot take advantage of it because of a charter provision that it shall not charge more than a five-cent fare. Hence, if it consolidated with the Boston & Northern, for instance, it would be obliged to carry a passenger a long distance for five cents. This would not be necessary if, instead of consolidating with the connecting lines, it bought the controlling interests in them and thus dictated the operations. Authority to acquire such control is sought by the Elevated, and the Commission is asked to recommend it to the Legislature.

Underground Tramway.

An American consular officer in Latin America reports that the officials of a tramway company have presented to the local municipality the outline of a plan for the construction of an underground tramway system to extend under the entire city.

The company has made a deposit to guarantee the fulfillment of its obligations and will undertake to complete the construction, at a cost of $21,250,000, within about three years of the signing of the contract.

Particulars in relation thereto can be obtained on application to the Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C., reference being made to File No. 3855.

Brunswick Terminal and Railway.

With enlarged property and public-utility holdings, the Brunswick Terminal and Railway Securities Company, Brunswick, Ga., has materially strengthened its resources. The company, formerly called the Brunswick Dock and Improvement Company, has recently acquired all the public utilities of Brunswick, Ga., which include the Mutual Light and Water Company and the Brunswick & Suburban Railroad Company. The first-named company is earning fifteen per cent on its stock, while the traction company has just completed six miles of track, with equipment of the latest type. From $5,000,000 the stock of the new company has been increased to $7,000,000. There are no bonds or preferred stock.

With the acquirement of these properties the total holdings consist of 3,600 city lots in Brunswick, 3,200 acres of land, seventeen miles of water mains, twelve miles of gas mains, thirty-two miles of electric-light wires, and six miles of electric street railway.

To Sell Traction Company.

Judge Holt, of the United States District Court at New York, has signed an order authorizing the sale of the Westchester Traction Company at Ossining, N. Y., on a date to be fixed by the special master appointed by the court for that purpose.

Judge Holt has directed that no bid for the property under $1,200 be accepted. Each bidder will be required to deposit $600 or a note on any trust company in this city.

A mortgage on the property to be sold was given by the Westchester Traction Company to the New York Trust Company on April 12, 1902.

Denies Third Avenue Company's Application.

The New York Public Service Commission has denied the application of the Third Avenue Bridge Company for a certificate of public convenience and necessity to form the basis of an application to the Board of Estimate for a franchise to operate surface cars on the Queensboro Bridge.

One of the principal reasons given for the decision of the commission is the belief of the board that the company is a dummy one. It is a subsidiary concern of the Third Avenue Railroad Company and is composed of stockholders who are employes of that corporation.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Small Motors.

The General Electric Company has recently placed on the market a new line of alternating and direct-current fractional horsepower motors. These have been termed the "drawn shell" type, due to the fact that they have their field and stator iron securely bound in shells drawn from plates of steel.

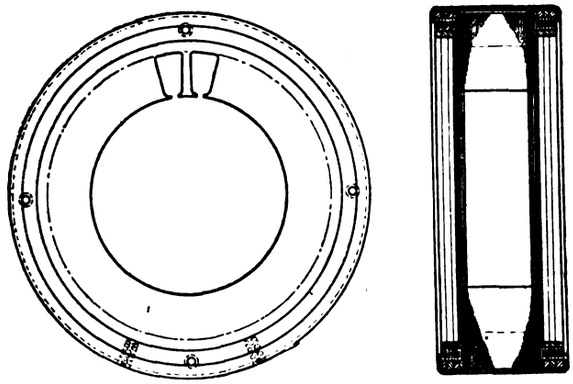

FIG. 1.—MOTOR FIELD STRUCTURE

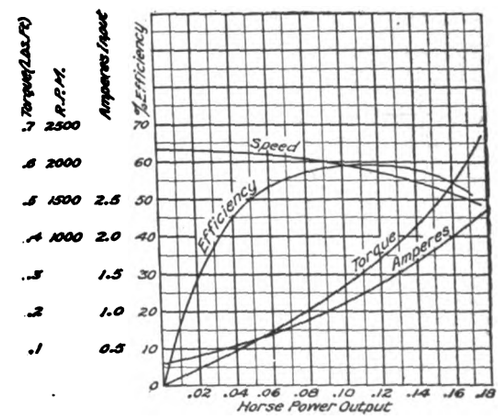

FIG. 3.—TYPICAL CURVES OF DIRECT-CURRENT MOTORS.

The fields of the direct-current motors are built up of punchings, a construction which secures much smaller diameters than is possible with the usual cast-steel or iron-magnet frames.

The field and stator punchings are assembled under compression, with thick punched rings to serve as spacers for the end turns of the winding, and the whole is pressed into a steel shell. The edge of the shell is spun over, securely holding the iron in place. This construction is shown in Fig. 1.

These steel shells or frames for both direct and alternating-current motors are cylindrical, and have no lugs or projections whatever. They are placed on an arbor, and the rim is trued and grooved to receive the heads, which are made of cast-iron. The heads are machined on centers to fit the frame, consequently the whole structure of the motor is correct; an accurate air gap and alinement of bearings is the result.

The standard base is shown in Fig. 2 and this is securely held in place by two screws tapped into the magnet frame.

The shafts of all motors are of ample size and the bearing linings are of bronze.

The induction motors have high power factor, efficiency, and liberal overload capacity, with moderate heating. This is evident from the curves in Fig. 4. The windings are of the concentric type, and the starting coils are automatically cut out by a switch when the motor has reached a suitable speed. A centrifugal clutch is furnished when necessary.

Since the frames are cylindrical and without lugs and projections they may be fitted with ease to any form of support, and the heads may be turned through any angle to permit of the motor being inverted or attached to a wall or vertical bracket.

This method of construction eliminates the outside frame of cast-iron that is usually employed, as well as the necessity for all holes through the active iron. It also makes possible accurate methods of manufacture, which insures perfect concentricity of parts and an alinement not usually found when the common cast shell is used.

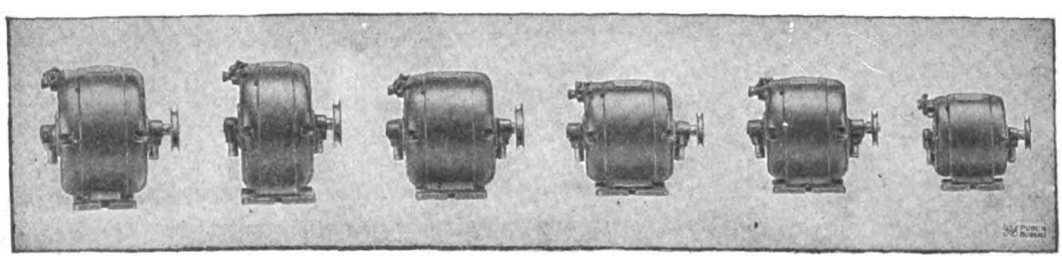

FIG. 2.—COMPLETE LINE OF ALTERNATING-CURRENT MOTORS.

These motors are supplied to meet all commercial circuit conditions of voltage, and, in the case of the induction motors, can be supplied for the various frequencies with either single or polyphase winding.

If one wishes to have direct and alternating-current motors of the same dimensions so as to use them interchangeably, it will be necessary to interchange an alternating-current with a direct-current motor of the next larger capacity. Their electrical characteristics are clearly shown by the curves in Figs. 3 and 4.

The motors are very compact, light in weight and of fine workmanship. They are adapted to such service as driving sewing machines, small lathes, automatic musical instruments, air pumps, small

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blacksmith forges, dental instruments, jeweler's tools, pumps, buffing and grinding tools and a large variety of small special machines.

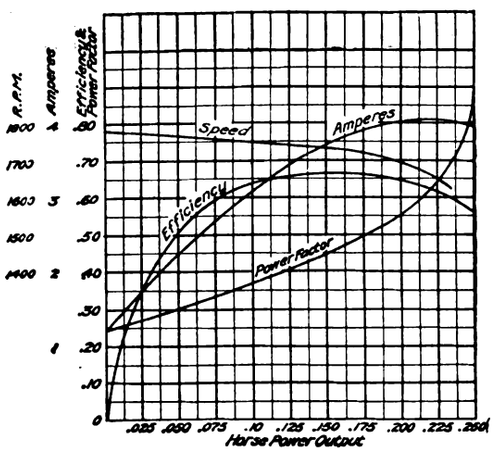

FIG. 4.—TYPICAL CURVES OF ALTERNATING-CURRENT MOTORS.

New Wire Building for the Diamond Rubber Company.

That the insulated wire business of the Diamond Rubber Company has advanced very rapidly is evidenced by the new six-story factory building now being erected. This structure, 371 feet long and 103 feet wide, will be used principally as an addition to the already extensive equipment of the insulated wire and cable department. Although this department is but three years old, the original capacity has been doubled already three times.

The equipment is complete in every detail for the manufacture of all classes of National Electrical Code Black Core, Red Core intermediate compound, thirty per cent Para and high-grade specification wires and cables, lead-encased cables, and a complete line of igniter cables for gasoline and other explosive engines.

Continuous wire-drawing machines, annealing and tinning furnaces, insulating machines, both longitudinal and tubing, single and double braiding machines, vulcanizing and wax tanks for saturating, and two lead presses—one now installed and the other in process of construction in Germany—are a part of the machinery necessary.

The Diamond Rubber Company asserts that the great output of this department in three years' growth has been due in a large measure to an absolute knowledge of correct rubber chemistry, resulting in the removal from the raw material of all elements that tend to hasten disintegration or deterioration in the finished product.

A New Pliable Insulating Material for Floors.

For some time past an insulating material possessing high insulating qualities and also strength and durability, has had considerable attention. The careful and exhaustive tests which have been conducted by the foremost experts in electrical engineering have shown the practical value of a large number of materials, among which is that known as "Electrose." For the past seven years this material has been extensively used on electric-railway, light and power installations with most satisfactory results.

The success with which this material has met along these lines has led to a development of a new insulating flooring. The Electrose Pliable Insulating Flooring, recently invented by Louis Steinberger and placed on the market by the Western Electric Company, is a new development and is being used extensively in connection with high-tension switchboards. It is also used as a protective covering for floors and walls adjacent to high-tension apparatus. This insulating flooring possesses not only extraordinary dielectric properties, but also has a uniform composition. On an official test, a slab twelve inches by twelve inches by three-eighths inch arced over at 89,000 volts without puncturing, which gives an idea of its dielectric strength. The material is permanently pliable, very tough and strong, thoroughly waterproof, and possesses a dull surface, which will not become smooth or slippery from wear. It is made in various colors and of practically any size or thickness.

The material conforms to any inequalities of a floor upon which it is laid, and while the standard form of the material is pliable, it can be made, if desired, very hard and inflexible. When installing the covering, the slabs are placed on the floor or secured to a wall and spaced about one-quarter of an inch apart. A cement made of the same material is then poured, or otherwise applied, between the slabs. When this cement "sets" (which will occur within ten minutes of time of application), a homogeneous mass is formed which becomes an integral part of the slabs.

The Electrose flooring may be sawed, planed or drilled and nails may be driven through it without danger of cracking or otherwise injuring it. The material naturally clings to the floor or other surfaces upon which it is laid, and does not curl at the edges or corners, thereby not making it necessary to secure the material to the floor, except under certain conditions—when the slabs are small and it is necessary to keep them from moving along the surface of the floor.

In those cases where the Electrose Pliable Insulating Flooring has been laid in power stations having high-tension switchboards, this new floor insulating material has given thoroughly satisfactory results.

Jewel Electric Washers.

One of the new electrical devices which is being favorably received by electrical dealers and central stations is the Jewel electric washer which is being manufactured by the American Washer Company, of St. Louis, Mo. For central stations this device should offer a means for enabling an increased sale of current for domestic purposes.

The Jewel washer, while very simple in construction, is guaranteed by the manufacturers for its strength and durability. It confines both the operations of washing and wringing to one machine, carrying out both without the aid of the hands.

The field of usefulness of this device is large. It is made in types and sizes sufficient to supply the varying demands of private families, hospitals, small hotels, boarding houses, boarding schools, small laundries, cafés, restaurants and similar institutions.

The manufacturers are carrying on an extensive advertising campaign, advertising particularly in journals and magazines which have a large circulation among women.

New Factory of the Moore Electrical Company.

The Moore Electrical Company has recently purchased its new brick factory at 167-171 Malvern Street, Newark, N. J. The building is forty-two by 100 feet, of mill construction, three stories in height, with 16,000 feet of floor space and cement basement. The building is well lighted on all sides and has skylights over the third floor. The plant includes a complete generating equipment and freight elevators, and is complete and modern throughout. This space will provide proper manufacturing facilities for the constantly growing business of the Moore light. The first floor is used for the glass department and shipping. The machine shop and offices are located on the second floor and the engineering department is on the third floor.

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FLAME ARC-LAMP CARBONS.

BY K. ODWALD.

Flame carbons are radically different from the so-called pure carbons, and one has to put them in a class by themselves. Their distinct feature, compared with pure carbons, is the extremely *long*, but intensely *luminous, arc* which they produce when properly used.

In the selection of the core material care must be taken to use arc-enlarging ingredients which do not vaporize, but decompose into minute particles which move along the arc and are brought to intense incandescence by the high temperature.

The larger percentage of light then comes from the arc proper, while with common carbons the arc itself is inefficient, most of the light coming from the craters of the carbons.

These principles have been known for years, since arc lighting was in the first stages of development. While the superiority of the "chemical carbon" had been fully recognized at that time, it did not find practical application because the lamp mechanism was in a crude and primitive state, and arrangements for ventilation were inadequate. The light produced was unsteady, the flame smoked badly, and the color of the light did not suit the taste of the time.

For two decades nothing had been done to improve upon the good start which had been made until with the dawn of this century the problem found its solution.

COMPOSITION OF THE MODERN FLAME CARBONS.

The exact proportion and nature of the ingredients is, of course, a factory secret; the main substance, however, is, for the yellow carbon, a compound of calcium, while the white carbons are principally composed of material similar to that of the Welsbach mantle. These substances, mixed with powdered carbon and binder (silicate), are filled into carbon tubes.

The study of the operation of flame carbons for direct current has shown that it is advantageous to use a negative carbon without the chemical core. It is a fact that the direct-current arc is steadier with a pure carbon negative and a chemical-core positive electrode. For alternating current, of course, both carbons must be alike, both have chemical cores.

SPECIAL DETAILS OF LAMP CONSTRUCTION AND CARBON STRUCTURE.

Experiments with chemical carbons in the first stages of their development have shown that thin electrodes with high current intensity produce a steadier arc than those of larger diameter.

In order to get reasonably long burning hours it was necessary to make the carbons very much longer than those of the common arc. To place these long thin pencils co-axial was not feasible on account of the extreme length of the lamp frame. The only way out of this difficulty, then, was to put them in inclined positions, side by side. This departure of the former practice brought a number of new constructive details for the lamp:

(1) The blow magnet.
(2) The sliding negative guide plate.
(3) The economizer and reflector.

THE BLOW MAGNET.

To prevent the arc from traveling upward along the carbons, the magnetic blow (very extensively used for high-amperage switches) was put into service. In addition to the blowing action the magnet has a tendency to hold the flame in position; *i. e.*, to prevent its wandering.

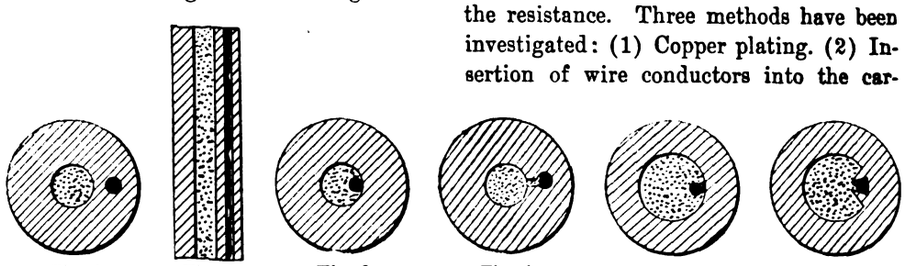

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6.

VARIOUS WAYS OF ENCLOSING AN AUXILIARY CONDUCTING WIRE.

THE ECONOMIZER.

After all, it is the application of heat concentrated on the carbon tips which is essential for the production of the arc. To economize this electrically generated heat is important for a highly efficient source of light. The porcelain cup called the "economizer" conserves the heat, keeps away disturbing air currents, and at the same time acts as a very effective reflector. A further feature is that the gases which accumulate in the economizer are not rich in oxygen; *i. e.*, they reduce, or act as a check on mere cumbustion.

THE SLIDING GUIDE.

Though the manufacture of carbons has advanced today to a stage where uniformity of the product is practically perfect, there are always small differences in homogeneity. To adjust for the changes which the arc resistance suffers from these variations in structure and to take care of unavoidable fluctuations in the supply voltage, the sliding guide, which moves the negative carbon to or away from the positive, has been added to the governing mechanism. This guide also plays an important part in the striking of the arc.

THE CARBONS.

There are today two kinds of flaming arc lamp carbons: For inclined arrangement; for co-axial arrangement.

The carbons burning in inclined position are very long in proportion to their diameter. This ratio is about 1:60 for the seventeen-hour lamp. It is clear that the ohmic resistance of these electrodes should be very much higher when the lamp is newly trimmed than when the carbons are nearly consumed. As a matter of fact, the resistance of each carbon proper for the seventeen-hour lamp is about one-half ohm; *i. e.*, the voltage drop would be about ten volts for a ten-ampere lamp. To eliminate these disadvantageous conditions various expedients have been tried. The leading idea is, of course, to reduce the resistance. Three methods have been investigated: (1) Copper plating. (2) Insertion of wire conductors into the carbon. (3) Current admission near the carbon ends.

COPPER PLATING.

This method has not proven reliable. The copper film forms beads on the carbon tips which suddenly drop and very often splash against the globe, causing breakage. Adjacent beads may fuse together and prevent the adjustment of the carbon distance; or, in other words, the lamp will be short-circuited.

INSERTION OF WIRE CONDUCTORS INTO THE CARBON.

The insertion of a wire of proper alloy is, today, the best solution of the problem. There are, however, different ways to accomplish this. First, the wire was put in by hand in a canal near the core, but through the carbon proper (Fig. 1). These carbons gave pretty good results, due to the irregular contour of the wire affording a sort of spring contact with the carbon, but this method was expensive. Later this operation was done by machinery, but then the wire had to be pulled through nearly straight, and burning tests showed that the contact between

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wire and carbon was not good, the wire being loosely held in the channel.

Some patents have been granted for the use of corrugated wire in order to insure proper contact by spring action (Fig. 2). Some carbons give good results, others fail. They are not uniform and the wire loses the temper, so reducing the contact. Others placed the wire in the core (Fig. 3). As the main center of heat, however, is in the core, the wire vaporized eruptively and threw out part of the core, so reducing the light-emitting material.

The best method today used is that of Siemens and shown in Fig. 4. The core material enters the side recess and presses the wire to the carbon, insuring good contact. This form of carbon is uniform in consumption and avoids all of the difficulties enumerated above.

cations apply as for the regular carbons.

As the arc of the flaming arc lamps is especially sensitive to air currents care should be taken that the globe is not cracked and that the ventilation is arranged properly according to the lamp construction.

All measurements should be made with the globe in place. The investigation should include: (A) Shape and position of the arc. (B) Form and appearance of the carbon ends. (C) Deposits. (D) Condition influencing the rate of carbon consumption. (E) Color, steadiness of arc and light output.

The arc should build up between the two cores, and stay in this position quietly. Only here and there it will wander to the carbon shell, but it should return quickly to the core.

Little beads of the core material will

impossible. There is no crater formed, either on the positive or negative; the arc wanders slowly around and both carbons are consumed equally. As a general rule co-axial flame carbons are about double in diameter and little less than half the length of the inclined carbons of same amperage and burning hours. This changing of arc position does not have a bad effect on the light distribution. The long arc with broad, radiating surface will not cause pronounced shadows of carbons or carbon holders. The source of light not being concentrated in one point, but sending out rays against obstructions from different directions, does not throw heavy shadows of the rods along which the carbon holders slide. See Fig. 7.

With inclined carbons the shape of the arc may be compared with the form of a bean pointed near the negative and

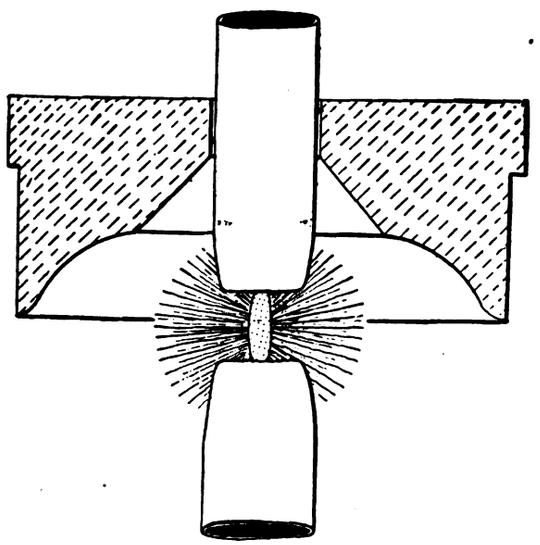

FIG. 7.—THE FLAME ARC WITH CO-AXIAL CARBONS.

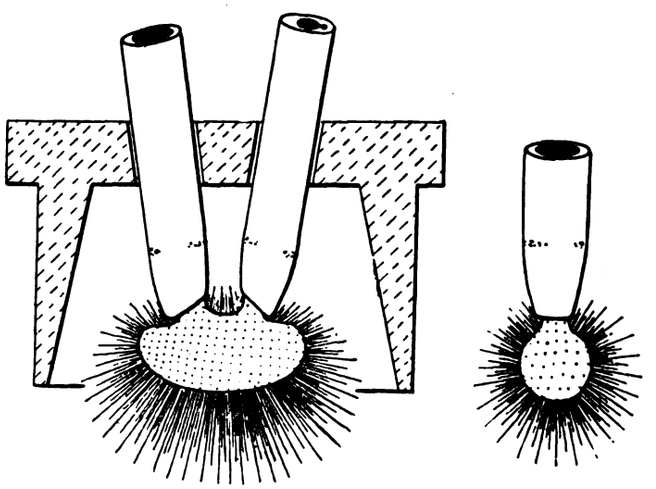

FIG. 8.—FRONT AND SIDE ASPECTS OF THE FLAME ARC WITH CONVERGING CARBONS.

For carbons with a thin shell, *i. e.*, carbons with small diameter, the cross-section used is similar to that shown in Fig. 5; *i. e.*, the wire may be placed in the side of the core. A recent patent (Siemens) improves upon this method, as shown in Fig. 6. To insure good contact in the carbon holder, the wire is flattened on the upper end and bent over.

CURRENT ADMISSION NEAR CARBON ENDS.

Some deposit formed during the consumption of the carbons will settle between the sliding contact and the carbon and prevent proper conduction of the current. This method has been practically abandoned.

TEST FOR QUALITY AND PROPER CARE OF THE CARBONS.

As far as straightness and uniform thickness are concerned, the same specifi-

occasionally appear on the outer sides of the shell, having found their way through some of the larger pores. These beads usually drop on the ash-tray; sometimes, however, when the arc approaches, they suddenly evaporate, radiating a short flicker of brilliant light. The fluctuations of light caused by these occasional irregularities cannot be avoided with flame carbons; one might say they are part of the carbons' character.

The position of the inserted wires relative to one another should be such that the wires shall be separated as widely as possible.

With co-axial (vertical) carbons the ends of the carbons when burned under proper conditions should be dark black. The little beads may be present, but they will not disturb the arc. As the arc length is very great, freezing is practically

round near the positive carbon. The core of the arc is highly luminous. The surrounding part is less effective and spreads, fanlike, around the carbon points. The position of the arc, under normal conditions, is in the plane of the carbons. The best efficiency is obtained with the arc in position, as indicated in Fig. 8.

DEPOSITS.

The white powder, the product of disintegration and combustion of the chemical core by the arc must be taken carefully into consideration for the construction of the lamp feeding mechanism. A well ventilated lamp, *i. e.*, a lamp in which this product of the lamp is carried off by properly controlled air currents, is important for reliable service. The air-admitting ash-tray needs close attention, and the greatest care in designing must be exercised in order to proportion correctly

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the length and cross-sectional area of the ventilating ducts.

CARBON CONSUMPTION.

The diameters of the positive and negative flame carbon for direct current differ as a rule only one millimetre, while the cross-section of the negative of pure carbon is only one-half of that of the positive. The consumption of flame carbons, however, is practically equal to that of the pure soft carbon for the open arc. The position of the arc in the economizer also changes and variations in ventilation influence the consumption materially.

COLOR AND LIGHT OUTPUT.

Inclined flame carbons make it possible to change the color of the light from the arc. White, yellow and red may be secured. Yellow, however, is the most efficient and especially effective where penetrating power, as in smoke-filled foundries, etc., is demanded.

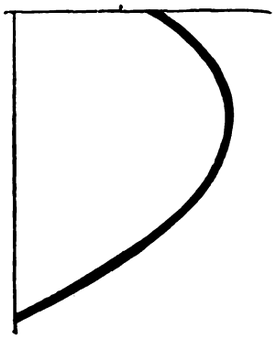

FIG. 9.—LIGHT DISTRIBUTION WITH CONVERGING CARBONS.

"Alba" carbons, for white light, have about the same efficiency as the yellow inclined carbons.

While the light output of "Alba" carbons and the yellow inclined carbons is about the same, the distribution is altogether different. Fig. 9 shows the distribution of light which the inclined carbon arc produces. The maximum goes straight downward. When the lamp is hung very high (thirty feet or more), the actual distribution obtained is more satisfactory, as the light can spread.

Wherever the lamp is hung lower (eighteen feet and less), the "Alba" vertical arc carbon with a characteristic distribution as indicated in Fig. 10, gives better results. The light spreads over a very much larger surface than that which could be illuminated with the same intensity by the inclined carbon arc.

While the limits where the one or the other type is best suited cannot be indicated very closely, there are two separate fields in which one or the other type may be used to the greatest advantage.

Blackburn-Smith Feed-Water Filters.

A six-inch Blackburn-Smith feed-water filter has been installed in the Marion power station of the Public Service Railway Company of New Jersey, to eliminate the oil which had heretofore reached the boilers in considerable quantity. At this plant there are twenty-five 625-horsepower boilers, arranged in five batteries, and carrying a pressure of 200 pounds. Each battery is served by one filter, which has sufficient capacity for handling 150,000 pounds of water per hour. The exhaust steam from Curtis turbines and their auxiliaries is condensed and used again as feed water, but it was found that the open heaters did not catch the oil present in the condensed exhaust steam from these auxiliaries. The new filtering arrangement, as provided by the Blackburn-Smith filters, now passes all the feed water through two separated layers of the linen Terry cloth at the last point before the water enters the boilers. In this way both make-up water and condensation are given a final clarification, after which there is no possibility of the introduction of further impurities. The water reaches the filters at a pressure of about 230 pounds and at a temperature of about 208 degrees, but neither this pressure nor temperature affects the efficiency of the filters. The filtering surfaces are kept clean by renewing the media on the cartridges when they are replaced by the spares. This operation is quickly performed, as the swing bolts which hold down the cover of the filter are easily loosened and the cover is swung to one side by means of a crane, which is furnished as part of the filter. The oil retarded in this instance is plainly noticeable by the discoloration of the cloth of the two foul cartridges resting against the foundation, in comparison with the spare one, which is being put into place. These foul cloths are afterward boiled out in soda and kept in readiness for use again at the next cleaning.

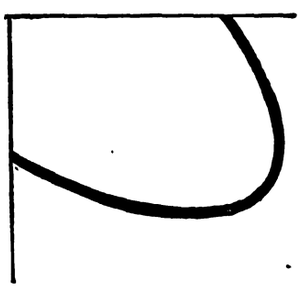

FIG. 10.—LIGHT DISTRIBUTION WITH CO-AXIAL CARBONS.

Blackburn-Smith filters are made by James Beggs & Company, 109 Liberty Street, New York.

Allis-Chalmers Steam Turbines.

The Allis-Chalmers Company has recently received orders for steam turbines aggregating a total of 25,225 kilowatts. Recent contracts for new machines comprise turbines ranging from 300 to 3,000 kilowatts for generating current in a great variety of industries. Among the purchasers of large units are the Nashawena Mills, New Bedford, Mass., where two 3,000-kilowatt units, as well as one of 500 kilowatts, will be installed; the Whitman Mills, New Bedford, Mass., 2,000 kilowatts; the Wilmington City Electric Company, Wilmington, Del., 1,500 kilowatts, and the Paine Lumber Company, Oshkosh, Wis., which has contracted for 1,000 and 500-kilowatt turbines. The Diamond Rubber Company, of Akron, Ohio, manufacturer of rubber wearing apparel, automobile tires and rubber novelties, has purchased a 1,250-kilowatt low-pressure turbine.

Sales of 500-kilowatt turbines have been made to the Byron Weston Company, Dalton, Mass.; Sheffield Car Company, Three Rivers, Mich.; E. I. Dupont De Nemours Company, Wilmington, Del.; Coventry Company, Anthony, R. I.; Alexandria Electric Company, Alexandria, Va., and two units for the Casparis Stone Company, for operation in its plants at Patterson's Creek, W. Va., and Havre de Grace, Md.

The National Conduit and Cable Company, Hastings-on-Hudson, N. Y., has bought a 750-kilowatt turbine, and the Ponemak Mills, Taftville, Conn., has contracted for a 600-kilowatt turbine. Two 375-kilowatt low-pressure turbines are to be installed in the plant of the Cherry River Paper Company, Richwood, Va., and one in the plant of the Virginia Electric Power and Water Company, Virginia, Minn.

The Taylor Iron and Steel Company, High Bridge, N. J., will put in operation a 300-kilowatt Allis-Chalmers steam turbine. Sales for turbines of the same capacity have also been consummated with the Noblesville Heat, Light and Power Company, Noblesville, Ind.; Citizens' Lighting Company, La Salle, Ill.; Huntington Valley Light and Power Company, Jenkintown, Pa., and the Pacific Lumber Company, Wilmington, Cal.

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MODERN METHODS IN THE CREAMERY.

A SUCCESSFUL CHICAGO EXPERIMENT WITH AN OZONE DEODORIZER.

Strange as it may seem now, the Pure Food Law passed by Congress a few years ago did not include in it the requirement of labeling all butter made from stale cream as "manufactured from stale cream," but the loop-hole was left open and stale cream is made into butter every day all over the country.

Many creameries mix their stale cream with the fresh cream, and all of it is finally made up into butter. The reason the creameries get stale cream is that the farmer now separates his milk and cream with his own separator and brings it to the railroad for shipment only once or twice a week. Naturally cream separated, say on Monday, will not be fresh on Thursday when it reaches the creamery, and so on through the week. Some years ago before the farmer became rich and independent, he was obliged to bring his milk each morning to the creamery at the railroad. The cream in this way would reach the city creamery fresh every day, and rarely ever was received in a stale condition. Now it is all different.

The creameries have long tried to find some way to deodorize and freshen up the stale cream. Several experimental stations have worked out different methods, employing forced air, and it was found that the active principle in the air to take up the rancidity, etc., in the cream and milk was the oxygen, and better still, ozone which is condensed oxygen. This being proved without any question of a doubt, it remained for someone to take further along experiments in this line.

For some years past, since the application of ozone to dairy products was thought possible, has this subject claimed the attention of various agricultural colleges in various parts of the country. Some have advocated it while others have been non-committal, and not until early in March, 1909, did the subject receive an impetus sufficient to bring it to the immediate attention of several large creameries in Chicago. The stumbling block heretofore has been the generating of ozone in sufficient commercial quantities, and above all the purity of the gas to be used; moreover, the application of the gas itself to raw milk, cream, etc., had been little experimented with owing to the scarcity of pure ozone gas.

The National Air Filter Company, of Chicago, has developed an ozone generator particularly adapted for the complete deodorizing and purifying of stale milk and cream. After making numberless tests in its own laboratory, the company proceeded to find a creamery large enough where a prolonged run and test could be made so as to determine exactly the merits of the ozonizing process on a definite quantity of raw milk or cream. An arrangement was obtained with a creamery in Chicago to make this test on raw milk and cream each day as it was received from the country. A 100-gallon agitator was installed alongside a battery of eight 1,500-gallon primers connected to shafting, etc., the same as the rest of the plant complete.

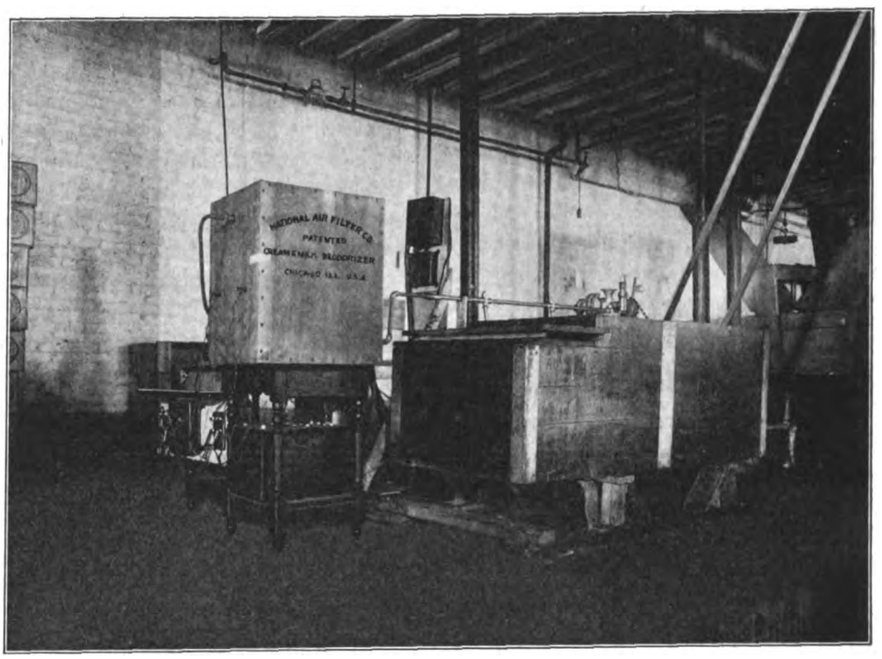

FIG. 1.—SHOWING NATIONAL OZONIZER AND CREAM AGITATOR.

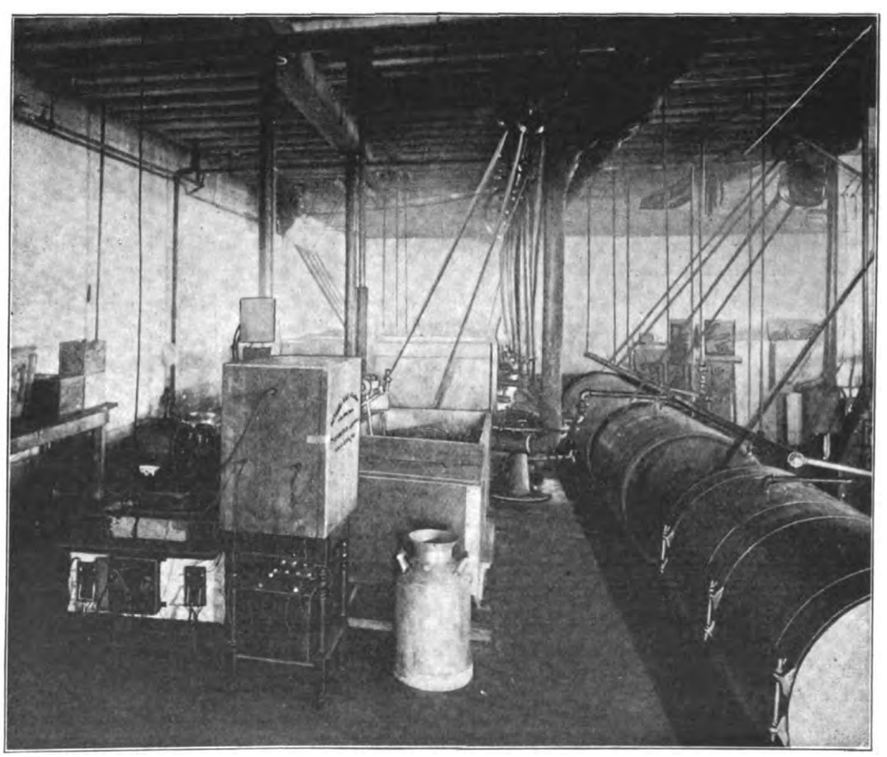

FIG. 2.—ANOTHER VIEW OF OZONIZER AND AGITATOR.
The pasteurizer is in the extreme background of the picture, and the churns are shown to the right.

In sampling the raw cream in cans,

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those that were quite stale and foul-smelling were set aside until about eighty gallons were obtained which ordinarily would be condemned as unfit for use. This was first put through the pasteurizer at a temperature of 130 degrees; from there it was promptly run into the agitator and treated with ozone for forty minutes, and at the end of this period the cream was bleached and completely deodorized, the acidity being reduced from 0.7 to 0.36. After being cooled it was churned into butter grading up to No. 1. On subsequent runs the results were duplicated with the exception that in one case, through the carelessness of the operator, too much ozone was taken up by the cream and the butter tasted strongly of "mountain air."

It was found that the best results were obtained in deodorizing stale cream after pasteurizing and at a temperature of 110 degrees, and the length of time for ozonizing this stale product varies, of course, with its age. The cream subjected to the above tests varied in age from two to five days and the rancidity was pronounced, of course, prior to ozonizing. Subsequently, however, the cream was fresh and palatable, making No. 1 grade butter. The treatment of unskimmed milk showed a large reduction in the acidity, while leaving the butter fats, etc., unchanged.

The National ozonizer used in these tests is constructed on the same general principles as that described in our issues of June 26 and August 28 last. In this particular instance, however, the dry filtered air is forced by the electric air pump at a rate of about four cubic feet per minute through the ozone generator, the ozonized air being discharged into the bottom of the agitator at as fast a rate as may be desirable to suit the exigencies of the sample under treatment. In creameries which have an output of 50,000 pounds of butter per day and are operated on a large scale, the ozone generator is installed so as to discharge directly into the pasteurizer, thereby saving one operation and time consumed.

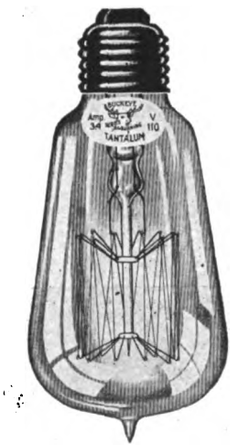
The application of ozone to the process butter industry opens up a large field, and time will tell when ozone will be applied to the other arts little thought of now.

More than 15,000,000 miles of single wire are used by the people of the United States in communicating with each other over telephone and telegraph lines.

Tantalum Lamps for Railway Service.

The Buckeye Electric Company, Cleveland, Ohio, has recently put on the market a tantalum lamp, in sixteen and thirty-two-candlepower sizes, specially designed for use on street railways. These high-efficiency lamps use only about four-sevenths as much power per candlepower as the carbon-filament lamps, inasmuch as they consume but 2.3 watts per candle as compared with the ordinary four watts per candlepower of the carbon lamps.

Important advantages claimed for the new lamps are: (1) They are economical in operation, considering cost of power plus renewals. (2) The candlepower is not greatly affected by the voltage variations ordinarily occurring on street-railway systems. (3) The light has a splendid color quality. (4) The light is comparatively free from glare, especially so when lamps are frosted. (5) The lamp has



TANTALUM RAILWAY LAMP.

a life equal to that of the carbon lamp. (6) The filament is extremely rugged in construction. (7) The lamp is extremely economical in current consumption, thus permitting current to be available for overload on the motors when required.

The installation of these lamps presents no difficulty, as there are no changes to be made in the car or in the wiring.

The lamp has been thoroughly tried out under actual operating conditions on several different roads and has given the highest satisfaction in every case.

A fine exhibit of these lamps was made by the Buckeye Electric Company at the street-railway convention in Denver, Colo., this week, where the new lamps occasioned more than a passing interest among the 3,000 delegates who were in attendance, and a practical demonstration was also afforded by the 300 street cars in Denver which have been equipped with the new Buckeye tantalum lamps.

General Motors Company's Plans.

Supplementing the announcement from Trenton, N. J., that the General Motors Company had filed an amended certificate of incorporation, increasing its capital stock from $12,500,000 to $60,000,000, it was reported in trade circles that the company had under consideration the purchase of a number of leading plants. At the offices of the General Motors Company it was stated that it was too early as yet to give out any statement regarding the proposed plans of the company, although some announcement might be made later on.

In reply to a question on the subject an official states: "We have increased our common stock to $40,000,000 from $5,500,000, and the preferred from $7,000,000 seven per cent cumulative preferred to $20,000,000. We now control about twelve companies, all of which are doing a large business. Most of our companies are located in Michigan."

The General Motors Company, which was incorporated in New Jersey September, 1908, absorbed at that time the Rainer, at Saginaw, Mich.; the Olds Motor Works, at Lansing, Mich.; the Oakland plant at Pontiac, Mich., and the National and Reliance factories at Indianapolis, Ind. According to statements made recently, the production in 1909 will be 22,000 automobiles and the sales for the year will approximate $25,000,000. Under the proposed plans the producing capacity will be greatly enlarged.

General Electric Company Awards at Alaska-Yukon-Pacific Exposition.

The General Electric Company has received grand prizes (highest award) at the Alaska-Yukon-Pacific Exposition in each class of electrical apparatus in which an exhibit was made by the company. General Electric apparatus was ranked first in the following divisions:

Apparatus for cooking by electricity, apparatus for heating by electricity, automatic motor starters, arc lamps, rail bonds, cabinets, circuit-breakers, cut-outs, fans, indicating instruments, integrating instruments, insulated wires, insulated cables, incandescent lamps, mine locomotives, motor generators, motors for direct current, motors for alternating current, recording instruments, rectifiers (mercury arc), sockets, switches, transformers and wiring devices.

General Electric turbines were also entered in the government exhibit, in which no awards were made.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, SEPTEMBER 24.—It has been an open secret for some time past that the Underground Electric Railways Company of London was deposing the original Westinghouse turbines and was installing Parsons turbines in their place. One of these latter machines is now in place, driving a 6,000-kilowatt alternator.

A remarkable offer is being made by the Welsbach Incandescent Gas Mantle Company. The company is putting on the market a metal-filament lamp and offers to remove the whole of the carbon electric lamps from any existing installation and replace them with Welsbach filament electric lamps of at least equal candlepower, and will accept as settlement in full of its account the difference saved by the consumer in his electric current bill as ascertained by comparison with the corresponding quarter of last year. It is a sign of the times that a gas mantle company should see fit to put an electric lamp upon the market, although I believe the original metal-filament lamp patents were granted to Baron Welsbach.

There is no doubt that the trackless trolley system of electric traction is impressing itself more and more upon tramway managers in this country as time goes on. Despite the failure of any tramway authority to secure the necessary Parliamentary powers last session, the Leeds corporation intends to promote a bill in the coming session, and at the annual conference of the Municipal Tramways Association now being held in London many decided opinions in its favor are being expressed. The Railless Electric Traction Company has built a car which is experimentally running near London and a complete description will shortly be available. Among the more recent and prominent advocates of the system are the tramway managers of the London County Council and the Sheffield corporation, and there is every prospect of the system being largely adopted in the near future.

Another matter appertaining to tramways which has been discussed is the mode of collecting the current on trolley tramways; i. e., whether by rolling contact, as in the trolley arms, or by rubbing contact, as in the bow collector. With the exception of a small system close to London, viz., Sheerness, where a Siemens bow collector is employed, all our trolley tramways use the rolling contact, or trolley wheel, but the manager of the Sheffield corporation, in a paper on this subject, regards this as a most unmechanical device and is inclined to favor the use of the bow collector, although he has been unable to ascertain definitely whether this entails any further considerable wear upon the trolley wire. In general terms he has ascertained that the additional wear is not appreciable, but no definite figures appear to be available. Yet a further tramway question which has received discussion at the tramway conference is that of single-deck versus double-deck tram cars, but there continues to be a big difference of opinion on this point between British and American and continental tramway managers. Single-deck cars are only used here in very small numbers, and then when low bridges render their use imperative, but opinions are all against this type for ordinary use, it being argued that the current consumption of a double-deck car is very little more than that of a single-deck car, while the seating capacity is nearly double.

The Home Office will shortly appoint a committee to consider the regulations concerning the use of electricity in mines which were drafted in 1902, with the object of bringing them up to date and more in accord with the latest practice. That there is need for such an investigation is shown by the fact that as the result of an explosion in a Durham mine—which may or may not have been due to electrical causes—a resolution was recently put before the council of the Durham Mines Association urging coal owners to remove electrical machinery and cables from their pits. No action is to be taken, however, in view of the appointment of the committee referred to above, before whom a considerable volume of evidence will be placed.

An action is being taken by the Electrical Contractors' Association against the Aberdeen corporation for undertaking electric-wiring work which the association claims is illegal.

The Wireless Telegraph Act, which gives the state a monopoly, and which was renewed in 1906 for three years, is to be renewed for a further period of twelve months. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, SEPTEMBER 24.—One of the traction lines at Brussels, which runs from Gros-Tillene to Grimberghe, is being changed over to the electric system, and this work is now practically finished. The line will soon be opened for regular traffic. Electric traction is also to be adopted on one of the tramway lines of Vienna. The Union Bank, in which are deposited the Municipal Commission funds, is interested in the enterprise. A new section of standard-gauge railroad, belonging to the Austrian State lines, was opened for traffic not long since. The new section lies between the localities of Innerstadt and Fabriksstadt, and is now running regularly with electric trains. With a view of using electric traction on the Vintimille-Savona railroad line in north Italy, the government is considering a project for erecting a hydraulic plant of considerable size, which is to supply the current for this section. The new plant will probably be located at Vado and will thus lie near the railroad. Among the recent Spanish projects I note that the concession has been granted for a new system of tramway lines at Barcelona. At Epinac, France, there is being developed an extensive electric-light and power distribution, which will have this locality as a center and will operate a network of lines in the surrounding region. The principal promoters of the scheme are the Epinac Coal Mining Company, and measures are already being taken to carry on the erection work. A Paris electrical firm is engaged in an enterprise for an electric station to be erected at the town of St. Michel, for light and power supply.

The town of Cherbourg is to have a new electric-tramway system, and the work will be carried out by the Cherbourg Traction Company, seeing that sanction has been given by the Municipal Council. In the region of Belfort and Doubs there is to be installed a narrow-gauge electric-traction line, which will connect numerous localities. Oran, Algeria, is to have a tramway line, which is to run to El Ancos and various suburban points.

A syndicate of European banks, especially those of Antwerp and Brussels, is promoting an extensive metropolitan subway scheme for Buenos Aires. The project has recently been submitted to the government. Among the concerns which are interested in the affair are the Antwerp Bank and the Comptoir de la Bourse, of Brussels, also the Antwerp Electric Tramway and Electrical Enterprise Union and the Mutual Tramway Company of Brussels. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., OCTOBER 2.—The Shawinigan Water and Power Company, of Shawinigan Falls, Que., continues to make substantial gains in its earnings, the gross earnings for the past seven months being $447,780, against $448,959 last year.

The Enterprise Electric Company, of Warren, Ohio, is seeking a location in Ottawa for a Canadian branch of its plant. The company will manufacture electric supplies of all kinds.

The Temiskaming Telephone Company expects to have its new service in operation in Cobalt, Ont., within three months. Poles are being erected and arrangements are being made for the work of installing the system later.

A contract was signed at Montreal this week by the Mexican Northern Light and Power Company with the well-known English contracting firm of Sir Whitman Pearson & Sons for the construction of a dam-power plant and twenty miles of railway on the Conchos River. The contract price covers about $5,000,000 and the work is to be completed in three years.

The fiscal year of the Montreal Street Railway ended on the 30th of September, and it is estimated that the gross earnings of the system for the year will show upward of $3,860,000. This is the largest year in the history of the company, and it is believed that the company will show around eleven-and-three-fourths to twelve per cent on the stock.

It is stated that the Quebec Street Railway stock will be taken up at $75 a share if the present plans of those who are negotiating with a view of bringing about a merger of the light and railway companies of that city are successfully carried out. It is understood that the light companies at Quebec are cutting rates to a price at which there is a minimum of profit.

A report is current that the Ottawa Light, Heat and Power Company will shortly increase its dividend from five to six per cent. This company is the holding concern for the Ottawa Electric and Ottawa Gas companies. Application has been made to list $1,600,000 on the Montreal Stock Exchange from the two millions outstanding common stock of the new company. The stock has never been on the open market.

At the annual meeting of the American Peat Society, held at Boston, Mass., last week, Dr. Eugene Haanel, of Ottawa, director of mines for Canada, was elected president for the

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ensuing year. This distinction for a Canadian and by a society which embraces in its membership the leading geologists and mineralogists of the United States is in recognition of Dr. Haanel's work in paving the way for the development of the metallic mineral resources of Canada by means of electric smelting.

Power from the hydroelectric commission of Ontario will be delivered in the city of Toronto next March. The city would have been able to receive it much earlier but for the delay in selecting a site for the transformer station. Four other of the municipalities will receive power from the commission in March. The transmission line from Niagara Falls will be ready before any of the municipalities have their stations completed.

The Mexican Northern Power Company, a Canadian concern recently incorporated with a capital of $10,000,000, intends to develop electrical power in the northern part of the Mexican Republic. The company possesses valuable concessions from the federal government of Mexico as well as the state government. These concessions constitute a practical monopoly for the development of electric power in northern Mexico. The company intends to supply ten or twelve towns with electric power and light, and furnish power to a large number of mining districts situated around Chihuahua, the capital of the state. The company will have 210 miles of transmission lines and will develop about 50,000 horsepower. The directors of the company are: G. F. Greenwood, Montreal, president; E. B. Greenshields, Montreal, vice-president; Edwin Harrison, S. M. Brookfield, Halifax, N. S.; B. F. Pearson, J. D. Patterson, Woodstock, Ont., and Paul Githner, Mexico. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

EXTENSIVE ELECTRIC RAILWAY DEVELOPMENT PLANNED—Announcement has been made at Bloomsburg, Pa., by E. R. Sponsler, of Harrisburg, president of the Columbia Power, Light and Railways Company, a $1,500,000 corporation, which recently absorbed the Columbia & Montour and Danville & Bloomsburg Electric railways and the six electric and gas-lighting plants in Columbia and Montour counties, that in the near future work will be started to extend the lines of the Columbia & Montour from Berwick to Wilkesbarre, thirty-two miles, and the Danville & Bloomsburg from Danville to Sunbury, fourteen miles, with the possibility of making further extensions to Shamokin and then throughout the West Branch, giving the holding company control of upward of eighty miles of railway. It is authoritatively stated that the present $1,500,000 corporation is only the beginning of the absorbing and consolidating of electric plants in Central Pennsylvania and that eventually the Columbia Power, Light and Railways Company, whose main offices are at Bloomsburg, will be at least a $5,000,000 corporation.

SAN FRANCISCO LIGHTING AND POWER CONTRACTS—Seven contracts between the United Railroads of San Francisco, its allied corporations, the Knickerbocker Trust Company, of New York, and the United States Mortgage and Trust Company, of New York, were filed in this city last week. The first of these papers was a contract for the purchase by the railroad company from the Sierra and San Francisco Power Company of 122,120,000 kilowatt-hours of power annually at seven-and-one-half mills per kilowatt-hour, or a total yearly payment of $975,200. Other agreements provided for the leasing by the power company of the United Railroads power houses on Bryant Street and North Beach, in this city, and for the purchase of power by the United Railroads from these on the basis of eight mills per kilowatt-hour. Two mortgages covering all of the property of the Sierra and San Francisco Power Company, in favor of the United States Mortgage and Trust Company, were also filed. The first mortgage provided for a bond issue of $14,000,000, with a possible increase to $30,000,000, and the second mortgage provided for a possible bond issue of $6,000,000. The bonds are to be dated from August 1, 1909, and to run forty years. Among the rights and properties catalogued in the mortgages are: Rights to 23,000 miner's inches of water from the Middle Fork of the Stanislaus River, to 50,000 inches in Relief Creek Fork and 100,000 inches of flood waters in the latter. The other documents filed set forth the transfer of the properties of the Stanislaus Electric Power Company, the Stanislaus River Water Company, the Union Construction Company and the Tuolumne Water Power Company to the Sierra and San Francisco Power Company, which were effected some months ago.

LIGHTING AND POWER.

(Special Correspondence.)

MANDEVILLE, LA.—The City Council has granted an electric-light franchise to S. Pigagio.

ARDMORE, OKLA.—Judge J. T. Dickerson is reported to ask this city for an electric-light franchise.

ATLANTA, ILL.—The Atlanta Electric Light, Heat and Power Company is building a high tension line to McLean, a distance of five-and-one-half miles. This plant was formerly operated upon a voltage of 220 and will install an alternator to care for the increased load. V.

FERGUS FALLS, MINN. The City Council will call for bids for installing the new system of lights.

ERICK, OKLA.—This city has voted bonds to the amount of $10,000 for installing of electric-light plant.

CLINTON, LA.—This city will vote September 21 on issuing $15,000 in bonds for an electric-light plant.

LOS ANGELES, CAL.—The Board of Public Works is advertising for bids for 10,400 feet of copper cable.

ELGIN, TEX.—This city is considering the construction of an electric-light plant. W. H. Kennedy is mayor.

AZTEC, N. M.—The Aztec Light and Power Company has been incorporated, with a capital stock of $20,000.

EL RENO, OKLA.—H. M. Byllesby & Co., of Chicago, have purchased the property of the El Reno Gas and Electric Company.

WESTVILLE, OKLA.—The Westville Electric Light and Power Company has been incorporated, with a capital stock of $10,000.

GRAND FORKS, N. D.—The Electric Construction Company, of St. Paul, has decided to proceed with the installation of the lighting system. C.

DAVENPORT, IOWA—A vote will be taken October 15 by the Town Council of Bettendorf on granting a franchise for an electric-light plant. C.

WATERTOWN, S. D.—An ordinance has been introduced into the Council granting a franchise to Ferris Brothers to operate an electric-light plant. C.

VIRGINIA, MINN.—The Virginia Electric Power and Water Company will shortly commence the erection of an office building at a cost of $12,000. C.

PORTLAND, ORE.—The Gibson Manufacturing Company will build a power plant on the Clackamas River to develop power for manufacturing purposes.

WELLS, NEV.—The Pacific Reclamation Company will establish a power plant on Bishop Creek and convey the current to Wells for light and power. U.

AURORA, MINN.—The Hartley Electric Company, of Virginia, Minn., has petitioned the Council for a twenty-year franchise to operate an electric-light plant. C.

PETERSBURG, ILL.—The Petersburg Electric Light Company is building a high-tension line north to Greenview and Mason City, a distance of sixteen miles. V.

FORT LINCOLN, VIA BISMARCK, N. D.—J. D. Elliott, constructing quartermaster, will receive bids in triplicate until October 19, for wiring buildings at Fort Lincoln. C.

SAN FRANCISCO, CAL.—The Oro Water, Light and Power Company has filed amended articles of incorporation, increasing the number of directors from five to seven.

ABERDEEN, WASH.—The town of Cosmopolis has granted a franchise to the Grays Harbor Railway and Light Company to install an electric-lighting system in that city.

IOWA FALLS, IA.—This city is to vote on giving a 25-year electric-light franchise to the Interstate Power Company; if granted, the company will expend about $500,000.

POINT RICHMOND, CAL.—The Richmond Light and Power Company has arranged to establish a reinforced concrete substation at Second and Nevin streets to cost about $8,000.

CHIHUAHUA, TEX.—Plans have been completed by the Nazas River Power Company to build a hydroelectric power plant in Fernandez Canyon on the Nazas River, in Durango.

RATON, N. M.—The French Town Company, of French, near this place, has been granted a franchise for an electric transmission system for light and power purposes in that place.

LOS ANGELES, CAL.—Work has been started on the installation of a power plant for the irrigation of orange lands on the Armstrong tract in San Bernardino and Riverside counties.

SNOHOMISH, WASH.—The Snohomish Electric Company is remodeling its power station with a view to increasing the voltage from 30,000 to 60,000 volts. Two large transformers will be installed. C.

ELK CITY, IDAHO—J. D. Wooden, from the Buffalo Hump camp, reports that machinery will be installed for treating the ore and that a waterpower plant will be installed for operating the mill. U.

SACRAMENTO, CAL.—The California State Engineer, with offices at this place, is advertising for bids for the construction of a power house at the California Polytechnic School, at San Luis Obispo.

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PORTAGE, WIS.—The Southern Wisconsin Power Company has commenced work on the erection of a substation, which will be two stories, 65x35 and 40 feet high, of brick construction, with concrete floors. C.

LOS ANGELES, CAL.—The Chapal Hydro-Electric and Irrigation Company has negotiated for a loan of $2,200,000 needed for the completion of the new power plant at Puente Grande, on the Santiago River.

PIERRE, S. D.—The City Council has closed a contract for a 150-horsepower engine and dynamo for the lighting plant at a cost, including a 250-horsepower engine and pump for the waterworks, of $20,500. C.

CARTER, MONT.—The Iron Mask Mining Company near here is preparing to install a concentrating plant at this place. The company will also install a compressor plant and other machinery to drive a tunnel. U.

BATAVIA, N. Y.—The Genesee Light and Power Company has been incorporated, with a capital of $250,000, by W. C. Lewis, Boston, Mass.; F. W. Keller, New York city and A. Ludeke, Hoboken, N. J.

OELWEIN, IOWA—The Oelwein Light, Heat and Power Company is making extensive improvements at its plant. A 100-foot smokestack and a brick building, 110x100x80, with new engines and dynamos, will be installed.

DETROIT, MINN.—Bids for the extension and improvement of the light and power, waterworks and heating plants, from plans by L. P. Wolff, engineer, St. Paul, Minn., were rejected and new bids will be taken later. C.

WENATCHEE, WASH.—Frank McKean, general manager of the Ranier Power and Irrigation Company, of Seattle, has secured control of power plants along the Columbia River, from which 45,000 horsepower will be developed.

LOS ANGELES, CAL.—The Board of Public Works has recommended to the City Council that bonds to the amount of $3,500,000 be issued for the development and distribution of electric power along the Los Angeles aqueduct.

MACHIAS, ME.—The Eastport Electric Light Plant, which has had a history, and entered into the hands of a receiver, it is reported, was sold to Dr. Stephen A. Welch, of Providence, R. I., on September 1. A. W. Morey, Jr., will be in charge.

LOGANSPORT, IND.—State Geologist W. S. Blatchely, who is making a survey of the rivers of the state, with a view of determining their power sites and facilities, is at present engaged in making a few days' survey of the Eel and Mississihewa rivers.

CARSON CITY, NEV.—The State Board of Commissioners for the Insane, Carson City, Nev., will receive bids up to October 11 for furnishing pole lines, waterwheels, generators, exciters, switchboards, power-house equipment, pump, motors, wells and pipe lines. U.

BUTLER, N. J.—The Butler Electric Light and Power Company has been incorporated to operate electric-light and power works, with a capital of $50,000. The incorporators are: E. O. Jones, Rutherford, N. J.; J. B. Lydecker, Bloomingdale, N. J.; H. R. Schneider, Westwood, N. J.

KINGMAN, ARIZ.—The Desert Power and Water Company has started up its plant. From now on power will be transmitted to Goldroad, where about 200 horsepower will be taken off by the Gold Road M. & E. Company for use in running hoists, compressors and other machinery. The Gold Road Company has its hoists and compressors installed and is prepared to handle the juice. The completion of this great plant marks a new era in mining in this county. Heretofore power cost the Gold Road company from $26 to $43 per horsepower per month, while the new and better power will cost but $11.50 per horsepower per month.

LOS ANGELES, CAL.—The Kern River power plant No. 1 of the Edison Electric Company resumed operations last week after being shut down for eight months. The plant, which has a capacity of 35,000 horsepower, was completed about two years ago, but, after it had been in operation a year, a break was discovered in the main pressure pipe. The plant was shut down and the company's auxiliary steam plants put in operation in its stead. Under the supervision of W. A. Brackenridge an entirely new pipe of heavy steel was inserted in the old pipe, to which it was cemented. This has a total length of 1,300 feet.

SANTA ANA, CAL.—The articles of the Southern California Edison Company, filed here with capital stock of $30,000,000, of which $9,000 has been actually subscribed, show the following directors: S. M. Kennedy, of Alhambra, O. P. Schoonmaker, J. A. Lighthipe, E. W. Sax, A A. Maxwell, William Dieterle, A. E. Morphy, John Otto, all of Los Angeles, and F. W. Balfour, of Pomona. The thirty-million-dollar capital stock is divided into 300,000 shares of the par value of $100 each. Four millions of this is preferred stock and twenty-six millions common stock. The principal place of business will be at Chino, San Bernardino County.

ELECTRIC RAILWAYS.

(Special Correspondence.)

CENTERVILLE, IOWA—Work has been started on the grading for the Centerville-Mystic interurban line. C.

WATERLOO, IOWA—The Waterloo, Cedar Falls & Northern Railway Company has decided to increase its capital stock to $2,250,000. C.

BRECKENRIDGE, MINN.—The Wahpeton-Breckenridge Street Railway Company, D. J. Jones, secretary, has been incorporated, with a capital of $50,000. C.

BILLINGS, MONT.—A company composed of J. B. Arnold, H. W. Rowley and others has been organized for the construction of an electric road to Laurel. C.

LOS ANGELES, CAL.—The Board of Supervisors is advertising for bids for the West Adams Street electric railway, a franchise for which was recently obtained.

MINNEAPOLIS, MINN.—The Electric Short Line has been purchasing land with a view to constructing a line to Medicine Lake, and ultimately to Watertown and Rockford. C.

SIOUX CITY, IOWA—It has been definitely decided that the route of the Sioux City & Spirit Lake road will be through Granville instead of through Paullina and Germantown. C.

BLOOMINGTON, ILL.—Cars will be running on the interurban from Lexington to Chenoa by the first of the year, according to the information given out by the company. V.

DECATUR, IND.—The Fort Wayne & Springfield Traction Company has begun the work of extending its line from Decatur to Berne and will ultimately extend the line to Portland. S.

COLUSA, CAL.—The City Trustees have passed an ordinance granting to the Northern Electric Railway Company the right to construct and maintain a double-track railroad of standard gauge along the streets of Colusa, for fifty years.

INDIANAPOLIS, IND.—The earnings of the Indianapolis & Crawfordsville Traction Company are increasing under the management of H. J. Milligan, receiver for the company. The total earnings for August were $18,910.41, against $12,809.17 for July. S.

BOSTON, MASS.—The Middlesex & Boston Street Railway has petitioned the Railroad Commissioners for the privilege of issuing $200,000 additional capital stock for the purpose of perfecting the consolidation with the Newton & Boston Street Railway Company.

NEW CASTLE, IND.—Track laying is progressing rapidly on the Indianapolis, New Castle & Toledo traction line. About 400 men are at work on the road, car barns and a shop are being erected here, cars have been purchased and the power house is almost completed. S.

NEW YORK, N. Y.—It is announced that the New York, Westchester & Boston Railway has purchased almost all the right-of-way needed for its White Plains branch, at prices ranging from $3,000 to $6,000 an acre. It is estimated that the entire line will cost upward of $1,000,000.

SALT LAKE, UTAH—It is announced here that the work of electrifying the eighteen-mile road from Salt Lake City to Saltair, on Great Salt Lake, will be started early this fall. It is reliably reported that the Oregon Short Line, representing E. H. Harriman's interests, now own the line. U.

POMONA, CAL.—According to a report circulated today, prominent business men here have become interested in a project to build an electric line from Pomona to Claremont, the seat of Pomona College, and on to Indian Hill, a distance of about five miles. Surveys have already been made.

TELL CITY, IND.—Articles of incorporation have been filed in the office of the secretary of state for the Tippecanoe & Monticello Interurban Railway Company, capitalized at $100,000, with the purpose of constructing an electric railway connecting Fowler and Logansport and intervening points.

INDIANAPOLIS, IND.—H. J. Milligan, receiver for the Indianapolis, Crawfordsville & Western Traction Company, has purchased ten new motor cars from the Westinghouse Electric Manufacturing Company, subject to the approval of the court. The road is greatly in need of additional equipment. S.

HAMMOND, IND.—The Western Indiana Construction Company has incorporated, with a capital stock of $100,000. The company proposes to make a specialty of constructing interurban railroads and telephone plants and equipping the same. Allen T. Russell, F. M. Zimmerman and T. W. Potts are the directors. S.

ROCKPORT, IND.—It is reported that the officials of the Rockport Traction Company entered into a contract during the past week with C. H. Battin, superintendent of the Tennis Construction Company, of Pittsburg, Pa., for building an extension of the road from this city to Troy, Tell City and Cannelton. Hammond township has voted a two-per-cent tax in aid of the con-

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struction of the road. Ultimately the road will be extended to Louisville, affording trolley service between Louisville and Evansville. S.

WILMINGTON, DEL.—An extension beyond Brandywine Springs Park to Marshallton is being made by the People's Railway. The extension will be operated within a month. Cars will run over the Springs line, and over the West Chester and Kennett Square line a short distance, leaving it by way of the Wilmington Hard Fibre plant to Marshallton.

VANCOUVER, WASH.—Articles of incorporation of the Tum Tum Mountain Railway Company, of Vancouver, have been filed with the state auditor at Olympia. The object of the corporation is to build and operate a railway in Clark County from Tum Tum Mountain, northeast of Yacolt, through Chelatchie Prairie, Amboy, View and La Center, to Ridgefield, on Lake River.

OTTAWA, ILL.—Ottawa and Streator will exchange Christmas greetings over the new interurban railway now under construction between the two cities if the calculations of the engineers and managers prove correct. The work between Ottawa and Grand Ridge is being rushed, and the work that is being done strikes the observers as being of a high grade.

PEORIA, ILL.—The grade for the Bloomington, Pontiac & Joliet Railway Company's line between Pontiac and Chenoa is about completed and ready for the rails. This is the line that is owned by the Fishers of Joliet and they now have a line in operation from Pontiac to Joliet, and this will make a southern extension from Pontiac, and will finally end at Bloomington. V.

WARSAW, IND.—Subsidy élections in aid of the construction of the Wabash & Northern Electric Railroad from Wabash to Warsaw have been ordered for October 11 in Clay and Lake townships. The town and city people are favoring the tax, while the farmers will oppose it on the ground that another company stands ready to build the road without the aid of a subsidy tax. S.

INDIANAPOLIS, IND.—The Indiana Railroad Commission has furnished the attorney-general with complaints and evidence of the violation of the sixteen-hour law by a number of interurban roads and directed that they be prosecuted. The law prohibits railroad companies from working their employes more than sixteen consecutive hours under penalty of from $100 to $500 fine. S.

DELPHI, IND.—The Delphi, Flora & Burlington Traction Company has filed articles of incorporation, with a capital of $125,000. The company proposes to construct and operate street and interurban lines in and connecting the above-named towns and cities. The line will be twenty-six miles long. E. W. Bowen, J. C. Smock, Wm. Dolin, F. S. Blythe and H. G. Haun, directors. S.

FRESNO, CAL.—A. G. Wishon, general manager of the Fresno Traction Company, announces that within the next few months the company will expend $60,000 on new equipment and $25,000 on a new car barn. The new equipment includes ten new forty-foot pay-as-you-enter cars, with a seating capacity of forty-six people each. The new car barn will have a capacity for forty-four cars.

NAPERVILLE, KY.—The Kentucky Rapid Transit Company, capitalized at $10,000,000, has been chartered at Dover, Del., to take over traction companies in Kentucky. Its principal operations at first will be Louisville, Lexington and Frankfort. The company is said to have been organized by Boston, New York and Philadelphia capitalists. It is also authorized to operate electric-light and gas plants.

OLYMPIA, WASH.—Vigorous protest has been filed with the Tax Commission by Stone & Webster against the levy on lines of the Puget Sound Electric Company, controlling the Tacoma-Seattle interurban line and the Tacoma Railway and Power Company. Company officials say a double assessment has been made on stocks and bonds, listed against the T. R. & P. Company and the Puget Sound company.

TOLEDO, OHIO—The unusually large number of accidents on the interurban lines of Ohio this summer is said to be responsible for the action of the State Railroad Commission, in calling into conference the operating officials of these lines, at the hearing room in Columbus, Tuesday, September 28. It was hoped that some plan might be evolved for furnishing better protection to the traveling public.

SOUTH BEND, IND.—Inspector Shane made a report to the Indiana Railroad Commission to the effect that the Chicago & South Bend interurban line has put into effect the recommendations made by the commissioners following the investigation of the wreck at Chesterton, in which twelve people were killed. The recommendations included a change in the entire management and a greatly improved method of operation. S.

HELENA, MONT.—E. C. Horner announces the letting of the contract for the building of an interurban line between Helena and West Helena, the new manufacturing suburb of Helena. The contract has been let to R. L. Leonard. The motive power is to be electricity, and the cost of the road is to be about $40,000, besides the cost of erection of a modern electric plant, which will be installed in West Helena. Work will be started immediately.

ANITA, IOWA—New impetus to the building of an interurban from Des Moines to Adel, in Dallas County, has been given by the organization of the Adel City Railway Company, with a capital stock of $10,000. The articles of incorporation for the new company show the incorporators to be Dan A. Blanchard, L. M. Macy, W. B. Kinnick, Robert Pilmer, F. F. Flynn, B. J. Flynn, R. L. Parrish and H. A. Smith, all of whom are deeply interested in the proposed Des Moines-Adel interurban.

NEW ALBANY, IND.—A franchise has been granted by the Board of Orange County Commissioners to Jacob H. Fawcett and Charles D. Kelso, of New Albany, authorizing the construction of an interurban railroad over the Paoli and New Albany Turnpike. It is provided that the company shall complete and have in operation its line of railroad from the city of New Albany to the town of Paoli by December 15, 1910. It is also proposed to secure a private right-of-way for the road from Paoli to French Lick.

COLUMBUS, IND.—The first case on record where a balloon put a railroad out of commission happened to the Indianapolis, Columbus & Southern Traction Company October 1. A balloon sent up from Indianapolis collided with the high-tension wires of the company near Edinburg and did considerable damage to the lines and power plant. Traction companies have had tilts with about everything, but this is the first case on record where a balloon has put a railroad out of commission. It was lucky that the occupants had no ground connection, because the wire which their anchor struck carries five thousand volts of electricity, and if there had been a ground connection it would have been instant death to the two men, who threw out ballast and sailed on. S.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

BIG TIMBER, MONT.—Paul Van Cleve, of Melville, will extend his telephone line to Harlowton.

MEXIA, TEX.—The Mexia Telephone Company has been incorporated, with a capital stock of $12,500.

COLEMAN, TEX.—The West Texas Telephone Company is about to expend $16,000 on improvements.

AMARILLO, TEX.—The Oldham Telephone and Telegraph Company will extend its lines out of this city.

WHITE EARTH, MINN.—The White Earth Telephone Company will extend its line to Waubun and Ogema.

GREAT FALLS, MONT.—The Rocky Mountain Bell Telephone Company will reconstruct its toll line to Helena. C.

FAYETTEVILLE, ARK.—The Oxford Telephone Manufacturing Company has begun manufacturing telephone boxes, etc.

NORTHFIELD, MINN.—The Northfield Telephone Company is asking for a franchise, and the vote will be taken September 28.

OROVILLE, CAL.—Work has been started by the Pacific Telegraph and Telephone Company in rebuilding its Oroville system.

WARSAW, IND.—The Commercial Telephone Company has decided to build a No. 10 copper toll line from Warsaw to Wabash. S.

LIGONIER, IND.—The Ligonier Telephone Company will soon begin the work of building a new toll line from Ligonier through Goshen to Warsaw. S.

PETALUMA, CAL.—The Lakeville Telephone Company has awarded a contract to W. D. Thomas to build the new telephone line in the Lakeville district.

SANTA ROSA, CAL.—H. C. Eastman has asked the Board of Supervisors for a franchise to erect and maintain telegraph and telephone lines along certain public roads of the county.

DECATUR, IND.—The Citizens' Telephone Company has declared a dividend of six per cent, to be paid to its stockholders. The directors also planned to make some improvements in the plant. S.

DES MOINES, IOWA—The Hawkeye Telephone Company has been incorporated by officers of the Iowa Telephone Company, with a capital of $100,000, to handle the toll business that was formerly done by the Mutual Telephone Company. C.

VALPARAISO, IND.—The officials of the Northwestern Indiana Telephone Company have notified the Secretary of State that the capital stock has been increased from $100,000 to $150,000. The company will extend the lines and add some new equipment. John H. McGill is president. S.

LINCOLN, NEB.—According to the monthly report to the Council the August gross receipts of the Lincoln Telephone and Telegraph Company were $13,882.81. The total receipts from rentals of telephones connected with the Lincoln exchange was $12,596.58, from which deductions are made for rentals for tele-

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phones outside of the city and those used by the state, as well as for "no service" claims, leaving $12,167.81 subject to occupation tax. The total revenue upon which an occupation tax is assessable is $13,882.81, and the tax is $277.65.

WASHINGTON, D. C.—The Southern Bell Telephone and Telegraph Company is constructing three lines of telephone wires in West Virginia. Two of these lines run to Huntington from the Boone oil field and Griffithsville oil field, respectively, and the third line is along the Virginia Railway.

RENSSELAER, IND.—At the annual meeting of the directors of the Home Telephone Company the following officers were elected: President, R. T. Yeoman; vice-president, F. K. Wilsh; treasurer, M. I. Adams, and secretary, E. F. Babcock. The directors made plans to improve the system. S.

TOLEDO, OHIO—The Western Ohio Railway has completed details of an issue of bonds amounting to $360,000, drawing six per cent interest, to take up the floating indebtedness of the road. The notes are secured by $500,000 of the company's first-mortgage bonds. It is said that Cleveland banks took the entire issue. H.

SPICELAND, ILL.—The stockholders of the Spiceland Telephone Company have notified the Secretary of State that the capital stock of the company has been increased from $10,000 to $20,000. The proceeds of the additional stock sale will be used in modernizing the plant, adding new equipment and extending the lines. S.

AURORA, ILL.—It is stated in financial circles that the board of directors of the Interstate Telephone and Telegraph Company has decided on an expenditure of $5,000,000, to be spent in yearly installments of $1,000,000, for improvements of present service, extensions of lines and in the purchase of new general equipment.

PORTLAND, IND.—The Home Telephone Company has purchased the Bell Telephone Company's exchange and wires in Jay County and will combine the two systems. The surrender of the Portland field to the Home company increases its subscribers about 1,500. The plant will be rebuilt and considerable underground cable laid. S.

ALBANY, N. Y.—The Hudson Valley Telegraph Company, of New York, has been incorporated to operate telegraph and telephone lines through this state, northward to Canada and through the eastern states, Pennsylvania and New Jersey. The directors include: James M. Ryan, P. F. Crowe, Edward J. Kelly, all of New York. The capital is $25,000.

CRAWFORDSVILLE, IND.—The Covington & Southwestern Traction Company has filed a mortgage with the recorder of Montgomery County for $825,000, in favor of the Union Trust Company, of Indianapolis. The proceeds will be expended in the construction of a traction road from Covington to Crawfordsville. The work is progressing rapidly. S.

LA CROSSE, WIS.—Through an offer to purchase the system of the La Crosse Telephone Company the Wisconsin Telephone Company has prospects of removing the only serious competition in the western part of the state. The local company doubled its capitalization last week, it now being $200,000, and the stockholders have been offered par for their holdings.

INDIANAPOLIS, IND.—The Indianapolis Telephone Company is expending $100,000 in improving and extending its plant. This includes new exchange buildings, automatic switches, underground and aerial construction, principally on the north and west side of the city. The company has nearly 16,000 subscribers and is making new contracts at the rate of 450 per month. S.

INDIANAPOLIS, IND.—The court has entered an order authorizing the issuance of $460,000 in receiver's certificates for the completion of the Indianapolis, New Castle & Toledo traction line. The Union Trust Company, receiver, will now let contracts for the speedy completion of the road. The electrical equipment will be reinstalled in the powerhouse at New Castle and the power plant finished. Ties are now being distributed along the line. S.

TOLEDO, OHIO—The Ohio Electric Company will build a new union interurban depot at Lima, Ohio, the work to be started at once. A suitable site has already been secured and bids received for the building, which will cost about $50,000. It will be modern and complete in every detail, two stories in height and built of cement and brick. The upper story will be devoted to the traffic department offices. The structure is to be completed within one year. H.

MITCHELL, S. D.—The annual meeting of the Dakota Central Telephone Company was held at Aberdeen a few days ago, and its officers made a very satisfactory report of the past year's achievements. The officers were authorized to expend $300,000 for the coming year in making improvements and enlarging the service. The stockholders showed their faith in the enterprise by at once subscribing for an issue of $250,000 in new stock. Much new copper wire will be stretched the coming year and several exchanges on the company's lines enlarged.

ELECTRICAL SECURITIES.

The call for money to move the crops, although anticipated, has had the usual effect on the security market. The rate set at six per cent was expected, yet produced considerable liquidation among the active securities. There is nothing, however, in the present situation in the least bit unusual, other than a decidedly confident feeling in regard to business generally. Money is tight, but that is a normal condition at this season of the year.

Traffic on the Metropolitan Elevated during September ran eleven to thirteen per cent over that of last year.

The New York Public Service Commission has approved the application of the Nassau Electric Railway Company for authority to issue $730,000 bonds to refund the same amount of bonds expiring October 1.

The $2,000,000 Oregon Electric Railway first-mortgage five-per-cent bonds which N. W. Harris & Company and Moffat & White offered, were sold within a few hours after the offering was made. The bonds are secured by first mortgage on the entire property of the company, which cost more than $3,000,000.

The gross receipts from passenger traffic by the Philadelphia Rapid Transit Company in September amounted to $1,610,510, comparing with $1,494,605 in September, 1908. The receipts for the first three months of the current fiscal year ended September 30, amounted to $4,835,633, comparing with $4,495,182 in the first quarter of the previous year.

For the first time since the organization of the Massachusetts Electric Companies, ten years ago, that company and all its subsidiary companies are now free from floating debt, the last note having been paid off within a few days, and the companies have $1,200,000 cash in the bank.

The Westinghouse Electric and Manufacturing Company has declared a quarterly dividend of one-and-three-fourths per cent on the preferred stock and three-and-one-half per cent accumulated dividends. This restores the stock to the seven-per-cent-per-annum basis and leaves nine per cent still due on the accumulated dividends on the preferred stock. The dividends are payable October 15 to stock of record October 9. Books close October 9 and reopen October 16.

NEW YORK.

	Oct. 4.	Sept. 27.
Allis-Chalmers common	15⅝	15
Allis-Chalmers preferred	54¼	52½
Amalgamated Copper	84	83
American Tel. & Cable	*80	80
American Tel. & Tel.	142¼	143⅞
Brooklyn Rapid Transit	80½	79⅞
General Electric	167	166
Interborough-Metropolitan common	16½	14¾
Interborough-Metropolitan preferred	50¼	47¾
Kings County Electric	135	131
Mackay Companies (Postal Telegraph and Cables) common	93¼	92½
Mackay Companies (Postal Telegraph and Cables) preferred	75½	76¾
Manhattan Elevated	142	142¾
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	139	139
U. S. Steel common	92⅞	84¾
U. S. Steel preferred	130¼	128¼
Western Union	78¾	79½
Westinghouse common	87¼	86
Westinghouse preferred	140	133

*Last price quoted.

BOSTON.

	Oct. 4.	Sept. 27.
American Tel. & Tel.	142¼	143⅜
Edison Elec. Illuminating	....	252
General Electric	167	166
Massachusetts Electric common	18¼	15⅞
Massachusetts Electric preferred	81½	79
New England Telephone	....	138½
Western Tel. & Tel. common	10½	11½
Western Tel. & Tel. preferred	....	89

PHILADELPHIA.

	Oct. 4.	Sept. 27.
American Railways	45¾	16
Electric Company of America	12⅛	12
Electric Storage Battery common	60¾	59
Electric Storage Battery preferred	60¾	59
Philadelphia Electric	12½	12⅜
Philadelphia Rapid Transit	29	27½
Philadelphia Traction	90	90
Union Traction	53½	53

CHICAGO.

	Oct. 4.	Sept. 27.
Chicago Railways, Series 1	108	108
Chicago Railways, Series 2	36	36
Chicago Subway	7¼	9
Chicago Telephone	138	136¼
Commonwealth Edison	120	120½
Metropolitan Elevated common	15	15
Metropolitan Elevated preferred	51	51
National Carbon common	97	95
National Carbon preferred	118	118¾

PERSONAL MENTION.

C. O. FRISBIE has been elected president of the Illinois Tunnel Company, succeeding Samuel McRoberts.

CYRUS O. BAKER returned from an extended trip through Europe recently, accompanied by Mrs. Baker. While abroad Mr. Baker was quite ill for several weeks, but a prolonged visit at one of the German springs benefited his health. Mr. Baker, who

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is known to the electrical fraternity as "the platinum king," will at once resume active duties in this field, and also in the financial and banking circles, in which he is largely interested.

P. F. SULLIVAN, president of the subsidiary companies and general manager of the Massachusetts Electric Companies, has sailed for Europe for a month's vacation.

A. W. LEWIN was advanced on September 1 to the position of manager of the New Orleans office of the Sprague Electric Company. Mr. Lewin has been connected with the office for some time. He is a member of the American Institute of Electrical Engineers, and has had extensive commercial and engineering experience in the electrical business in both North and South America. This experience, combined with his command of the various languages spoken in his territory, should portend a successful career in his new position.

ARTHUR H. BOETTCHER has joined the staff of Brown & Williams, patent attorneys and counselors, 1550 Monadnock Block, Chicago. Mr. Boettcher is a graduate of the Chicago-Kent College of Law and has been admitted to practice in the State and Federal courts. His engineering education at Lewis Institute and the University of Wisconsin, together with six years of experience in practical work before the United States Patent Office, especially qualify him to conduct the prosecution of patent applications and proceedings incident thereto.

WILLIAM A. BRACKENRIDGE left Niagara Falls on Friday, October 8, for Los Angeles, Cal., to become vice-president of the Southern California Edison Company. Mr. Brackenridge has been a member of the Canal Board of New York state. During his many years of residence at Niagara Falls Mr. Brackenridge has endeared himself not only to residents, but to the many visitors who have viewed the power development. Engineering bodies will recall his courtesy when they were at Niagara and extend to him best wishes in his new home. E.

EDWARD C. BROWN, who is manager for the Dearborn Drug and Chemical Works in the Hawaiian Islands and the Orient, has been elected president of the Commercial Club of Honolulu. This club is similar to the chamber of commerce and association of commerce organizations in the large cities of the states. This is an honor highly esteemed, and is an evidence of the high standing of the Dearborn company's representative in the Hawaiian Islands. Mr. and Mrs. Brown recently made a trip in the interests of the Dearborn company to the Orient, spending several months in China, Japan, Korea, and the Philippines.

OBITUARY.

EDWARD G. COCHRANE, formerly general superintendent of the Postal Telegraph Company, stationed at New York city, died last week at his residence in Manchester, Vt. He had been afflicted with paralysis for a long time. Mr. Cochrane was fifty-six years old. He leaves a son, Dr. F. L. Cochrane, of Brooklyn, and a daughter, Mrs. E. B. McLean, Hoosic Falls, N. Y.

MARTIN J. WULSTEIN, district superintendent of the Brooklyn Rapid Transit Company's surface lines, died from paralysis at his home in Brooklyn on October 2. He was thirty-six years old. Within twelve years, the time of his service with the Brooklyn Rapid Transit lines, he held different positions, beginning with that of conductor. He was made district superintendent three years ago.

STEPHEN HANLEY, formerly connected with the Interborough Railway Company, and father of Deputy Tax Commissioner Stephen J. Hanley, died of kidney trouble at his home, 1408 Madison Avenue, Wednesday, September 30. He was sixty-five years old, and had been an invalid for five years. He was a member of the Tammany Hall General Committee of the Twenty-sixth Assembly District. He is survived by his widow, one son and one daughter.

PROPOSALS.

POST OFFICE, LEAD, S. D.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until October 26 for the construction, complete, of the United States Post Office at Lead, S. D., in accordance with drawings and specifications, copies of which may be had at the office of the postmaster at Lead, S. D., or at the Supervising Architect's office.

ELEVATORS—Sealed proposals, endorsed "Proposals for Elevators," will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until October 16 for installing two electric passenger elevators at the United States Naval Medical School Hospital, Washington, D. C. Plans and specifications can be obtained on application to the bureau. Wm. M. Smith, acting chief of bureau.

POST OFFICE, COLUMBUS, MISS.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until October 22 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Columbus, Miss., in accordance with drawings and specifications, copies of which may be had from the custodian of site at Columbus, Miss., or at the Supervising Architect's office.

POST OFFICE, HOBOKEN, N. J.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until October 21 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the United States Post Office at Hoboken, N. J., in accordance with drawings and specifications, copies of which may be obtained from the custodian at Hoboken, N. J., or at the Supervising Architect's office.

POST OFFICE, MANITOWOC, WIS.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until October 20 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Manitowoc, Wis., in accordance with drawings and specifications, copies of which may be had from the custodian of site at Manitowoc, Wis., or at the Supervising Architect's office.

NEW MANUFACTURING COMPANIES.

SEATTLE, WASH.—The Pacific Battery and Electric Novelty Manufacturing Company has been incorporated, with a capital of $100,000.

LOS ANGELES, CAL.—The General Special Electric Company has been incorporated, by O. A. Glasgow and others, with a capital stock of $100,000.

JERSEY CITY, N. J.—The Tate Gas Electric Motor Vehicle Company has been incorporated to manufacture motor vehicles, motor boats and aerial machines, with a capital of $100,000. The incorporators are: J. L. Tate, C. E. Tate and J. L. Tate, Jr., Jersey City.

AUGUSTA, ME.—The American Power and Light Company has been incorporated, with a capitalization of $15,000,000. The company will manufacture machinery and electrical apparatus. The promoters are Harry M. Durning, George J. Anderson, H. B. Squiers and E. W. Hammonds, all of New York city. None of the capital stock is paid in. Stock of the company is valued at $100 par.

INDUSTRIAL ITEMS.

THE H. T. PAISTE COMPANY, PHILADELPHIA, PA., is issuing a new, conveniently arranged price list of its electric-light supplies.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing several new folders descriptive of Columbia tungsten sign lamps. These circulars contain information of an educational nature which should assist central-station managers in increasing their load.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has issued the October number of "Trumbull Cheer," which contains, besides the usual magazine stuff, some particulars, with illustrations, of Trumbull panel boards, Kappa switches and panel cut-outs.

EDGAR ALLEN AND COMPANY, LIMITED (Imperial Steel Works), Sheffield, Eng., announce that their arrangement with Edwin R. Kent and Company for the sole agency of their manufactures in the United States, terminated on June 30 last. The company will continue to maintain offices under its own name at 282 Pearl Street, New York city, and 23 West Randolph Street, Chicago, where full stocks of tool steels and other specialties manufactured by the company will be carried.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., in Circular No. 1502, gives a great deal of valuable information on alternating-current distribution covering transformers, lightning arresters, insulators, cross-arms, etc. Considerable space is devoted to underground and overhead construction applicable to congested and scattered districts. There is also given information on potential regulating systems. The circular contains fifty-two pages of information of value to any central-station man or anyone connected in any way with the distribution of power by alternating-current lines.

THE KEUFFEL & ESSER COMPANY, New York, N. Y., has published an interesting eight-page pamphlet, describing the K. & E. log-log duplex slide rules, manufactured by this concern. They are especially devised for the solution of examples and formulas involving fractional powers and roots, as well as natural or hyperbolic logarithms. In addition to the log-log scale, all the ordinary logarithmic and trigonometrical scales are on the log-log duplex slide rules, and these rules are therefore capable of performing a practically unlimited range of problems. They are made in two sizes. The smaller rule does not have the D scale on both sides, but otherwise embodies all the novel features of the larger rule. The log-log scale, as its name indicates, represents the logarithms of the logarithms of a series of natural numbers, so that, while the C. D. scale gives the logarithmic loca-

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tion of the natural numbers read on them, the log-log scale gives the corresponding log-log location. The value of such an arrangement is best appreciated in involution and evolution, where the root or the power is taken on the log-log scale, while the exponent or root index is taken on the C scale, proceeding as in ordinary multiplication or involution and as in division for evolution.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has recently issued bulletin No. 4675, which describes and illustrates a new single-phase induction motor of the repulsion induction type, designated as Type "RI," and developed for use in connection with installations where the starting torque of the resistance reactance type of induction motor will not meet the demand of the driven machine, or where within certain limits variable speed is required. The bulletin mentions various applications of this type of motor, illustrates and describes controllers for use in starting it and contains other data, including diagrams of connections.

THE WESTINGHOUSE MACHINE COMPANY, of Pittsburg, has supplied four thirteen-by-twelve-inch, three-cylinder Westinghouse gas engines, direct-connected to Root position blowers, for the Public Service Corporation of New Jersey, at its Hoboken and Passaic gas plants, for the purpose of boosting the gas pressure in the mains. The engines are of the vertical type, develop ninety horsepower each, and utilize illuminating gas for fuel. This application of gas engines to raising the pressure in gas lines is one that is attracting much favor among the officials of the Public Service Corporation, and it is expected that the future will see a great many similar installations for this work.

THE LIBERTY ELECTRICAL MANUFACTURING COMPANY, 543 Fourth Avenue, Pittsburgh, Pa., has ready for distribution some very interesting information concerning its noncellulose carbon filaments. These filaments are prepared by a French process from pure carbon black having only sufficient binder to make the mass of proper consistency to squirt into the filament shape before carbonizing. As a result there are no air bubbles, no uneven diameters, no chemical processing, and the life of the filament is very certain. It is stated that in flashing these filaments, ninety per cent can be relied upon for proper candlepower, watts and volts, and ten per cent vary only a few volts. Full information will be sent to those interested upon request.

THE GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., has issued a number of new publications, as follows: Bulletin No. 4665, "Electrical Operation of Pulp and Paper Mills," describing and illustrating the application of the electric motor to the paper industry. Bulletin No. 4680, "Sign Lighting with Tungsten Lamps," showing by means of curves the comparative cost of sign lighting with carbon and tungsten lamps. This bulletin also discusses at some length the points in favor of the tungsten lamp. Bulletin No. 4688, "Compound Meter Board," describing a new meter board of moulded metal material which is intended to replace the wooden board used in mounting meters. This company has also issued two attractive booklets describing its tungsten lamps and small fan motors, respectively.

THE UNION SWITCH AND SIGNAL COMPANY, Swissvale, Pa., has prepared a new catalogue of its electric crossing-bell appliances. This catalogue of sixty pages gives detailed descriptions and prices of the large number of crossing-bells made by this company. They are arranged for direct-current and alternating-current operation, and are suitable for electric or steam railroads. Layouts of single and double-track installations are given. Interlocking relays for this service are described for various classes of service. In its new bulletin No. 41 the company describes its latest form of universal relays, type 9C. This bulletin of thirty-six pages is elegantly illustrated with the details of the various forms of these universal relays, and gives the improvements that have been made in their construction.

THE ALBERT AND J. M. ANDERSON MANUFACTURING COMPANY, Boston, Mass., has issued an attractive illustrated bulletin (No. 22) on the Anderson automatic time switch. These time switches can be used to advantage in all cases where a circuit has to be opened or closed at definite times and at points where there is no reliable person stationed to do this work. Great economies may oftentimes be accomplished by the use of a time switch in place of a device requiring personal attention. The bulletin shows, with the aid of some excellent diagrams, the construction and working of the Anderson switch, and in addition gives instructions for its adaptation in connection with show-window illumination, after closing, up to a predetermined time, for turning on and off electric signs, for handling individual street lights, etc.

FRANK W. PARDEE, 48 Fifth Avenue, Chicago, manufacturer of the Paragon Ground Cone, has just returned from an extended trip through the East in the interest of his cone and other specialties. The cone particularly met with great favor among the engineers of central stations, trolley lines, power plants, and telephone and telegraph companies. Mr. Pardee also says that when he showed the cone to the various jobbers and independent engineers, they were as enthusiastic about it as he himself. He was greatly gratified to find that the central-station engineers, particularly, believe that the cone is going to solve one of their greatest difficulties and fill a long-felt want. It is used by them largely for grounding transformer secondaries and for grounding neutrals of three-wire systems. It is also being used with a great deal of satisfaction for grounding lightning arresters of every type.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., in circular No. 1132 describes the Westinghouse lightning protective apparatus. This takes up in detail the theory of lightning discharges, an analysis of the lightning arrester problem, and describes Type MP lightning arresters for alternating and direct-current circuits up to 1,000 volts, Type C for alternating-current circuits from 500 to 2,500 volts, Type S for 2,200 to 6,600 volts alternating current, Types E and A electrolytic arresters 4,000 to 110,000 volts alternating current, low equivalent arresters 3,600 to 50,000 volts alternating current, Types I and J up to 4,000 volts, fuse-type lightning arresters, choke coils, spark gaps, safety gaps, selection and location of protective apparatus, location of choke coils, insulation and ground connections. This circular forms one of the most interesting and valuable pieces added to the literature of lightning protection.

J. B. TAYLOR & COMPANY, INCORPORATED, have been chartered under the incorporation laws of Delaware to do a general engineering and contracting business. The capital stock is $500,000. The company's offices are at 305-322 Hudson Terminal Building, New York city. W. E. McClintock is chief engineer. Four departments have been organized: The engineering department will design the complete plants for public utility corporations and make reports on electric railway, light, power and similar projects for trust companies, bankers and investors. The operating department will undertake the operation of such systems. The construction department will build the plants completely and install all the apparatus needed for their equipment. The finance department will assist the financing of meritorious public utility projects. Among the important work of this company upon which it is at present engaged is 300 miles of construction work on the American Central Railway between Vernon and Miami, Tex.

THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY has issued, through Thomas A. Biddle and Company, of Philadelphia, a handsome twenty-four-page pamphlet, reviewing the property and interests of the company. The American Telephone and Telegraph Company began operating in 1885, when it established the long-distance lines. In 1900 it acquired control of all the Bell Telephone systems. The history of the telephone company and its earnings are carefully reviewed, and the steps in the rise of the company to its present growth are pointed out. Attention is directed to the fact that under patent protection all the Bell Telephone companies in the country had only 250,000 stations. This number has been increased in the past fifteen years, without patent protection and with competition, to 4,364,629 stations. Of this total, 525,629 were gained during 1908, a year of general business depression. This gain of 14 per cent was accomplished by a gain in net earnings of 10 per cent. It is now, therefore, an operating company, operating all long-distance lines; is a holding company, owning a majority of stock of all the Bell Telephone systems; and it also owns all of the Bell telephone instruments and electrical appliances. There was a daily average of 19,000,000 calls a day over this system last year, or, reckoning on a business day of ten hours, considerably more than 31,000 calls a minute.

THE AMERICAN DISTRICT STEAM COMPANY, Lockport, N. Y., in its bulletin service, has contributed some of the most complete and interesting data on the subject of district steam heating which is available for study of engineering of this nature. Not only has the subject been taken up from a general standpoint, but there are a number of treatises which describe specific installations where both live and exhaust steam heating plants are operated from central stations. To anyone interested in this matter the company's literature should prove very valuable. Specific information on any subject coming under this category may be secured upon request. Among the bulletins which have already been published may be mentioned the following: Catalogue 8, "Price List of General Supplies for Heating Trade;" Bulletin 101, "Steam Traps, Meters, Separators, Cooling Coils;" Bulletin 102, "Valves, Pressure Regulating and Reducing Valves and Thermostats;" Bulletin 103, "Steam Pipe Casing, Wooden Water Pipe;" Bulletin 104, "Anchorage Fittings, Expansion Joints and Special Fittings;" Bulletin 105, "Underground Pipe for Steam Distribution;" Bulletin 106, "Atmospheric System of Heating;" Bulletin 108, "Atmospheric System of Steam Heating;" Bulletin 109, "Suggestions for Consumers and Prospective Customers of District Steam Heating Plants;" Bulletin 110, "Some Results of Steam Heating from a Central Station;" Bulletin 111, "A Live Steam Heating Plant at Wilkes-Barre, Pa.;" Bulletin 112, "An Exhaust Steam Heating Plant from a Central Station at West Chester, Pa.;" Bulletin 113, "Standard Steam Pipe Casing and Wooden Water Pipe."

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DATES AHEAD.

New York Electrical Show. Madison Square Garden, New York, October 11-21.

Railway Signal Association. Annual meeting, Louisville, Ky., October 12-14.

The Order of Rejuvenated Sons of Jove. Seventh annual meeting, Cleveland, Ohio, October 14 and 15.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

Illinois State Electric Association. Annual meeting at Alton, Ill., October 26, 27 and 28.

Alabama Light and Traction Association. Annual convention, Birmingham, Ala., November 15 and 16.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 and 16.

Boston Electrical Show. Mechanics' Building, Boston, November 15-25.

Empire State Gas and Electric Association. Annual convention, New York city, November 17 and 18.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the second issue of each month.)

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary, Lloyd Lyon, secretary and auditor Mobile Light and Railway Company, 158 Government Street, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis Avenue, New York city.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York city.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West One Hundred and Sixteenth Street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, Flatiron Building, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

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CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

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CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 33 Melinda Street, Toronto, Ontario.

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ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, George William Russell, Jr., 500 Fifth Avenue, New York city.

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ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, San Francisco, Cal.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York city.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau Street, New York city.

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ENGINEERS' SOCIETY OF MILWAUKEE. Secretary, W. Fay Martin, Milwaukee, Wis.

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MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

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NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, Frank M. Tait, Dayton, Ohio.

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NEW ENGLAND SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, C. H. Hodskinson, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass. Meetings held on fourth Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

NEW YORK RAILROAD CLUB. Secretary, H. D. Vote, 95 Liberty Street, New York, N. Y.

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OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD-TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, Frank J. Scherrer, 195 Broadway, New York city.

ORDER OF THE REJUVENATED SONS OF JOVE. Mercury, C. B. Roulet, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

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RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa. Next annual meeting, Louisville, Ky., October 12-14, 1909.

SOCIETY OF AUTOMOBILE ENGINEERS. Secretary, Alexander Churchward, 30 Church Street, New York city.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York city.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. A. Gould, Ennis, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby Street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary and treasurer, A. B. Marsden, Manchester, Vt.

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WESTERN SOCIETY OF ENGINEERS (Electrical Section). Chairman, William B. Jackson, 115 Adams Street, Chicago, Ill.; secretary, J. H. Warder, Monadnock Block, Chicago, Ill.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 207 East Ohio Street, Chicago, Ill. Annual convention, Detroit, Mich., October 26-28, 1909.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

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RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) September 21, 1909.

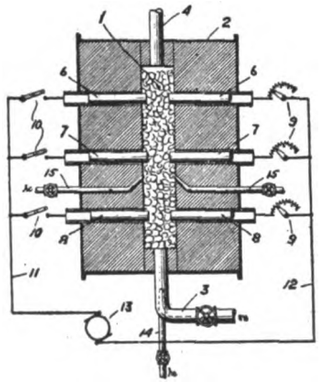
934,988. PROCESS OF MAKING DURABLE CARBON ELECTRODES FOR ELECTROLYTICAL PURPOSES. Gustav Adolph, Ammendorf, and Albert Pietzsch, Madgeburg, Germany, assignors to Chemische Fabrik Buckau, Magdeburg, Germany. Filed April 27, 1907. The process of making electrolytic electrodes resistant to chemical attack, comprises impregnating the carbon throughout the entire body of the electrode with an electrical conductor of the first order, forming conducting bridges between the particles of carbon, whereby local electrolytic actions between the particles of the electrode are prevented.

934,992. ADJUSTABLE ELECTRIC-LIGHT HANGER. Louis Buendert, Chicago, Ill. Filed August 12, 1907. Push buttons are fastened to a spring clamp secured within the lower (detachable) portion of a globular casing, and a spring-operated pulley is adapted to take up and pay off surplus lengths of a cable containing electrical conductors feeding a lamp or lamps.

934,995. OUTLET-BOX. Lewis H. Church, Stamford, Conn. Filed March 31, 1906. Renewed March 15, 1909. A bushing for outlet boxes comprises a tapered, split body-portion having an oppositely tapered bore, and means for the retention of the body-portion in the cable-receiving opening of the box.

934,996. RAILWAY-SIGNAL. Clarence W. Coleman, Westfield, N. J., assignor to the Hall Signal Company. Filed February 12, 1908. Signal-controlling circuits comprise the track, sources of supply are provided at intervals in operative relation therewith, and bonds diagonally connecting the rails of the track and each completing signal-controlling circuits from a source at each side of the bond.

934,997. ELECTRIC DISTRIBUTION. John L. Creveling, New York, N. Y., assignor to Safety Car Heating and Lighting Company. Filed April 16, 1909. In combination with a source of current supply are translation circuits and means for regulating the voltage upon these circuits, and a variable shunt (around this means) the resistance of which depends upon the number of translation circuits in operation.



934,344.—PROCESS OF MAKING WATER-GAS.

935,012. ELECTRIC SHADE HOLDER. Emil F. Gennert, New York, N. Y., assignor to the Manhattan Brass Company. Filed April 29, 1909. The holder has a beaded neck provided with notches, slits connecting the notches with perforations in the holder, and means for supporting a shade, in combination with an annular beaded collar provided with depressions adapted to engage the beaded neck.

935,023. SELECTIVE A.C.-D.C. SYSTEM. George H. Hill, Schenectady, N. Y., assignor to General Electric Company. Filed January 18, 1908. Describes such a system for electric cars.

935,024. LOCK-OUT TELEPHONE SYSTEM. William W. Hill, Sumter, Minn. Filed May 16, 1908. Differentially acting devices are provided at the several stations for closing the transmission line.

935,040. TROLLEY-BASE. Leslie F. Mansfield and Paul D. Smith, Minneapolis, Minn. Filed June 15, 1908. The springs are put under tension by means of a toggle device.

935,049. CALLING DEVICE FOR TELEPHONE EXCHANGES. Nils E. Norstrom, Chicago, Ill., assignor to the Anderson Electric and Manufacturing Company. Filed November 16, 1904. Renewed February 10, 1909. Comprises a spring by which the device is actuated, a series of numbered levers or keys by the movement of any one of which the spring is wound, and means by which upon moving any one of the levers the calling device will be automatically set for the selection of a station corresponding to the particular lever moved.

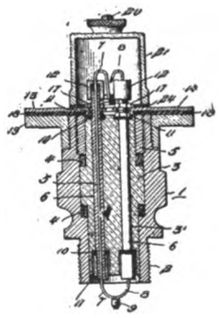
935,051. DEVICE FOR REGULATING THE SPEED OF GENERATORS TO SECURE CONSTANT POTENTIAL. Arthur L. Parker, Cleveland, Ohio. Filed November 9, 1908. In combination with a generator, are a prime mover, a differential mechanism operatively connecting the prime mover and generator, means for holding the differential mechanism normally from compensating, and means for causing the differential to compensate to reduce the speed of the generator when the voltage across the generator brushes exceeds a predetermined voltage.

935,069 and 935,070. SELECTIVE A.C.-D.C. SYSTEM. John F. Tritle, Schenectady, N. Y., assignor to General Electric Company. Filed January 18, 1908. Similar to No. 935,023.

935,092. CIRCUIT-CONTROLLING MECHANISM. Maxwell W. Day, Schenectady, N. Y., assignor to General Electric Company. Filed October 17, 1906. Circuit-breakers are automatically opened by abnormal current-variations.

935,097. OUTLET BOX FOR ELECTRIC FIXTURES. Oscar F. Erickson, Berkeley, and Richard H. Bradshaw, Oakland, Cal. Filed June 11, 1908. Describes an outlet box having a base and cylindrical wall formed integral with a lath-and-plaster backing for securing to a wall.

935,105. TELEPHONE SYSTEM AND THE LIKE. Robert Hamilton, Boston, Mass. Filed June 1, 1908. Means are provided at each station for closing the main-line controlling switch and maintaining the latter continuously closed while the system is in use, and means at each station for selectively controlling communication between each station and the other stations of the system through the main-line circuit.



935,154.—DYNAMOMETER THERMO-COUPLE FOR EXPLOSION ENGINES.

935,109. APPARATUS FOR THE ELECTROLYSIS OF AQUEOUS SOLUTIONS. Max Huth, Charlottenburg, near Berlin, Germany, assignor to Siemens & Halske A. G., Berlin, Germany. Filed January 5, 1909. The process of producing massive peroxide of manganese anodes for electrolyzing aqueous solutions, consists in heating pure nitrate of manganese in molds.

935,136. SUSPENSION DEVICE FOR ELECTRIC ARC LAMPS. Adolph Wunderlich, Croydon, England, assignor to the London Electric Firm, Croydon, England. Filed May 10, 1906. The lamp carried is guided by an arrangement of cams, etc.

935,150. AUTOMATIC PAY-STATION. Harry W. Hamlin, Milo, Me. Filed September 17, 1908. Describes a form of coin-actuated mechanism with electrical contacts.

935,154. DYNAMOMETER THERMO-COUPLE FOR EXPLOSION ENGINES. Nevil M. Hopkins, Washington, D. C. Filed July 28, 1908. Comprises a metal body, insulated

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thermo-couple wires having their ends united to provide a heat-receptive junction (the wires being longitudinally adjustable in the body and exposing a variable length to the source of heat), and stuffing boxes receiving the outer ends of the wires.

935,164. TELEGRAPH-KEY. George S. Perry, Branford, Fla. Filed January 28, 1909. Includes an energizing circuit, a key lever, a vibrator actuated by the lever, and an oscillating member disposed in the path of movement of the vibrator and arranged to intermittently close the circuit.

935,178. WORD-METER. Herbert I. Watts, Winchester, Ind., assignor of one-third to Edward S. Goodrich and one-third to George H. Ward, Winchester, Ind. Filed March 27, 1909. A typewriter electromagnetically operates a cyclometer step by step with the space key.

935,180. GRAPHITE ARTICLE AND PROCESS OF MAKING THE SAME. Arthur M. Williamson, Niagara Falls, N. Y., assignor to International Acheson Graphite Company, Niagara Falls, N. Y. Filed July 19, 1909. Carbon articles impregnated with materials yielding a carbonaceous residue are subjected to a graphitizing process, thereby producing graphite having small porosity.

935,207. AUTOMATIC FLASHER FOR ELECTRIC LIGHTS. John O. Houser, Cincinnati, Ohio. Filed May 22, 1908. Has a bar carrying a contact piece, another bar carrying another contact piece and having a slot therein, a cam adapted to rotate through the slot in the bar, means for engagement between the cam and the bar, and means for electrically connecting the bars with the electric lights and to the source of an electric current.

935,215. RAILWAY-SIGNAL. Alonzo C. Mather, Chicago, Ill. Filed July 3, 1907. A lever is electromagnetically operated.

935,226. ELECTRIC SWITCH. Johann G. Peterson, Hartford, Conn., assignor to the Arrow Electric Company, Hartford, Conn. Filed December 28, 1908. Describes a form of push-button switch.

935,250. ELECTROLYTIC WINNING OF ZINC FROM SOLUTIONS OF ZINC SULPHATE. Victor Engelhardt and Max Huth, Charlottenburg, Germany, assignors to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Filed May 25, 1907. The process consists in employing an anode of lead peroxide in compact form and free from constituents or parts attackable by the electrolyte.

935,252. STORAGE-BATTERY ELECTRODE. Louis H. Flanders, Wilkinsburg, Pa., assignor to the Westinghouse Machine Company. Filed December 15, 1905. Comprises a number of panels and flexible means connecting adjacent ends of the panels.

935,285. APPARATUS FOR FACILITATING COMMUNICATION BETWEEN TELEPHONE EXCHANGES. Arthur T. M. Thomson, London, England. Filed August 28, 1906. A rotary visiting organ is provided with the contact springs electrically connected to a concentrically-mounted ring on the organ.

935,291. ELECTROMAGNETIC DRILL-SUPPORT. George Boenig, Trenton, N. J. Filed July 14, 1908. A support for portable drills has a base comprising two sections hinged together, an electromagnet in each section, and electric circuit wires connected to one end of one section.

935,299. FORMER FOR ARMATURE COILS. Edwin Denham, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 5, 1907. Describes a coil-bending machine.

935,300. COMMUTATOR. William A. Dick, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed November 8, 1907. In combination with a commutator bar, is a two-part neck or connecting strip the parts of which are connected together by a hinge joint.

935,304. TROLLEY SWITCH-PLATE. Edward Heydon, Indianapolis, Ind. Filed February 13, 1909. A wire-receiving finger is provided with a pair of flanges decreasing in depth so that a gradual approach from trolley wire to plate may be produced.

935,316. PROCESS OF PREPARING STORAGE-BATTERY PLATES. William Morrison, Chicago, Ill., assignor to David P. Perry, Chicago, Ill. Filed December 26, 1903. The process of preparing a storage-battery plate, which includes as steps the repeated immersion of the plate in different solutions formed by combining ingredients including glycerin, sulphuric acid, formaldehyde and formic acid.

935,319. HANGER FOR ELECTRIC OUTLET-BOXES. Adnah McMurtrie, New York, N. Y., assignor to Thomas & Betts Company, New York, N. Y. Filed January 15, 1906. An interiorly threaded annular member is arranged to pass and be seated upon the threaded periphery of the article to be secured, such as a pipe, and an integral loop portion extends at an angle to the annular member in position to pass the article to which attachment is to be effected, the loop being of sufficient size to permit free traversal by said articles into binding contact with each other, and open to permit inspection.

935,320. ANNUNCIATOR. Elmer E. Nye, Los Angeles, Cal. Filed February 11, 1908. Comprises a service drop, a plurality of location drops, a latch for each drop and a ball connection to the latch for the service drop and operated by lifting of the latch of any of the location drops.

935,327. CONTROLLING ELECTRIC MOTORS. Joseph L. Routin, Lyon, France. Filed February 10, 1908. Describes a form of electric servo-motor.

935,344. PROCESS OF MAKING WATER-GAS. Charles E. White, Philadelphia, Pa. Filed January 26, 1909. The process consists in confining a mass of refractory material, heating portions of the mass to different temperatures by the application of different current densities thereto, and at the same time passing steam or water vapor through the heated mass of refractory material.

935,346. ELECTRICAL WELDING-MACHINE. William C. Winfield, Warren, Ohio. Filed August 17, 1908. Comprises a movable power member and a current-conveying contact member having a ball connection therewith, and a second current-conveying member having a number of contact pins opposite the first contact member.

935,347. REFLECTOR. Lawrence Zamboni, New York, N. Y., assignor to Charles A. Sterling, Orange, N. J. Filed November 16, 1907. A reflector of disk form is provided with yielding holding arms normally located in the plane of the disk, and an opening at the inner ends of the arms.

935,348. MEANS FOR USE IN CONNECTION WITH COMBINED REFLECTORS OR SHADES AND ELECTRIC LAMPS. Lawrence Zamboni, New York, N. Y., assignor to Charles A. Sterling, Orange, N. J. Filed November 23, 1908. Describes a means for insulating a conducting or metallic reflector or shade from both of the conducting terminals of an electric lamp.

935,352. ALTERNATING-CURRENT MOTOR. Alonzo C. Bell and Thaddeus R. Bell, Westfield, N. J. Filed November 23, 1908. Describes the details of a commutator for a self-starting single-phase motor.

935,363. ELECTRIC HOIST. Alfred A. C. Gese, Bremen, Germany. Filed April 29, 1908. A portable electric hoist comprises a motor, a controller, a hoisting drum mounted between the motor and controller and having its axis perpendicular to the axis of the motor shaft, and gearing connecting the latter and hoisting drum.

935,381. TRANSMITTING APPARATUS FOR WIRELESS TELEGRAPHY. Guglielmo Marconi, Adelphi, London, England, assignor to Marconi Wireless Telegraph Company of America, New York, N. Y. Filed October 1, 1907. In combination with a sending circuit, are mechanically operated means for positively completing and interrupting the circuit synchronously with the time period of Hertzian oscillations of definite frequency.

935,382 and 935,383. APPARATUS FOR WIRELESS TELEGRAPHY. Guglielmo Marconi, Adelphi, London, England, assignor to Marconi Wireless Telegraph Company of America, New York, N. Y. Filed April 10, 1908. Describes transmitting apparatus.

935,386. WIRELESS TELEGRAPHY. Walter W. Massie, Providence, R. I., assignor to Massie Wireless Telegraph Company, Providence, R. I. Filed February 27, 1907. A magnetic detector having a coil and magnets has means for simultaneously moving the magnets toward and simultaneously from each other in a direction substantially axially of the coil.

935,397. ARMATURE. John P. Nikonow, Evansville, Ind., assignor to Schroeder Headlight Company, Evansville, Ind. Filed November 10, 1908. Comprises a core, windings for exciting the same, a cap engaging the windings, leads connected with the windings and extending outwardly over the cap, a commutator connected with the leads, and an endless metallic member encircling the leads and disposed adjacent to the cap.

935,457. APPARATUS FOR ELECTRICALLY TREATING AIR AND OTHER GASES. James H. Bridge, Philadelphia, Pa. Filed April 30, 1907. An ozonizer contains a perforated electrode adapted to allow air or other gas to pass into a number of discharges originating thereon, and then to be led through the perforations in fine streams to the other side of the electrode out of the influence of the discharges.

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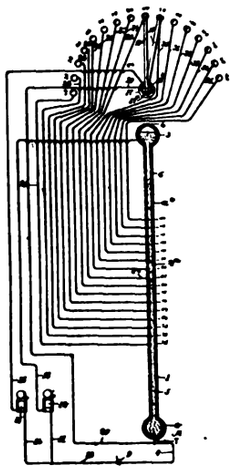
935,460. ELECTRIC THERMOSTAT. James R. Carpenter, Hancock, Mich., assignor of one-half to Theodore A. Steller, Houghton, Mich. Filed August 31, 1908. Comprises a maximum and minimum thermometer, alarms (controllable of maximum and minimum temperatures), including electric circuits, a number of contact members connected with the maximum and minimum thermometer, etc.

935,503. CAPPING-MACHINE FOR INCANDESCENT BULBS. Thomas J. Hetherington, Youngstown, Ohio. Filed February 27, 1909. Describes such a machine in detail.

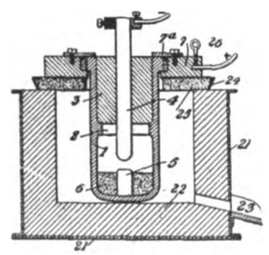


935,460.—ELECTRIC THERMOSTAT.

935,515. COIN-FREED LOCKING DEVICE FOR TELEPHONE APPARATUS. Hermann Janke, Halberstadt, Germany. Filed January 28, 1909. The insertion of a coin releases the hearer hook of the telephone apparatus.

935,518. ELECTRIC ARC LAMP. Adrian D. Jones, Holloway, London, England. Filed September 16, 1907. Has an arc-enclosing chamber, unobstructed draft chambers, communicating with its upper and lower ends, and unobstructed draft tubes connecting the upper and lower draft chambers, and forming therewith a substantially airtight receptacle.

935,523. ATTACHMENT-PLUG. Charles J. Klein, New York, N. Y., assignor to Ida S. Rosenheim, New York, N. Y. Filed February 25, 1907. Comprises two separably operatively connected body members jointly provided with means for maintaining electrical circuit conditions, and connection



935,548.—ELECTRIC FURNACE.

means detachably uniting the body members and enabling the same to be angularly separated.

935,542. METHOD OF TREATING SODIUM PEROXIDE. David E. Parker, Niagara Falls, N. Y. Original application filed May 18, 1906. Divided and this application filed August 27, 1906. The process consists in subjecting the peroxide to an electric current for melting the same, maintaining the temperature of the melted peroxide by the electric current at such a point as to liberate any carbonic acid gas contained therein without freeing the oxygen from the molten material, and finally solidifying the electrically-treated material.

935,548. ELECTRIC FURNACE. Alleyne Reynolds, London England. Filed February 10, 1908. An electric-heating element comprises a tube of carbonaceous material immersed in the furnace charge, means are provided for closing the ends of the tube, also means for conducting an electric current to the interior of the tube, and means for converting electric energy into heat within the tube.

935,558 and 935,559. CARPET SWEEPER AND CLEANER. James M. Spangler, Canton, Ohio, assignor to the Electric Suction Sweeper Company, New Berlin, Ohio. Filed November 16, 1908, and February 3, 1909. Is driven by an electric motor.

935,605. SAFETY APPLIANCE. Quincy T. Howard and William M. Stark, Muscatine, Iowa. Filed December 31, 1906. Describes an electric system for operating the brakes of a vehicle through conductors arranged along the track and engaging with contact devices on the vehicle.

935,614. BLOCK-SIGNAL SYSTEM. Herbert H. Sims, James M. Hatch, and James M. Turrentine, Raleigh, N. C., assignors of one-fifth to Albert L. Cox and one-fifth to William H. Pace, Raleigh, N. C. Filed March 16, 1909. Comprises stations at opposite ends of each block, a telephonic transmitter and receiver at each station, wires connecting the same, and sound-receiving funnels connected with each transmitter and arranged over the track at an elevation above the moving train.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired October 4, 1909:

483,545. ELECTRIC FAN. Elisha B. Cutten, New York, N. Y.

483,556. ADJUSTABLE ELECTRIC-LIGHT HANGER. Herbert L. Holt, Ellsworth, Me.

483,562 and 483,563. STORAGE BATTERY. Edward R. Knowles, Brooklyn, N. Y.

483,564. ELECTROMAGNETIC MECHANISM FOR OPERATING PRINTING PRESSES. Ernst H. Korsmeyer, Kansas City, Mo.

483,582. MOTOR-MOUNTING FOR ELECTRICALLY-DRIVEN FANS. Andrew L. Riker, New York, N. Y.

483,625. ELECTRIC BURGLAR-ALARM. Homer T. Wilson, Louisville, Ky.

483,646. PROCESS OF MAKING ARTIFICIAL MICA SHEETS FOR ELECTRICAL INSULATION. Arthur H. S. Dyer, Schenectady, N. Y.

483,653. MOLDING MICA FORMS FOR ELECTRICAL INSULATORS. Chas. W. Jefferson, Schenectady, N. Y.

483,654. GALVANIC BATTERY. Harry T. Johnson, New York, N. Y.

483,692. ELECTROLYTIC DIAPHRAGM. Anton J. Lehman, New York, N. Y.

483,700. ARMATURE FOR DYNAMOS AND MOTORS. Elihu Thomson, Swampscott, Mass.

483,704. ELECTRIC SWITCH. David H. Armstrong, Long Island City, N. Y.

483,712. ELECTRIC SWITCH. Axel Eckstrom, Lynn, Mass.

483,713. ELECTRIC SNAP SWITCH. Axel Ekstrom, Lynn, Mass.

483,728. ELECTRIC BURGLAR-ALARM. Alfred Stromberg, Chicago, Ill.

483,729. ARMATURE-WINDING FOR DYNAMO-ELECTRIC MACHINES. Ernest P. Warner, Chicago, Ill.

483,732. COMMUTATOR FOR ELECTRIC MACHINES. Norman C. Bassett, Lynn, Mass.

483,739. DOOR-LOCK SWITCH FOR ELECTRIC LIGHTS. Chas. Green, Toronto, Canada.

483,745. ELECTRO-THERAPEUTICAL INSTRUMENT. Jas. W. Moliere, San Francisco, Cal.

483,758 and 483,759. ELECTRICAL HEATER. Arthur E. Appleyard, Boston, Mass.

483,761. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. Wm. G. Creighton, Norwood Park, Ill.

483,768. POLICE-TELEGRAPH SYSTEM. Chas. A. Rolfe, Chicago, Ill.

483,782. THERMO-ELECTRIC BATTERY. Paul Giraud, Chantilly, France.

483,822. ELECTRIC LOCOMOTIVE. Thomas L. Willson, Brooklyn, N. Y.

483,844. BURGLAR-ALARM CONTACT. Nevil M. Hopkins, Washington, D. C.

483,856. ELECTRIC RAILWAY. Wm. G. Murphy, Jr., Marysville, Cal.

483,862. ELECTRIC SWITCH. Harry T. Paiste, West Chester, Pa.

483,940. ELECTRIC HEATER. Fred B. Perkins and Chas. S. Jones, Toledo, Ohio.

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CONTENTS.

EDITORIAL:
Result of Minimum Rates ... 723
An Important Distribution Agreement ... 724
The Association of Railway Electrical Engineers ... 724
The Electric Railway Conventions ... 725
Handling Right-of-Way Problems ... 725
Distinguished British Telegraph and Telephone Official Visits Chicago. 726
Mr. Insull to Speak Before the Chicago Electric Club ... 726
Luncheon of Denver Members to the Secretary of the American Institute of Electrical Engineers ... 726
Franklin Institute ... 726
An Electrically Equipped Stone Quarry ... 727
An Electric Recorder for Mine Cages ... 730
Distribution of Electrical Energy by Farmers' Co-operative Societies. 730
A Hydroelectric Plant in Nyassaland ... 731
Putting Electric Wires Underground ... 732
Electricity in the Hospital ... 732
Turbines for American Battleships ... 732
Newspaper Reporting Extraordinary ... 732
Association of Car Lighting Engineers ... 733
Chicago Electric Club ... 735
New Niagara Power Company ... 735
INDUSTRIAL POWER:
Extended Uses of Electricity on Board Ship.—III ... 736
Effect of Electric Power on Transvaal Gold and Coal Mines ... 737
Year's Issues of Securities ... 738
Why Not? ... 738
Important Decision Relating to Waterpower Rights ... 739
Electrochemical Development in Norway ... 739
ELECTRIC TRACTION:
American Street and Interurban Railway Association—Full Report of the Convention at Denver ... 740
New York Electrical Show ... 753
The Colorado Electric Light, Power and Railway Association ... 754
The Honorary Commercial Commissioners of Japan at Schenectady ... 755
INDUSTRIAL SECTION:
Westinghouse Strain Insulators ... 756
Speer Carbon Brushes ... 756
Edgerton's Lamp Cleaner and Adjuster ... 757
Turbine-Blade Guessing Contest at the Denver Railway Exhibition. 757
Railway Exhibits at Denver ... 757-759
Low-Voltage Transformers ... 759
Electric Commercial Vehicles ... 760
Motor Cars for the New Haven Suburban Service ... 760
A New Rubber Tree in Chili ... 760
CURRENT ELECTRICAL NEWS ... 761
RECORD OF ELECTRICAL PATENTS ... 768

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RESULTS OF MINIMUM RATES.

Perhaps the strongest reason advanced for a minimum meter rate in electric-light and power service is that many unused meters would remain indefinitely on the premises of consumers if no such rate were in force, as the consumer would gain nothing by having the meter removed.

There is the additional fact that large numbers of meters show very little consumption in many months, so that the energy used, if charged at the regular rates, with no minimum, may hardly cover the fixed costs per meter to the company.

An illustration along these lines is here presented from the records of a large electrical supply company. This company makes a minimum charge of one dollar per meter per month for electric light or power service, and last year had out about 21,000 meters.

During last October 4,752 customers paid only the minimum rate of one dollar per meter, so that about twenty-two per cent of all the meters were on the minimum basis. For these meters the total recorded energy during the month was 18,185 kilowatt-hours, amounting on an average to 3.8 kilowatt-hours per meter. Out of the total number of meters there were 576, or 2.7 per cent, that recorded no consumption of energy, and these meters that showed no use of the electric current formed 12.1 per cent of all those that paid only the minimum rate.

At the one-dollar minimum charge per meter the 4,752 consumers paid a total of $4,752 during the month. Aside from the minimum rate, the maximum charge of the company for electric energy was twelve cents per kilowatt-hour, and the 18,185 kilowatt-hours recorded by all the meters that paid only the minimum rate of one dollar per month thus amounted to $2,182.20 as a direct energy charge. To this last-named sum, however, the minimum rate required the addition of $2,569.80 to make up the $4,752 actually received. If there had been no minimum rate, the charge of $2,182.20 for energy at twelve cents per kilowatt-hour would have amounted to only forty-six cents per meter.

Even for the 4,176 meters that showed some use of current, the average consumption was less than 4.6 kilowatt-hours, and amounted to fifty-two cents per meter. As the total energy recorded by the 4,176 meters was 4.6 kilowatt-hours each on an average, the use at some of these meters must have been much less than this amount, while at others the energy may have reached 8.33 kilowatt-hours without exceeding the minimum charge of one dollar per meter.

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It can hardly be doubted that the number of absolutely idle meters would have much exceeded the 576 actually found, if there had been no minimum charge or meter rent, and it is also probable that the number of meters showing a consumption of energy amounting to less than one dollar at twelve cents per kilowatt-hour, would have been materially greater without the minimum charge in force.

Of course, the costs of reading meters, sending bills, and to a large extent the repairs on meters, are independent of the amount of energy consumed.

AN IMPORTANT DISTRIBUTION AGREEMENT.

There has just been concluded between the Fitchburg Gas and Electric Company and the Connecticut River Transmission Company an agreement of general interest to engineers concerned with the introduction of transmitted power into the central-station field. Frequent reference has been made in these columns to the advance of Connecticut River power into Worcester County along lines destined to be of great economic benefit to the manufacturing communities within commercial radius of the Vernon plant. It has been only natural that the established central-station companies have at first appeared somewhat alarmed at the introduction of this power into fields which they have borne the brunt of developing and maintaining, but through the foresight of the Massachusetts Gas and Electric Light Commission the limitations of each class of service have been well laid down and existing plants protected without discouraging the initiative of those who have labored to bring to this field a cheap supply of power on a large and attractive scale. The appeal of the Fitchburg company on behalf of its small-power business and the limitation by the Commission of sales by the Transmission Company to customers having at least 300 horsepower connected load and an annual consumption of at least 450,000 horsepower-hours are now matters of central-station history. The agreement now entered into by the parties formerly in dispute illustrates, quite apart from the specific terms embodied, the necessity of a thorough handling of such problems by experts in order to avoid overlooking many points of importance which the layman would be unlikely to appreciate.

The Fitchburg company now agrees to distribute power at 6,600 volts to the authorized customers of the Transmission company, and for this service it is to receive a price of five-one-hundredths of a cent per kilowatt-hour measured at the substation of the Connecticut River organization. In general, the bills for this service are to range between twelve and fifteen per cent of the first cost of construction of such 6,600-volt distribution lines as may be needed to reach the 300-horsepower class of customers authorized by the decision of the Commission last summer. The local company is to have nothing to do with the prices charged the large consumers above indicated, but it may compete with the Transmission company for their business without prejudice to the agreement—certainly a broadly conceived feature of the situation, and one which should do much to establish the sharp limits of economical supply from a steam-driven plant on the ground and a water-driven station many miles distant.

Other matters covered by the agreement are the assignment of cost for locations, line construction and maintenance in the distributing district; the right of the Transmission company to scrutinize all bills for such work and to approve the plans and specifications therefor; the bearing of the cost of relocating its substation by the Transmission company; the provision for temporary line construction by the local company and the payment for such work by the hydroelectric organization; an exhaustive definition of the means of energy measurement and billing to be adopted between the companies; provision in case of default of payments; right of each party to have meter tests made; definition of construction costs and consideration of the bearing of future extensions or underground construction upon the distribution investment necessary to handle the waterpower in Fitchburg; responsibility of the local company for the 6,600-volt system, with the exception of service reliability at the customers' premises; responsibility of the Transmission company for the operation of its 66,000-volt lines and substation; provision of bonds, life of the agreement and arrangements for arbitration in case of dispute. Review and modification of the agreement by the Commission under certain circumstances are also provided. Space will not permit a detailed review of these features, but they are cited as indicative of the fact that the making of power agreements is no task for amateurs, but one requiring a combination of technical, executive and legal ability for the most permanently satisfactory results to the contracting parties and the communities which they serve.

THE ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.

The second annual convention of the Association of Car Lighting Engineers, held in Chicago last week, marks the beginning of a new era of progressiveness and usefulness for the association. In only a few cases are the duties of electrical engineers and chief electricians of railroads restricted to car-lighting work, and in fact in many cases this is by no means the most important phase of their activities. As was brought out at the convention, it very often happens that the operation of electrical shop equipment and the installation and maintenance of power stations come directly under their supervision. It will also undoubtedly be true that the men at present employed in the electrical departments of the various railroads will become intimately associated with the problems that are now uppermost in the minds of the railway officials—namely, the electrification of steam railroads.

Accordingly, the action of the association in broadening its apparent scope and in changing its name to that of the Association of Railway Electrical Engineers was indeed a wise measure. Its membership will include electrical engineers who have heretofore considered themselves ineligible as members of

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the association on account of not being directly interested in car lighting. Thus, the strength and influence of the association will be materially increased.

In the matter of car lighting, which will continue to occupy much of the association's time, it will be well for it to cooperate with the Illuminating Engineering Society, for in much of the train and depot lighting in vogue there has been but a poor application of the principles of illuminating engineering. Heretofore the generation and regulation of the lighting current has engrossed the attention of the car-lighting engineers; it is time that the resulting illumination be considered. In the matter of the electrical propulsion of trains it would be well for the new association to confer freely with the American Street and Interurban Railway Engineering Association. The convention of the latter, just held in Denver, shows that the electric railways, particularly the interurbans, are adopting very extensively the practice of the large trunk railroads of the country. When the latter are to take up electrification it will be well for them to study the work that has been done on electric railway systems. It will be well, also, for the new association to co-operate in general with the American Institute of Electrical Engineers on such electrical topics as do not come specifically in the sphere of the other associations that have been mentioned.

THE ELECTRIC RAILWAY CONVENTIONS.

From every point of view the conventions of the American Street and Interurban Railway Association and its affiliated associations held in Denver, Colo., all last week were entirely successful and thoroughly enjoyable. The determination to concentrate attention upon a discussion of the reports of the standing committees, or upon papers tributary to these reports, was not only a fine acknowledgment of the services of the committeemen, but indicated the true line along which progress can be made.

All of the sessions of the various associations were well attended and the discussion maintained enthusiastically. The ardent discussion of such matters as interurban rules, equipment, standards, and materials, with in many cases a referring back to the committee showed clearly the interest with which these matters are being watched. Long discussion may defer adoption, but the air is clearing all the time, and much progress may be looked for soon.

As for the entertainment features, they were so numerous and diversified that there was something for someone all the time. The Denver committee on entertainment may well feel proud of its hospitality.

The exhibition of electric railway apparatus presented by the Manufacturers' Association was in keeping with the magnitude of the industry and the importance of the meeting. The exhibition arrangements were skillfully handled, and the visiting delegates well repaid for their attention to this very important feature of the convention work.

HANDLING RIGHT-OF-WAY PROBLEMS.

In the establishment of a power transmission line the problem of securing a suitable right-of-way after the engineers have indicated its generally desirable course is one of the most important and interesting matters that arise. A peculiar ability is needed to deal properly with a right-of-way situation. It calls for no very deep knowledge of impedance and capacity, but for a combination of engineering judgment and tact which need not be despised by those of high technical attainments. A recent trip over the route of a forty-mile transmission line with the engineer who negotiated the right-of-way proved to be an eye-opener, as the saying goes, as to the importance of this work.

The fundamental point to insure in right-of-way bargaining is the minimum possible investment to establish a permanently reliable route. It is easy for an inexperienced man to overlook the fact that interest and taxes must be paid upon the line from one end to the other, and that every dollar expended for the right-of-way or for additional construction safeguards required by alterations of route lays its yearly burden of interest and taxation upon the earning system. Prompt action is therefore most desirable when favorable terms are broached to or by owners of property along the route, and the sooner settlements can be made the better, generally speaking. The amount of money which has to be paid for easements will naturally vary through the widest limits. On the line in question an average price for a perpetual pole location was about $1.50. This price gave the company a signed statement releasing it from any further payments on account of the pole location, and was unusually reasonable; but in this case the line was built to supply power to the substations of a long interurban railway which provided a district with transportation facilities that almost revolutionized the life of each community traversed. There was a generally favorable sentiment toward the construction of the railway.

On the above line the most difficult negotiations were in connection with the removal or cutting of trees, and in some instances, as consent could not be obtained to trim, it was necessary to cross the highway and pass by on the other side. This proved to be the best course in several instances where the trees could not be removed, for as the line was built to carry 33,000 volts, no chances could be taken of tree branches coming in contact with the circuits. In some cases a cash settlement sufficed for trees, in others the farmers required the company to cut them down and saw them into cord wood—a process which was rather expensive in labor and time. Practically every mile of the route exhibited special situations and comparison of the different solutions was difficult. For this reason the company doubtless saved money by prompt action, for the strong neighborly spirit of the rural districts passes along the word very quickly that the right-of-way man is on the trail of the farmer, and it is only natural for Smith to expect $15 for the right to cross his pasture if the same amount has been paid to Doe, although the engineering situation in one case may be entirely different from that in the other.

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Distinguished British Telegraph and Telephone Official Visits Chicago.

Major Walter O'Meara, late of the Royal Engineers, now chief engineer of the British post office department, in company with J. F. Preston of the same department, has been in Chicago the last week gaining pointers on American telephone methods in particular, and also in general on American telegraph business. In 1911 the British Government will take over the entire telephone system of the British Isles. Within the last two weeks the wireless system of telegraphy has been acquired from the Marconi Company by the government.

Major O'Meara has been interviewing Bernard E. Sunny, president of the Chicago Telephone Company, Postmaster Campbell, and a number of leading officials interested in the telephone and telegraph business in Chicago. His itinerary takes him to Grand Rapids, Omaha, St. Louis and back to Chicago, then again to New York.

The major, a typical officer of the most distinguished corps in the British army, is a man of fine appearance, with ability, in his particular line, well recognized the world over. He served with distinction in Burma; was mentioned in the dispatches, received medals and clasps, and was chief officer of the intelligence department during the siege of Kimberly in the Boer war. Later he was chief intelligence officer at Bloemfontein, and head of the Orange River Colony mounted police. Major O'Meara received the official thanks of the British Postmaster-General for his services in installing the telephone service between France and England. He has a record for executive ability and practical experience in electrical affairs in their relation to telephone and telegraph matters.

Mr. Insull to Speak Before Chicago Electric Club.

At the regular meeting of the Chicago Electric Club, to be held in the rooms of the Chicago Automobile Club, on Wednesday noon, October 20, Samuel Insull, president of the Commonwealth Edison Company, will address the club. Mr. Insull's subject is announced to be "The Sale and Distribution of Electrical Energy in Chicago."

Chicago Street-Car Casualities.

An average of eleven persons have been injured daily and one person killed every other day for the last three months by the Chicago street cars.

Luncheon of Denver Members to the Secretary of the American Institute of Electrical Engineers.

The Denver members of the American Institute of Electrical Engineers under the leadership of Dr. W. E. Goldsborough, tendered a luncheon to Ralph W. Pope, secretary of the American Institute of Electrical Engineers, at the Brown Palace Hotel, Denver, Colo., Thursday, October 7. Mr. Pope has been making an extensive trip throughout the western states, meeting the members of the Institute in connection with the formation and development of geographical sections of the Institute. At Portland, Ore., Seattle, Wash., San Francisco, Los Angeles, Palo Alto and Visalia, Cal., Mr. Pope has met with the local members of the Institute and created great enthusiasm for the organization and strengthening of the local sections.

He was en route to Kansas City, when he stopped off at Denver to look in at the meeting of the Street Railway Associations and look over the exhibits of the Manufacturers' Association. Under the leadership of Dr. Goldsborough, a very enjoyable party was arranged, and about forty members and guests greeted Mr. Pope and felicitated with him upon the great work this Institute was doing and the wisdom of President Stillwell's course in so actively taking up this branch of the work. Dr. Goldsborough acted as chairman, and in introducing the guest of honor paid a high tribute to the quality of the men and the work which the Institute represented in Denver.

Mr. Pope responded briefly and gracefully and was followed by Charles Hewitt, of Philadelphia, J. F. Dostal, of Denver, O. B. Coldwell, of Portland, and James H. McGraw, of New York.

New Telephone and Telegraph Concern.

The Continental Telegraph and Telephone Company has been incorporated at Trenton, N. J., with $50,000,000 capital. The company will be a holding concern "to unite and consilidate any telegraph, telephone or cable lines and systems into one system," and may send messages "with or without wires." The incorporators are W. M. Clark, of Plainfield; Powell Crichton and William E. Conley, of New York, who are connected with Philbin, Beekman & Menken, the attorneys for the interests behind the company. The Continental is said to have nothing in common with the American Telephone and Telegraph Company.

Industrial Exposition in Buffalo.

The city of Buffalo, beginning last week, has been presenting the various industries of that city in a large exhibition hall. The electric illumination is particularly attractive, and a number of arches and special illumination designs calling attention to the exhibition hall are to be seen on the streets.

The Buffalo General Electric Company has a very complete exhibit of household electric appliances. The parlor, heated by an electric grate, bedroom, dining-room, kitchen and laundry supplied with various devices needed, are shown and attract a great deal of interest. Wm Huntley, assistant general manager of the Buffalo General Electric Company, takes a special interest in this exhibit, which is one of much credit to his company.

Among other exhibits are the Babcock Electric Carriage Company, showing a number of Babcock electric automobles; Tabor Pump Company, exhibiting the Tabor vacuum cleaning machine; the Wegner Machine Company, builders of the Wegner refrigerating machine; Foster & Lynn Engineering Company, exhibiting the Keystone vacuum cleaning system; and the Buffalo Copper and Brass Rolling Mill, exhibiting a fine display of sheet and roll copper of various sizes.

The exhibition is very largely attended and will continue through the present week.

Franklin Institute.

The section meeting of Franklin Institute, Philadelphia, that was held on the evening of October 7, was addressed by Prof. Edward H. Landis, of the Philadelphia Central High School, on the subject, "Some of the Laws Concerning Voltaic Cells." For the meeting of October 14 Charles A. Barton, of the Nernst Lamp Company, was scheduled to give an illustrated lecture on "Recent Improvements in the Design of Nernst Lamps."

Steam and Electric Traction on the Same Tracks.

Steam and electric traction on the same tracks has been in operation on the Colorado & Southern Railway for about twenty-six miles out of Denver, since May, 1908. No difficulty has been experienced in the operation of trains, and it has not been found that smoke or steam has in any way damaged the overhead construction. The electric cars operate a suburban and interurban service auxiliary to the steam-train service.

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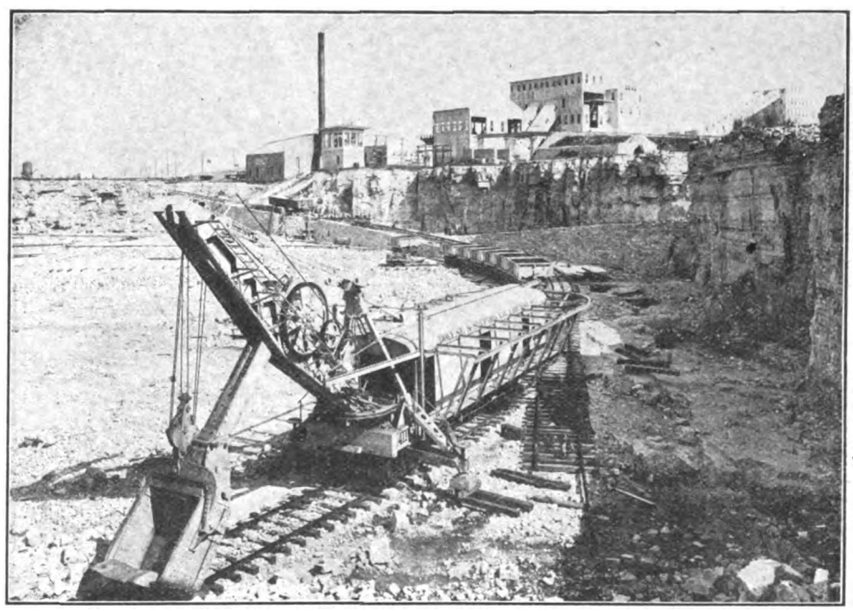
An Electrically Equipped Stone Quarry.

Near Gary, Ill., about eighteen miles southwest of Chicago, is located the new stone-crushing plant of the Dolese & Shepard Company, which has recently been put in operation. This plant, which is believed to be the most complete of its kind, replaces one which was destroyed by fire in April, 1908, on approximately the same site. Its design is based upon the most modern practice in equipment and operation. The plant is located on the Chicago, Illinois & Western Railroad, which enables the Dolese & Shepard Company to make deliveries with its own locomotives direct to Chicago, and connection is also provided with the Indiana Harbor Railroad, which is an outer belt road extending to the steel plants around the southern end of Lake Michigan. These plants use an immense quantity of limestone for flux in blast-furnace operation.

The Dolese & Shepard Company owns at the site a tract of land covering about 350 acres, 135 acres of which are available for quarrying purposes. It is believed that stone can be taken out to a depth of 250 feet under the 135 acres available, but at present it has been excavated to a depth of only forty feet from the surface, covering an area of about eleven acres, so that stone will be available at this quarry for years to come. The stone, so far, has been found quite uniform in character and has only a slight overlay of earth. It is quarried readily and can be handled and crushed in a very satisfactory manner with the present equipment. The output of this plant varies in size from particles which pass through a screen with 100 meshes to the square inch to stones four inches in size. The former are used as a substitute for sand, the latter shipped directly to the steel works for use as flux in blast furnaces.

VIEW OF QUARRY TRACK, SHOWING THIRD RAIL.



GENERAL VIEW OF QUARRY AND BUILDINGS, SHOWING ELECTRIC SHOVEL AND CENTRAL CONTROL TOWER.

The crushing plant includes seven main buildings, located in a row, and constructed of concrete and structural steel. This material is used on account of the heavy loads to be carried. The quarry from which the stone is mined is located directly north of the plant. Starting at this point the first building in the row is the substation. The other buildings in the order in which they are located may be designated as follows: The receiving crusher building; the No. 9 and the No. 6 buildings; the main screening building, and the recrushing building. The output of the quarry is delivered to the receiving crusher building, and then is passed continuously through the remaining buildings to the loading point for shipment.

The entire mechanical equipment of this plant is driven by electricity. All large machines are driven by individual motors, and the smaller machines are group-driven from line shafts belted to motors.

Power is purchased from the Economy Light and Power Company, of Joliet, Ill. In addition to the feeder from this company, there is also a circuit connecting the plant with the Fisk Street station of the Commonwealth Edison Company, of Chicago, so that in case of a breakdown on the Joliet line power may be received from Chicago.

Sixty-cycle three-phase current is received at a pressure of 33,000 volts at the substation of the plant and is passed through two 750-kilowatt Westinghouse step-down transformers, which reduce the pressure to 440 volts for local distribution.

The power and substation building, fifty by 150 feet in plan, has walls of hollow concrete blocks and is covered with a sheet-iron roof. All electric power and lighting circuits throughout the plant are controlled from a twenty-three-panel Western Electric switchboard in this building. Each section of the plant is supplied from a separate panel on which are mounted integrating wattmeters of Sangamo and Westinghouse make, that keep a continual check on the amount of power consumed by the different sections. The switchboard is also equipped with Wagner ammeters and voltmeters and Cutter circuit-breakers.

Current is delivered from the substation to the different buildings in three-conductor lead-covered cables placed in vitrified ducts laid underground the full length of the crushing plant. Manholes are placed at each section of the latter, so that branch connections may be made to distributing cabinets within the building. From these cabinets a separate supply feeder delivers power to each motor.

The plant is lighted throughout by arc and incandescent lamps, the current for lighting being stepped down by transformers in each building from 440 to 120 volts. Arc lamps are provided about the grounds and in the quarry, in order that operations may be carried on at night. These lamps are supplied with current direct from the substation and are entirely separate from the lighting circuits within the buildings.

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The first process in the operation of the plant is to loosen the stone around the quarry. This is accomplished by drilling holes in the rock by means of automatic-feed Ingersoll-Rand rock drills mounted on rectangular frames, and arranged to be moved as a unit. The drills are operated by compressed-air motors mounted on the frame. The air is furnished by two two-stage Ingersoll-Rand compressors installed in the substation. These two compressors each have a capacity of 2,200 cubic feet of free air per minute delivered at a pressure of eighty pounds. Each compressor is belted to a 300-horsepower induction motor. These compressors deliver to a receiver tank located in the substation, from which a supply pipe is laid on the surface in a loop extending entirely around the edge of the quarry. This pipe line is arranged in sections and provided with necessary valves, so that branch lines may be extended to points where drilling operations are in progress.

Stone loosened by the process of drilling and dynamiting is loaded into cars by electrically operated power shovels, built by the Vulcan Shovel Company, of Toledo, Ohio, and operated by Westinghouse motors. A description of these shovels appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, on page 260, in the issue of August 7, 1909.

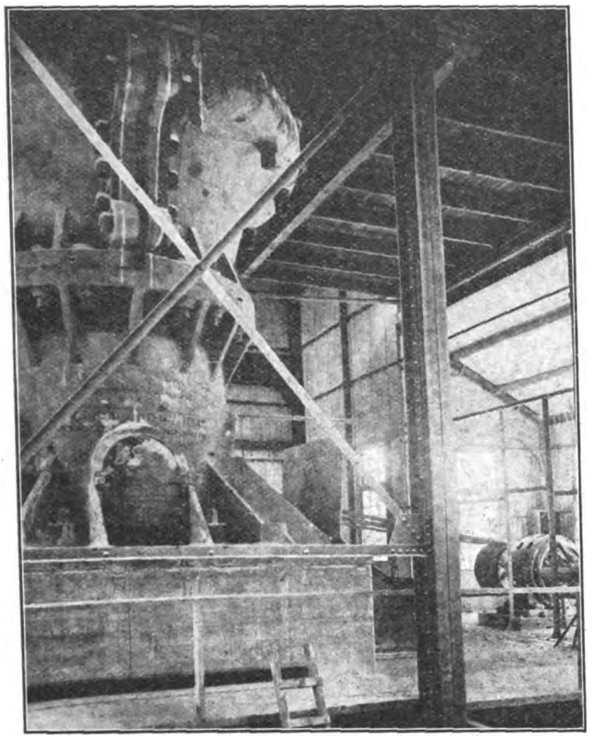
For conveying stone from the quarry to the receiving crusher building an electric traction system is installed, operated on the Woodford system of central control, which is one of the most important and interesting features of the entire installation. This is an industrial haulage system, consisting of electrically driven cars operated from an ordinary track and controlled from a central point.

At the plant of the Dolese & Shepard Company a double track of standard gauge is laid on the quarry bed, extending around its entire periphery and having cross-over tracks at intervals. The inner track, or that farthest from the sides of the quarry, is considered the main track, and the other the loading track. At the end of the quarry nearest the crushing plant a track leading off from the main one leaves the lower level and extends up a six per cent grade to the surface, where it turns to the right on a three per cent grade and extends further up a six per cent grade and on a steel trestle to the crushing plant. The total elevation above the lower level of the present quarry is about eighty feet. On its approach to the crushing plant the track divides, a branch running on each side of the crusher and uniting again into one track on the opposite side of the plant, extending down an eight per cent grade, curving to the right and connecting with the main track at the lower level. The track on the incline to the crusher and back forms half of a figure eight, the other half being completed by a track on the lower level, the one on the six per cent grade crossing that on the eight per cent grade, making the entire track circuit free for a continuous cycle of operations.

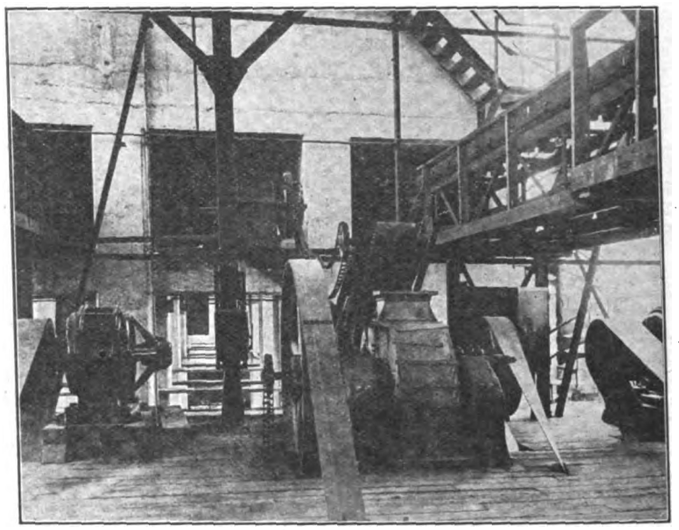
The cars of this system for handling the stone are of the side-dump type, of ten yards capacity each, built entirely of steel, except the box, which is steel-lined. Each car is equipped with two thirty-horsepower street-railway motors and also with an automatic controlling mechanism for this system of control. Each car is also equipped with an electric brake under the control of the central operator. Included in the automatic controlling mechanism on the cars is a selective relay, which, upon the forward movement of the controlling lever in the tower, places itself in such a position as to close the motor circuit. Upon the opposite movement of the lever this relay closes the brake circuit, causing the brakes to operate.

Electric current is conducted to the motors and controlling mechanism by means of a third rail, divided into sections, which is mounted between the track rails. This location of the third rail is particularly adapted for tracks which are necessarily portable.

The controlling tower from which all of the cars in the system are manipulated is located near the crusher and in sight of a large portion of the quarry bed, where the circuit of main and loading tracks is located. From this tower each car may be operated independently from any of the others. It is possible to start it in either direction or to stop it with a brake upon any portion of the



Motor-Driven Mammoth Stone Crusher.



Motor-Driven Conveyors.

APPLICATIONS OF MOTOR DRIVE IN A STONE QUARRY.

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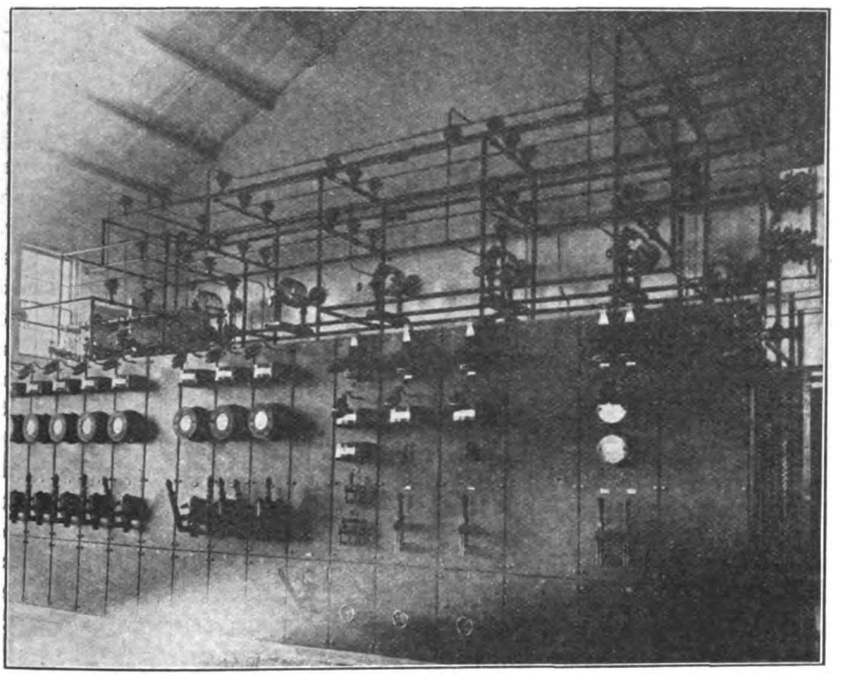
system of tracks over which it is being operated. The switches of the cross-over tracks are operated from the controlling tower, so that the operator may dispose of the car on either the main track or the loading track at will.

Each of the electrically operated shovels is equipped with an auxiliary controller for a part of this central control system with which the shovel operator manipulates the cars which are to be loaded on the loading track, and moves them forward after loading, to a position so as to be taken by the tower control. In this position the loaded car operates a signal in the tower indicating on which loading track the car is loaded and ready to be taken up. In this position the car



VIEW OF SWITCHBOARD IN SUBSTATION—DOLESE & SHEPARD COMPANY'S STONE QUARRY.

can be moved by neither the shovel man nor the tower operator unless the main track at this point or at this cross-over track is cleared.

After the car is loaded it is unnecessary for the operator to pay any attention to it on its trip out of the quarry, up the grade, and to that portion of the track approaching the crusher, as it here runs on a level track through the building and stops without his attention.

The section of the track in the crusher building is under the control of the operator stationed in the latter. When a load is needed at the crusher it is brought forward by this operator, electrically dumped and started on the downward trip.

The speed of each car on this downward trip from the crusher to the quarry is governed automatically. As each car approaches the downward grade it comes in contact with a stationary trip which automatically operates a lever extending out from the side of the car. This lever operates a switch which changes the connection, causing the motor to operate as a generator. The current thus generated passes through a resistance mounted on the car, which limits the speed. It may be seen that this speed can either be increased or decreased, according to the amount of resistance inserted.

The level portion of the track leading to the crusher and which divides into two branches extending on each side of it, has a capacity for a number of loaded cars. As these loads may be kept close together, and with the opportunity to dump them on each side of the crusher, it will be seen that the amount of raw material that can be delivered to the crusher is limited only by the number of cars in operation and the facilities for loading them.

The control of the cars is resolved into starting them from the shovels, and bringing them forward at the crusher to be dumped, and starting them upon their downward trip. While in an emergency the car may be started or stopped upon any portion of the track, the operation of each car is continuous and does not require the attention of the operator except at the terminals. A car loaded at any of the shovels will be 1,000 feet or more on its way by the time the next car is loaded at the same shovel, making it possible for empty cars and loaded cars to be operated along the main track and distributed to and from the different shovels as they are needed.

An automatic scale is installed along the route of the loaded car track which weighs each load as it passes over. Each car, by a non-interfering signaling device, indicates at the scale by which shovel the car being weighed was loaded. The weight of the load and the number of the shovel loading it is automatically marked on the tape at the same time. The tonnage of each shovel for the day may in this way be recorded at the scale.

Direct current at a pressure of 250 volts for the operation of the car and track system is furnished by two 200-kilowatt motor-generator sets. Motor-generator sets of the same capacity furnish current for the electrically operated shovels, and the switchboard is so arranged that any of the generating units may be made to supply current for either shovels or the haulage system.

The receiving crusher to which the quarry cars deliver in the first building is of the McCully gyratory type with receiving openings forty-two inches in width. This crusher is called the "Mammoth," as it is believed to be the largest of any type that has been built to date and breaks the stone to a size of eight inches and under. Its approximate weight is 213 tons, and it has an estimated capacity of 800 cubic yards of stone per hour. For operating, it is connected by means of a steel rope drive to a 250-horsepower induction motor.

This crusher has two discharge openings, one on each side, which deliver stone into pan conveyors fifty-four inches wide. These conveyors extend up into the top of the No. 9 crusher building at an angle of forty-five degrees. Each conveyor is driven at the upper end through gearing by means of a seventy-five-horsepower induction motor.

These conveyors both discharge at the top into two No. 9 gyratory crushers, which are each belt-driven by an individual 100-horsepower induction motor. The stone is reduced in these crushers to pieces having a maximum size of four inches, and is discharged through each crusher into two forty-eight-inch by twenty-four-foot revolving screens, having two-and-one-half-inch perforations. The stone passing each of these four screens drops into a hopper supplying a

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twenty-four-inch horizontal belt conveyor. These four conveyors are placed in concrete-lined trenches and extend from this building to and through the adjoining No. 6 crusher building, where they discharge the stone at the bases of four thirty-inch belt conveyors leading to the main screening plant. The oversize from each of the screens to which the output of the No. 9 crushers also is delivered falls into a forty-eight-inch pan conveyor similar to the one in the receiving crusher building, which elevates the stone from these screens at an angle of forty-five degrees and discharges it into storage bins of the No. 6 crusher building.

In buildings on each side of these bins there are installed four No. 6 gyratory crushers, which reduce this stone to about three inches in size and discharge it into twenty-four-inch belt conveyors that extend from the No. 9 building to the thirty-inch conveyors leading to the main screening plant. These crushers are operated by fifty-horsepower induction motors.

Four thirty-inch belt conveyors, gear-driven by sixty-horsepower induction motors, convey stone to the main screen building, where it is discharged in the revolving screens. The stone is here distributed, according to size, to the main storage bins.

The recrushing plant is equipped to reduce the size of any stone, suitable conveyors and crushers being provided. All the crushers and conveying machinery are driven by individual motors.

It is estimated that when the plant is working at its full capacity the total horsepower used will exceed 2,000.

The forty-two-inch gyratory crusher, pan conveyors, screens and crushing rolls were supplied by the Power and Mining Machinery Company, of Cudahy, Wis. The No. 9 and No. 6 Gates gyratory crushers, the motor-generator sets and the motors for the quarry cars were furnished by the Allis-Chalmers Company, of Milwaukee, Wis. All induction motors throughout the plant were furnished by the General Electric Company, Schenectady, N. Y. The belt-conveyor mechanisms were supplied by the Webster Manufacturing Company, of Chicago, Ill., and the Stephens-Adamson Company, of Aurora, Ill. The steel chutes and hoppers throughout the plant were supplied and erected by the Hamler Boiler Works, of Chicago. The traveling cranes, jib cranes, trolleys and chain blocks were furnished by the Whiting Foundry and Machine Company, of Chicago. F. E. Woodford, of the Woodford Engineering Company, of Chicago, designed and supervised the installation of the quarry traction system.

George W. Patnoe, general superintendent of the Dolese & Shepard Company, has been directly in charge of this plant during its construction and is credited with a number of inventions which add to the completeness of its equipment.

An Electric Recorder for Mine Cages.

A mining engineer in South Africa has recently constructed a device for automatically registering signals given in the shaft and in the engine room as well as the travel of the skip or cage. The records are obtained by means of a specially constructed clock, between the face of which and the mechanism is fixed a cylinder about six inches in length by two inches in diameter. A paper band, sectioned into time spaces, is placed over the cylinder, and a small disk recorder with a separate needle attachment is adjusted in close proximity to one side of the cylinder. The disk and needle are both operated electrically, but separately. The disk, which records the cage journeys, is brought into contact with the sectional paper on the cylinder by means of a small motor driven from the winding drum, marking a line on traveling paper as long as the drum is in motion. When the drum ceases to revolve the contact is cut off automatically and the disk is raised from the paper, which continues to travel without being marked until the drum commences to revolve anew, when the process is repeated. The signal registrations are attained by means of a separate wire connected with the signal bell. Immediately a signal is given, the needle is simultaneously projected upon the traveling cylinder barrel and perforates the paper, the perforation being repeated each time the bell is rung. The time sectional paper thus records each and every signal given, and the times at which they occurred. The clock and registering apparatus is enclosed in a glass case which permits observation of the movements to be made when desired. A separate instrument is, of course, required for each engine. The machine need not necessarily be placed in the engine room, but in any place which may be deemed convenient, such as the engineer's or manager's office; it is only a matter of wire connection.—*Abstracted from the Engineering and Mining Journal, July 24.*

Distribution of Electrical Energy by Farmers' Co-operative Societies.

Many agricultural establishments are not of sufficient importance to warrant the installation of a private electric generating plant, and waterpowers which might furnish cheap motive power are not always present. In order to permit such establishments to profit by the advantages which the application of electricity to farming operations and illumination offers, several co-operative societies have been formed by farmers for producing and distributing electrical energy to their customers, which may include other persons than members of the association, and in such case the society may derive a profit from the sale of current. But the consumers may also be limited to the persons founding the co-operative society, and if it makes no profit from its installation, it may receive aid from the Minister of Agriculture and particularly from the Bureau of Agricultural Improvement. This Bureau has attempted to show what benefits may be gained by a co-operative society, and has started and subsidized a company of this kind, the Société de Maison Neuve, which utilizes a fall of the Oise and distributes the electrical energy produced among its members at such a price that no profit remains, except for the establishment of a reserve fund. For lighting, current is sold under contract or by meter, and for power purposes by meter only. The price for light is sixteen francs a year per sixteen-candle-power lamp, and 0.18 franc per kilowatt-hour for motive power. According to M. Petit, who has recently issued a book from which this information is taken, the installation operates in a perfectly satisfactory manner, and the selling prices are considerably lower than those of commercial stations in that region.—*Translated and abstracted from La Revue Electrique (Paris), August 30.*

Cable Company Work Stopped.

The work of the Commercial Cable Company at St. Johns, Newfoundland, in putting in underground conduits in the streets of St. Johns, in order to connect its city office with the place of landing of its cable, has been stopped by the Newfoundland authorities. This makes it necessary for the cable company to operate its cable in a hut on the seashore in a wild and desolate location. The cable company has decided to ask the American Government to intervene.

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A Hydroelectric Plant in Nyassaland.

One of the selected papers printed by the Institution of Civil Engineers is an interesting account by A. S. Chalmers of a hydroelectric installation which he put up on the Shiré River in Nyassaland. The Shiré is now only intermittently navigable, railway construction is making slow progress, and transport by native carriers is expensive. Minerals are plentiful, chiefly hematite and magnetite, with occasional seams of coal, but the country's development seems to lie mainly in agriculture. One or two small townships have sprung up, as Blantyre and Zomba, the engineering needs of these being supplied chiefly by a small electric lighting plant driven by a Pelton wheel, which has not proved very reliable. At Livingstonia, at the north end of Lake Nyassa, there is a considerable white population, mostly engaged in the education and the industrial training of natives, and there has arisen a need for the employment of a considerable quantity of machinery for woodworking, printing and milling, to take the place of what, though cheap, is not very efficient native labor. Oil engines with petroleum at $1.75 per gallon were out of the question, and the installation of a steam plant would have necessitated the introduction of an unwieldy boiler. As waterpower was available, it was decided to lay down turbines, and to have them of such simple construction that skilled native labor could be requisitioned to superintend the installation when once it was erected. The main points which had to be considered were, first, that at times both lighting and power would be required simultaneously; and secondly, that the center of distribution would be two-and-one-half miles from the supply station. As to the first point, storage batteries for equalizing the load were unsuitable, being too expensive, so it was decided to generate the power as required. The choice lay between a three-phase high-tension system and a direct-current supply. The cost of overhead lines precluding the latter, the installation of three-phase units generating current at a pressure of 2,000 volts was decided upon. There was a supply of water, said to be thirty cubic feet per second, with an available fall of more than 100 feet. It was under these conditions that in 1901 Mr. Chalmers undertook the design and erection of the plant. It consisted of the following: Two thirty-horsepower reaction turbines and generators; one high-tension motor of twenty-five brake-horsepower; six step-down transformers with outputs ranging from four to seventeen kilovolt-amperes; low-tension motors, two of ten horsepower, one of five horsepower, and one of two-and-one-half horsepower; and 500 sixteen-candlepower incandescent lamps. The plant equipment was of Swiss manufacture.

Erecting the plant in such a remote place proved to be more difficult than was anticipated. There were two porterages of fifty and seventy miles, respectively, on the route, and a timber-pile jetty 700 feet long had to be constructed out into the lake to effect a safe landing of the machinery. The site lay 2,500 feet above lake level, and after several unsuccessful efforts to sledge the machinery up the hillside the attempt was abandoned, and the construction of a road eleven miles long was begun. The road occupied the greater part of two years in construction, and cost over $20,000. Directly the road was through the machinery was brought up in ox wagons. Owing to repeated outbreaks of dysentery in the settlement from contamination of the water supply, all work in connection with the electrical installation was stopped until a new supply could be brought from the hills. This involved the laying of eight miles of steel pipes, from four inches to one inch in diameter. In 1904, a start was made with the electrical scheme. A dam was formed across the stream by two rows of piles four feet apart and a filling of clay puddle; the face was battered with nine-inch courses of sharp gravel, sand and clay to a height of twelve feet. The water, which actually amounted to only nine cubic feet per second in the dry season, was led in a brick lade for 400 yards to a settling pond of 10,000 cubic feet capacity, and thence by a fourteen-inch pipe 490 feet long to the turbines. The hydraulic plant consists of two thirty-horsepower inward-flow reaction turbines with horizontal axes, running at a speed of 1,000 revolutions per minute.

As to the electrical plant, there are two 23.5-kilowatt generators supplying current at a pressure of 2,000 volts. The generators are of the usual type with rotary magnets and direct-coupled exciters. The windings are delta-connected, as the voltage reaction produced by uneven loading of the phases is much smaller for this than for the star connection, unless the increased expense of a fourth neutral wire is incurred. A voltage variation of ten per cent up or down is obtainable through a resistance, but owing to the reliability of the governor this is very seldom altered. The installation of equal units has resulted in a considerable saving in spares, besides facilitating the running of the two machines in parallel. The switchboard consists of three panels, one for each machine, the current being combined for distribution on the third. The connections are behind the metal framework and so out of reach of the native operators. The machine panels each carry a low-tension voltmeter connected through a three-point switch to a potential transformer. There is also an ammeter, a phase lamp, and a three-pole high-tension switch. These are fixed on the third panel, one high-tension voltmeter with a six-point switch, three ammeters and a three-pole high-tension switch.

Concerning the overhead lines, these consist of three No. 8 Standard Wire Gauge, hard-drawn, copper wires, which were carried on Buller steel poles fourteen feet above the ground. Horn-type arresters at both ends and middle protect the high-tension lines from lightning, and the secondary lines where overhead are protected by low-tension arresters of the zinc-plate spare-gap type.

The scheme of distribution is arranged in sections as follows:—Section 1, at a distance of 100 yards from the power house: One twenty-five-horsepower high-tension motor, driving a saw mill and a plastic brick-making plant. Section 2, at one-and-one-half miles: One three-phase step-down transformer (oil cooled) ten kilovolt-amperes, with a star-connected secondary at 190 volts pressure, driving a ten-horsepower motor for a flour mill and a threshing mill. A pressure of 110 volts for lighting is obtained between a fourth neutral wire and phase 3. Section 3, at two-and-one-fourth miles: One single-phase seven kilovolt-ampere transformer on phase 1, for lighting only. Section 4 at two-and-one-half miles: One seventeen-kilovolt-ampere three-phase transformer, star-connected to feed three motors at 190 volts. The motors are of ten, five and two-and-one-half horsepower, being used for woodworking, engineering and printing shops, respectively. Section 5: One single-phase transformer of seven kilovolt-amperes for lighting only, on phase 2, secondary 115 volts. Section 6, at three miles: One single-phase transformer of four kilovolt-amperes for lighting only, on phase 1, secondary 115 volts. Section 7, at three-and-one-fourth miles: One seven-kilovolt-ampere transformer, the same as on section 5 and on phase 2. Section 8,

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at three-and-one-half miles: One seven-kilovolt-ampere transformer, the same as last, but on phase 3.

The only trouble experienced with the plant was in connection with the thrust-bearings on the turbines. These have now been replaced by experimental bearings; one is a Hoffmann double-thrust ball-bearing; the other, designed by Mr. Chalmers, is a hydrostatic bearing, which automatically adjusts itself to the working pressure. A pipe was brought to the rear of the bearing direct from the main fourteen-inch pipe, and the pressure of the water thus comes on to the diaphragm fixed to the shaft. If the pressure should tend to be too great for the thrust, the shaft travels endwise to a small extent and so produces a greater opening to exhaust and establishes equilibrium. This bearing, if rather cumbrous on such a small plant, should be very effective on plants working under a much higher fall. For two years the plant has been in operation on an average of 120 hours a week and without a single stoppage for repairs. —*From the Electrical Engineer (London), September 17.*

Putting Electric Wires Underground.

There seems to be a general activity all over the country in an endeavor to do away with overhead wiring. Among the cities which are foremost in their efforts in this direction are Baltimore, Md., and Malden, Mass.

In the former town Subway Engineer Phelps reports that more than two-thirds of the total mileage of subways contemplated has already been constructed, and that it is expected to have the entire system finished in about two years. To put underground all of the overhead wires in the city requires the laying of about 166 miles of conduits, and of this 111 miles has been laid. Of the $1,000,000 conduit loan, Engineer Phelps spent last year about $219,000.

In Malden work has already been begun by the Malden Electric Company in putting its wires underground. By agreement with the city the company was to begin this year. The cost of the work in Malden to care for all the main trunk lines will be $300,000, and it is to be done in seven years. In the first three years the company will expend $100,000 and from then until the work is completed $50,000 each year. The work is being done under the direction of Electrician F. C. Sergent, and the contractor is G. M. Gest, of New York.

Electricity in the Hospital.

Not unnaturally, the majority of medical men in the United Kingdom are turning their attention to St. Bartholomew's Hospital, says *The Electrical Engineer*, of London, Eng., for the electrical department there has recently been enriched by the introduction of a Von Lepel generator. It is the first, so far, put into use over there, and is intended to cure rheumatoid arthritis and other diseases of the articulations. By means of a transformer a current of low frequency is stepped up to a sinusoidal current of high frequency. The electrodes consist of copper disks, which are brought into contact with the bare skin at the desired points. The current is controlled by means of a pedal arrangement, the operator thus having his hands free and being able to watch both patient and ammeter. Under the control of Dr. Lewis Jones, the Von Lepel instrument is already giving promise of success in rheumatoid cases, and is being tried in the treatment of paralysis. The instrument and treatment are too new for one to venture the prophecy that these appliances will become part of the obligatory equipment of every hospital and surgery, but, if Continental experience is confirmed in England, it will only be a question of time. Once more the electrician will have conferred an immense boon on humanity.

Turbines for American Battleships.

Both the new American "Dreadnoughts," of 26,000 tons displacement, for which contracts were recently awarded, are to be equipped with Parsons turbine engines.

This decision was reached at a conference in Washington, D. C., between Secretary Meyer, Commander Cone, Chief of the Bureau of Steam Engineering, and Rear Admiral W. L. Capps, Chief of the Bureau of Yards and Docks, who has just returned to the United States from an extensive tour of European shipyards.

The New York Shipbuilding Company, which is to construct the Arkansas, was notified some time ago that turbines would be installed. Decision as to the motive power for the Wyoming, to be constructed by the Cramps, was postponed temporarily, but Secretary Meyer and his associates have decided favorably for the Parsons turbine, feeling satisfied, as Secretary Meyer expressed it, that this would be more advantageous to the Government that the proposed combination of turbines and reciprocating engines, which had been insistently urged by some naval officials.

Newspaper Reporting Extraordinary.

By the use of the electrophone the London *Evening News* was able to print a verbatim report of Lord Rosebery's speech on the Budget proposals the same afternoon, says *The Electrical Engineer*, of London, Eng., the sentences being in type almost as soon as they were delivered in the Glasgow City Hall. The electrophone transmitters, tiny brass fittings, were attached to the rostrum in the City Hall, and in all 2,000 miles of telephone wires were used to connect the hall with Carmelite House. The route was from the City Hall, Glasgow, to the Glasgow Post Office by underground wires, and then, by the overhead trunk system, via Carlisle railway station, Leeds Post Office, Hunslet railway station, Sheffield railway station, London-road Station, Nottingham, Luton railway station, and Finchley-road Station to the York-road Post Office. Then, by underground wires, the route was to the trunk telephone exchange in Carter-lane, and from there to Carmelite House. A staff of a dozen shorthand writers listened to the speech at the London end, each working two minutes at a time and then transcribing his notes. The arrangements were so complete that the slips of "copy" were in the printers' hands a few minutes after the words were heard in London, which was four seconds after they were uttered in Glasgow. The electrophone, as now improved by the introduction of a new transmitter, has been tested over artificial circuits representing 3,500 miles of wire, and gives a loud-sounding reproduction of the voice.

Tungsten as a Valve Electrode.

In an original communication to the Institution of Electrical Engineers, London, Eng., L. H. Walter gives an account of some experiments showing that tungsten, when used as an electrode in an electrolytic cell, gives a pronounced "valve action," or rectifying effect. Several electrolytes were tried, including sulphuric acid, potassium dichromate solution, and others, having for the most part a high conductivity and less adapted to the securing merely of high critical voltages. The critical voltages in the strong acids proved to be, as a rule, higher with tungsten than with aluminum, but not so high as with tantalum. The sensitiveness to heating was not pronounced, but the sensitiveness to cutting of the current proved to be very great. The experiments were carried out and are continued at the South Western Polytechnic Institute.

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Association of Car Lighting Engineers.

Second Annual Convention at the Hotel La Salle, Chicago, October 4, 5, 6 and 7.

The second annual convention of the Association of Car Lighting Engineers was held in Chicago, in the convention hall of the new Hotel La Salle. A report of the proceedings of the meetings of Monday and Tuesday, October 4 and 5, appeared in the issue of October 9, on pages 672 and 673.

Undoubtedly the most important feature of the convention was its action on Monday in regard to changing the name of the association to that of "The Association of Railway Electrical Engineers."

As the problem of electrification of steam railroads is uppermost in the minds of railway officials, and as this would necessitate the employment of many electrical men and also a great deal of study of electrical problems, this change of name will mark the beginning of a new era for the association, as it not only includes car-lighting engineers, but will also include engineers and electricians employed by railroads in other branches of electrical work.

The convention's progress during the first year of its life was outlined in the opening address by the president. Among the other notable features of the first two days' session was an excellent address by Mr. Klinck and the reports of the several committees.

WEDNESDAY MORNING SESSION.

Wednesday morning session was opened at 10 a. m. by the president, who introduced George W. Cravens, of Chicago. Mr. Cravens addressed the convention extemporaneously on the subject of "Electrification of Steam Railroads."

Mr. Cravens introduced the subject by asserting that the members of the association he was addressing would undoubtedly be called upon in the future to decide upon questions arising in connection with the problem of electrification. He discussed the arguments in favor of electrifying and compared steam roads with the present interurban and other electric lines. Some of the points brought out in the address of Mr. Cravens were the benefits gained by the passengers on account of the frequency of service which would be possible should the railroads electrify and on account of the increased accommodations which could be offered by maintaining stations closer together. A feature that is becoming a serious one to many railroads is the competition offered by interurban lines in carrying both passengers and mail and express, due to greater frequency in service and having stations at more frequent intervals. In regard to the cost, Mr. Cravens compared the electric lines with steam roads showing the cost of operation to be decidedly less in the case of the former. The methods of electrifying were discussed briefly, Mr. Cravens being in favor of the third rail wherever it is allowable.

The discussion of this address was deferred until after the reading of the next paper. The paper entitled "Train Lighting on European Railways," by Dr. Max Buttner, was then read by J. Henry Klinck.

This paper opened with a comparison of train lighting by electricity with other methods employed by railroads in Europe. Some countries, as, for instance, Russia, still light their trains by means of candles, and, in a few cases, gas. In most other countries the question of train lighting has resolved itself into a comparison between gas and electricity. Although electric train lighting has always been considered favorably, the marked advancement made by gas some years ago led that form of illumination to become popular, but with the recent decided improvements in the electrical field, electric lighting is being considered more highly. The paper outlined the methods of train lighting in vogue, which in nearly every case corresponded to the methods used here. In concluding, Dr. Buttner claimed that the unquestionable advantages of electricity for train lighting will undoubtedly lead to its exclusive use in the near future.

Following the reading of this paper, the discussion of the address of Mr. Cravens was opened by Mr. Pomeroy, who claimed that it was unfair to compare the costs of operation between steam and interurban railways. He claimed that most electric roads are considered as amateurs by the steam roads. The electrification of steam roads would mean the expenditure of about twenty-five per cent more in addition to the money invested. As this is the case, the railroads must be guaranteed an increase in traffic of twenty-five per cent, or a decrease in operating expenses of twenty-five per cent, and then they would be no better off than they are at present.

J. R. Sloan, of the Pennsylvania Railroad, called attention to a division of the road he represents which is used exclusively for freight traffic. The increase in traffic between the points connected by this division has grown to such an extent that two more tracks were necessary. Electrification was considered, and it was found that the operating expenses would be the same in either case, but the entire trip could be made in one-half the time now required by using electricity. This would mean a decrease in the number of cars necessary, which would represent an enormous saving in a year.

J. R. Klinck entered into the discussion by asserting that the question resolves itself into whether or not electrification will save or lose money for the railroads.

O. W. Ott, of the Oregon Short Line, asked Mr. Sloan how electrification of that division would increase the business and whether the present operating conditions could not be bettered to such an extent that the same time could be made as is claimed for the electric line. In reply, Mr. Sloan said that an extended study had been made as to operating conditions and the causes for delay determined. In comparing the two systems it was shown that the average speed possible for the steam train was twelve miles per hour, and that possible for the electric was found to be thirty miles per hour. In making this test the time lost was deducted and the average speed only considered.

Mr. Cravens added that the railroad makes money only when it is moving cars, but the expense constantly goes on just the same. Hence, by reason of being able to operate more cars when electricity is used, the earning capacity of the railroads can be increased. Mr. Seymour, of the Lake Shore & Michigan Southern Railroad, claimed that the electrification that has been accomplished so far on such roads as the New York, New Haven & Hartford, the Baltimore & Ohio, and the Grand Trunk at Port Huron has been on account of the smoke nuisance, rather than an increase in the earning capacity.

WEDNESDAY AFTERNOON SESSION.

The early part of the session Wednesday afternoon was devoted to the continuation of the reading of the report of the committee on standards.

Following this, H. M. Beck, of the Electric Storage Battery Company, read a paper entitled "The Storage Battery in Train-Lighting Service." Mr. Beck said in part:

The most economical way to handle the storage battery is to give it the regular attention it requires, even at considerable cost, rather than to wait until it fails and then try to doctor it back into shape again. The best battery can be ruined in a comparatively short time when it should have given years of service with proper treatment. Cleanliness is an important factor in the consideration of storage batteries. From the time the battery material arrives on the ground until it is worn out the matter of cleanliness cannot be too strongly emphasized. Almost any foreign impurity will cause trouble if gotten into the cell, and some will result in the de-

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struction of the plates. The initial charge is of extreme importance, for, if incomplete, the plates are not thoroughly worked up and will not show capacity or efficiency, and their life may be materially shortened. A large percentage of trouble in the past has been traced directly to mistakes in putting cells into commission. The charge should be started as soon as possible after the electrolyte has been put into the cells. If the plates are allowed to stand in electrolyte any length of time before the initial charge is started, they sulphate, due to local action. In addition to what might be called mechanical inspection having reference to cleanliness, broken connections, flushing, etc., the proper care of storage batteries necessitates an electrical inspection which aims to determine the electrical condition of the cells. Experience has shown that if the battery is charged too much, the excessive gassing washes out the active material of the positive plates, and thus decreases their capacity and life. On the other hand, undercharging results in sulphating, lack of capacity and rapid disintegration. In order to meet both of these conditions the best plan is to divide the charges into two types, which are called "regular charges" and "over charges." In connection with the subject of discharge, about the only points to be guarded against in railway service are, not to discharge too far, and, when completely discharged, to recharge as soon as practicable. The subjects of "readings," "low cells," "the cadmium test," "replacing evaporation," "restoring lowered specific gravity," "incomplete charging," were taken up and discussed fully by the author.

Following the reading of this paper, a brief discussion was entered into. O. W. Ott asked Mr. Beck what he considered the maximum electrolyte density in charging. Mr. Beck said he could only speak for one particular type of cells, and in that case the specific gravity should never go above 1225. In general, weak gravity is much easier on the plates than strong, and within reasonable limitations will not endanger them. Mr. Hutchinson asked Mr. Beck if ten points above 1225 would make any difference. Mr. Beck said that it is best to have the absolute maximum at 1225.

President Farrelly then asked Mr. Beck how he considers Lake Michigan water for battery use. Mr. Beck replied that the firm he represents had made many tests of Lake Michigan water, and in every case found that it was perfectly safe. The president also asked Mr. Beck what he considers dangerous for the maximum temperature in charging. In replying, Mr. Beck said that, owing to necessity in car-lighting work, the limit, 110 degrees Fahrenheit, was a little higher than he would like. The lower the temperature can be kept the longer life will the cells have.

THURSDAY MORNING SESSION.

At the opening of this session President Farrelly proposed the formation of a club to be known as the "Car Lighting Club," its object to be the bringing together more closely the members of the association who are located so as to meet in Chicago once a month and discuss informally subjects regarding car lighting. This suggestion was received favorably and a motion was made authorizing the president to appoint a committee of six

E. M. CUTTING.

Mr. Cutting, president-elect of the Association of Railway Electrical Engineers, was the founder of the Association of Car Lighting Engineers.

to select a place of meeting for the club, arrange a date and make other incidental arrangements. Following this a report of the special committee on lamps was read by H. C. Meloy, chairman. This gave complete data on all incandescent lamps. After a brief discussion regarding the merits of some of the lamps pro-

GEORGE B. COLEGROVE.

Mr. Colegrove, chief electrician of the Illinois Central Railroad, and secretary-elect of the Association of Railway Electrical Engineers, was secretary of the Association of Car Lighting Engineers.

posed in the report, the report was adopted upon vote of the members.

THURSDAY AFTERNOON SESSION.

The Thursday afternoon session was opened by the reading of the report of the committee on improvements by J. A. Shaw, chairman. Some of the subjects covered in this report were "Axle Lighting," "Head-End Systems," "Straight Storage," "Storage Batteries" and "Illumination." This report was discussed briefly and accepted.

The place of meeting for the next convention was voted upon, and it was decided unanimously to hold the next annual convention in Chicago, October 4, 5, 6, and 7, 1910. It was also decided to hold a semi-annual meeting in Buffalo, N. Y., June 7 and 8, 1910.

The election of officers was next taken up, and the following election announced:

E. M. Cutting, of the Southern Pacific Railway, president.

J. R. Sloan, of the Pennsylvania Railroad, first vice-president.

F. R. Frost, of the Atchison, Topeka & Santa Fe Railroad, second vice-president.

George B. Colegrove, of the Illinois Central Railroad, secretary.

ENTERTAINMENT.

The entertainment committee provided a most excellent programme of entertainment for the members and ladies during convention week. On Monday night an informal dance was held in the ballroom of the Hotel La Salle. On Tuesday afternoon the ladies were taken on an extended automobile trip through the parks and boulevards. Tuesday night a theatre party was given and an enjoyable evening spent. On Wednesday night an elaborate banquet was given in the banquet hall of the Hotel La Salle, followed by an informal dance. Chas. E. Brown, of the Central Electric Company, toastmaster, and the banquet committee are to be congratulated on the manner in which the affair was conducted.

EXHIBITORS.

Elaborate exhibits were in evidence and every appliance suitable for car lighting or heating was displayed in a manner most appropriate, several exhibitors decorating their space so as to represent the interior of a passenger car.

Among the manufacturers represented were the following:

Willard Storage Battery Company, Westinghouse Electric and Manufacturing Company, Westinghouse Lamp Company, Westinghouse Storage Battery Company, The United States Light and Heating Company, Gould Storage Battery Company, Gould Coupler Company, The Safety Car Heating and Lighting Company, The General Electric Company, Adams and Westlake Company, I. A. Bennett Company, Universal Electric Storage Battery Company, Economy Engineering Company, New York Leather Belting Company, Sangamo Electric Company, Central Electric Company, National Electric Lamp Association, Buckeye Electric Company, Columbia Incandescent Lamp Company, Charles L. Klewert Company, Ward Equipment Company, Electric Storage Battery Company, Pyle National Headlight Company, Western Electric Company, Watson Insulated Wire Company, Diehl Manufacturing Company, Dake American Turbine Company, Holophane Company, James Wolff, Oliver Electric and Manufacturing Company, Consolidated Railway Electric Light and Equipment Company, International Electric Meter Company, Standard Underground Cable Company, Tipless Lamp Company, Revere Rubber Company, Peerless Rubber Company.

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Chicago Electric Club.

Following the regular weekly luncheon of the Chicago Electric Club in the Grill Room of the Chicago Automobile Club on Wednesday, October 6, Foree Bain, patent attorney and electrical expert, entertained the club with an interesting address entitled, "In the Early Days of Electrical Development."

Considering the advanced stage of electricity today, it is hard to conceive such conditions as those related by the speaker in his early experiences.

Mr. Bain carried his listeners back to the time of the Civil War, when, as a boy, his ambition in life was to become a telegraph operator. He related how, when at school, he fitted up a crude telegraph instrument made of wooden levers and connected it to a companion's desk by means of twine, and when later on he became old enough to be considered seriously as an operator and wanted to practice, how he constructed an instrument, using a Daniel's cell, old zinc from scrap heaps and iron wire.

Mr. Bain's first invention, a self-closing telegraph key, was completed while he was employed as an operator on a southern railroad. It consisted of a treadle located under the operator's bench and connected by means of hand-made levers. One night a dog came into the office and went to sleep on the treadle, thus putting the invention out of commission and ending the dream of the inventor.

Mr. Bain later became interested in telephony, and constructed the first telephone he ever saw. Subsequently he obtained a position as salesman for the Post Manufacturing Company, soliciting telephone subscribers and making his own installations.

A number of interesting experiences regarding incandescent-lamp installations were related. A lighting plant once installed in a hotel by Mr. Bain in those days, caused all of the guests to remain awake during the night in celebration of the event. Incidentally, they could not sleep on account of the noise made by the generating units.

A few years later, Mr. Bain was appointed electrical engineer of the Minneapolis Electric Railways, his duties being to install an electric traction system in St. Paul and Minneapolis. The difficulties encountered in this installation were many. The city ordinance of Minneapolis provided that on certain streets all electrical conductors must be placed underground, and, to comply with this ordinance, Mr. Bain had to do considerable traveling in order to purchase the necessary materials. Probably the most interesting feature of this installation was the manner in which the conductor was laid underground. A number of pasteboard tubes, heavily insulated, were first laid. The question then was, how to get the conductor through the tubes. To accomplish this a contrivance resembling the thumb of a glove was fastened to the end of a cord, and with the aid of a blower this arrangement was shot through the tubes, and later a cord fastened to the conductor and drawn through. Other difficulties met with in this installation were the fitting up and installing of new generating units.

The speaker related a number of such amusing experiences, and told of the many difficulties encountered by electrical men in the early days of electrical development.

New Niagara Power Company.

Incorporation papers of the Genesee Light and Power Company, of New York state, the new corporation formed to take over the plant of the Genesee County Electric Light, Power and Gas Company, which went into the hands of a receiver on October 15, 1908, and which has since been sold by order of Judge Hazel, of the United States Circuit Court, have been filed in the county clerk's office at Batavia, N. Y.

The capital stock is given as $250,000, of which $150,000 is common stock and $100,000 six per cent preferred stock in shares of $100 each. Preferred stock has a preference in the assets in case of a liquidation of the company and dividends up to six per cent from the earnings of the company. The common stock is entitled to dividends up to six per cent, and after that both common and preferred stock shall share alike in the earnings, without preference. The voting power of both kinds of stock is to be equal.

It is understood that the new company will take over the property on October 21, which will be thirty days after Judge Hazel ratified the sale by the receiver. The new company, like the old one, will deal in Niagara power.

It is reported that the police force in Dundee, Scotland, are to be provided in future with electric lamps to replace the customary "bull's-eye" oil lantern.

Would Drop Telephone Suits.

Justice Bischoff, in the New York Supreme Court, reserved decision on Monday in the application of the Public Service Telephone Company, of New York city, for permission to discontinue the suit it began last July for a writ of mandamus to compel the Empire City Subway Company to allow it to run its telephone wires through that company's ducts.

Assistant Corporation Counsel Burr opposed the application upon the ground that the city had a right to intervene.

The telephone company obtained its franchise with reference to the telephone business from the Long Acre Light and Power Company, which contended that it had a perpetual franchise for the transmission of electric power through the city, purchased in 1906 for $100, and transferred the telephone part of these rights franchise to the new company, which was incorporated in Albany on June 24, for a term of 999 years.

Metropolitan Securities.

Judge Holt, in the United States Circuit Court, continued S. Sidney Smith as temporary receiver of the Metropolitan Securities Company in the supplementary proceedings instituted by William W. Ladd, receiver of the New York City Railway Company, as a judgment creditor for $5,271,582 and holder of cash to the amount of $1,013,783 and notes and securities worth about $500,000 belonging to the defendant corporation. Mr. Smith would probably have been appointed permanent receiver of the Metropolitan Securities Company had not the Court of Appeals on September 30 refused a rehearing of the matter from the judgment obtained by Receiver Ladd stating that upon proof being offered that application for a writ of certiorari had been made to the United States Supreme Court, a motion for which was pending, the decision of that court would be entertained. Judge Holt, when he took up the matter of receivership on Monday, was informed by Paul D. Cravath that application for a writ of certiorari was to be made and that a stay would follow.

Kentucky Electric Company Bonds.

It is announced that the Kentucky Electric Company has filed a deed of trust with the United States Trust Company, securing $1,500,000 five per cent bonds and has canceled a previous issue of $500,000 bonds.

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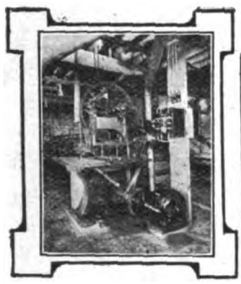
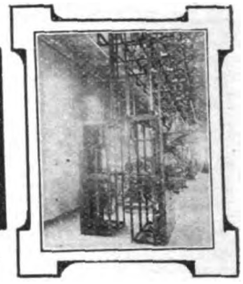


Industrial Power



EXTENDED USES OF ELECTRICITY ON BOARD SHIP.[1]—III.

BY JOHN MCLAREN.

Assuming the producer requires a certain amount of water. This is used for two purposes, viz., for converting into steam for the production of gas, and for cleaning the gas in the scrubbers. The total consumption for both these items varies from one-and-one-half to two gallons per brake-horsepower-hour. The greater proportion of water is used in the scrubbers, but as there is no objection to the use of sea water for this operation, the amount of fresh water required would be very little. Suction gas is non-odorous and poisonous, but as the whole plant is working below atmospheric pressure and the producer only generates just sufficient gas for the load on the engine, there is no possibility of escape when at work or standing by. When starting up, a small quantity of gas is blown to waste so that there can be no danger from this source.

The usual method of shutting a gas plant down for standing by is to open the waste-pipe cock and the ash-pit door to allow a draft of air to pass through the generator to keep the fire alight. The stand-by loss is the amount of fuel consumed during this period of rest. In Mr. Dowson's book, recently published, on "Producer Gas," will be found a complete comparison of the stand-by losses between gas plant and steam boilers, which shows an enormous difference in favor of the gas plant. When I say that for a given power the gas producer has far less radiating surface than a boiler and occupies less space, has less external settings to be heated up, and, moreover, requires less fuel to make up this loss than in the case of a steam boiler, the enormous difference in the stand-by losses will be more readily understood.

In a paper read by E. Shackleton before the Institute, and reported in Volume 20 of the Transactions, he gives some very interesting figures relating to the coal consumption required for loading or discharging cargo by steam; he bases his figures on a steam plant of 200 brake-horsepower, and gives the fuel consumption of this for twelve hours as 12,000 pounds, and goes on to say:

"Referring to the cargo-discharge consumption, the writer is of opinion that the majority of engineers are acquainted with the excessive fuel consumption of the average steam winch, which (on account of its very low efficiency, owing to condensation losses, etc.) may probably be put at five pounds per horsepower per hour as not too high an estimate." Comparing this figure with the coal consumption of the electrical winch driven from the suction gas alternator, I will refer you to the coal consumption of the gas plant which I gave at 0.85 pound per brake-horsepower-hour on the gas engine. To arrive at the consumption for the winch, we have to take into consideration the distribution losses of the electrical system. I stated this figure was twenty per cent. Supposing that we take this at twenty-five per cent, we shall get a coal consumption of 1.06 pounds of coal per brake-horsepower-hour on our electrical-driven winch, as compared with five pounds of coal for the steam-driven winch. This means that the coal consumption on, say, twenty-four hours' continual work with 300-brake-horsepower gas engine would be just over 4,800 pounds of coal, while the coal for the steam engine would be 24,000 pounds.

Dealing with the amount of mechanism in the two forms I have described, that is, between the producer and the steam boiler, the producer is a comparatively simple piece of apparatus, as no parts of it are subject to any pressure, and after the gas is cleaned and scrubbed no physical change takes place until it reaches the engine, no feed-water pumps are required, and the amount of cleaning required is extremely small. On the other hand, the steam boiler has to be well maintained, as it has to work under high pressure. Care has to be taken with the feed water, and the interior of the boiler must be kept free from scale, etc. The steam can lose a great amount of its heat in the steam pipes. The valve gear of the gas engine is extremely simple, and when once set cannot be tampered with.

As for the alternating-current generator and induction motors, these are simplicity itself, far more simple than continuous-current motors. The losses that occur in the distributing cables at the most only amount to about two per cent, and these cables require absolutely no attention when once installed.

From an article written in *Cassier's Magazine*, by the Marquis of Graham, on the gas-engine experiments in the Rattler, the gunboat stationed on the Clyde for the use of the Clyde division of the Royal Naval Volunteers, and which usually cruises at the week end, we gather the following:

Her description is as follows: Composite construction, single screw, length, 165 feet; beam, twenty-nine feet. Mean draft, eleven feet two inches; displacement, 715 tons; indicated horsepower with forced draft, 1,000 horsepower; speed, thirteen knots; with natural draft, 600 horsepower, speed, 11.5 knots. She was launched at Elswick, October 8, 1886.

Her old boilers and steam engines have been removed and a single set of vertical Beardmore Chaplain suction gas engine and producer installed in their place. The engine is 500 brake-horsepower, five-cylinder, single-acting, bore twenty inches, stroke twenty-four inches, 120 revolutions per minute. The five cylinders are independent of each other. One cylinder could be knocked off for examination, if required, while the other four are working. A magneto is fitted to each cylinder, the ignition being of the low-tension make-and-break type, this type of ignition being considered the most suitable for marine work, as there is so much moisture to contend with. This form of ignition has been running two years without a single failure. The producer is of the usual type, the fuel being anthracite; the steel shell of the generator being

[1] Abstract of paper read on September 4, in the Congress Hall, Imperial Exhibition, Shepherd's Bush, London.

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lined with firebricks and with the feeding hopper on the cover, the cover being water-cooled. The fire bars are trough-shaped and placed radially round the producer; the inner ends are supported on a frame. Water is kept circulating through this, and so prevents the edges of the fire bars burning away. The gas after leaving the producer enters the bottom of the cooling tower and leaves at the top. The gas in its upward course comes in contact with water sprays, and is thus cooled and cleared of any grit that may be in it. After leaving the cooling tower the gas passes to the centrifugal drier, in which the fan is revolving at a high rate of speed, and any water that is in the gas is thrown off to the walls of the casing, and is drained away to a water seal. The gas being lighter, remains in the center of the fan, and is then drawn through the cleaner to the mixing valve on the engine and then to the various cylinders. The exhaust gas passes into a nest of tubes through which water is circulating, and the heat from the gas generates steam which is used for the producer.

The engine is started by means of a mixture of gas and air pumped up to ninety pounds per square inch, which is admitted to the cylinder through a specially constructed valve and then fired. The engine invariably starts up with the first impulse and gets sufficient way on to draw in gas from the main mixture. As regards the performance of the vessel, she has run up to date over 1,800 miles at an average speed of eight to nine knots per hour. There is no shoveling coal in a dark and confined space. The feeding of the gas producer is intermittent, and can be done automatically instead of by hand. The heat from the producer is nothing compared to the heat arising from boilers in a stokehold. As regards weight and space, the gas producer saves from twenty-five to thirty per cent of the corresponding item of a steam outfit, but it is in the cost of labor and fuel that one of the chief benefits is to be found. The Rattler as a steam vessel had thirteen stokers and four engineers, now as a gas ship she has three engineers and four helpers. The producer only requires a few minutes' attention every two hours. It was found that starting from all cold took thirty minutes. Consumption of fuel compared with the steam plant was fifty per cent less for the gas plant.

In conclusion, I might mention that the maintenance and depreciation in seagoing installation, such as I have attempted to describe, would not be at all heavy. I think that an allowance of seven-and-one-half per cent is usually reckoned as a fair margin to allow for depreciation of the plant on land installations; perhaps at sea this might be a little heavier, say, ten per cent. As for maintenance, I think that two per cent would cover this item. So we get twelve-and-one-half per cent as an annual charge on the capital outlay of the installation. I think that the comparison which I have endeavored to make between the two systems, that is, the donkey boiler with its scattered units and long lengths of steam piping, and the suction gas plant, with its centralized generator, gives the case fairly for each system.

Effect of Electric Power on Transvaal Gold and Coal Mines.

The commission appointed by the Transvaal government to consider the desirability or otherwise of establishing large power companies, having regard to the effect upon the gold and coal industries and upon the country generally, recently commenced its sittings under the chairmanship of Sir Thomas Price. Its findings, United States Consul Edwin N. Gunsaulus, of Johannesburg, South Africa, reviews as follows:

According to published reports of the hearings, a statement summarizing information obtained from a number of mines was submitted on behalf of the Victoria Falls and Transvaal Power Company (Limited). Under the heading of capital expenditure it was pointed out that for substantial additions to existing plants the saving will be about $5,353 per 1,000 tons of monthly capacity. For large plants which are being newly equipped the leading engineers estimate a saving varying from $5,840 to $9,733 per 1,000 tons of monthly capacity, equivalent to a saving from twenty-five to forty per cent on the total capital expenditure for reduction plants. One of the leading engineers gave an instance of a mine property being brought to the producing stage by being able to purchase power, and, in addition, the saving effected permitted the erection of an additional forty stamps and a proportionate increase in underground developments.

Any means for effecting a saving in capital outlay on plant will materially benefit small mines. In the case of a mine having a short life it is manifestly to its advantage to be relieved from sinking money in plant which may become useless before it is worn out. The engineers of the various mining groups estimate a reduction in working costs of from twelve to twenty cents per ton milled, after allowing for interest and redemption of the capital expenditure necessary to convert existing steam-driven plants to electric drive.

The use of purchased electrical power will enable the mines to save the water now used for generating steam and to utilize it for reduction operations. It is variously estimated that total conversion of a steam-driven plant to electricity will result in a saving of from 120 to 140 gallons of water per ton milled. On the basis of tons milled in the Witwatersrand area during 1908 the saving of water, taking thirty-five kilowatt-hours per ton milled, would amount to at least 800,000,000 gallons of water per annum. During the year 1908, 18,200,000 tons of ore were milled; the coal consumption of the mines in the Witwatersrand area during the same period was 2,124,000 tons, being an average of 235 pounds of coal per ton milled. The mining groups estimate that the tonnage milled in 1911 will amount to 25,000,000 tons. It is a fact that the coal consumption per ton milled by steam-driven plants decreases as the tonnage milled increases. Taking a basis of thirty-five kilowatt-hours per ton milled and a coal consumption of four pounds per kilowatt-hour delivered, the coal consumption per ton milled, if power were purchased, would amount to 140 pounds, which shows a saving of approximately thirty per cent.

Against this reduction, however, must be set the prospective increase in tonnage to be milled in 1911 of 7,000,000 tons, which it is contended will be largely due to the knowledge that cheaper electric power will be available. On a complete electrification of the mines in the Witwatersrand area, the decrease in coal consumption between 1909 and 1911 on the above consumption will amount to some 370,000 tons, or, in other words, to about twelve per cent of the total coal sold from Transvaal collieries in 1908. But as electrification is only contemplated to affect about thirty-five per cent of the tonnage milled, the coal used for the purposes of the gold-mining industry will show an increase of about 100,000 tons in 1911 as compared with 1908. It is contended that the fears expressed of any violent dislocation of the coal-mining industry cannot reasonably be justified.

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YEAR'S ISSUE OF SECURITIES.

IMPORTANT DEVELOPMENTS THIS MONTH AND NOVEMBER.

Railroad systems, traction companies and industrial corporations in the United States have issued during the first nine months of 1909 new bonds, notes and stocks aggregating $1,217,305,080, which compares with $1,073,354,626 in the first three-quarters of 1908, showing therefore an increase of $143,950,450. During September several very large railroad loans were to have been offered for public subscription, but conditions were so unfavorable that in each instance delay was decided upon. However, although bond issues fell off, as compared with a year ago, stocks were put out in larger volume September's total contribution to the year's new securities was $151,014,000, an increase of $97,698,250 over 1908, due wholly to stock issues by industrial companies.

The September issues of new securities, as compiled by *The Journal of Commerce* and *Commercial Bulletin*, follow:

RAILROADS.	Sept., 1909.	Sept., 1908.	Change.
Bonds	$11,676,000	$ 5,500,000	+$ 6,176,000
Notes	6,160,000	20,500,000	— 14,340,000
Stocks	17,528,000	700,000	+ 16,828,000
Total	$35,364,000	$26,700,000	+$ 8,664,000
INDUSTRIAL COMPANIES.			
Bonds	$ 8,500,000	$21,800,000	—$13,300,000
Notes			
Stocks	107,150,000	4,815,750	+102,334,250
Total	$115,650,000	$26,615,750	+$89,034,250
Grand total	$151,014,000	$53,315,750	+$97,698,250

The final quarter of 1909 promises to bring heavy offerings provided the market for investments revives. Instead of bonds bearing a fixed rate of interest, however, stocks will be substituted, wherever possible, as the average investor is today disinclined to accept a low return upon his capital and the extraordinary advance on the New York Stock Exchange has emphasized the possibilities of appreciation in the value of stocks as contrasted with bonds. The New Haven Railroad is to issue $40,000,000 new stock, while the Pennsylvania Railroad is to offer at least twice that amount later in October. The general improvement in industry which is confidently looked forward to encourages the hope that industrial as well as railroad stocks will increase in earning capacity, and that higher dividend rates than those now current will be paid by numbers of companies next year.

The telephone business of the United States is designed, according to competent authorities, to become of even greater importance, from a financial standpoint, than even the steel industry. The American Telephone and Telegraph Company is rapidly extending its ramifications by absorbing other companies and developing new territories. Consequently a great deal of new capital has had to be provided. During September the New York Telephone Company increased its capital stock from $50,000,000 to $100,000,000. Another huge industrial issue last month was one of $47,000,000 by the General Motors Company, although there has been no public offering of the new stock; it is claimed by officials that this concern now controls some twelve companies, and that it is bent upon increasing its plants. These two items account for the increase in September's output of securities as compared with the corresponding month of last year. The brighter trade outlook has also fostered an increase in the working capital of numbers of industrial enterprises.

Total authorizations of new securities this year have reached the enormous total of $1,997,024,040, against $1,632,600,672 in 1908, an increase for the current year at the rate of $1,000,000 per diem, or, to be exact, $364,423,368. The great difference between the amount authorized and the amount actually issued is due in part to the poor absorption of new securities already referred to, but it should be explained that in many cases directors formally authorize new capital to be issued later on, but when the stocks or bonds, as the case may be, are actually disposed of no public announcement is made. In considering the financing done in this country no great attention need be paid to the mere authorizations, the issues constituting a more correct guide to the true position. Even the $1,217,305,080 put out this year does not represent strictly new financing, as much refunding has been taken care of, especially as it has been necessary to prepare to meet an enormous quantity of short term notes falling due in 1910—an aftermath of the forced financing done during the monetary stringency that prevailed in 1906-1907.

The following is a detailed list of the industrial bonds and stocks authorized and issued during September. The actual distribution of every item given under the head "issued" may not have been effected; a certain amount of latitude must be allowed so as to present a fair record of the new financing, since frequently no definite announcement is made of the actual placing of loans publicly authorized:

INDUSTRIAL BONDS.		
American Cement, Phila.	$ 300,000	$ 300,000
Big Lost River Irrigation, Idaho	2,000,000	2,000,000
Broad Exchange Building.	3,450,000	3,450,000
Bronx Gas, New York City.	1,500,000	.....
Bush Terminal	12,000,000	.....
Fremont (O.) Power	500,000	500,000
Los Angeles Gas	15,000,000	.....
St. Clair Co. Gas, Illinois.	250,000	250,000
Wilmington (Del.) Gas	.....	2,000,000
Total	$ 35,000,000	$ 8,500,000
INDUSTRIAL STOCKS.		
American Cement, Phila.	$ 350,000	$ 350,000
Canada Cement, Ltd.	.....	5,000,000
Citizens' Tel., Gd. Rapids.	1,500,000	1,500,000
Cluett, Peabody & Co.	11,000,000	.....
General Motors, New York	47,500,000	47,500,000
Gosnold Mills, New Bedford	550,000	550,000
Laurentide Paper, Que.	1,000,000	1,000,000
New York Telephone	50,000,000	50,000,000
Ohio Fuel Supply, Colo.	2,000,000	1,000,000
Scranton Electric	4,000,000	250,000
Tacoma Gas	4,500,000	.....
United Fuel Gas, W. Va.	9,750,000	.....
Total	$132,150,000	$107,150,000

Why Not?

Under the caption "Electrification of Industries," the following letter appeared in the Chicago *Tribune* of October 8:

Chicago, October 7. "[Editor of the Tribune.]—The Railway and Engineering Review, speaking of the Snow ordinance for the electrification of the railways in Chicago, says:

"The ordinance professedly is introduced not as a club to the railroads, but with the determination of forcing the smoke nuisance to the issue once for all. But the railroads do not make all the smoke of the city—not more than one-tenth of it, is the competent estimate. To electrify all industrial power of the city, by the way, would cost only a fraction and work only a small portion of the hardship involved in the wholesale railway electrification."

Let us grant the contention. It is not at all chimerical. Consider the loss caused by distribution of coal from the mine to the furnace, estimated as high as 50 per cent, not to mention the loss by smoke, and the waste of ash disposal, furnace space, etc., the danger of the thousands of power plants scattered all over the city, and the many nuisances caused by the transportation of coal and cinders, by the smoke and gases of the furnaces, and the fire risk in every shop and factory. The city of Chicago has not only the power of the drainage canal, but it has the immense coal deposits within practical reach, where power plants could be established, burning the run of mine without waste, and transforming the energy so that it could be transmitted to the city for all purposes of heat, light and power probably with greater economy than the already antiquated system of transporting the coal. You may say that this is quite as feasible as that man will fly, and I think so myself.

JOHN T. BRAMHALL.

Extends Third Rail Zone.

The New York & Harlem Railroad Company has begun laying the third rail between Mount Vernon and White Plains, N. Y., for the extension of its electric zone.

Owing to the inability of the company and the local authorities of several towns along the line to come to an agreement the trains will jump the crossings without electric power.

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Important Decision Relating to Water-power Rights.

The State Supreme Court in session at Madison, Wis., has handed down the decision that the Southern Wisconsin Power Company may maintain the large dam which it recently completed at Kilbourn, across the Wisconsin River. This and the hydroelectric plant located there were described in our issue of August 28, 1909. The decision insures the construction of another large dam across the Wisconsin River at Prairie du Sac by the same company. The court proceedings against the company stopped the making of plans, but now the work will be taken up and plans completed.

The Wisconsin State Legislature granted the Southern Wisconsin Power Company a franchise to erect a dam across the Wisconsin River at Kilbourn, and the dam was built. The franchise gave the company the right to condemn lands necessary for flowage purposes. C. B. Whitnall, of Milwaukee, who owned a small tract of land on the river which is now submerged, and the Black Hawk Land Company, of which C. B. Whitnall is president, resisted the condemnation of their lands. The power company instituted proceedings against them in the Circuit Court, and won. The defendants appealed to the Supreme Court, where they lost again.

C. B. Whitnall and the Black Hawk Land Company contended that the Legislature has not the right to authorize the construction of a dam across the Wisconsin River, because the state constitution, as well as the ordinance of 1787, provided that all navigable waters leading into the Mississippi River "should be common highways and forever free as well to the inhabitants of the United States without tax, impost or duty therefor," and that this provision related to physical obstructions in the stream. They also contended that the real motive for the construction of the dam was the generation of waterpower, and that this was a private and not a public use.

In reply to the first contention, the court holds that the section of the constitution quoted does not relate to physical obstruction, saying that this decision is in harmony with repeated decisions of the United States Supreme Court. Further, the court holds, that the State Legislature has absolute power to grant the right to construct these dams, subject only to the right of the federal government to come in under the commerce clause of the United States constitution and take charge of the navigable waters within the state of Wisconsin. The federal government, however, had consented to the erection of the dam at Kilbourn. Replying to the second contention, the court says that the Legislature granted the franchise for the purpose of improving navigation, and that it did improve navigation, and in nowise interfered with it. Perhaps the most important part of the decision was the statement that the generation of hydraulic power for public purposes is a public use and authorizes the condemnation of private property by right of eminent domain.

This decision, besides insuring the construction of the dam at Prairie du Sac, will cause new projects to be put on foot for generating waterpower on the rivers in Wisconsin. The Prairie du Sac project will furnish cheap electric power for the city of Madison and a good part of Southern Wisconsin. Madison is about twenty-five miles from the proposed site of the dam.

The same court held that the dam at Marshall, Wis., cannot be destroyed in order to create a drainage district. The towns of York and Medina recently were organized into a drainage district, which contemplated the removal of the dam, thus destroying the pond. The Circuit Court refused to confirm the preliminary report of the drainage commissioners, holding that the pond created by the dam constituted navigable waters of Wisconsin, and could not be destroyed under the drainage acts. Upon appeal to the State Supreme Court, the Circuit Court was upheld. M.

The Dielectric Strength of Air.

An important research on the dielectric strength of air has recently been undertaken by E. A. Watson of the University of Liverpool, England, and is given as a paper, together with the discussion that arose on it, in the August number of the Journal of the (British) Institution of Electrical Engineers. The potential difference necessary to cause a spark to pass between two small metal spheres at various distances apart, in air, was carefully measured, at air pressures between one and fifteen atmospheres. At the latter pressure it was found that air will stand an electrical stress of 40,000 volts per millimetre, a fact which may soon find an application in apparatus where high insulation is required.

New Queens Bridge Trolley Line for New York.

The New York Board of Estimate has granted to the Interborough Company, which controls the New York & Queens County Railway, a temporary permit to operate its cars over the Queensboro Bridge until the permanent franchise is granted. John Campbell, treasurer of the company, assured the board that passengers on the New York & Queens County lines would be transported over the bridge without paying an additional fare.

The Public Service Commission agreed to the necessary permission for operating the "shuttle" service across the bridge until final disposition is made of the company's application for a permanent franchise, which is pending before the Board of Estimate and Apportionment.

Electrochemical Development in Norway.

The plant of Messrs. A. S. Rjukanfas, of Christiania, Norway, for the production of nitrates from atmospheric nitrogen, is being installed as fast as possible, and when completed will be the biggest of its kind in the world. One-half the order for the electromechanical equipment has been given to the well-known firm of Brown, Boveri & Company, of Baden, Switzerland. This large order consists of five three-phase generators, each rated at 17,000 kilovolt-amperes (at 0.6 power-factor), at 10,000 to 11,000 volts and fifty cycles, with direct-coupled exciters of 130 kilowatts, for coupling to water turbines of 14,000 horsepower at 250 revolutions per minute. Each generator will weigh about 200 tons, the diameter being nearly twenty feet.

Traction Company to Issue Bonds.

An issue of bonds by the Connecticut Valley Street Railway Company not to exceed $700,000 par value has been approved by the Massachusetts Board of Railroad Commissioners. Of the proceeds of the issue, $500,000 is to be applied to the payment and refunding of bonds of several street-railway companies which have consolidated with the Connecticut Valley company. The balance is to be devoted to the payment of the floating indebtedness of the company and to improvements on the road.

The tramways committee of the thriving Yorkshire city of Leeds, England, has decided to promote a bill in Parliament for the construction of a trackless-trolley system in that city.

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American Street and Interurban Railway Association.

Annual Convention of the American Street and Railway Association, Accountants' Association, Engineering Association, Claim Agents' Association and Transportation and Traffic Association, Denver, Colo., October 4-8.

The twenty-eighth annual convention of the American Street and Interurban Railway Association was a distinguished success from every point of view. Beginning with the inception of arrangements the elements contributing toward an enjoyable and profitable convention season had moved along so that with the arrival of the special trains from all sections of the country there was never a moment's doubt that this convention would be a fitting successor to the memorable meetings which have heretofore been held. Special trains were run from New York, Boston, St. Louis and Chicago. The special from New York was over the lines of the Pennsylvania, Chicago & Northwestern and Union Pacific railroads. This train made a special run and broke all previous records between Omaha and Denver, making the run in twelve hours and thirty minutes, the fastest previous run being thirteen hours and forty minutes. The trip from Chicago over the Burlington was particularly enjoyable, a luxurious equipment being provided and every provision made for the enjoyment of the passengers.

The entertainment features were distinguished by a large attendance and thorough enjoyment. These included sightseeing trolley trips, automobile rides, the fifth annual supply men's amateur vaudeville and theatrical performance, a wild game barbecue at the White City, and a theatre party at the Broadway Theatre, where Mrs. Leslie Carter was seen in "Vasta Herne." Then there was a brilliant reception on Monday evening, informal dances each evening throughout the week at the Brown Palace Hotel, and a remarkable all-day excursion to Corona, 11,660 feet above sea level, over the Moffat route. An unlooked-for feature which was greatly enjoyed was the concert given to the Manufacturers' Association by Cook's fife and drum corps. This remarkable marching organization has traveled 90,000 miles to give concerts before G. A. R. encampments, and was organized by Colonel Cook, of Denver.

American Association.

The first session of the American Street and Interurban Railway Association was called to order by President James F. Shaw at 2:30 p. m. on Tuesday. The report of the executive committee was read by Secretary Bernard V. Swenson and accepted.

Following the reading of the reports of the secretary and treasurer, President Shaw delivered the annual address. Mr. Shaw paid a glowing tribute to the importance of Denver as a city for the citizens and as a street-railway center. He pointed out the justice and necessity of holding the convention in this western city, and commented especially on the value to the association work of the membership of the western companies. He called attention to the magnitude of the electric-railway companies. In round numbers there are 1,250 operating street and interurban railway companies in this country, with a total of 35,000 miles of single track and 75,000 passenger cars. The total number of passengers carried annually is 10,000,000,000, and the gross annual income is $440,000,000. The total outstanding par value of stock and bonds is nearly $4,000,000,000, and 225,000 salaried employes and wage-earners engaged in these properties receive more than $150,000,000 in compensation for their services.

Mr. Shaw stood squarely upon the proposition that the increased investment necessary in modern equipment made imperative in many cases an increase in rates and rendered particularly burdensome any form of taxation which penalizes the pioneer and man of courage who projected these great enterprises. The improvement in general business and financial conditions and the demonstrated stability of street-railway properties are rendering the marketing of bonds easier, and in all probability there will be released for investment and development a continually growing amount of money.

Mr. Shaw sketched the work which the association had successfully undertaken, the changes which had been brought about and the necessity for co-operation between every element of the organization. The work of the affiliated associations was touched upon, and particular emphasis laid upon the magnitude and value of the manufacturers' exhibit.

The reports of the Committee on Subjects, of the Committee on Active Membership, of the Committee on Associate Membership, and of the committee to Consider Suggestions Contained in the Address of President C. G. Goodrich before the 1908 convention were received and acted upon.

One of the important suggestions made by Mr. Goodrich related to the separation of the meetings of American Association and its affiliated associations. In the report of the present committee it was the sense of the committee that no change be made in reference to the holding at the same time and place the annual meeting of the American Association and its affiliated associations, but that the annual meeting be supplemented by a conference to be held in the city of New York at the time of the winter session of the executive committee, which conference shall be opened only to the president or other duly accredited representatives of the member companies, and which shall consider in executive session such matters as may be deemed of pressing interest and report to the executive committee in respect to policy.

Ernest Gonzenbach, president and general manager of the Sheboygan Light, Power and Railway Company, Sheboygan, Wis., read a very interesting paper entitled "Organization, from the Standpoint of the Smaller Companies." Mr. Gonzenbach analyzed the conditions under which the work of both the larger and smaller companies were similar and indicated the lines wherein each departed from the other. Mr. Gonzenbach was strongly in favor of a strict adherence to a military form of organization and the proper training of subordinates in every department so that the company might never be left upon the resources of an individual.

This paper was discussed very agreeably by D. A. Hegarty, of Little Rock, Ark.; P. P. Crafts, Clinton, Ohio; Mr. Foster, of New Orleans; H. W. Blake, of the *Electric Railway Journal*, and Gen-

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eral George H. Harries, of Washington, D. C.

Mr. Blake said that the reference to the statement which Mr. Gonzenbach had made in his paper concerning the difficulty of securing men properly equipped to handle car maintenance problems was important and that probably these suggestions should be considered in connection with the work of the committee on education, looking to the education of young men by railway companies for this character of the work.

General Harries warmly endorsed Mr. Gonzenbach's idea of a military organization and described briefly some of the instances in his career which substantiated the estimate of the value of such organization by Mr. Gonzenbach.

The report of the committee on education was presented by Mr. Blake in the absence of the chairman of the committee, Professor H. H. Norris.

The Wednesday meeting of the association was devoted to a discussion of the report of the committee on interstate commerce commission affairs and the report of the committee on compensation for carrying United States mail. The discussion on the latter subject was not completed and was carried over until the next session.

The last meeting of the American association was held on Thursday afternoon. The report of the committee on compensation for carrying United States mail was approved. The report of the committee on insurance and public relations was discussed at length.

The report of the committee appointed last year on an electric railway dictionary to be published by the McGraw Publishing Company was presented by Paul Winsor of Boston. Progress is being made with the work and it is expected that before the next convention the compilation and publication will be completed.

The report of the committee on the award of the J. G. Brill Company prize for the best essay on the subject "Design of an Electric Railway Car for City Service," was announced.

The report of the committee on nominations was presented. This report was accepted unanimously and the following declared officers for the ensuing year:

President, James F. Shaw, chairman board of directors, Boston & Worcester Electric Companies, Boston, Mass.

First vice-president, Arthur W. Brady, president, Indiana Union Traction Company, Anderson, Ind.

Second vice-president, Thomas N. McCarter, president Public Service Railway Company, Newark, N. J.

Third vice-president, George H. Harries, second vice-president, Washington Railway Electric Company, Washington, D. C.

Fourth vice-president, Charles N Black, vice-president and general manager, United Railroads of San Francisco, San Francisco, Cal.

The executive committee of the association consisted of these gentlemen and the presidents of the four affiliated associations who were elected as follows:

H. S. Swift, secretary Toledo Railways & Light Company and president of the Accountants' Association.

F. H. Lincoln, assistant general manager Philadelphia Rapid Transit Company and president of the Engineering Association.

E. C. Carpenter, claim agent, Indiana Union Traction Company, Anderson, Ind., and president Claim Agents' Association.

R. I. Todd, vice-president and general manager, Indianapolis Traction & Terminal Company, Indianapolis, Ind.

After a brief address by President Shaw, who thanked the members for the honor conferred upon him in re-electing him to office, he called upon the four vice-presidents, each responding in turn.

Several resolutions were passed voicing the appreciation of the association for the courtesies extended by the Denver City Tramway Company and its officers, for the splendid work of the Manufacturers' Association, to the technical press, to the officials of Denver, and the members of the American Association and its affiliated associations.

Accountants' Association.

The meetings of the Accountants' Association were held on Wednesday morning at the Savoy Hotel, and on Thursday and Friday in the Rose Parlor of the Auditorium Building. In addition to the annual address of the president, the reports of the executive committee, the secretary-treasurer, the committee on standard classification of construction and equipment accounts and form of report, the report of the joint committee on shop accounting and routine business, the following papers were presented:

"Interurban Statistics" by S. C. Rogers, treasurer and secretary, Mahoning & Shenango Railway & Light Company, Youngstown, Ohio.

"The Census and Electric Railway Statistics" by W. M. Steuart, chief statistician for manufacturers, Bureau of Census, Washington, D. C.

"The Electric Railway Auditor, his Duties and Relation to the Organization," by W. B. Brockway, chief accountant, Ford, Bacon & Davis, New York, N. Y.

"Pay-rolls and Time-keeping," by N. E. Stubbs, auditor, United Railways & Electric Company, Baltimore, Md.

"Stores Accounting and Inventory" by E. S. Pattee, secretary and controller, Twin City Rapid Transit Company, Minneapolis, Minn.

The following officers were elected:

President, H. S. Swift, secretary and auditor, Toledo Railways & Light Company.

First vice-president, A. L. Linn, Jr., general auditor, New York State Railways.

Second vice-president, A. S. Michener, comptroller, Stone & Webster Management Association.

Third vice-president, N. E. Stubbs, auditor, United Railways & Electric Company of Baltimore.

Secretary-treasurer, H. E. Weeks, secretary and treasurer, Tri-City Railway.

Executive committee, Robert N. Wallis, treasurer, Fitchburg & Leominster Street Railway; W. J. Thorp, auditor, Little Rock Railway & Electric Company; R. Morrison, Jr., secretary, Michigan United Railways; D. S. Mitchell, auditor, Pittsburgh Railways.

Engineering Association.

The first session of the Engineering Association was held on Tuesday afternoon, October 5. Paul Winsor, of Boston, president of the association, called the meeting to order at 2:15 o'clock and presented the annual address. Mr. Winsor referred to the wide distribution of the reports of the committees and asked for a full discussion. He emphasized the importance of the work the association was doing and the benefits which every member could derive by taking a wholesome and consistent interest in the work. He called attention to the untiring efforts which secretary and treasurer Corning had expended in furthering the work of the association and in facilitating the preparation of reports by the officers and committees.

The president announced that he would be obliged to attend the meeting of the American Association and Vice-president F. H. Lincoln took the chair. The reports of the executive committee and of the secretary and treasurer were presented and accepted.

The report of the committee on way matters was then taken up.

The committee has given its principal consideration to the subject of "The Use of T-rails in Paved Streets," and also submits a brief report on the subject of "The Use of Open-Hearth and Manganese Steel Rails." The committee recommends the use of T-rails in paved streets except where the traffic is confined to the railway strip or is so congested that the strip is continually used by vehicles. Under these conditions it is the opinion of the committee that a rail of girder section should be adopted, preferably sections following closely the lines of the two Trilby rails recommended by the committee on way matters of the American Street and Interurban Railway Engineering Association of 1907. In this section the rail is made coin-

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cident with the wheel loading, seven inches and nine inches in depth, and at the same time provided with a deep, roomy, self-cleaning groove that incidentally does not increase power consumption, besides a substantial, heavy beveled head to suit the street paving, and which allows a maximum wear. In regard to the use of open-hearth and manganese steel rails the committee has received reports from only thirteen companies that have used open-hearth rails and but one company that used manganese rails. This service has been of such short duration as to preclude any recommendations based on actual experience.

The discussion on this report was opened by C. H. Clark, Cleveland, Ohio. Mr. Clark did not think that the rail with the seventeen-thirty-seconds-inch web was quite strong enough. Concerning the laying of tracks in Cleveland, he puts ten inches of concrete longitudinally under the rail and digs tie holes to the bottom. With a five-inch tie there is five inches of concrete under the tie and ten inches under the rail between the ties. They put in concrete first between the ties and under the rail, and then fill the space left in between with dirt so as not to have over five inches of concrete under the pavement. Concerning T-rail construction he is in favor of this but considers that in the larger cities where the teams follow the track there is some uncertainty about the pavement holding up unless granite is used.

George Weston, Chicago, said that the Chicago City Railway Company and the Chicago Railways Company are confined to the use of a grooved type of rail by ordinance. It is his impression that engineers prefer a T-rail track where the pavement can be laid so as to withstand traffic and abrasion. The Calumet & South Chicago Railway Company has recently had an ordinance passed which carries with it the right to allow the use of Shanghai rail track construction on certain streets in outlying districts. Very little T-rail construction has been laid up to this time, and where it has been installed it has met with serious objection from aldermen and other city officials and teamsters and citizens generally. Up until about two months ago the paving done with the T-rail track construction was brick with a groove in the brick that fitted up against the rail and the flangeway ran in a groove formed by the track. Heavy teaming resulted in the abrasion or breaking down of this groove or nose on the side of the track. Mr. Weston did not approve of digging the tie holes for steel ties as suggested by Mr. Clark. He has concluded that the better construction is to excavate the track to one level throughout and have the concrete all of the same level, and roll the foundation. In rolling the foundation a great many soft places are discovered which would probably not be found if the roller were not put on. It is expected that ties treated with chloride of zinc will be preserved against decay when imbedded in concrete. It is intended to preserve the tie from destruction by the action of the rail by the use of tie plates in street-railway construction where the track must be built and the street closed before the cars can be put on the track. It is necessary to have the tie-plate home and in place before the cars can be put on the track in order to have the tie-plate become a part of the tie. In Chicago it is fastened to the tie with lag screws, and if there is any movement of the rail it expends its action on the tie-plate and does not destroy the fiber of the tie. The basis of the Chicago construction has been a substructure and a superstructure intended to keep the concrete and tie intact, using screw spikes and renewing the superstructure as might become necessary. Mr. Weston said he had considerable trouble with the paving coming up both on the inside and outside of the rail.

Mr. Clark said that in Cleveland with all new tracks they are now laying a six-inch vitrified sewer pipe buried in ashes. This pipe is laid in the center between the tracks about a foot below the bottom of the ties, and connected with every manhole at about every fifty feet. An open space is left about a foot wide which is filled with broken stone. Mr. Weston said that in Chicago he has recently adopted a method of putting in track drains, particularly at street intersections, in the hope of reducing the trouble from water getting through the joints.

R. C. Cram, of Connecticut, described a track construction under girder rail where a trench nineteen feet wide, two feet below the grade of the top rail, is used. Across the trench there is a concrete trough with sides, strips outside, sloping slightly from the center. This trough is drained at about every one hundred feet, or at every point where a manhole is located. On the concrete foundation either crushed stone or gravel is laid, and the hard track construction, well tamped, is put on top of this. Then the pavement is placed on top of that, using a six-inch concrete piece and the ordinary cushion, above this brick or asphalt or wood blocks. This makes a very good construction, overcoming the chief cause of trouble, which apparently is a poor, yielding base. The company is not in favor of girder rail and does not use it except where the political conditions compel it. They are thoroughly in favor of the T-rail, and even for work in a small town it is found that they can construct a five-inch or even a six-inch macadam roadway with this rail and have very good success with it. It is his impression that when the various forms of girder rail are considered and the expense of rolling these and making special rollers is taken into account, the T-rail is preferable.

W. H. McAloney, of Denver, in reply to a question, said the heaviest car on the Denver City Tramway system, forty-three feet, three inches over all, with a seating capacity of fifty-two, and equipped with four forty-horsepower motors, is 43,000 pounds. He thought, however, that the weight of the car would hardly determine the question as to what type of rail to use. A twenty-ton car, stopping every two minutes, could be operated on the same section of rail or roadbed longer and with less damage to the track than could a fifteen-ton car stopping every thirty seconds. The thrust of the car has a great deal to do with the damage done to the track.

M. Schrieber, of Jersey City, N. J., called attention to the great number of sections which are in use today. This means that the steel companies are paying out money to store and keep in repair these different rolls and are paying money on an investment that should in a great part be wiped out. It is to be hoped that the seven sections suggested will be adopted as standards and that railway companies will begin to order the rail for their renewals according to these standards.

A letter from C. G. Young, of New York city, was read. Mr. Young stated that the companies and cities which have had the greatest experience with T-rails in paved streets are its strongest advocates. With regard to paving where a concrete paving is used it is acknowledged that a smooth type of paving surface is preferable to a granite block. The block paving is generally expensive, is noisy, retains water in the joints, and the late Colonel Waring, who was Commissioner of Street Cleaning in New York city, estimated that the cost of cleaning rough pavements would pay the interest and depreciation on the total cost of smooth surface pavement. If the general use of granite pavements is discarded it is immediately found that the principal argument in favor of a grooved or flanged section of girder rail disappears. He was of the opinion that it is quite safe to assume that if we had not started with the use of granite block paving we would now be using a much greater percentage of T-rails in paved streets.

In closing the discussion, Mr. Ackerman presented several recommendations for the committee on way matters: For track construction where the type of pavement will permit, as in a macadam or other shallow pavement, T-rails weighing not less than eighty pounds per yard; for the heaviest service in connection with deep block pavements, T-rails seven inches high, six-inch base, seventeen-thirty-seconds-inch web, two-and-three-fourths by one and eleven-sixteenths-inch head, and weighing about one hundred pounds per yard; for light service in connection with deep block pavement, T-rails seven inches high, six-inch base, seven-sixteenths-inch web, two-and-one-half by one-and-nine-thirty-seconds-inch head, and weighing eighty pounds per yard; for heavy service in connection with deep block pavement on streets where the traffic is confined to the railway strip have Trilby sections as shown in Volume I of the Proceedings of the Engineering Association for 1907.

After considerable discussion it was moved and carried that the recommendations be referred to the committee on standards with instructions to pass upon them as soon as might be consistent. It was also moved and carried that the paper

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as a whole be received with a hearty vote of thanks to the committee.

WEDNESDAY MORNING SESSION.

The Wednesday morning session was called to order at 9:45 o'clock. The report of the committee on equipment was taken up.

The committee on equipment, owing to the enlargement of its scope, embraces in its report the work covered by the committee on maintenance and inspection of electrical equipment, control and economical maintenance. Its duties also include suggesting to the committee on standards any new and appropriate standards or desirable changes in existing standards relating to equipment. This report was voluminous and replete with valuable information concerning the following topics: Economical maintenance, car weights as affecting operating costs, carbon brushes, steel tired vs. rolled steel wheels, proposed standards for rolled steel wheels, proposed change of flange contour for interurban wheels, proposed gauge for mounting car wheels, heat treated carbon steel axles, knife vs. snap switches for car and carhouse light circuits, impregnation of field coils, 1,200-volt direct-current car equipment, and recent developments in railway motor control. Direct current at 1,200 volts has been adopted in preference to 600 volts as the trolley potential of a number of interurban and other railways on account of lower first cost and lower cost of operation. With dense traffic, where cars are required to run on a very close headway, consequently giving practically a uniformly distributed load, the substations at 1,200 volts can be located twice the distance apart as at 600 volts for the same maximum per cent line loss. The adoption of commutating poles has made the operation of 1,200-volt generators entirely practicable. Either the third rail or trolley wire can be used for carrying current to the car. No radical departure from standard 600-volt practice is required in the line construction to insure a safe insulation. The catenary form of suspension is usually recommended. The committee proposes for adoption standards for rolled steel wheels, as shown in the report.

A communication from John Lindall, superintendent of rolling stock and shops of the Boston Elevated Railway, was read. With regard to the committee suggestion with reference to trolley wheels, that it is economical to increase the life by increasing the diameter on suburban lines and later transferring them to city lines, Mr. Lindall discarded it. He is of the opinion that in order to maintain perfect contact between trolley wheel and wire it is very desirable to make the wheel and outer end of the pole as light as possible, and on some of his heaviest and fastest equipment he has been able to obtain better service from a four-inch wheel than from larger wheels of the same composition. It is also desirable to have a certain amount of spring in the trolley pole where this can be obtained without interference with the trolley wire at low points. With regard to car weights as affecting operating costs, undoubtedly much of the present unnecessary weight in cars is due to lack of proper appreciation of the cost of carrying weights and to patch-work methods of overcoming failures. Where failures occur it is the usual practice to increase the strength at that point by increasing the weight without giving consideration to the removal of the cause of the failure or obtaining more suitable material.

Considerable discussion brought out the opinion that increasing the diameter and slotting eliminated a great many troubles.

The point was also brought up that after the commutators have been grooved careful attention must be given to cleaning out the slot. In this connection Mr. Evans stated that in the device used in Buffalo an air jet is kept playing on the groove, which serves the double purpose of keeping the dust out of the operator's face as well as cleaning the slots.

In reply to a question, Mr. Taylor said that in slotting out the commutators he used saws proportionate to the thickness of the mica. Various saws are used and the endeavor is made to get a saw that is about the same thickness of the mica. As far as the diameter is concerned, this will run from one to two inches.

With regard to trolley-pole tension, Mr. Roberts said that the regulations require the trolley wire twenty-two feet above the track. In one place eight railroad tracks are crossed and there are some bad curves. He is using a twelve-and-one-half-foot pole with a tension of twenty-five pounds.

In opening the discussion on car weights as affecting operating costs, M. V. Ayres, who had charge of this section, stated that it had been a matter of surprise to him to discover the proportions of the effect of weight in any consideration. One of the first ways to approach the matter is to consider the effect in increasing power consumption. This, however, is not simple, because, although the cost of power should be somewhere near proportional to the weight, his study of the subject had impressed him with the idea that there were many other considerations involved.

Mr. Schrieber said that he had occasion to make some computations to determine whether it would be better to operate with five twenty-ton cars on one line of his road or to operate four forty-ton cars, intending in the latter case to increase the speed of the cars. One of the situations which immediately arose was the fact that in order to operate the heavier cars three or four bridges on the line had to be strengthened in order to take the extra load. This, of course, is an extraordinary case, but it indicates the other things which arise in making these determinations. The general conclusion was that it was not economical to operate the forty-ton cars in place of the lighter cars even if one car could be taken off.

In discussing this question, Mr. Lincoln said that much could be accomplished by educating the men to regulate the consumption of current. There are many divisions on the road where no current at all is needed, and others where either series or parallel connections will make a considerable difference in the overall consumption of current.

Mr. Roberts said that three men were selected on his road and put on their mettle to make a good showing. One of the three men operated the car over the specific distance with a ratio of consumption of 219 to 187 to 160.

Mr. McAloney called attention to the elimination of weight by the proper selection of the wood used in car construction. In many cases a lighter-weight wood could be used without sacrificing strength and without sacrificing appearance.

Mr. Evans called attention to the fact that by removing parts that were unnecessary if the car were always operated from one end, without taking into consideration at all the redesigning or remodeling of the car, he would be able to remove over 2,000 pounds. Apropos of this, he said that on one system he had experienced a great deal of trouble with broken axles. The cars were loaded pretty heavily and the axles were giving out. A heavier truck was designed, with heavier axles and heavier wheels. While the earlier trouble was eliminated, it was found that it was transferred from the breaking of axles to trouble with the track.

The question of carbon brushes was next taken up. L. W. Vacques, under whose direction this portion of the report was prepared, said that the improvement that has been made by the manufacturers within the last two years is very noticeable, although no specifications have yet been made and can hardly be made under the different conditions which apply owing to the grooving of commutators, the grades of mica, etc. Much good will be done by the engineers co-operating with the manufacturers and making tests for individual cases. The tests that were recommended last year have been carried out by most of the manufacturers, and they are using that test now before furnishing brushes to the railway companies. It is noticeable that twenty-three companies have gone from the low-grade to the high-grade brush within the last year, with the greatest satisfaction.

The section on steel-tired versus rolled steel wheels was taken up. The suggestions of the committee were referred to the committee on standards for action as promptly as possible. It was moved and carried that the recommendation of the committee to change the flange contour from the adopted standard be stricken from the report.

The recommendation covering the gauge for mountain wheels was referred back to the committee. The following resolution, "That the Engineering Association take up and investigate the question of a desirable system for the government and instruction of regular apprentices in the mechanical trades in connection with the maintenance of the equipment of electric railways," was referred to the incoming executive committee.

WEDNESDAY AFTERNOON SESSION.

President Winsor called the meeting to order at 2:15 o'clock. The discussion of the report of the committee on equipment was continued.

W. P. Barber of the Midvale Steel Company, of Philadelphia, in answer to an in-

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quiry, said that his company had just completed 700 axles for the Interborough Rapid Transit Company, of New York City, after Mr. Doyle's specifications. Mr. Doyle included these specifications in the report which was prepared under his direction. These specifications called for 50,000 pounds elastic limit, twenty-two per cent elongation, thirty per cent discard. This requirement is superior to the requirements of the Bureau of Steam Engineering of the United States. What they call their Class A material requires 50,000 pounds elastic limit, twenty per cent elongation, and leaves it optional with the manufacturer whether he will put out heat-treated material or material containing the proper amount of nickel to give the additional extension while maintaining the elastic limit to a point above 50,000 pounds. Mr. Doyle's requirements can be reached and exceeded in the ordinary type of axle—say the 5.5 inch in diameter—by using a very pure carbon steel properly treated. The tests which were developed to meet this requirement brought out several curious facts. Few specifications today call for a cold bend. From axle material such as would pass the ordinary requirements—say 80,000 pounds tensile and 40,000 pounds elastic limit—with twenty per cent stretch, the same steel after it received the heat treatment made necessary by the requirements of the Interborough gave astonishing cold-bend results. While the untreated material which is represented in all axles now in use will give a cold bend which will break at about thirty per cent, the treated material having 20,000 pounds additional elastic limit, bent cold flat and bent down hard with no sign of failure. An axle is practically never bent; if it is it goes out of service, yet there is a species of axle failure which is the direct result of repeated bends applied progressively on opposite sides of the axle and various tests show that clearly, by rotating the piece and applying the stresses up to or near the elastic limit while the piece is being rotated.

J. L. Replogle, of the Cambria Iron Company, said that if he had any criticism to offer on the specifications it would be that they are not quite severe enough. This company had made several thousand axles for the Interborough to this specification. Very heavy hammers were used for forging these axles, this effect being shown on the end of the forging, which is convex, showing that the effect of the heavy blow has penetrated the forging and forced it from the center. His company is a firm believer in the absolute necessity of annealing. He does not believe that any forged products show their intrinsic value when without a hot treatment for forging. The axle should be put in the cool part of the furnace and gradually worked up to the heat, so that the interior of the forging would be of the same temperature as the exterior.

In reply to a question, Mr. Replogle said that he believed for an axle of five inches or 5.5 inches for service of this kind that no hammer under 10,000 pounds fall should be used, as he did not think there would be a proper penetration with a lighter hammer. He did not believe that this should be inserted in the specifications, however, as there are many axle manufacturers who do not have hammers of this weight and who even without that may be able to make a forging entirely in accordance with the specifications.

It was moved and adopted that this specification be referred back to the committee for further investigation and reported. It was also moved and adopted that the report of the committee on equipment be accepted and printed in the minutes, and that a vote of thanks be extended to the members of the committee.

The report of the committee on power generation was then taken up.

There do not yet appear to be any thoroughly definite conclusions that may be deduced from replies received that would be safe for the committee to advance upon the subject of flue-gas analyzers. It is conclusively shown from the many replies received that the efforts of engineers to make flue-gas analyses have caused many investigations into the actual conditions existing in boiler rooms, resulting in much closer attention to methods of firing and a correction of many defects in boiler and furnace settings. From the replies received this year it appears that opinion is divided upon the question of what benefit is to be derived from the practice of making flue-gas analysis. The committee believes that the subject should be referred to next year's committee for further investigation, possibly to the extent of causing experiments to be conducted along definite lines. With regard to steam meters, it was found that there was but very little information of a reliable nature to be obtained. There is quite an interest in the subject, and many engineers are looking for a meter that is reliable for measuring steam when steam is supplied to turbine or engines. The committee finds that it is practically impossible to make an extensive report on this subject on account of its inability to locate any steam meters in service measuring steam supplied to turbines and reciprocating engines. Such information as the committee has been able to obtain shows quite conclusively that the steam meter has not yet been developed to the point at which it may be said to be entirely satisfactory for measuring accurately the quantity of steam supplied to large units where the steam is superheated or of intermittent flow. With regard to characteristic features and operating records of low-pressure turbine plants, three years' operation has demonstrated that the exhaust, or low-pressure, turbine has fulfilled very largely the expectations of the manufacturers and designers, and the past year has witnessed a number of installations.

Charles Hewitt explained some tests which he had made with the boiler setting made impervious to several degrees to air infiltration, and indicated the great variation which the flue gas analyzed showed on the content of carbon dioxide.

B. F. Wood, of the Pennsylvania Railway Company, said that recent tests which he had made indicated that there is a peculiar diversity in the composition of gas depending upon what point in the flue the sample for analysis was taken from. Mr. Hewitt said that he also had found this to be the case and that almost any percentage of carbon dioxide could be obtained by taking the gas at different points.

Mr. Winsor said that while the question of gas analysis would perhaps not show much in itself it was a good way of studying what is being done in the boiler-room and firing-room, and shows whether the fireman was firing too heavily and leaving the door open too long; in this way many matters of interest are discovered.

The subject of steam meters was taken up. F. E. Case, of the General Electric Company, stated that the Recording Flow Meter will accurately record the rate of flow of steam in pounds per hour in any diameter pipe at any condition of temperature, pressure or moisture met with in commercial practice.

Mr. Hewitt said that the installation of a steam meter in his plant had revealed a very interesting state of affairs, which will ultimately pay for the meter in the saving that will be effected.

The subject of low-pressure turbine plants was then taken up. Mr. Hewitt said that he had two low-pressure turbines, each of 800-kilowatts capacity, in service, which have been working very satisfactorily for two years. With turbines carrying from sixteen to twenty per cent of the total load of the station the coal consumption has been reduced from an average of 4.4 to 3.75. If he had enough turbines to take all of the exhaust steam in the station it would undoubtedly be much better. The relative economy depends on the original design of the station. He is of the opinion that the percentage of economy is higher with non-condensing single-cylinder engines and somewhat less with non-condensing compound engines, and still less with compound condensing engines.

Mr. Roberts contributed a long discussion based on the committee's work.

In continuing the work of the committee it was suggested and adopted that they investigate the subject of condensers. At the present time information on condensers is somewhat mixed and there seems to be no standard either in design or cooling surface. This suggestion was later expanded to include the question of forced draft.

THURSDAY MORNING SESSION.

President Winsor called the meeting to order at 9:50 a. m. In introducing the report of the committee of standards, Mr. Winsor said it would be impossible, probably, to get a committee to agree on every item of a specification, although he opined that anyone's opinion of them would be that they were good in general.

The committee reports that no recommendations are submitted nor suggestions made for changes or alterations in the standards and recommended practices that have been adopted by the association at the 1907 and 1908 conventions. These standards have met with general approval and there is an increasing tendency to adopt them as standard practice with a larger number of the electric railway companies throughout the country. The fol-

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lowing is a summary of the committee's recommendations:

(a) Gears and pinions: That this subject be continued for another year.

(b) Standard taper for pinions: The adoption as a standard taper for pinions, the proportion of one-and-one-fourth inches in diameter to one foot in length.

(c) Standard gear ratios: That the subject be continued for another year.

(d) Specifications for wrought-iron bars and limit gauge with table of sizes for round iron: The adoption as standard of the specifications for wrought iron bars, as given on pages 6 and 7 of this report; also the adoption as recommended practice of the limit gauge for round iron and the table of sizes of limit gauges for round iron, as given on page 8 of this report.

(e) Axles: The adoption as standard of the specifications for steel axles, as given on page 9 of this report.

(f) Rubber-covered wire: The further consideration of this subject, as reported on by the committee on power distribution, favoring the adoption of the standard specifications of the Railway Signal Association, as suitable for the recommended practice of this association.

(g) Adoption of standards: The committee further recommends that the adoption of standards be by letter ballot, as given on pages 10 and 11 of this report, and also that the necessary changes in the constitution and by-laws be made subject to the approval of the executive committee.

(h) Reprinting of standards: The committee recommends the reprinting of the standards and recommended practices in the annual report of the association, as given on page 12 of this report.

Mr. Heywood said that the executive committee laid out certain work for the committee on standards, as follows: (a) Gears and pinions; (b) standard dimensions, with particular reference to standard taper for pinions; (c) standard gear ratios ;(d) iron for brake riggings; (e) axles; (f) rubber-covered wire. At the meeting which was held in Atlantic City it was decided that this committee did not have the proper matter before it definitely to recommend on these subjects, it being the ruling of last year's convention that matters for consideration by the committee should come from one of the other standing committees. It was brought to the attention of the chairman, however, that the committee on power distribution was considering the subject of rubber-covered wire, and that matter was referred back to that committee. The manufacturers' representatives were present to give their opinions on the standardization of taper and standard dimensions of gears. The consensus of opinion among them seemed to be that it was practically impossible to standardize the distance between axle and armature shaft centers at the present time. They were also at odds on the subject of standard taper, but that was a subject on which they thought they could get together later. The manufacturers brought up the point that the standards which had been adopted already were not being used quite as extensively by member companies as they would like to see them used, and it was resolved that this matter be brought to the attention of member companies through a circular letter to be sent out by the president of this association and endorsed by the president of the main association. It was brought out that some companies had bought material other than standard when they could just as well have bought standard material. The committee was helped considerably in its work by the Master Car Builders' convention, which was then in session at Atlantic City.

President Winsor remarked on the standardization work of the J. G. Brill Company, and said he had written to other manufacturing concerns, calling their attention to what the Brill people had done and asking them to do the same kind of thing.

W. G. Gove, of the Brooklyn Rapid Transit Company, said that his company has about 4,000 cars, of which about 3,400 are scheduled. The greatest real benefits to be obtained, he said, means the standardization of the organization, the standardization of the management, for that matter, but more than anything else the education of all to the possible value and benefits to be derived from the standardization of the equipment. His company had spent about $40,000,000 in the last five years in rebuilding the property and getting it in its present condition. Everyone of the ten operating companies comprising his company owned equipment six years ago, because the Transit Development Company, which is the latest company, had already begun the purchase of equipment, and on the elevated division it meant the co-ordination or really the standardization, with a view to the interchangeability of all the equipment. Mr. Gove proceeded to tell in detail of the efforts toward standardization his company had made. Referring to operating costs, he said that one cent per car mile, while a reasonably fair figure for the roads in the past, is a little difficult to reach sometimes with a large car, four-motor equipment, air brakes and large seating capacities. Continuing, he said that the moment you get a contract for equipment that puts it on a car-mile or ton-mile basis you must necessarily have the active cooperation of the manufacturer. The operating man does not know it all by any means, but he knows certain features that the manufacturer does not know. The manufacturer is an expert in his particular line and will unquestionably know things that the operating man not only does not know, but does not have time to investigate. Taking as an example the question of wheels, Mr. Gove said that if it has not been reached today, and he thought it has, the point will be reached where you can obtain wheels of the American Street and Interurban Railway Association standard at less cost than the many special wheels that most every road has been providing in the past, and he did not believe that you could get a more concrete example of the real benefit of standardization than the case of the wheels. Mr. Gove then went on to talk about the question of properly educating the working force, and gave the details of the Brooklyn company in keeping a graphical record of all the costs and results in the operation of the road. In conclusion, and digressing somewhat from the trend of his former remarks, he told of the efforts in Brooklyn toward improving the attractiveness of the grounds around the shops by means of gardens.

President Winsor approved heartily of this last-mentioned policy.

Purchasing Agent P. J. Honold, of the Utica and Syracuse roads, said that he did not believe that any purchasing agent with any common sense intends to antagonize the engineer or attempts to dictate to him what he ought to use on his equipment. The purchasing agents are perfectly willing to work in co-operation with the engineer, but believe he ought to furnish them with specifications and tell them just what he requires. In this way it would put the manufacturers on an equal basis and give the agents a chance to get rock-bottom prices.

President Winsor then proceeded to take up the recommendations of the report in order.

James Heywood moved that the subject of gears and pinions be referred back to the committee on equipment for consideration for another year. This motion was carried.

The next recommendation was "Standard Taper for Pinions: The adoption as a standard taper for pinions, the proportion of one-and-one-fourth inches in diameter to one foot in length."

Mr. Evans said in regard to the tapering of pinions, he thought that it is pretty well agreed between the Westinghouse Company and the General Electric Company that the dimensions given gave a desirable taper. Mr. Storer, of the Westinghouse Company, had said that his company had not exactly adopted the stand-

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ard taper. The only question that comes up in that respect is the possibility of the future adoption of the metric system, which might change the dimensions.

President Winsor remarked that the proposed taper is very close to one in ten. If it is made 1.2 in 12 inches, instead of 1.25 it would be one in ten.

In the course of some discussion on this point Mr. Evans said that the committee has no desire to express themselves in favor of either the General Electric Company or the Westinghouse Company, although the standard is the same as the General Electric Company, except that it seemed to be agreeable to the Westinghouse people that that would be a proper taper, and also from the fact that Mr. Storer, of the Westinghouse Company, did not seem to be satisfied with the taper they were using.

J. L. Davis, of the Westinghouse Company, opined that it would be better to leave the question of standard pinion or taper to the motor designers. If, he said, you standardize the axle and the axle layout, the position of the gear on the axle, and the pitch of the gear, the matter ought to rest at that. He thought the association would be mostly concerned with the adoption of a standard for the axles and the gears, and particularly the length of the bearing pin, which has been overlooked by this association and is not given in connection with the standard axle.

The motion was then carried that the question of the standard taper for pinions be referred to the committee on equipment.

The next recommendation was that the subject of standard gear ratios be continued for another year. This was passed without comment, as was also the next recommendation, which was as follows: "Specifications for Wrought-Iron Bars and Limit Gauge with Table of Sizes for Round Iron: The adoption as standard of the specifications for wrought-iron bars, as given on pages 6 and 7 of the report; also the adoption as recommended practice of the limit gauge for round iron and the table of sizes of limit gauges for round iron as given on page 8 of the report."

Mr. Davis said that as he understood it, both the General Electric Company and the Westinghouse Company have adopted the association's standard axles, and have built and designed their motors accordingly. Of course, the companies thought that the American Street and Interurban Railway Association would immediately conform to these standards wherever they possibly could. Much to their annoyance and expense they found that in nearly every case where they have brought these motors so designed to the operating men they have in almost every instance required some change. The consequent expense coming on the manufacturers in the end must revert against the consumer. The American Association should adhere more closely to these standards. The manufacturers have met the association more than half way, not only in fixing the standards, but also in adapting the motor design so as to meet them, and therefore they feel that the association ought to meet them half way. It was to be hoped that the association will stick more closely to these standard axle layouts, because the manufacturers were prepared to furnish motors designed along these standard lines.

The next recommendations, "iron for brake riggings," and "specifications for wrought-iron bars," page 6 of the report, were referred to the executive committee.

With regard to the specifications for rubber-covered wire, President Winsor said that the recommendation of the committee on power distribution favors the adoption of the standard specifications adopted by the Railway Signal Association as suitable for the recommendation of this association, which would pass that subject over to the power distribution committee.

The next recommendation was as follows: "Your committee would further recommend that the adoption of standards be by letter ballot, as given on pages 10 and 11 of the report, and also that the necessary changes in the constitution and by-laws be made, subject to the approval of the executive committee."

After much discussion on the question of substituting a method of one vote per million car miles (objected to) for one vote per member (as hitherto), a motion by Mr. Winsor to refer the subject of approval of standards to the incoming executive committee was carried.

The recommendations that the reprinting of the standards and recommended practices be embodied in the annual report of the association, and that a reprint of all the standards, recommended practices and specifications that have been adopted up to the time of each convention, together with proper notations as to the time adopted with any additions or alterations made, be embodied with each annual report of the American Street and Interurban Railway Engineering association as an appendix, were approved.

A communication from A. A. Stevenson, of the Standard Steel Works Company, was read at this point in which it was recommended that the manufacturers should be represented on the Standard's committee. This was referred to the executive committee.

The next paper was the report on power distribution. Mr. Heywood, the chairman, made a few remarks before taking this up.

The committee's report is divided into the following classifications:

Feeders—(1) high tension; (2) low tension.

Working conductors—(1) ordinary trolley; (2) third rail; (3) catenary; (4) underground trolley; (5) contact system.

Return system—(1) bonds; (2) supplementary copper.

Conduit system—(1) duct and conduit construction; (2) manholes; (3) ventilation and drainage.

For high-tension underground feeders from 11,000 to 13,200 seems to be the most popular range of voltage. An appendix gives the specification for purchasing high-tension underground cables. The committee recommends that in general cables be made large enough to accommodate future needs. The majority of later installations have been made with paper insulation. Rubber and cambric are sometimes used for high-tension underground cables, and if it is desired to use rubber a specification is given to be used to determine the quantity of rubber compound. High-tension cables should be protected outside the lead where they pass through manholes, the common practice being to cover the lead with woven asbestos saturated with a solution of silicate of soda. This solution should be omitted in manholes full of water. With overhead high-tension construction, the committee recommends steel supports in the form of towers where the line is isolated. When along the tracks the circuits are to be supported from extensions to poles that support trolley wires. For low-tension underground circuits the committee recommends the use of paper-insulated and lead-covered cable. For overhead low-tension cables triple waterproof braid provides sufficient insulation. For working conductors with the ordinary trolley the committee believes that for roads with frequent service 211,600 circular-mil wire should be used, preferably of the grooved section. The committee favors the use of under-the-fish-plate bonds for T-rail construction, and suggests the redesigning of standard fish-plates with a view to giving more room for bonding.

In the course of a discussion which arose, Mr. Heywood remarked that the proposed table of gauges for copper wires is the B. & S. gauge correct to three significant places of decimals only, as the manufacturers do not care as a rule to draw wire to a diameter more exact than given by the three figures.

Other recommendations were also discussed.

H. H. Stannard, of the New York Pole Company, then took up the matter of reinforced poles. He said that the amount of steel necessary to reinforce a pole is not so great as to be prohibitive. He did not

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know, furthermore, of any case where the swaying of the pole had loosened the bond between the concrete and the metal. Again, in his experience his company had to take off but one or two span wires in the thousands of poles it had reinforced. The method adopted by his company is simply to take out the plug at the top of the pole and insert a steel cage with sufficient steel in it to reinforce the pole. Mr. Stannard also took exception to other details in the report.

Martin Schreiber, Engineer of Way to the Public Service Railway, Newark, N. J., then gave an interesting talk on the open-tank treatment of poles.

F. E. Case, of the General Electric Company, heartily endorsed the suggestion of the committee which favored the use of under-the-fishplate bonds for T-rails as well as for girder rails. He proposed, however, that the committee should take action to see that the fishplates are designed to give a greater amount of clearance.

Mr. Heywood moved that the bond matter be referred to the Executive Committee. This motion was carried.

Mr. Heywood said that as regards the subject of testing line material, the committee started out with the object in view of trying to arrive at standards for some of the classes of line material. The object was to arrive at a fair average from which standards could be derived. The manufacturers represented in these tabulations of tests were given numbers, there was no intention to show which manufacturer supplied the best sample, and that next year the committee could probably take from the results of these tests enough data to start the standardizing of line materials.

E. J. Dunne, Superintendent of Distribution, Public Service Railway, Newark, N. J., then gave a most interesting talk on the methods of installation of standard iron poles. This gave rise to a discussion and other gentlemen present gave, in some detail, their experiences on the matter.

A motion was then made by Mr. Matthews that the committee on power distribution take up the question of standardizing overhead material. The motion was carried.

Mr. Matthews said that in Denver his company had about 400 crossings of high-tension lines, and that cradles are used in nearly all these cases. He had heard that this matter is going to be taken up by the Board of Underwriters.

After some further discussion it was moved that the discussion be carried, and that the report of the committee be accepted. Both motions were carried.

The subject of the joint use of poles was then taken up, and a motion by W. J. Harvie to the effect that the executive committee be requested to appoint a committee to consider this subject, was carried.

THURSDAY AFTERNOON SESSION.

The Engineering Association reassembled for its final session at 2:30 o'clock.

The first business was the report of the joint committee on shop accounting, which was appointed last year to consult with a similar committee of the Accountants' Association to take up the question of shop accounts, the idea being to see what the operating men wanted in the form of shop accounts and to get the accountants to formulate such accounts. The secretary read the report presented by W. G. Gove, of Brooklyn, chairman, to the effect that the committee had held a meeting on April 14, 1909, and had a preliminary discussion of the work involved, but that no definite results had yet been accomplished. The committee was continued.

President Winsor then called for consideration of the Question Box. Much work had been done on this by the secretary and a great amount of very useful material compiled. It was ordered to be accepted and to be spread on the minutes with the thanks of the association to the secretary.

Resolutions were adopted thanking the parent association for its co-operation with the Engineering Association, the Manufacturers' Association for its excellent exhibits, and the local committee and other bodies for the success of the convention.

The nominating committee presented the following names in its report:

President, F. H. Lincoln, assistant general manager, Philadelphia Rapid Transit Company, Philadelphia, Pa.

First vice-president, W. J. Harvie, chief engineer, Syracuse Rapid Transit Company and Utica & Mohawk Valley Railway Company, Syracuse, N. Y.

Second vice-president, E. O. Ackerman, engineer maintenance of way, Columbus Railway and Light Company, Columbus, Ohio.

Third vice-president, J. S. Doyle, superintendent of car equipment, Interborough Rapid Transit Company, New York city.

Secretary-treasurer, John W. Corning, electrical engineer, Boston Elevated Railway Company, Boston.

Executive committee: Martin Schreiber, Newark, N. J.; W. H. McAloney, Denver, Colo.; John Lindall, Boston, Mass.; Thomas Elliott, Cincinnati, Ohio.

The nominations were accepted and the secretary was authorized to cast one ballot for the nominees.

President-elect Lincoln, on being ushered to the rostrum, briefly addressed the association and thanked it for the confidence reposed in him by his election.

The convention was concluded with the unanimous passage of votes of thanks to the retiring president, Paul Winsor, and to the secretary-treasurer, J. W. Corning.

Transportation and Traffic Association.

MONDAY SESSION.

President C. Loomis Allen, of Utica, N. Y., called the first session of the second annual convention of the American Street and Interurban Railway Transportation and Traffic Association to order at the Auditorium at 2:45 o'clock Monday afternoon.

John A. Beeler, vice-president and general manager of the Denver City Tramway Company, welcomed the members to Denver and pointed out some of the interesting things about that city. President Allen then read his presidential address:

President Allen said that at the close of the 1908 convention, held in Atlantic City, it was the firm conviction of the officers and executive committee of this association that the work during this year should be wholly confined to the standing committees, and that the sessions of the 1909 convention would be devoted to the consideration of the reports submitted by these committees. The standing committees are those on passenger traffic, interurban rules, express and freight traffic, city rules, transfers and transfer information, and the training of transportation employes. The Transportation and Traffic Association was organized in January, 1908. It has not as yet accomplished or produced any one definite thing. It has not recommended the adoption of, or given the stamp of its approval upon, any of the reports of its committees. This can now be done intelligently and should be done at this convention. The adoption of the reports of the standing committees will not mean the end in these matters. The reports should be referred to the incoming standing committees for further consideration, suggestions and improvements. The work during 1910 will without doubt pro-

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duce amendments which should be presented at the 1910 convention and if accepted by the association will bring the reports up to date, so that at the close of each annual convention the amended reports will reflect the best energy, thought and practice on all transportation and traffic subjects.

Secretary Bernard V. Swenson next read the annual report of the executive committee and his own annual report as secretary-treasurer.

At the request of President Allen, M. C. Brush, of Newtonville, Mass., chairman of the committee on creation of passenger traffic, took the chair and presented the committee's report. Mr. Brush said in part:

At the convention held at Atlantic City in October, 1908, the committee on passenger traffic submitted a lengthy report on the methods of procedure by various electric railroads throughout the United States for creating traffic, laying particular stress upon the methods pursued and results obtained in connection with the operation of parks or pleasure resorts. At the time of securing that report efforts were made to cover the ground as thoroughly as possible, and it therefore seemed wise in the report of the committee for this year to endeavor to lay before the association examples of means adopted by electric railway companies throughout the United States, in calling to the attention of the public features which would result in increased traffic. The committee was reluctant to forward a circular letter to all the member companies for this information, and therefore the greater portion of the United States was divided into arbitrary divisions, governed to a certain degree by the homes of the respective members of the committee, and each member endeavored to secure from his territory a comprehensive assortment of all kinds of printed matter, such as folders, flyers, time-tables, pamphlets, postal cards, etc., referring to the matter in hand. The committee was successful in securing printed matter from 117 companies, varying in number from one to twelve classes of printed matter, making a total of 278 different samples submitted. These the committee has endeavored to carefully arrange and have on exhibition in the convention hall. It will unquestionably be surprising to some members of the association to note the tremendous amount and variety of this matter being published, particularly when it is realized that it is but a few years since any effort along these lines was inaugurated. The committee believed that the best results from its report could be secured by requesting a discussion of the relative merits of the different classes of printed matter.

Chairman Brush then called upon E. F. Peck, of Schenectady, N. Y., as a member of the committee, to give his views.

Mr. Peck said that judicious advertising for the creation of passenger traffic is a very serious problem. All railroads appreciate the fact that they must advertise; in the case of the interurban roads, first by issuing time-tables. Newspaper advertising they all must have. Mr. Peck believes it is necessary for every company to publish its time-tables in the local newspapers, and to call attention to important features, such as excursions, on their roads. The other class of advertising is the folder. Some of the folders are merely time-tables, others are devoted to scenic places on the lines of the interurban roads. His own experience has been that if a large amount of money is to be spent in advertising of that nature the very best is none too good.

F. W. Coen related the methods of advertising in use in the central territory, and asserted that the folder and time-table are considered the most profitable. He also favored the pictorial map for advertising purposes.

H. C. Page, of Springfield and Worcester, Mass., said that he is a thorough believer in advertising. A person would not think of conducting a business of any magnitude, any other line of business, without advertising that business, unless he had a monopoly and were manufacturing an article that people were compelled to buy out of necessity. Railroads have something to sell in the way of a ride, and there is a lot of business to be secured by advertising in a reasonable and intelligent way. He claimed that the newspaper of today is something that the traction manager has to reckon with—the newspapers are alive to the pulse of the people, they are very quick to catch on to the way in which the current of public opinion is drifting, and unless traction companies are doing business with them and recognize them they are liable to lose business.

Chairman Brush then requested that some member of the association give some information in regard to the amount of money spent for advertising literature of different character.

F. D. Hunt, of Portland, Ore., said that his company was greatly interested in the handling of passenger traffic this year, especially in view of the fact of the Seattle Exposition, and during the early part of the year prepared a pictorial folder and ordered 20,000 copies, which cost $850. They found that the supply was exhausted long before the Fair was really started, and ordered 10,000 copies more. The result has been very beneficial. Another good plan of advertising was to string banners across the intersecting streets where a great number of people pass each day, calling attention to any special excursion which is going out on the interurban line. Also to carry an advertisement on the front end of the cars announcing any particular attraction.

P. P. Crafts, of Clinton, Iowa, said that from the standpoint of a small interurban road, they have allowed an annual expenditure of approximately $4,000 for advertising and conducting pleasure parties. Of that sum approximately $1,000 is appropriated out of the receipts, for making up losses on the park, which is more than amply covered, of course, by the returns from the tickets sold on the cars.

J. W. Brown, of Connellsville, Pa., said that the traction company in Connellsville has an advertising expenditure of about $10,000 a year. It issues time-tables, which cost about $8 a thousand. Blotters are also used—the ordinary hotel blotter, in bright colors, with the schedule of the particular cars, the line of cars, running into that town. That catches the traveling man when he reads his letters, and is getting ready for his next day's route—he has the schedule in front of him in black type. These cost about $3 a thousand. They also use a wall schedule for the interurban lines, about eleven by eighteen inches; these cost about $3 per hundred.

T. C. Cherry, of Utica, said that it seemed to be the consensus of opinion that pictorial literature, time-tables, etc., is a good scheme of advertising, but it seems that traction companies should go further than that, and a good deal of this work is up to the passenger agent. He said that if the literature is well distributed, so far so good; but thought that this work should be followed up by the passenger agent.

J. H. Pardee, of New York, stated that there are two classes of people to be reached by advertising, one class is composed of those who know about the road and know where it goes to, and must be induced to ride more, and there is another class which is composed of those who do not know the road, are not familiar with it, and would not ride on it unless they were informed that there is such a road, where it goes to, and a different kind of advertising is needed to reach this class of people. For the latter class a plan which brought good results at very little expense was to mail under personal cover to each one of the ticket agents of the steam railroads in their vicinity a complete time-table and folder, and thus the ticket agents were able to give this information to travelers and people not familiar with the electric road.

W. H. Collins said that a large part of their traffic is derived from hauling people to pleasure resorts, and a traveling passenger agent looks particularly after that kind of business. It is his duty to go around through the surrounding country, to a distance even as great as a hundred miles, and book picnics. But to catch the popular travel, a great deal of poster advertising is done.

J. C. Calisch said the conditions of his road are rather peculiar, in that they have local suburban and interurban trolley travel, steam railroad and steamboat. They found on the whole that for the general information of the public a folder was best, and they distributed them very thoroughly over the entire system. In fact they put out 50,000 of them, and they cost $2,500. They also got out a fan, which was very popular, and for which the office received a great many calls.

F. W. Coen said there is another side of the advertising business which it seems to have been lost sight of. A pleased patron is the best advertising medium. Mr. Coen then cited a case where his road transported a picnic which the steam road had disappointed, and claimed that those people were now doing more for them than any printed advertisements.

Ernest Gonzenbach said that his road owned a summer resort which is a favorite one-day outing, and they found that cer-

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tain cars during the day were heavily overcrowded, while other cars during the day were underloaded, so they started an advertising campaign this summer instructing the public as to when to take cars and how to avoid the crowded cars. It was found very profitable.

A. H. McKay said that conditions have a great deal to do with the amount of advertising one is called upon to use. If traction companies have parks or summer resorts or anything which they want the public notice called to, Mr. McKay was strongly in favor of advertising.

Mr. Dozie related a scheme which proved to be a good advertising proposition. His road gave a free clam-bake at the terminal of his road to advertise their route. This did a great deal toward familiarizing the public with the pleasures derived from a trolley trip.

C. Loomis Allen, of Utica, said that he belongs to that class of men which is doubtful about the wisdom of distributing large sums of money in advertising for the sake of increasing passenger traffic. The gross earnings of the electric railways are approximately $3,000,000 per annum. His road spent last year in twenty-eight papers scattered over a territory of seventy-five miles, advertising time-tables giving the leaving and arriving time of electric trains, $2,800. The first day of June, 1908, they inaugurated a limited service which was in direct competition as to running time with the main line of the New York Central. The only method of advertising this line successfully was to have time-tables distributed in homes along the route.

R. P. Stevens said that his road does almost all kinds of advertising, but in particular the line which he had the figures on is the Liberty Bell route, which caters to the Delaware Water Gap travel from Philadelphia to the Delaware Water Gap mountain resorts. Although this business is not nearly as large in winter as it is in summer, it is to a certain extent all the year around business. This year they appropriated $3,000 for advertising in the Philadelphia papers, for the reason that they did not think they could turn out the time-table and distribute it promiscuously. He related a number of expenditures that were to be made for advertising purposes —the largest being for an attractive folder advertising a special trip.

Chairman Brush called attention to one folder sent to the committee, reading, "Free Trips to Evansville and Return Every Day in the Year." On the back of it was the following: "The following merchants, all the members of the Evansville Rebate Association, have combined, and under their plan your fares will be refunded on your purchases. Particulars at every store." Regardless of the amount of folders issued, Mr. Brush still felt that unless service was given that could be depended upon absolutely, the money spent on folders was wasted.

President Allen then took the chair and the meeting was adjourned until Tuesday morning.

TUESDAY SESSION.

The second meeting was called to order at 10 a. m. by President Allen, who asked C. D. Emmons to read the report of the committee on interurban rules.

Acting in conformity with the resolution passed at the last convention the committee sent to every electric-railway company in this country and Canada a copy of the code of rules as submitted to the 1908 convention asking that they make such criticism and suggestions as to changes in the code submitted as their experience dictated. Many of the replies contained criticism that was very helpful to the committee. At several meetings the code has been discussed in great detail and a number of important changes recommended. After an experience with the coded form extending over several years, it is the belief of the committee that it is wise to refer to the practice outlined in the American Railway Association code of rules as nearly as possible. With this idea in mind, several changes have been made in the code. Two forms of train orders, 19 and 31, have been adopted and the code form dropped; rules 203. 230 and 261 have been changed and rule 203A added, outlining conditions when a train may proceed, preceded by a flag.

This report was considered in sections. When the question of time-tables came up, C. A. Coolidge, of Portland, Ore., said that Rule 84, regarding the "Supersedure of Time Tables," is a rule which has been discarded by the American Railway Association. The conditions affecting the operation of a great many of the Western roads are such that they are required to operate under the latter rules for a good many reasons, one of which is that trainmen from the standard steam roads can be put to work on the interurbans and be at once familiar with the rules. Under the proposed code of rules a steam man would be absolutely lost.

Mr. Emmons declared that the American Railway rules on time-tables and the corresponding rules of his committee show that there is not a great variance.

Mr. Coolidge, however, moved that Rules 84 and 85 of the proposed code be amended by the substitution of Rule 4 of the Standard Code of Train Rules of the American Railway Association.

W. R. W. Griffin, of Rochester, N. Y., offered an amendment to that motion, to the effect that the latter rule be adopted in the code as an optional rule. Then followed a discussion in which J. D. Wardle, Cedar Rapids, Ia.; C. L. Henry, Indianapolis, Ind., and Messrs. Emmons, Coolidge and Griffin participated. Upon final vote, however, the entire amendment was lost.

F. A. Boutelle, Tacoma, Wash., protested against the explanation given of "Protected by Flag," viz., that "trains will be operated under control within one-half of the range of vision on straight track," asserting that this was not a safe practice for high-speed roads, as it gives the trainmen too much discretion. He later submitted his ideas in the form of an amendment, which failed of adoption, however.

P. P. Crafts, of Clinton, Ia., submitted an amendment to Rule 219, which relates to the protection of trains when stopped on the main line between stations. This rule, as it is given in the report of the committee, is practically the same as the American Railway Association rule, but in his opinion did not state the proper signals nor the procedure to be followed by the flagman in any way. In the amendment that he submitted these details were specified, and incidentally the conductor was ordered to go back 1500 feet with stop signals. These rules were the ones used by the Chicago & Northwestern Railway and accounted partly for its freedom from serious accidents.

William B. Rockwell said that this distance is unnecessarily long, and it puts a burden on the employe that he never carries out. A man can see on a straight track a danger signal far enough ahead to enable him to stop his train.

Mr. Griffin declared that these rules should be formed so that they can be applied in general to any road. The individual operating rules can be made to suit the conditions on any individual road. If it desires, a road can put on added protection, and that does not take the general rule from the standard code of rules. The question was also discussed by President Allen, C. D. Emmons and S. W. Cantrell, of Denver.

On a final vote the amendment offered by Mr. Crafts was lost.

C. E. Morgan, Crawfordsville, Ind., moved that Rule 212 be eliminated, as he claimed that Rule 213 covers the same thing. After some discussion this amendment was lost.

Chas. R. Henry, of Indianapolis, discussed Rule 256, which provides that the dispatcher telephones his order to the motorman, who writes it on a blank, with sufficient carbon copies for each member of the crew, and when he has finished writing the order he reads it to the dispatcher, who will O. K. the same if correct. The motorman thereupon signs his name upon the order. The conductor then reads the order to the dispatcher, and, if correct, the latter completes the order by giving the initials of the superintendent, or other designated authority, and the time of completion. He moved that there be eliminated from this rule the provision that the conductor shall read the order back to the dispatcher. In Indiana in getting up the rules with the State Railroad Commission it was decided that that part of the rule should be optional to each company. One road in that state adopted that portion of the rule, but the rest believed it ample if the conductor takes the order and the motorman reads it carefully. The committee has reported it differently here, but he supposed they are probably ready to justify it, or at least some of them are.

Mr. Emmons asserted that he was proud to say that his was that one road in Indiana that is using the double order. It is the only way to be absolutely sure that both men get the order and that they fully understand it. The dispatcher has instructions absolutely to refuse to complete

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an order until he gets the second voice over the telephone. The objection about the time that it takes is not very serious.

F. W. Coen, of Cleveland, declared it had always been his idea that the train order should be received by the conductor. The place for the motorman is on his car, where he should stay.

Mr. Griffin said every time a movement other than as provided by the time-table is made, it enters into danger. Any dispatcher's order is a dangerous procedure, no matter what it is, and cannot be hedged around with enough safeguards.

J. C. Calisch, of Buffalo, said he would rather take a chance on the message being repeated by the second man to the dispatcher to know that it is on record there, than to take the chance that the motorman has read it back to the conductor.

S. W. Cantril, of Denver, Colo., said he was opposed to a divided responsibility between the motorman and the conductor. He preferred to have the motorman deal with the dispatcher.

After further discussion by Messrs. Wardle and Brush, H. A. Nicholl read a letter from J. N. Shannahan, chairman of the committee, who said he had changed his mind about the matter since the committee's report was printed. He therefore submitted an amendment similar to that of Mr. Henry.

On a vote the amendment was lost. Mr. Henry then moved that his amendment be inserted in the rules as an optional practice, thus leaving it to the companies to decide whether they shall have orders repeated back twice or only once. After some discussion of the propriety of such action it was adopted.

As scarcely any other amendments to the remaining rules through No. 446 were submitted, and as over two hours had been consumed in the detailed discussion of all these rules by groups, the question of the adoption of the entire code was brought up. In this connection J. H. Pardee submitted the following resolutions:

Whereas, The committee appointed at the last meeting of this association has prepared and reported a certain code or set of rules governing the operation of electric interurban cars, which code is intended to include such general rules as represent the best and most modern practice in electric-railway operation, and

Whereas, This association has duly and carefully considered and amended the same in some particulars, and

Whereas, It is for the interest of the members of this association that the association adopt, approve, promulgate and recommend a code of rules which shall be considered the standard code, except in so far as it may, in specific instances, be necessary to omit, add to or change rules in order to conform to state or municipal laws and regulations or to local conditions;

Now therefore be it resolved, That the rules reported by the committee, and as changed, omitted or amended at this meeting, be the standard code of rules of this association for the operation of interurban cars, until such rules may be duly amended or changed at a meeting of this association, and

That this association request its members to adopt this standard code of rules for the operation of interurban cars on their respective railways except in so far as such rules may conflict with state or municipal laws or regulations or be unwise or inapplicable on account of local conditions, and

That the committee on interurban rules be continued to report at the next meeting of the association such proposed changes or amendments as may seem wise or necessary.

C. A. Coolidge, of Portland, Ore., moved as an amendment that the standard code of train rules of the American Railway Association be submitted for the code as proposed. The motion of Mr. Coolidge elicited a spirited discussion, in which C. J. Franklin, of Portland, Ore., and F. A. Boutelle, of Tacoma, Wash., sided with him in declaring that the northwestern roads could use the American Railway Association's rules only. The committee's code was defended by Mr. Pardee, C. F. Henry, D. A. Hegarty, F. W. Coen and President Allen. These gentlemen asserted that under the resolutions proposed a road might use the American Railway Association rules, if it found local conditions required this. Only three votes were cast in favor of Mr. Coolidge's amendment.

The resolution as offered by Mr. Pardee was then carried by an almost unanimous vote.

Mr. Coolidge then moved that the committee on interurban rules confer with the corresponding committee of the American Railway Association as to changes desirable in either code of rules. After some discussion relative to the form of this motion it was adopted unanimously.

WEDNESDAY SESSION.

The association was called to order at 9:50 a. m. by President C. Loomis Allen, who announced the appointment of the following committees: Committee on nominations: E. F. Peck, F. I. Fuller and H. A. Nicholl. Committee on resolutions: P. P. Crafts, J. H. Pardee and H. W. Blake.

President Allen then called upon Mr. Crafts to read the report of the committee on express and freight traffic.

The report of the committee shows in tabulated form the amount of business, both freight and passenger, carried on by thirty-nine electric roads, which responded to the request of the committee. A significant point in the report is the rate at which the freight revenue of the roads has increased. It pointed out that steam roads were built with the primary intention of handling freight, and interurban roads, in the past, for handling passenger traffic almost exclusively. Now, however, electric railroads are being financed on that basis that a considerable percentage of their earnings shall be obtained from freight traffic. Among the important recommendations emphasized by the report were the following: Traction companies should pay more attention to the matter of solicitation of freight traffic; many companies provide for too elaborate freight facilities without first being assured of the business; the committee recommended that some action be taken to prescribe a standard method of freight and express accounting. The committee also recommended that companies adopt a standard bills of lading, waybills, expense bills, etc., and also that careful attention be paid to the handling of all claims.

The discussion was opened by F. J. Hanlon, of Mason City, Ia., who said he thought that they were the first road to handle freight in connection with steam road, and also the first ones to have through tariffs in connection with them. All of their freight rates are based on the same rate that the paralleling steam line charges. On passenger fares they are higher than the steam rate. For instance, between Mason City and Clear Lake, the Chicago, Milwaukee & St. Paul steam rate is nineteen cents, their rate is twenty-five cents.

H. A. Nicholl said that about ten per cent of their gross earnings came from their freight and express business. They have separate terminals in some of the larger cities, and in the smaller ones have a combined freight and passenger agent. They do considerable advertising of the freight business, get out a special magazine every three months, devoted to the subject of express and freight. This company is doing only a state business, not an interstate business. In the larger cities where they have the separate freight terminals, they, of course, have sidetracks as well. He said his company did not solicit a great deal of carload business except it be live stock, and did not attempt to handle coal or lumber or things of that character.

Mr. Hanlon discussed the possibility of determining the actual operating expenses of the freight car movement and thought it would be difficult to do this accurately.

Mr. Crafts said that in charging the freight department with track expenses they figure up the entire track overhead maintenance at so much per car-mile, including freight and express. On single cars, regardless of whether they are trolleys, motors or freight cars, then they charge the freight department with its proportion in accordance with the mileage operated, and in the particular case in charging power they know how much the power costs.

Mr. Todd said that the Brooklyn Rapid Transit Company has figured out the charge of fourteen cents to cover the maintenance of track and repair and maintenance of overhead wires in power consumption.

Mr. Hanlon was of the opinion that a freight car would not do more damage to the track than the average heavy in-

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terurban car, and mainly on account of the speed.

A. H. MacKay said that their line is a short system running between Tacoma and Seattle, a distance of about forty miles. The earnings at the present time per month have run from $12,000 to $14,000. They handle on that road three-car passenger trains, frequently with two-car second sections, with some short hauls between. Considerable freight traffic is necessary, however, to have the earnings total that amount. They handle from 3,500 to 4,000 gallons of milk every morning. They also handle refrigerator cars over the line, that are built especially for service between the two cities. In handling beef, all of the packing houses are fitted with tramway appliances, as are the cars, which operate right from the cold-storage room into the cars, so that it is possible to handle the meat directly from the cold-storage houses and load it into the cars, without the hooks being taken off from the wires, and the same is true at the unloading stations. There is nothing that steam roads handle that they do not handle—lumber, coal, all kinds of merchandise, all kinds of heavy material; they handle anything except live stock.

F. A. Boutelle said that in addition to the freight business mentioned by Mr. MacKay, the company was handling from fifteen to thirty cars of coal per day, from Renton. They have forty standard fifty and sixty thousand-pound capacity cars which they furnish, and the Seattle Electric Company furnishes fifteen or twenty in addition, and the coal business averages from fifteen to thirty cars per day between Renton and Seattle.

President Allen, in discussing the difficulty of arriving at a proper charge against freight cars, quoted an incident of a southern road which wants to finance some of its securities. The earnings of the road were apparently large, but upon investigation it was found that the company was loading gravel into the cars, at a gravel pit along the line and depositing it along the roadbed. The earnings, however, were charged up at the full rate. Mr. Allen said the difficulty of determining the cost of freight operation was not confined to the electric roads, but was also just as serious with the steam roads.

George W. Parker, of Detroit, said he had an opportunity to raise the rate on a certain community, with the result that he had to appear before the railroad commission of the state of Michigan. The opposing counsel took the ground that the handling of freight and express on electric cars should be done much cheaper than with steam roads. Mr. Parker had to contend the other way, and not only contend, but produce facts that would bear out that contention. Fortunately, in order to arrive at the consuming of power some months ago the road took up the question of handling coal a distance of twenty-eight miles to the power house. The difference in rate from the mines to the power house in comparison with the steam roads was twenty-five cents in favor of the electric, with the result that they were making ten cents a ton. A power test of car consumption was made, with the result that they are getting that coal over the steam road and paying the railroad extra compensation for taking care of it up to the power-house destination.

Mr. Cooper said that for the last six years his road in Galveston has been reconstructing the line, and it has been necessary to keep a motor car and five double-truck trailers merely for the construction work. They have been trying to get at the cost of the operating of those, and operate them sometimes twelve to eighteen hours a day steadily all the year round. They have been absolutely unable as yet to determine on any basis as to what the operating cost was.

Mr. Fuller said that they had purchased a road which had a freight and passenger line about forty miles long and another one sixteen, which does a regular freight business. They have about 140 freight cars, and handle a great deal of timber, sawed lumber and logs, as well as general merchandise and agricultural products. The cost between the freight and passenger business was divided on a car-mile basis, and he thought that a fair arrangement. The passenger cars run faster than the freight cars, and possibly average a little lighter. On this basis the freight operating expenses amounted to about sixty per cent.

President Allen then asked for the report of the committee on city rules. In the absence of the chairman of that committee, the report was submitted by D. A. Hegarty, of Little Rock, Ark.

Mr. Fuller, of Portland, read a communication which was addressed to the committee on city rules.

The phraseology of a number of the rules has been changed in an effort to make them more clear and definite, but the general intent of the rules as adopted in 1907 has been preserved. The growing use of the "pay-as-you-enter" types of cars introduces new conditions of operation, and the committee recommends that a standard code of rules governing the operation of such cars be prepared and submitted to the association for consideration and adoption.

President Allen then said that, with the permission of the delegates, he would rule that amendments relating only to grammatical or typographical errors of the rules would not be considered in the discussion, but that they should be submitted to the 1910 committee for their consideration. The rules would be considered in sections, and amendments to them should be presented in writing.

The rules were considered in this way, and with a few changes here and there the report was adopted.

THURSDAY SESSION.

The last meeting of the Transportation and Traffic Association was called to order by President Allen at 10 a. m. Thursday. The consideration of the report of the committee on city rules was resumed at Rule 201. The remaining city rules were adopted with only slight changes.

H. S. Cooper, of Galveston, then offered a set of resolutions, similar to the ones passed at the Tuesday session, relative to the interurban rules, adopting as a standard code of city rules the committee's report as amended. These resolutions were unanimously adopted.

A paper on "Chicago's Transfer Crusade," written by Joseph V. Sullivan, of the Chicago Railways Company, was then read by Mr. Brush.

In this paper Mr. Sullivan pointed out the difficulties encountered in Chicago in combating the former general misuse of the transfer privileges, and the practice adopted by his company to stop the evil. Chicago has probably the largest number of transfer points of any city in the world. About 41.03 per cent of the total passengers carried last fiscal year were transfer passengers. An extensive traffic in transfers had sprung up at transfer points all over the city. A city ordinance was passed which forbade this practice. Under it very numerous arrests of transfer vendors were made and the prosecutions successfully pushed. By humane treatment of the offenders the crusade overcame the unpopularity it had to contend with at first. By warnings displayed in the cars and printed on the transfers the public was educated to the proper viewpoint and in about a year the transfer abuse had been practically wiped out.

C. C. Learned, of Boston, opened the discussion by narrating the similar circumstances in Boston, where the misuse of transfers has caused a considerable loss. A law was enacted which was not as broad as the one in force in Chicago. This law does not make it an offense to give away a transfer or solicit one, but

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makes it an offense to offer the same for use. It was necessary to get absolutely conclusive evidence and the prosecutions, therefore, were not as numerous. However, the abuse has been almost entirely stopped.

M. C. Brush, of Buffalo, spoke of his experience with the transfer question. An extra cent is charged for the issuance of a transfer. Some difficulty was at first experienced in making the conductors give a proper accounting, but a system of checks had been instituted, which put a stop to their exchange of transfers at junction points.

C. D. Emmons, of Fort Wayne, Ind., outlined the manner in which the transfer abuse was diminished by insisting that passengers transfer only at branching points and not at the old transfer center of Fort Wayne.

R. I. Todd, of Indianapolis, and S. W. Cantrell, of Denver, also discussed the subject.

J. W. Brown was then called on to read the report of the committee on training of transportation employes.

This is the second annual report of this committee. The operation of electric railways throughout the country during the year has emphasized the necessity of more thorough training of the transportation employe. The need of a more intelligent class of men is apparently due to the increased speed at which cars are operated, the increased complication of equipment and the increased number of cars which are moved against each other, together with the ever-swelling traffic density as the territory adjacent to the various lines becomes more closely built up. It is of the utmost importance that the physical condition of the men be determined, together with the sight, hearing and color perception, and that this information be made a matter of record. The matter of making more dignified the calling of motormen and conductors is one of the best ways of attracting to the service men of higher mental and moral standards. Too much care cannot be exercised in instructing men who come in contact with the public of the obligations to the patrons of the road. The old adage, "A man is known by the company he keeps," is reversed, and it is now stated that "A company is known by the man it keeps." The giving of both oral and written examinations has considerable value from the fact that, while many first-class employes do not have the power of expression in a very great degree, it encourages them to further self-education and is a step toward putting the service on a higher level. As far as discipline is concerned, no matter what form of discipline be used, there should be greater attention paid to the education of the men and the discipline meted out accordingly. It does not seem right and just to attempt to educate a man into the duty of trainman in a few days and then treat him in discipline with the full merits or demerits of the case as though he were an experienced employe. The value of the pension system is not only in the benefits which accrue to the employe, but also is a means of directly benefiting the company. The sober, thinking class of men are loath to leave the service of the company which assures them support in their old age. There is also that question of moral responsibility, if not legal responsibility, to the employe who has given the best years of his life to the service.

C. B. Wells, of Denver, submitted a written communication, in which he described the rigid entrance requirements exacted by the Denver City Tramway Company. A course of instruction is given the new men on the equipment placed in their charge and the duties of their position. The Brown merit and demerit system had been tried in enforcing discipline, but it incurred the ill-will of the employes and had to be partly abandoned.

N. W. V. Bolen, of Newark, also submitted his discussion in writing. He advised superintendents and their immediate subordinates to become personally acquainted with their men for the purpose of studying their work. He also advocated the use of a good "follow-up" system.

C. C. Learned described the practice in use in Boston of paying ten cents a day bonus the year round to instructors, which increased the desire of the men to advance to this rank. His company employed from 1,500 to 2,000 new men a year and had found its system of instruction to give excellent results.

W. R. W. Griffin, of Rochester, N. Y., spoke of the recommendations of the committee of last year to adopt standard forms, blanks and methods whereby the different companies could quickly get information in regard to the men who leave the employ of one company and enter that of another in a different city. One of the greatest difficulties has been in trying to find out about a man from the other companies that previously employed him.

C. J. Franklin, of Portland, Ore., said his company had found the merit and demerit system to give very satisfactory results for the claim department. It was desirable to be very generous in giving merits to the men, more particularly when good accident reports are made out, and when they secure a larger number of witnesses than are required, and for many other things relating to the claim department in which they figure.

The subject was also discussed by Dana Stevens, of Cincinnati, and P. P. Crafts, of Clinton, Ia., who outlined in detail the methods of instruction and discipline employed on their respective lines. On the latter system the men are taught to fill the positions both of motorman and conductor.

On President Allen's motion the Atlantic City convention report of the committee on the training of employes, which had not been adopted last year, was now adopted with its appendixes giving standard forms. The part of the 1909 report referring to methods of discipline was referred back to the committee for further consideration for the 1910 report, on account of differences of opinion on this topic.

President Allen then appointed a committee composed of Messrs. Emmons, Brown and Hegarty to present to the American Association in the afternoon a report of the work done by the Transportation and Traffic Association and to request the parent association to ratify the adoption of the various codes of rules, in order to make them stand as the act of the association.

The nominating committee submitted the following nominations:

President, Robert I. Todd, vice-president and general manager, Indianapolis Traction and Terminal Company, Indianapolis, Ind.

First vice-president, Henry C. Page, general manager, Springfield Street Railway Company, Springfield, Mass.

Second vice-president, N. W. Bolen, superintendent of transportation, Public Service Railway Company, Newark, N. J.

Third vice-president, George Whitfield Parker, general express and freight agent, Detroit United Railway Company, Detroit, Mich.

Executive committee: J. N. Shannahan, Baltimore, Md.; Dana Stevens, Cincinnati, Ohio; J. W. Brown, Connellsville, Pa.; A. H. Mackay, Tacoma, Wash.

The secretary was instructed to cast the unanimous vote of the association for these nominees as the officers for the forthcoming year, and they were duly declared elected. President-elect Todd made a brief address, thanking the association for the honor conferred on him.

Resolutions were then passed thanking all those responsible for the success of the convention. After this the convention adjourned.

Claim Agents' Association.

The sessions of the Claim Agents' Association were held at the Metropole Hotel on the morning and afternoon of Monday, the morning and afternoon of Tuesday, and the morning of Wednesday. The business of these sessions included the address of the president, the reports of the executive committee, secretary-treasurer, and the appointment of convention committees. Special discussion was had

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upon the best means to prevent collision of cars and of cars with vehicles and pedestrians, the diminishing or elimination of boarding and alighting accidents, the best plan for having trainmen procure and report an increased number of witnesses to accidents, the advisability of furnishing an injured party with a copy of his statement concerning the accident, the question as to whether a school of instruction for trainmen is essential, the advisability of furnishing newspapers with information concerning the work of the claim department, the relationship of the medical and claim departments, and the extent to which the medical department can best serve the claim department in the handling of accidents; and the relation of the claim department to the operating department.

The following officers were elected for the ensuing year:

President, E. C. Carpenter, claim adjuster, Indiana Union Traction, Anderson, Ind.

First vice-president, J. S. Harrison, claim agent, Jacksonville (Fla.) Electric Company.

Second vice-president, J. Handlon, general claim agent, United Railroads of San Francisco.

Third vice-president, H. K. Bennett, claim agent, Fitchburg & Leominster Street Railway, Fitchburg, Mass.

Secretary and treasurer, B. B. Davis, claim agent, Columbus (Ohio) Railway & Light Company.

Report on Meter Tests.

At a meeting of the New York Public Service Commission the secretary presented a report on the gas and electric meters tested during the month of September. Gas meters tested during the month number 29,209, of which 5,303 were new meters; 23,715 repaired and removed meters and 191 "complaint" meters.

The tests of the "complaint" meters are summarized as follows:

Two per cent or more fast, eighty-four (forty-four per cent); two per cent or more slow, twenty-three (twelve per cent); between two per cent fast and two per cent slow, eighty-four (forty-four per cent).

The number and percentage of complaint meters correct, fast and slow were: Absolutely correct, twenty-four, per cent 12.6; fast, 112, per cent 58.6; slow, fifty-five, per cent twenty-eight.

During the month tests on twenty-eight electric meters of which complaint was made, resulted as follows: Four per cent or more fast, one (3.5 per cent); four per cent or more slow, three (10.7 per cent); between four per cent fast and four per cent slow, twenty-four (85.8 per cent).

New York Electrical Show.

The third annual New York Electrical Show, at Madison Square Garden, was opened to the public on Monday night, October 11, to continue until October 21.

The show started with all the booths and exhibits in good order and with practically all spaces occupied. The exhibits include most of the leading electrical manufacturers of the country.

The application of highly artistic effects in illumination and decorations have transformed the interior of the Garden into a pleasing and beautiful spectacle. The use of over 75,000 incandescent lamps, as well as other forms of electrical illumination in the various booths, makes a brilliant effect. The most conspicuous of the lighting effects is, in point of fact, a row of large chandeliers with varied colored lights extending down the center of the building with a row of smaller ones on either side. The booths are of a uniform style of construction and a decorative color scheme of white and gold has been followed throughout.

The application of electric current for domestic and industrial purposes is generously displayed in practical operation and shows the multiplicity of uses of electricity, in store, factory, home, office and on the farm. The demonstrations of wireless telegraphy made from one end of the building to the other, are proving a constant attraction.

A good musical programme is rendered each afternoon and evening by d'Asquin's Military Band. In effect the "Show" bids fair to surpass anything of its kind ever held in New York.

Much credit is due the management for the efficient and prompt manner in which the exhibits and all matters pertaining to the show have been taken care of. Among the booths that occupy the largest space and attract the general attention are those of the New York Edison Company, General Electric Company, Westinghouse Electric and Manufacturing Company, the Edison Electric Illuminating Company, of Brooklyn, and the United Electric Light and Power Company. A complete working model of an automatic electric push-button elevator on direct current, for private-residence use, is one of the features of the show displayed by the Otis Elevator Company in the center of the building.

The ELECTRICAL REVIEW AND WESTERN ELECTRICIAN occupies a booth prominently located just within the main entrance, where all visitors are being cordially welcomed and headquarters for out-of-town electrical men established.

The following is a complete list of the exhibitors:

American Electric Lamp Company.
American Metal Hose Company.
Automatic Electric Washer Company.
Baltimore Enamel & Novelty Company.
Charles Biele.
Consolidated Telegraph & Electric Subway Company.
Collins Wireless Telephone Company.
Como Electrical Company.
The Crane Company.
Duntley Manufacturing Company.
Dossert & Co., Inc.
Electrical World.
Electric Suction Sweeper Company.
Edison Electric Illuminating Company, of Brooklyn.
Electric Testing Laboratories.
Excello Arc Lamp Company.
ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.
Electric Home Supply Company.
Electric Cleaner Company.
Empire Vacuum Company.
Economical Electric Lamp Company.
The Electric Storage Battery Company.
Fox Brothers & Company.
Feature Advertising Company.
F. L. Guirdth & Company.
Goulds Manufacturing Company.
General Vehicle Company.
General Compressed Air and Vacuum Cleaner Company.
General Electric Company.
German-American Electric Company.
Harley Machine Company.
The Heany Company.
International Correspondence School.
Keller Manufacturing Company.
H. Krantz Manufacturing Company.
C. L. Kiewert Company.
J. Livingston, Jr., & Company.
The Lansden Company.
Murphy Electricity Rectifier Company.
Manhattan Electrical Supply Company.
Moore Electrical Company.
National Electric Lamp Association.
The New York Edison Company.
New York Electrical Trade School.
Nugget Polish Company, of New York, Ltd.
Otis Elevator Company.
Public Service Corporation of New Jersey.
Pelouze Electric Heater Company.
W. P. Pressinger Company.
Radio Reflector Company.
Shelton Vibrator Company.
Stanley & Patterson.
Southern Exchange Company.
Sunray Electric Lamp Manufacturing Company.
The Storage Battery Supply Company.
Tucker Electric Construction Company.
United Shoe Repair Machine Company.
United Electric Light and Power Company.
Vacuum Engineering Company.
Watson-Stillman Company.
Westchester Appliance Company.
Roger Williams (The Simplex Electric Heating Company).
The Westinghouse Companies.
The Wonderful Pump Company.

Iowa Telephone Merger Enjcined.

The Iowa courts have enjoined the Iowa Telephone Company, a Bell concern, from absorbing the Mutual Telephone Company, of Des Moines, an independent concern, on the minority stockholders' petition. The Bell company has secured a majority of the Mutual company's stock.

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THE COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION.

ANNUAL MEETING, DENVER, COLO., OCTOBER 7, 8 AND 9.

The annual meeting of the Colorado Electric Light, Power and Railway Association was held at the Auditorium Hotel, Denver, Colo., October 7, 8 and 9. There was a very representative gathering of electrical men representing various light, power and railway enterprises throughout Colorado, and the sessions covering the three days were marked by the enthusiastic attention to the business in hand by a careful discussion of the excellent papers presented, and by a thorough threshing out of the problems forming the question box.

The first session convened on Thursday morning, and after roll call and the announcement of the minutes, J. F. Dostal, superintendent of construction of the Denver Gas and Electric Company, and president of the association, delivered the annual address. Mr. Dostal called attention to the value of the association work and emphasized the importance of membership. The association had a comfortable balance in the treasury and was a growing influence throughout the entire state. As managers of electrical properties the members must take cognizance of the fact that much depends upon them in satisfying consumers and in keeping upon the books of their companies the customer once secured. The country is now recovering very rapidly from its recent financial depression, and the new conditions are rendering easier the securing of money for investment for permanent improvements. Legislation must be carefully watched and methods of financing given close attention. While a good deal of the recent agitation has shown that some corporations have indulged in questionable financing, it was a fact that in general the Colorado corporations represented in their capitalization dollar for dollar. While sane regulations of corporations would not be frowned upon, the commissions must be composed of practical men. The association's best efforts must be directed toward defeat of harrassing legislation, and nothing would be so important in this direction as keeping the consumers satisfied.

F. W. Frueauff, president of the National Electric Light Association, was introduced. Mr. Frueauff said that while he was active in affairs of the National organization and had been honored by election to its presidency, he wished rather to greet the members as one of their own organization. He believed in the future of the state organization and could see and feel where much valuable work could be accomplished. Mr. Frueauff referred briefly to the important work which the National organization was taking up, and emphasized the importance of the appointment of T. C. Martin as permanent secretary. A great deal of good work had been done in securing new members, and various committees had been appointed or would be appointed to deal with the problems which affect every central station in the country. He took up the matter of affiliation of state organizations with the National Electric Light Association and explained the benefits which would accrue to the local association, and asked that this matter be given some consideration.

George B. Tripp, manager of the Colorado Springs Electric Company, suggested that a committee be appointed to prepare a report on the matter of affiliation.

Mr. Dostal reported that at a meeting of the presidents of the state railway associations just held, the matter of affiliation with the American Street and Interurban Railway Association had been discussed and a committee appointed with instructions to wait upon the executive committee of national association to secure data in this direction. The remainder of the morning session was devoted to the comprehensive consideration of various questions in the question box.

The Thursday afternoon session was convened at about 2:30 o'clock, and the association listened to an address by J. R. Cravath, of Chicago, on several features of illuminating engineering.

Two years ago Mr. Cravath had addressed the association on the subject of the lighting of small stores. The rapid introduction of tungsten lamps with auxiliary appliances had changed conditions somewhat. For the first time in the history of lighting the subject of illumination had been placed upon a sound engineering basis, and with the introduction of the high-efficiency lamps gasoline competition had been almost eliminated. The greatest improvement that had been brought about in the last three years was the increase in the knowledge of the exact effect which could be produced by the various sources of illumination and the improvement in the design and application of proper reflectors. The attention which was now being given to the proper directing of the light rays was making the matter of illumination an exact science. Mr. Cravath described various types of installments and showed how the selection and placing of the light unit and its equipping with proper glassware could be carried out accurately and any predetermined arrangement arrived at. He showed particularly the conditions which were to be avoided and indicated the pitfalls into which lighting men had strayed through not taking into consideration both the source of light and the reflecting surfaces in the room which was the subject of illumination.

S. E. Doane, chief engineer of the National Electric Lamp Association, Cleveland, O., contributed several very valuable features to this discussion. Illuminating engineering had been placed on a scientific basis, and where the lighting companies and consumers could get the advantage of the right kind of experience the results were far beyond the expectations of the most sanguine enthusiasts. In one city where the engineers of the National Electric Lamp Association had sent several of its engineers to install one of two tungsten equipments, the results had been so satisfactory that within three weeks there were 1,700 tungsten lamps on the circuits.

In almost every case the installment of the high-efficiency lamp did not reduce the amount paid to the company. As soon as the better quality of illumination was recognized, others followed suit. In this connection, however, there are more serious problems than the mere efficiency of illumination to be considered. With the increasing efficiency of the incandescent lamp, the present system of charging by central stations was proving inadequate, and unless there was an opportunity for a greatly increased consumption of current the time might come when there would be a reduction in revenue for the central station company. Based upon a readiness-to-serve charge the company was in a position to face any increase in the degree of efficiency without concern.

Mr. Doane also described the successful introduction of eighty-watt series tungsten lamps for street lighting to replace direct-current series arcs. These lamps had a guaranteed life of 1,300 hours and were proving very successful.

The balance of the afternoon session was devoted to the question box.

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The Friday session was devoted to a consideration of the question box and several contributed papers. F. P. Cummings, Denver, Colo., contributed a paper entitled "Notes on Meters and Meters Operating on Current Transformers." Mr. Cummings explained the various tests which should be made on meters in order to determine their accuracy and to determine the best meter which might be used on different kinds of circuits.

A paper entitled "Selling Electricity" was presented by H. M. McConnell, of Colorado Springs.

W. J. Canada, of Denver, presented a paper entitled "Notes on Grounded Secondaries." This paper elicited a great deal of discussion, and a number of the members stated that, although they had had experience in grounding neutrals, they considered it advisable because of complications which inevitably arise.

Another matter which was given serious consideration was the question of the best method to use in forcing operators of moving picture shows to discontinue the employment of defective home-made rheostats. Many cases were pointed out where dangerous fires had been started through the use of these devices. It was the consensus of opinion that the association should take definite steps to compel the proprietors of the picture shows to adopt safe appliances.

In opening the Saturday morning session Mr. Tripp, as chairman of the committee on the matter of affiliation, reported that as changes in the constitution and by-laws were necessary in order to act upon the matter of affiliation, the committee recommended that the subject be referred to the incoming administration.

The reports of the secretary, treasurer and auditing committee were received and adopted. The following officers were elected:

President, W. T. Wallace, Colorado Light and Power Company.

Vice-President, H. L. Corbett, United Hydro-Electric Company.

Secretary and Treasurer, J. C. Lawlor, Colorado Springs Electric Company.

Executive Committee, Geo. B. Tripp, Colorado Springs Electric Company; J. F. Dostal, Denver Gas and Electric Company.

Advisory Committee, W. J. Barker, Denver Gas and Electric Company; J. F. Vail, Pueblo and Suburban Traction Company; L. M. Cargo, Westinghouse Electric and Manufacturing Company; John A. Clay, Animas Power and Water Company; John A. Beeler, Denver City Tramway Company.

Finance Committee, W. G. Matthews, Denver City Tramway Company; J. C. Davidson, Hendrie & Bolthoff Company; F. C. Carstarphen, Carstarphen Electric Company.

Membership Committee, J. J. Cooper, Mountain Electric Company; George Woolley, General Electric Company; J. K. Durbin, United States Traction and Lighting Company.

DISTINGUISHED JAPANESE VISITORS AND OFFICIALS OF THE GENERAL ELECTRIC COMPANY AT THE SCHENECTADY WORKS.

The Honorary Commercial Commissioners of Japan at Schenectady.

In the tour of the United States now being made by a group of officially appointed commissioners from Japan a notable point of the itinerary, to the electrical world at least, was the visit made to the principal works of the General Electric Company.

On Monday, October 11, the party of fifty-eight Japanese, including six women and thirteen secretaries, and American representatives of the government and various cities, arrived in Schenectady, N. Y., in their special train. The train carrying the party was shifted into the General Electric Company's yards about 9 o'clock and the party escorted to one of the reception headquarters.

A comprehensive tour of the factories was then made, in which the party was divided into groups, each accompanied by interpreters and guides. An informal luncheon was served to the visitors and company representatives, totaling 125, in the new factory restaurant, which is a new concrete building with modern facilities for serving large numbers of employes daily. At this luncheon the visitors were welcomed by Vice-President E. W. Rice, Jr., who referred to the international significance of the tour as indicating better relations between the two nations, due to the opportunities it afforded for observation of industrial methods and commercial conditions in this country, as well as the personal acquaintances made by the visitors with American business men. He called attention to the fact that as large as the Schenectady plant is it was but one of the General Electric Company's works, representing about sixty per cent of the manufacturing facilities of the company. Brief acknowledgment was made by Baron Shibusawa, chairman of the commission, in which he proposed a toast to America and the General Electric Company, which was heartily responded to by the visitors, and followed by shouts of "Banzai."

Seated at the head table at this luncheon were the following: Baron Eiichi Shibusawa; President C. A. Coffin, of the General Electric Company; Mayor H. S. Van Voast, of Schenectady; President Richmond, of Union College; Vice-President E. W. Rice, Jr., of the General Electric Company; Consul-General K. Midzuna, and others.

In the evening, at the Mohawk Golf Club, the entire party of commissioners was entertained by the General Electric Company at a dinner.

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Vol. 55—No. 16

INDUSTRIAL SECTION

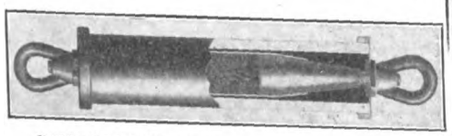
ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Westinghouse Strain Insulators.

The necessity of having a power line well insulated, with the conductors securely in place and taut, is well recognized; but the difficulties encountered in erecting such a line are also realized by the constructing engineer. The fragile nature of most insulating material, and the high stresses involved in line construction, render the design of effective insulators very difficult. On the other hand, the economy of high line voltage is a stimulus to the engineer to devise insulators that will withstand heavy electrical and mechanical stresses, because it has been found that the line potentials are only limited by the strength of the insulators available.

The Westinghouse company is marketing a line of insulators which are claimed to solve the insulator problem. These strain insulators include types for any duty that may be required in modern line construction, and are the result of careful research in conjunction with an efficient manufacturing system.

The type adapted to the greatest variety of requirements is known as the wood strain insulator. These insulators are made in various strengths, so that an effective and economical style of insulator is available for any service. They are designed for a working pull up to 4,000 pounds, and single insulators are adapted to voltages ranging from 150 to 11,000 volts. For higher potentials they may be connected end to end in series. The construction of these insulators possesses many inherent advantages, among which are low first cost and long life. The metal parts are furnished in a galvanized finish, which will withstand any atmospheric conditions, and the wood parts are especially treated and sealed to render them thoroughly moisture-proof.

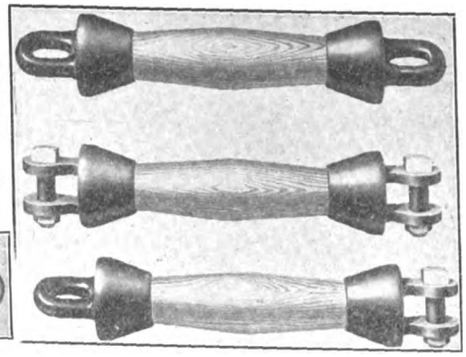


CONSTRUCTION OF WESTINGHOUSE TYPE C INSULATOR.

The end caps are secured to the body by being pressed around the taper shatts on the ends of the wood. This method of securing the caps insures a reliable joint whose strength equals that of the wood body or the metal eye. As the wood body is not fragile, like most insulating materials, it is not subject to breakage from impact.

The end caps are provided with eyes, clevises or tapped lugs, which adapt the insulator for dead-end, anchor guy or steady strain service.

For high-tension lines, the Westinghouse type C insulator is a new and interesting development. The insulator is tested at 40,000 volts before shipment, and its ultimate mechanical strength is upward of 30,000 pounds in tension. For service voltages up to 12,000, and for mechanical strains up to one-third, or in special cases one-half, of the ultimate strength, the type C insulator may be used with entire success. The construction is shown herewith.



WESTINGHOUSE WOOD STRAIN INSULATORS.

A pull on the eyebolts acts directly on the insulating cone to produce compression. This cone is constructed of sheet mica, under heavy pressure, and will withstand a heavy stress. The outside tube is of porcelain, and, being twenty inches long, offers ample creepage distance in any weather. It has no fragile petticoats and is quite inconspicuous. The porcelain acts only as a weather seal and is relieved of any mechanical strain.

The line of high-potential insulators includes disk and skirt types, which excel all others in their respective classes.

The line of low-voltage strain insulators includes Globe, Giant and Brooklyn types, which have been found very efficient in their several classes of service. The adjustable ties include two insulated turnbuckles. One has a porcelain insulator and the other has its eye molded in a special Westinghouse company. This is the same compound used on the Globe, Giant and Brooklyn types, and combines great insulating resistance, with stable structure, in the most extreme climates.

Speer Carbon Brushes.

Since the committee of the Engineering Association of the American Street and Interurban Railway has taken up the carbon-brush question and expressed a desire for a higher grade brush than what they have been using, the Speer Carbon Company, of St. Marys, Pa., has brought out a brush to conform with their specifications. This brush is made by a new process—perfectly homogeneous, uniform, no laminations, and made in four degrees of hardness.

For the past year they have been running some very elaborate service tests on some of the largest city railways and also on the large interurban railways, and they have more than exceeded their expectations. These tests were run on all classes of motors, regardless of the condition of the commutator or brush holder, and a great many of these motors had brush-holders that were badly worn, as they desired to give them the hardest test possible. All these tests showed a mileage of from 30,000 to 50,000 miles. They have now completed a sufficient number of their large tests to satisfy themselves that this new brush meets with all the requirements of the Engineers' Association.

Going into comparisons between the statistics of the twenty-five commercial land line and ocean cable telegraph systems and of the telephone systems, it may be noted that the first telegraph line in the United States was opened for business in 1844, and thirty-two years later the telephone was introduced. At the 1880 census the telephone companies reported 34,305 miles of wire, about one-ninth of the mileage of the telegraph companies. In 1902 the telephone mileage of wire was almost four times as great as that used for telegraph purposes. In 1907 the telephone mileage was eight times as great as the telegraph.

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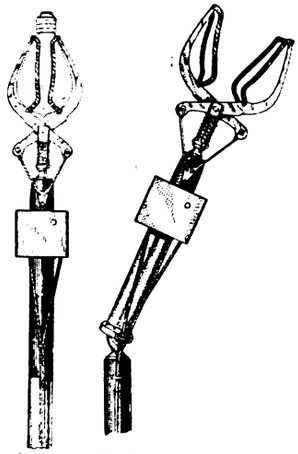
Edgerton's Lamp Cleaner and Adjuster.

A new form of electric lamp cleaner and adjuster, made by E. E. Edgerton, 6319 Lexington Avenue, Chicago, is shown in the accompanying illustrations. It is operated by adjusting it upon a one-and-one-eighth-inch pole of light wood, suitable for the height wanted. It is made in two styles, as may be seen in the illustrations. No. 1 is straight and No. 2 has a joint for inverted lamps. Lamps from one-half to four inches in diameter and six inches long may be held in this device by means of clamps.

The clamps are covered with rubber, and a light pull on the cord will grip the



No. 1. No. 2.
EGDERTON LAMP CLEANER AND ADJUSTER.

lamp firmly, and it is held so by the ratchet until released by the other cord. Thus an old lamp can be taken out and released and a new one clamped and inserted without handling the lamp. A telescope joint, screw-eyes, and cords are furnished with each outfit.

The simplicity and durability of its construction and its adaptability to all lamps of ordinary size make this cleaner a very desirable article.

Turbine-Blade Guessing Contest at the Denver Railway Exhibition.

One of the interesting features of the exhibition of street-railway apparatus held by the American Street and Interurban Railway Manufacturers' Association at Denver, Colo., October 4 to 8, was the guessing contest conducted by the Allis-Chalmers Company, of Milwaukee, Wis. The blades from a 1,000-kilowatt steam turbine were placed in a glass case, and everyone was invited to participate, there being no limit to the guesses allowed each person. Both delegates to the railway convention and their ladies, and manufacturers and manufacturers' representatives and their ladies participated.

The prizes were beautiful, serviceable and costly, and included a brushed brass writing set, a game set with mahogany case, a pair of sterling silver-mounted military brushes, a gold-mounted Gillette safety razor set, a set of embroidery scissors, silver crumb-tray, cut-glass powder jar, jewel case, and twenty-four silver Milwaukee souvenir spoons.

At 4 o'clock on Thursday afternoon the contest was declared closed. The number of blades in the case was found to be 6,199. The winners of first prizes for both delegates and manufacturers guessed the exact number, and the winners of the second prize for both delegates and manufacturers guessed 6,200, one away from the exact number. Among the men the guesses bunched closely around the exact number, the time-stamp in several instances determining the award. The indefatigable manager of the contest, F. G. Bolles, placed the prizes in the hands of practically every one of the lucky ones before the exodus from the convention city began.

J. T. Ross, of the Northern Ohio Traction and Light Company, Akron, Ohio, guessed the correct number, and won the first delegate's prize. The second delegate's prize went to Edwin C. Faber, of the Aurora, Elgin & Chicago Railroad. Milwaukee souvenir spoons were awarded to F. M. Ellis, Rockford & Interurban Railway, Rockford, Ill.; Sydney M. Bamburger, Salt Lake & Ogden Railroad; J. H. Pardee, J. G. White & Company, New York; A. E. Hook, Colorado Springs & Interurban Railway; Thomas A. H. Hay, Northampton Traction Company, Easton, Pa.

In the ladies' delegate class the first prize went to Mrs. W. M. Quackenbush, Mt. Clemons, Mich. Mrs. Ernest Gonzenbach, Sheboygan, Wis., won the second prize. Souvenir spoons were awarded to Mrs. W. H. Collins, Schenectady; Mrs. H. G. Vordenmark, Fort Wayne, Ind.; Mrs. Thomas Hawkin, Rockland, Me.; Mrs. Russell Howard, Green Bay, Wis.; Mrs. George Radcliffe, Schenectady.

In the manufacturers' class, the prizes were awarded as follows: First, George H. Berg, Illinois Stoker Company; second, A. A. Gray, ELECTRICAL REVIEW, Chicago, Ill. Souvenir spoons went to J. C. McQuiston, Westinghouse Companies, Pittsburg, Pa.; Percy Houts, Brecht Company; H. L. Monroe, General Electric Company, Chicago, Ill.; W. M. Lawyer, Whitmore Manufacturing Company, Cleveland, Ohio; H. J. Summers, Planet Company.

The ladies of the Manufacturers' Association secured prizes as follows: First, Mrs. J. M. Griffin, Wheel Truing Brake Shoe Company; second, Mrs. E. D. Batchelor, Pittsburg, Pa. Souvenir spoons were awarded to Mrs. W. H. Stieglett, John A. Roebling's Sons Company; Mrs. Rollin Gerry, Jones & Laughlin Company; Mrs. E. H. Hammond, American Electrical Works; Miss M. Sampson, Denver, and Miss Helen T. Fuller, Denver.

In connection with the guessing contest a peculiar coincidence was discovered in the fact that Mr. Faber and Mr. Gray, who each won second prizes, both guessing the same number, were close together in the guess on the arriving time of the special train from Chicago over the Chicago, Burlington & Quincy, the pool going to Mr. Faber from Mr. Gray by a margin of two minutes.

The Railway Exhibits at Denver.

One of the most important and valuable features of the convention of the American Street and Interurban Railway Association and its affiliated associations at Denver, Colo., October 4 to 8, was the great exhibition of electric-railway apparatus under the auspices of the Manufacturers' Association. The big Auditorium floor space and galleries were filled, and the overflow was well housed in a tented structure extending as an ell flanking the Auditorium on two sides The car exhibit was made on the tracks in the street adjoining one section of the tent. The display was well arranged, with plenty of room for freedom of movement, the exhibition buildings were well lighted and well ventilated, and the weather conditions almost perfect. Too much commendation cannot be given to the Manufacturers' Exhibition Committee for their magnificent arrangements and handling of this great display.

The Manufacturers' Exhibition Committee was composed of L. M. Cargo, chairman, the Westinghouse Companies, Denver, Colo.; C. M. Atwood, the Sherwin-Williams Company, Denver, Colo.; R. M. Babbitt, *Electric Railway Journal*, Chicago, Ill.; G. W. Cox, Electric Service Supplies Company, Keokuk, Iowa; Arthur T. Herr, American Brake Shoe and Foundry Company, Denver, Colo.; H. J. Kenfield, *Electric Traction Weekly*, Chicago, Ill.; Chas. Knight, American Steel and Wire Company, Chicago, Ill.;

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H. G. McConnaughy, Dearborn Drug and Chemical Company, New York city; S. P. McGough, the Lorain Steel Company, Chicago, Ill.; C. J. Olmstead, Westinghouse Traction Brake Company, Chicago, Ill.; R. H. Thompson, J. G. Brill Company, Denver, Colo.; A. L. Wilkinson, the Ohio Brass Company, Mansfield, Ohio; F. W. Darlington, director of exhibits.

The exhibits and general arrangements were under the direction of Vice-President Kenneth D. Hequembourg, general sales agent, Walker-Bennett Manufacturing Company, New York city.

Among the companies exhibiting were the following, with their representatives:

Allis-Chalmers Company, Milwaukee, Wis.—Air brakes, railway motor and controllers. Represented by F. G. Bolles, J. H. Waterman, J. R. Jeffrey, James Gardner, I. L. Dimm, R. B. McConney, E. W. Stull, F. W. Fanger, George Baiz. In addition to an elaborate exhibit of railway and kindred appliances, the company exhibited parts of steam turbines and distributed a series of handsome bulletins describing its various products. The company also conducted a unique guessing contest, which is described on another page of this issue. The company also exhibited Bryan-Marsh tantalum railway lamps.

Aluminum Company of America, Pittsburg, Pa.—Aluminum cable for high-tension transmission lines, aluminum feeder cables, lead-covered aluminum cables, rubber and paper insulation, various styles of joints, aluminum busbars. Represented by F. N. Baylies, E. H. Noyes, S. K. Colby.

American Steel and Wire Company, Chicago, Ill.—Electrical wires and cables, rail bonds and bonding tools, right-of-way fence. Represented by Charles R. Sturdevant, B. H. Ryder, F. A. Keyes, J. M. Holloway, J. D. Sutherland, E. R. Pool, W. H. Williams, W. R. Abbott, E. E. Aldous.

Anderson, Albert & J M., Manufacturing Company, Boston, Mass. — Sixty-six-thousand-volt, truss type, disconnecting switches, switches and pure copper castings, remote control mechanism for oil switches and time switches for alternating circuits up to 3,000 volts. Represented by Alfred E. Anderson, Henry Woltmann, Ernst Woltmann.

Avery Scale Company, North Milwaukee, Wis.—Automatic track scale and automatic elevator scales. Represented by B. P. Ordway, N. C. Webster.

Babcock & Wilcox Company, New York, N. Y.—B. & W. model of horizontal boiler and two types of boiler heads. Represented by F. A. Einfeldt, Charles Onderdonk, William Turner, Harry Byer.

Buckeye Electric Company, Cleveland, Ohio—Buckeye tantalum railway lamps. Represented by L. P. Sawyer, J. H. Cooke, A. G. Lucas, J. M. Johnson.

Consolidated Car Heating Company, Albany, N. Y.—Electric car heaters, motorman's cab heaters, house heaters, quick break knife switches, high-voltage push button, signal system, light signal to motorman indicating when doors are closed on multiple-unit train service, pneumatic door operator. Represented by Cornell S. Hawley, W. S. Hammond, Jr., Thomas Farmer, Jr.

Crouse-Hinds Company, Syracuse, N. Y.—Arc and incandescent headlights, condulets, panel-boards and cabinets, knife switches, harpoon guy anchors. Represented by F. F. Skeel, A. F. Hills, F. W. Buchanan, D. C. Gidley.

D & W Fuse Company, Providence, R. I.—Fuses and cut-outs including railway cut-outs, service switch boxes and fuse boxes for 250 and 600 volts and transformer and high-tension junction fuse boxes for both pole and subway installations, square and rectangular wires with Deltabeston insulation, field and armature coils. Represented by L. W. Downes, Willard S. Sisson, F. D. Ligon, H. M. Nichols.

Dearborn Drug and Chemical Works, Chicago, Ill.—Scientific methods in the treatment of boiler feed waters to prevent scale, corrosion, pitting and foaming. Represented by George R. Carr, H. G. McConnaughy, D. E. Cain.

Duntley Manufacturing Company, Chicago, Ill.—Pneumatic cleaners, motor-driven section cars. Represented by L. C. Thompson, George Clements.

Electric Service Supplies Company, Philadelphia, Pa.—Pay-within car, automotoneer, Garton-Daniels lightning arresters, Keystone pneumatic bell ringer, sander and valves, protected rail bonds, Keystone overhead material, improved St. Louis trolley pick-up, Lyon reinforced steel gear cases, sheet steel tool boxes. Represented by Chas. J. Mayer, J. W. Porter, Max A. Berg, J. V. E. Titus, E. R. Mason, Thos. H. Henkle, C. E. Ewing, G. W. Cox, M. S. Earl.

General Electric Company, Schenectady, N. Y.—Type M control equipment; complete emergency straight-air brake equipment for motor car and trail car; New York variable release motor car air brake equipment; railway motors; aluminum cell lightning arresters; magnetite arc headlights; indicating and recording steam meters; air compressors; alternating-current railway signal system; complete line of rail bonds and line material. Represented by F. H. Gale, J. G. Barry, H. N. Ransom, W. G. Carey, C. E. Barry, E. D. Priest, F. E. Case, A. H. Armstrong, S. W. Trawick, W. J. Clark, C. B. Keyes, T. Beran, H. G. Geier, R. E. Moore, H. L. Monroe, J. W. Buell, G. D. Rosenthal, C. C. Peirce, H. M. Winter, A. W. Arlin, A. V. Thompson, C. W. Blivin, H. C. Marsh, W. J. Hanley, Irving Hale, G. A. Woolley, H. C. Glaze.

Gest, G. M., New York, N. Y.—Cable racks. Represented by H. H. Stannard. Mr. Stannard also represented the New York Pole Company, exhibiting its patented method of reinforcing tubular poles with nests of steel rods and cement grout introduced into the hollow pole under pressure.

H. W. Johns-Manville Company, New York, N. Y.—Porcelain insulators, transite asbestos wood, low-voltage overhead line material, catenary line material, molded insulations, indurated fiber forms for third-rail protection, high-voltage oil-switch tanks and fiber conduit, Noark enclosed fuse and service boxes, fuses and devices for high and low-voltage service, J-M guy anchors and mine supplies, friction tape and rubber compounds, asbestos and magnesia pipe and boiler coverings, packings, linolite, desk and table lamps. Represented by J. W. Perry, George A. Saylor, A. H. Pierick.

Kerite Insulated Wire and Cable Company, New York, N. Y.—Insulated wires and cables for alternating-current and direct-current feeders, transmissions, signals, telephone, telegraph, car wiring, and car house wiring. Represented by R. D. Brixey, Azel Ames, P. W. Miller, J. A. Renton, J. V. Watson, B. L. Winchell, Jr., R. E. Butterick.

Massachusetts Chemical Company, Walpole, Mass.—Liquid and rubber insulating specialties, Armalac, Enamelac, friction tapes, splicing compounds, filling compounds, cement; molded rubber specialties. Represented by L. O. Duclos, A. E. Duclos, E. W. Furbush.

National Carbon Company, Cleveland, Ohio.—New Laclede railway motor brushes, also Columbia, National high-grade Partridge, high-grade Partridge, Perfection and other railway motor brushes, special graphite brushes, standard pig tail brushes, Columbia dry cells, railway signal dry cells, headlight carbons, turbine rings. Represented by W. B. Brady, O. T. Weaver, F. D. Kathe, F. J. Kysela.

Ohio Brass Company, Mansfield, Ohio.—Trolley hangers, ears and clamps, catenary fixtures, mine trolley fixtures, rail bonds, automatic car couplers, pneumatic sanders, electric car signals, third-rail insulators, high-tension porcelain insulators. Represented by C. K. King, A. L. Wilkinson, L. W. Olson, E. F. Wickwire, G. A. Mead, N. M. Garland, J. E. Slimp, F. V. Cook, E. C. Brown, F. E. Johnson, R. J. Deneen, F. S. Deneen, G. W. Cooper, C. H. Tomlinson, A. L. Price.

Rail Joint Company, New York, N. Y.—Continuous, Weber and Wolhaupter rail joints for T, high T and girder rails, both standard and compromise. Represented by F. C. Webb, J. A. Greer, W. T. McCaskey, W. E. Clark, E. L. Vandresar, P. D. Watson.

Roebling's Sons Company, John A., Trenton, N. J.—Reception room and literature describing all grades and kinds of wires and cables. Represented by A. B. Conover, W. H. Slingluff, J. McG. King.

Standard Paint Company, New York, N. Y.—P. & B., S. P. C. varnish, compounds and insulating tape; Novac compound for impregnating coils. Represented by Charles E. Smith, Bernard C. Beckman, John H. Thomas, J. I. Pfeiffer.

Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.—This company made an elaborate and very interesting working exhibit of telephone apparatus and railway signaling apparatus. Represented by A. M. Hanbrich, H. W. Lucia, C. P. Button, H. C. Slemin.

Speer Carbon Company, St. Marys, Pa.—Motor and generator brushes. This company's line of high-grade railway motor brushes, conforming to the specifications of the Standards Committee of the Association, commanded a great deal of interest. Represented by J. S. Speer.

Wagner Electric Manufacturing Company, St. Louis, Mo.—Wagner single-phase motor, skeleton governor mechanism of single-phase motor; the Wagner "moral-ameter," with which a good deal of fun and diversion was had. The "moral-ameter" was always surrounded by a lot of railway men anxious to have their mental condition prognosticated. Represented by Walter Robbins, Frank N. Jewett, Ray D. Lillibridge, O. H. Davidson.

Western Electric Company, New York, N. Y.—Railway telephones, portable telephone sets, bells, buzzers and batteries, Electrose insulation, strain insulators, Ideal cap and cone hangers, line and overhead construction material, armature and field coils, Kalamazoo trolley wheels, harps and sand boxes. Represented by F. C. Killion, R. H. Harper, W. E. Harkness, M. H. Nichols, C. L. Howk, A. Brown, H. C. Biglin, H. Olsen.

Westinghouse Companies, Pittsburg, Pa.—Sixty-ton interurban car of the Denver & Interurban Railway, equipped with unit switch control and four 125-horsepower motors, and designed to operate on 11,000-volt alternating current and 600-volt direct current; fifteen-ton mining locomotive, twenty-five-kilowatt turbo-exciter set, No. 5 Westinghouse-Leblanc condenser with motor-driven air and water pump; line and trolley material, catenary construction, poles; car circuit-breakers, arc headlights, multiple-unit switch control apparatus, train connectors, gears, traction brakes, lightning arresters, interpole railway motors, types CCI, DA, HF and SA motors; series, 110-volt and "W" and "V"

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sign tungsten lamps. Represented by Joseph R. Ellicott, Charles Ellicott, S. D. Hutchins, S. J. Kidder, A. L. Humphrey, E. L. Adreon, E. H. Sniffen, J. C. Kyle, J. A. Brett, C. W. Register, J. L. Tritle, Horace Clark, C. Olmstead, C. C. Chappelle, I. L. Brinsmade, G. O. Noble, E. E. Heise, W. S. Bartholomew, J. C. McQuiston, E. H. Heinrichs, J. C. Kyle, L. M. Cargo, Thomas Cooper, L. H. Kidder, W. L. Conwell, D. W. Belden.

The *Electric Railway Journal* maintained a publication office at Denver and printed daily issues during the convention. Complete lists of exhibits and exhibitors were published, together with full reports of the proceedings, and papers and committee presentations. A feature of these dailies were the "Conventionalities" and side-lights upon the exhibitions and the prominent men in attendance. The representatives were James H. McGraw, J. M. Wakeman, H. W. Blake, Joseph A. Kucera, L. E. Gould, Rodney Hitt, F. Nicholas, Walter Jackson, W. E. Keily, C. A. Babtiste, W. K. Beard, C. T. Walker, R. M. Babbitt, E. J. Hunt, H. E. Hopkins, Malcolm Muir, Miss J. Phelps, Miss M. Murphey.

The American Carbon and Battery Company, Chicago, Ill., was represented by H. J. Wrape, P. H. McGauley and C. V. Mayer.

The Bryan-Marsh Electric Company, Chicago, Ill., was represented by J. S. Corby.

The Standard Underground Cable Company, Pittsburg, Pa., was represented by J. R. Wiley, western manager, Chicago.

The Kenfield-Fairchild Publishing Company, Chicago, Ill., publisher of the *Electric Traction Weekly*, was represented by H. J. Kenfield, George S. Davis, W. J. Field and A. M. Standish.

The National Electric Lamp Association, Cleveland, Ohio, was represented by S. E. Doane, chief engineer, and George S. Merrill, of the engineering department.

The ELECTRICAL REVIEW AND WESTERN ELECTRICIAN was represented by A. A. Gray, managing editor.

The Electric Storage Battery Company, Philadelphia, Pa., was represented by Godfrey H. Atkin, western manager, Chicago, H. P. Marshall and R. L. Lunt, of the Chicago office.

The Valentine-Clark Company, Chicago, was represented by President E. L. Clark.

The Western Pole and Lumber Company, Denver, was represented by President B. F. Vreeland, M. G. Graff and W. H. Lewis.

The Chicago Pneumatic Tool Company, Chicago, was represented by C. B. Coates, B. C. Morse, J. A. Ercland, George Morse.

Dossert & Company, New York, was represented by H. B. Logan, president, F. C. Shaw, W. A. Cowling.

Westinghouse, Church, Kerr & Company, New York, were represented by H. H. Kerr.

The John A. Stewart Electric Company, Chicago, was represented by W. H. Stewart.

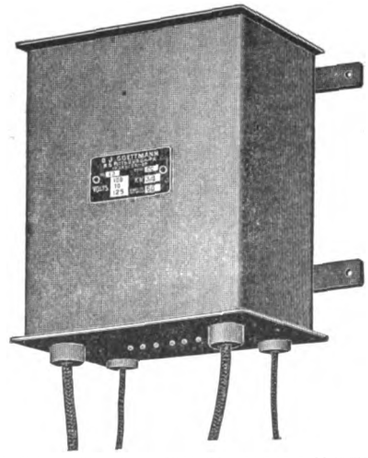
The Lord Electric Company, New York, was represented by Henry Jones, O. N. Davidson, J. C. Williams.

The Crocker-Wheeler Company, Ampere, N. J., was represented by D. Vance Sickman, George Mitchell.

The Joseph Dixon Crucible Company, Jersey City, N. J., was represented by John Ready, L. H. Snyder.

Low-Voltage Transformers.

The wide and varied use of electricity in the advertising world has opened a field for the electrical transformer, by means of which the ordinary commercial current can be utilized for the various forms of street signs to the best advantage. As the electric sign business has



GOETTMANN TUNGSTEN SIGN-LIGHTING TRANSFORMER.

developed, the demand comes for the brightest light obtainable, and good results in this line have been secured by the use of tungsten lamps. To use these lamps the ordinary commercial current must be reduced and regulated by the use of a transformer, and O. J. Goettmann, 525 E. Ohio Street, Pittsburg, Pa., is marketing one which is giving good satisfaction.

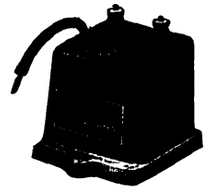
This transformer, shown in an accompanying illustration, is mounted in an enameled weatherproof case so constructed as to be easily attached to the wall, and in appearance is very neat. Special care has been exercised in the core, the highest grade of silico-vanadium steel being used. On account of the low voltage secured the transformer is a self-cooling one.

This company is also marketing three special types of transformers particularly adapted for household and office use. By

GOETTMANN TYPE "C" TRANSFORMER.

using these transformers an electric-light current may be made available to operate electric bells, annunciators, indicators, electric toys, etc.

One of these, known as the "Roberts" or type "C" transformer, is the largest of the three, and is suitable for a large annunciator for hotels, for operating a small train of cars, or, in fact, will meet all

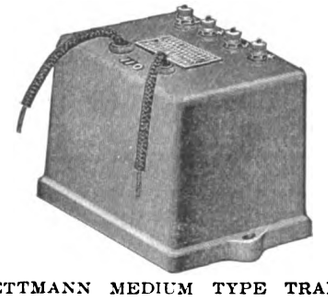


GOETTMANN BELL TYPE TRANSFORMER.

ordinary requirements of a large establishment.

The medium size transformer will operate a dozen bells or push buttons at one time, and fill the requirements of a residence, store or hotel.

For residences where only the ordinary door bell, and, probably one or two annunciators are in service, the smallest or bell type has been found suitable.



GOETTMANN MEDIUM TYPE TRANSFORMER.

All sizes of transformers can be placed inside the building, and are built and finished with that end in view. They will operate successfully on circuits ranging from 100 to 125 volts. Views of these three sizes of transformers are shown herewith.

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Electric Commercial Vehicles.

In a recent issue of one of the New York dailies there appeared a striking commentary on the actual effect which confidence in motor-driven vehicles was having in replacing the horse for commercial trucking. It is not unusual nowadays to find large companies owning teaming privileges abandoning entirely the horse-drawn vehicles and substituting motor-driven wagons. In line with the rapid introduction which the electrical vehicle is having in every large city in the country a number of orders recently booked by the General Vehicle Company is of interest.

The R. W. Macy Company, of New York city, has had a very fortunate experience with electric wagons and has added to its equipment by placing a repeat order for twelve 2,000-pound capacity delivery wagons.

The New York *Sun* has had an unusual experience. In 1907 the company put in an equipment of electric wagons, and during this interval has tried out several types of gasoline machines, importing a number from abroad. It is encouraging, indeed, to note that, after a thorough trial of each type, an order has just been placed for three more electric wagons similar to those installed in 1907.

The service required of these delivery wagons for newspaper work is very severe. They must operate in all kinds of weather, must be absolutely dependable, as the papers are loaded at the last minute and a very quick run must be made to all of the outgoing railroad stations. The drivers are a hardy, reckless lot, and both motor and wagon must withstand almost every conceivable vicissitude of service.

The Commonwealth Edison Company of Chicago, has been using a five-ton electric General Vehicle truck for the past six years and has just placed an order, through the western office, for a number of electric wagons of a lighter capacity.

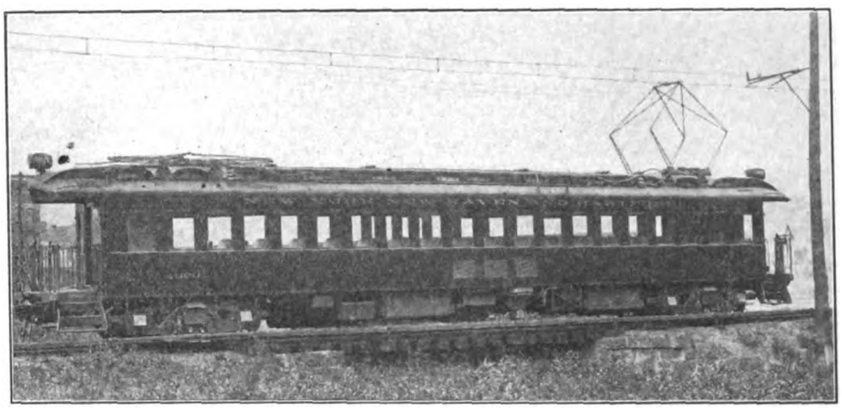
The Cleveland Electric Illuminating Company has placed an order, through the Chicago office, for a three-and-one-half-ton truck, with an electric windlass for pulling cable and loading and unloading.

The principal office and factory of the General Vehicle Company is at Long Island City, New York, and the Chicago office is at 417 Rookery, in charge of P. C. Chrysler, western manager.

Motor Cars for the New Haven Suburban Service.

At the East Pittsburg shops of the Westinghouse Electric and Manufacturing Company, there is now being installed the electrical equipment of a number of motor cars for the suburban service of the New York, New Haven & Hartford Railroad. These handsome cars are designed to operate on both 11,000-volt alternating-current catenary trolley of the main New Haven electrification, and on the 600-volt direct-current third-rail section entering the New York terminal.

By reason of the fact that the New Haven equipments are also required to operate on the direct-current third-rail, the control equipment for effecting a change from alternating to direct current is necessarily more extensive than had the control been arranged for straight alternating-current operation throughout, but as seen in the accompanying illustration, this auxiliary apparatus has been so well distributed under the floor that there is ample room for everything in the space between the trucks.



ELECTRIC STEEL PASSENGER COACH FOR NEW HAVEN SUBURBAN SERVICE.

These cars, which are intended to pull trailers, are equipped with four series compensated motors. These and the step-down auto-transformers are supplied with forced ventilation from the blower system. When the equipment is operated under forced ventilation the one-hour railway rating of each motor is then 200 horsepower.

Each car is guaranteed to haul two fifty-ton trailers, and when so operating will accelerate normally at a rate of 0.7 mile per hour per second.

The arrangement of the motors differs from that of any other cars in use in this country, in having the motor geared to a quill surrounding the axle, which is geared to the driving wheels by means of driving springs of the same type as are used successfully on the New Haven electric locomotives.

The cars are seventy feet in length, weigh eighty-six tons, and have a seating capacity for seventy-two persons. The car bodies and trucks were built by the Standard Steel Car Company, and are of fireproof steel construction throughout. They are handsomely finished and are said to be the most easy-riding cars ever built.

A New Rubber Tree in Chili.

The United States Consul at Valparaiso writes as follows concerning the *Euphorbia lactiflua,* a rubber shrub discovered by the botanical section of the national museum of Chili:

"A very good quality of rubber can, it is claimed, be easily made from this shrub, which is found on the mountains and table lands of that portion of the interior of Chili extending from Taltal south to Caldera, a distance of about seventy-five miles. It is said to be of no other use than for rubber and wood pulp. It is claimed that extracting the sap does not injure the plant, and that there seems to be a future for the industry if attention be given to its cultivation. It is badly scattered, and in many cases difficult of access, but it is claimed that it could easily be cultivated. A company has been organized to develop the industry, and is seeking a concession."

Independent Telephone Convention at Chicago.

The annual convention of the International Independent Telephone Association will be held at the Auditorium Hotel, Chicago, on December 7, 8 and 9. An attendance of from 800 to 1,000 Independents is expected. Arrangements for a very successful meeting are being perfected by the executive committee.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, OCTOBER 4.—An interesting item is the fact that a twenty-two-and-one-half candlepower Osram lamp for burning on 200 to 260-volt circuits has now been placed on the market.

An endeavor is being made in the House of Commons, by those interested in motor omnibuses, to secure Government action in the direction of compelling tramway authorities to fit hooters to their cars which will "audibly" announce when the legal limit of speed has been exceeded. It may be stated that such a provision was recently put upon the motor omnibus companies in London by the Commissioner of Police. In connection with tramways, however, varying limits of speed are imposed for different portions of the district traversed, and this naturally introduces considerable difficulties in attempting to enforce such a regulation. The question, however, is said to be under consideration by the authorities.

A year or two ago it may be remembered that there was considerable controversy concerning the effect of the London County Council electric-power station at Greenwich upon the Royal Observatory, which is close by. A committee of experts was appointed to go into the matter with the result that certain modifications were made in the design of the second portion of the tramway power station, which was then under construction. About the same time the question also arose as to the possible effect upon the instruments in the observatory in the event of the Council deciding to install the overhead system, or any system in which there is not an insulated return. To pacify the authorities at the time it was agreed to give the Astronomer Royal a veto upon all tramways within a radius of three miles of the observatory. In other words, he would have to approve of the mode of construction. An instance has just arisen in which this veto has been given effect to, the tramways in question being in the Woolwich district and within the three-mile limit. Although work had actually been started on the line in question—which it was proposed to equip upon the ordinary overhead system—operations have had to be suspended and there is some talk of a special three-wire system being evolved to meet the exigencies of the case. Officials on both sides, however, are very reticent as to what is going on.

It is announced that the opening of the single-phase railway in the south of London will have to be postponed from October 1 until December 1, the reason for this being differently stated in different quarters. There have been no technical difficulties encountered with the construction of the line, however, and it may be taken as correct that delays on the part of the contractors are the main cause. As far as the work has progressed the Board of Trade, as the authority which has to be satisfied, has not made any complaints.

The first British-made railless electric car is now undergoing experimental trials near London. The car has much the appearance of a small single-deck tramcar or motor omnibus on rubber-shod wheels, plus the double trolley pole. The electrical equipment consists of two twenty-five-horsepower railway motors of the B. T.-H. Company's standard construction, with the usual series-parallel controller and grid resistances. It seats twenty-two passengers and has two additional seats on the rear platform. The drive is by chain as in the case of most petrol-driven omnibuses, the two motors being independent of each other. The equipment of the car differs considerably from its continental prototypes in that the trolley head is of the under-running variety and special precautions have been taken to prevent the metal framework of the car becoming electrically charged, a point which those responsible for the continental cars of this description have, to some extent, overlooked, or at any rate have run great risks. The overhead line with which the experiments are being made consists of a pair of trolley wires, but a design in which three overhead wires are employed has also been prepared.

A proposal to deposit a bill in Parliament for powers to construct a tube-electric railway from Victoria station to the Crystal Palace has not been particularly well received generally. A feeling has been gaining ground for several years past that the best way in which to improve locomotion in London is to reorganize the existing services, and evidence of what can be done in this direction is given by the results obtained upon the district and other lines during the past half year. In any case the capital of the proposed undertaking will have to be underwritten, for it will assuredly never be forthcoming from the general public. The capital is $17,500,000 and a very eminent traction expert is advising the promoters.

For some years now a question which has remained unsettled in relation to traction undertakings is as to who should bear the cost of installing in telephone exchanges the heat coils and fuses necessary to afford protection against the accidental contact of telephone wires with traction trolley wires. The tramway authorities have held that this expense should fall upon the postmaster-general and the latter, of course, has held a contrary view. Arbitration was eventually resorted to to settle the dispute and the proceedings duly came off this summer. It was agreed that all tramway authorities in the Kingdom should abide by the arbitrator's award, although the actual arbitration proceedings only related to one particular tramway. The arbitrator decreed that the expense in question should be borne by the tramway companies. As there is no question of an appeal the point is settled for all time.

A very gloomy statement was made by the chairman of Messrs. Dick, Kerr & Company at the annual meeting this week. He stated that during the past year less work had been carried out in all their departments than in any previous year and that he could hold out no immediate hope of any improvement. Severe competition still continued and had even penetrated into foreign markets. It may be mentioned that the company paid six per cent dividends on both preference and ordinary shares.

The Poplar Borough Council (London) has decided to duplicate its plant for the manufacture of disinfectant by electrolytic methods, so successful has this proved during its two years' existence.

An instance of commercial methods in electric-power supply in Great Britain is to be found at Hanley (Staffs). In order to secure a large power user the corporation agreed to purchase the firm's stock of coal which had been laid in for the existing steam plant. The purchase was agreed to be carried out at the rate per ton paid by the corporation for its ordinary coal supply for the electricity works.

G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, OCTOBER 5.—At Marseilles there is an electric-traction project on foot for a local railway line, which is to run from the suburban town of Saint Antoine to Martigues. In the Pyrenees region of France a local company has applied for a concession for an electric tramway, which is to run from the port of Bayonne to the much-frequented watering place of Biarritz. At Roubaix, in the north of France, it is likely that there will be an extension made of the present electric-tramway system in the town, and the municipality is to award the contract for the work to a local company.

As regards electric-lighting projects, I note that the town of Pleaux is to install an electric plant. The locality of Milau will also have a light and power plant erected in the near future. Le Chatelet-en-Brie is another town in which an electric-lighting project is being considered and, among others, I may mention the localities of Dazulé in the Channel region, the town of Firmy and the town of Bourges, all of which are to have electric plants erected.

Among the new companies formed at Paris is the General Construction and Renting Company for erecting electric plants. At Collonges there is formed the Schussel, Guy and Dumartheray firm, for electric-lighting plants. The Société Française de l'Electricité Economique, at Mureaux, is to be engaged in light and power plants. At Mendon, the firm of Charet Bros. is occupied with electrical construction work. Taupin, Auge et Cie, of Paris, are constructors of electric apparatus. Dynamos and apparatus are built by the new firm Bosshard, Poirier et Cie, at Charleville.

In Austro-Hungary there is being considered a project of some scope for a hydraulic plant, which is to furnish a supply for several towns of large size such as Arad, Hadju and Bihar. The station is to be erected on the Dragan stream by one of the large electric companies, and as the stream runs in a narrow valley there is to be used a large reservoir formed by backing up the water for some distance. The head of water to be secured in the present plans is 290 metres, at the rate of 7,000 litres per second. There is a project on foot for an electric railroad from Budapest to the town of Peczel, and the municipalities are now coming to an agreement on the question.

A syndicate of electric firms has made a proposition to purchase the whole of the electric tramway system of St. Petersburg. The Allgemeine firm, the English Westinghouse Company and the Siemens & Halske firm compose the syndicate in question and all the lines, stations and rolling stock are to be

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purchased for the sum of thirty million roubles. In this agreement the municipality will receive a certain portion of the net receipts of the lines, about seven-and-one-half per cent, and will become the ultimate owner of the whole system in fifty years.

A. DE C.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, OCTOBER 11.—The city of Fort William, Ont., has granted the Slate River Telephone Company connection with the municipal telephone system. Connection will also be made with several other nearby systems in the near future.

At Lethbridge, Alta., a local company is being formed to build a street-railway system with radial lines to adjacent settlements and villages.

The Hydro-Electric Commission, Toronto, Ont., is making arrangements to erect a substation at Port Arthur, Ont., to supply that city with power from Niagara Falls. The rate will be $17 per horsepower, which will be gradually reduced to $13.

The Creston Telephone, Light and Power Company, of Creston, B. C., is now completing its telephone system in that town and proposes shortly to commence the construction of telephone lines to adjacent towns.

The British Columbia Electric Company has decided to rush to completion its proposed power development and plant on the Jordan River, near Victoria, B. C. Wynn Meredith is supervising engineer for the work, which will cost approximately $1,500,000. R. H. Sperling, Vancouver, B. C., is general manager.

The hydroelectric plant at Fort Francis, Ont., is nearing completion and it is expected to be in operation by December. The price to consumers will be $12 per horsepower.

Rural telephones are in great demand in Manitoba at the present time and the Government Telephone Commission is unable to keep up with the demands. During the past two weeks a large number of applications have been received, but the majority of them will be left over until next year. Local exchanges at Gimli, Tuelon, Strathclair and Medora have been opened within the past few days.

By an almost unanimous vote the ratepayers of Lacombe, Alta., voted in favor of the town taking over all the assets of the Blindman River Power Company, which supplied the town with light until recent financial difficulties appeared.

The Kootenay Telephone Company, of Cranbrook, B. C., is rushing construction on its lines to the east in order to make connections with the system of the Alberta government. To the south the company is also building lines to connect with the Bell Company in the state of Washington.

The Grand Trunk Pacific Railroad Company is installing a complete telephone system in Prince Rupert, B. C., its western terminal. Address A. B. Smith, manager of telegraphs, Winnipeg, Man.

The Burrard Power Company, Vancouver, B. C., has been granted 25,000 miner's inches of water from the Lillooet River and will at once proceed with the erection of a large power plant to supply light and power in Vancouver. The proposed development is twenty-three miles from Vancouver.

R.

IMPORTANT DEVELOPMENT.

(Special Correspondence.)

POWER AND LIGHT COMBINATION—The Electric Bond and Share Company, of New York, with which interests of the General Electric Company are identified, has effected a consolidation of a number of important light, heat, power, electric and gas companies of the West. The consolidated company is known as the American Power and Light Company, and will have a capital stock of $15,000,000, of which $5,000,000 will be accumulative six per cent preferred from October 1, 1909, and $10,000,000 common. There will be issued $2,500,000 of preferred stock and $5,500,000 common. The company will be organized under the laws of the state of Delaware, and has acquired the following properties: The Home Light, Heat and Power Company, of Pittsburg, Kan.; The United Gas Company and the Edison Light and Power Company, of Wichita, Kan., and the Astoria Electric Company, of Astoria, Ore. Negotiations are now pending for several other important western properties, the acquisition of which, when accomplished, is expected to increase the earnings of the company materially. The new company will commence business with a cash working capital of at least $500,000. The gross earnings of the four companies above mentioned for the year ended May 31, 1909, were $777,481. Gross earnings for the current fiscal year are estimated at over $1,000,000.

LIGHTING AND POWER.

(Special Correspondence.)

GREENVILLE, S. C.—The Monaghan Mills will shortly be using both electricity and steam power. This company has been operating with a 2,000-horsepower engine, and is installing an electric drive with electricity furnished by the Greenville transmission lines of the Southern Power Company, of Charlotte, N. C. The Monaghan company has contracted with the Southern management for secondary power, and its mill will at times be operated by electricity and by steam. About $30,000 is the cost of the electrical installation. The company is also arranging to furnish electric lighting in the streets and houses of its village.

ROCK HILL, S. C.—R. T. Fewell, the present manager of the Rock Hill Water, Light and Power Company, recently sold at a receiver's sale to Philadelphia capitalists, announces that a charter will be asked by himself and P. A. Wilcox, Florence, S. C., for the Rock Hill Lighting and Water Company, books of subscription to be opened at once.

L.

WESTBORO, MASS.—The Westboro Gas and Electric Company has found that it would cost a good deal to keep up the efficiency of its plant, and so has closed a deal whereby the Westboro Gas and Electric Company will receive its electricity from the Connecticut River Power Company, through the Marlboro Electric Light Company. The right to erect poles and string wires has been granted by the Westboro Selectmen, and Northboro and the State Highway Commissioners. The work of making the connections was started September 25.

ATHOL, MASS.—The State Gas Commissioners have given a hearing on the petition of the Athol Gas and Electric Light Company for authority to issue 1,748 shares of additional capital stock of the par value of $100, for the purpose of raising money to be applied to the payment liabilities incurred for buying additions to the plant. The additional stock, if approved by the Commission, is to be offered to stockholders of the Athol company of record August 24, 1909, at $100 per share. There was no opposition and the Commission took the matter under advisement.

NEBRASKA CITY, NEB.—A new corporation, known as the Nebraska City Light and Power Company, has been formed and the articles of incorporation have been filed with the county clerk. It has a capital stock of $100,000 and the shares are $5,000 each, of which 20 per cent was paid in at the time of the adopting of the articles of incorporation. The incorporators are E. K. Bradley, H. H. Hanks, J. F. Johnson, Walt McNamara, Fred E. Johnson, A. G. Hastie and G. E. Hanks. They are all well-known capitalists of this city, and most of them are stockholders in the King Falfa Company, at which plant the power house is situated.

FREDERICK, MD.—At a public meeting of citizens of Thurmont, in the interest of lighting the town with electricity, it was decided to form a corporation and build an electric lighting plant. It is the purpose of the Town Council to get power by an act of the legislature to issue bonds for the payment of the plant, after which it will be turned over to the town officials. The incorporators will include Col. John R. Rouzer, Peter N. Hammaker, J. W. Creager, M. A. Birely, L. N. Creager, L. S. Birely, L. R. Waeshe, Thomas E. Lycett, D. R. Rouzer, Charles Mackley, Senator J. P. T. Mathias and J. P. Waesche. Articles of incorporation are being prepared.

ASHLAND, PA.—The Mineral Railroad and Mining Company recently installed an electric plant at its Luke Fiddler colliery, at Shamokin, and now purposes to light all of its collieries from this plant. Arc lights have been placed at the Hickory Swamp colliery and the electricity is about ready to be turned on. Arc lights will be placed about the outside workings of all of the company's collieries, and the colliery offices will be lighted with electricity from this plant. The company has its own telephone system and the light wires will be strung on the telephone poles. It is likely that the company will commence to light with electricity the homes about its collieries.

HICKORY, N. C.—The transmission lines of the Southern Power Company will be completed to Hickory, about 125 miles from the generating plants, by November 1, according to present calculation. The Thornton Light and Power Company will handle 400 horsepower from the Southern Power Company, using 150 in its own plant, and using the remainder for distribution among numerous industries of the town and vicinity. The Thornton Company will control the power only within the city limits, and outside, where a number of larger industries are located, the Southern Power Company will have full sway. Colonel Thornton, of the local company, declares that he now has in sight the money for developing a waterpower on the Catawba near Hickory, from which he proposes to supply several smaller towns to the north of Hickory with electricity.

L.

FREDERICKSBURG, VA.—President W. C. Whitner, of the Fredericksburg Power Company, has returned from New York, where he was in consultation with Mr. Gould in reference to the Gould interests at this city. The result is that developments on an extensive scale are to begin here at once. A large force of hands has been started crushing stone to be used in the construction of the power house of the company to be erected in this city. This will require 6,000 yards of the crushed stone. The stone to be used will be taken from the quarries on both sides of the Rappahannock River, one mile above this city. The ground for the power house will be broken as soon as the material to be used for its construction can be got together. The site is between Main Street and the river front at the foot of

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Factory Street, which intersects Main Street. The new dam of the company has been completed at great expense and is in use, the old dam having been abandoned. It is expected that the electric railroad line will be extended from Ashland to this city and on to Washington as soon as the power house is completed.

LIMA, OHIO—The much-talked-of project of harnessing the Sandusky River at Ballville near Fremont has finally become a reality and work will soon be started on the job. The Fremont Power and Light Company is financing the scheme and has let the contract to Engineer Robert H. Lysle, of Chicago. Mr. Lysle has arrived at Fremont and is busy getting things in readiness to begin operations. The work will cost in the neighborhood of $600,000 and will be finished within three months if a large force of men are employed. The dam will be of reinforced concrete and will be about 260 feet in length at the base. The structure will be twenty-seven feet in height.

LOUISVILLE, KY.—What is expected to prove a thoroughly up-to-date power house is to be erected by the Louisville Street Railway Company as an addition to the power plant at Campbell and Logan streets. This official statement has been made by T. J. Minary, president of the railway company. The project was approved some weeks ago and work has already started on the structure, which will involve an expenditure of more than $70,000. According to the specifications accepted for the new building, it will cover an area of sixty by 110 feet and will be one story in height. The building itself will cost about $20,000, to which will be added more than $50,000 for modern machinery.

SAGINAW, MICH.—Since the articles of the eighteen big power companies of Michigan were filed with the secretary of state at Lansing last week the subject has been debated here as to whether the Saginaw River, the Tittabawassee and the Cass rivers, all streams in this vicinity, could develop enough of a force in their waterfall to generate power as do the Muskegon, the Grand and the Au Sable rivers. Engineers have investigated the conditions in this vicinity with a view to harnessing the streams that traverse this country. The investigators find in most instances the waterfall is not enough and that the generation of power from local sources is in all probability impracticable.

CARTERSVILLE, GA.—United States Army engineers have begun surveys and borings for proposed storage reservoir on Etowah River, near Cartersville; dam to be 160 feet high, with storage capacity of 35,000,000,000 cubic feet of water, thus storing excess water during rainy seasons, preventing flood and equalizing flow of river during dry periods; electrical control planned for regulating amount of water to pass through dam; estimated cost $3,000,000, to be expended by United States Government, it being proposed this amount be refunded by various water-power companies deriving benefits from increased power value of river; earth and concrete construction proposed for dam; no construction to be undertaken until approval by Congress; Capt. H. B. Ferguson, Montgomery, Ala., can probably give information.

OGDEN CITY, UTAH—The Telluride Power Company has been replacing its power lines between Salt Lake City and Logan Canyon, a distance of seventy miles, with a double line constructed of steel towers and wooden towers. The steel tower line has been completed between Salt Lake City and North Ogden Canyon, a distance of forty miles. This line will support one circuit of three 115,563-circular-mil stranded copper cables and will be insulated for 60,000 volts. The towers are set upon cement bases and are spaced from 200 to 950 feet apart. This line when fully completed will be one of the finest transmission lines in the West. Parallel to the steel tower line a line made of wooden towers, composed of two poles, is in course of construction. This line will support one circuit of three 181,500-circular-mil aluminum wires. N.

UTICA, N. Y.—The appraisers of the property of the various Hudson River power corporations, which are now in bankruptcy, have filed their report in the United States District Court. The total appraisal of the property is $7,117,093.02, as follows: Hudson River Electric Power Company, $852,803.89; Madison County Gas and Electric Company, $150,634.69; Ballston Springs Light and Power Company, $56,024.29; Saratoga Gas, Electric Light and Power Company, $443,101.98; Empire State Power Company, $357,654.73; Hudson River Power Transmission Company, $681,199.21; Hudson River Water Power Company, $3,049,642.40; Hudson River Electric Power Company, $1,526,037.03. The power house at Mechanicville owned by Hudson River Power Transmission Company is appraised at $390,642 and the Spier Falls plant owned by the Hudson River Water Power Company at $1,831,700.

ST. LOUIS, MO.—Plans are being formed for the consolidation of several Missouri electric companies. To this end the Empire District Electric Company is being incorporated under the laws of Kansas, with $6,000,000 authorized capital, of which $4,000,000 will be common and $2,000,000 preferred stock. The new company will take over the properties of the Consolidated Light, Power and Ice Company, of Joplin; Joplin Light, Power and Water Company, the Galena Light and Power Company and fifty-seven per cent of the stock of the Spring River Power Company. The new company will make a bond issue of $6,000,000, of which $1,250,000 will be issued at once. Already plans have been completed for the erection of a large electric power plant on Spring River near Joplin. The capacity of the present plant at that point is now 10,500 horsepower, but this will be more than doubled.

EAST TAWAS, MICH.—Articles of association of the following companies have been filed in the office of the county clerk of Iosco County: Cooke Hydro-Electric Generating Company, Thompson Hydro-Electric Generating Company, Rogers Hydro-Electric Generating Company, Loud Hydro-Electric Generating Company, Five Channels Hydro-Electric Generating Company. These companies are all organized with the same stockholders, viz.: Edward F. Loud, H. Kimball Loud and L. A. Wood, of New York, the two former each holding one share of stock, and the latter 998 shares, except in the case of the Five Channels Company, which is incorporated with a capital stock of $50,000 and shares numbering 500, of which L. A. Wood holds 498 shares. There have also been filed articles of incorporation of the Iosco Land Company by Henry F. Loud, E. F. Loud, H. Kimball Loud, Zenas C. Eldred, for himself, and as trustee.

SANFORD, ME.—A contract has been closed whereby the Portland Electric Light and Power Company is to furnish the Sanford Mills with electric energy to the extent of 2,000 horsepower from the electric station at West Buxton. At present the Portland company has machinery installed at the West Buxton plant to develop 3,000 horsepower on a full head of water. This is all sold in Portland at present, and the taking on of the new contract means that it is to develop its great waterpower privilege at Bonny Eagle. It is also said that the Portland company will install an auxiliary steam plant at West Buxton to assist in developing the necessary power when the water is low, as the contract is an ironclad agreement to furnish 2,000 horsepower at all times. At present the Sanford Mills have a contract calling for 1,600 horsepower from the Atlantic Shore Line Railroad, but this is conditional and only a part of the amount is furnished during the run of low water in summer.

ALBION, N. Y.—The property of the Albion Power Company, owners of the electric-light and gas plants in Albion, Brockport, Middleport, Waterport and Clark's Mills, was sold recently on a foreclosure sale by the People's Bank and Trust Company, of Passaic, N. J. Lucien H. Tyng, of Philadelphia, Pa., representing the bondholders' committee, was the purchaser, at $38,250, subject to various incumbrances. Since the organization of the Albion Power Company two issues of bonds, one for $75,000 and one for $200,000, were marketed, and the representatives of the purchasers, William Marcy, of Buffalo; John L. Romer, of Buffalo; Frank A. Dudley, of Niagara Falls; Albert Span, of Buffalo; Frederick W. Danforth, of Buffalo; Charles H. Roberts, of Brockport; C. L. Slanborough, of Oswego, and attorneys from Romeo were present at the sale. It is understood that the property was immediately transferred after the sale to A. L. Sweet, of Medina, who owns the Medina power plant, on condition that the sale is confirmed by the court.

CHARLOTTE, N. C.—The 4 C's Company has applied to the Board of Aldermen for the right to separate its gas and lighting business from its traction business, and desires to form the Charlotte Gas and Electric Company, to take over these departments of the 4 C's interests. The petition will probably be granted. The new company has been chartered for some months by E. D. Latta, president of the 4 C's Company, and associates. The same company is taking aggressive steps toward beginning work on a new car barn and will also soon build a short connection out First Street to bring its suburban Hoskins service into the city by a route that will cut out a grade railway crossing, and permit of the electric cars going under the railway tracks. The company has numerous improvements in view. As to the separation of the traction interests from the electric-light and gas interests, it is set forth by the company that such will greatly facilitate the issuance of bonds in the future. L.

LOS ANGELES, CAL.—Thirty-five thousand horsepower of electric energy, or within 1,000 horsepower of the entire amount of current consumed for power purposes in this city, has been made available for Los Angeles, Pasadena and a number of other towns of Southern California at 6 o'clock last night, by the resumption of service from the waterpower of the Edison Electric Company Kern River plant No. 1 after an interval of eight months. During this interval it has been made so permanently endurable by one of the greatest pieces of steel construction in America that the most expert hydraulic engineers pronounce it impervious to anything that can ever occur. This gigantic piece of constructive work has required the services of about 1,000 men, working night and day, for six months, and has been completed at a cost of approximately $300,000 for labor and material and an additional $200,000 for the production of power to take the place of the Kern River power during the period that the repair work was in progress, making a total expenditure of half a million dollars.

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ELECTRIC RAILWAYS.

(Special Correspondence.)

CLAREMONT, CAL.—The City Council has awarded to the Ontario & San Antonio Heights Railway Company a fifty-year franchise for an electric railroad in this city.

WARSAW, IND.—The report that the Murdock syndicate had leased the Winona Interurban system is denied by C. O. Johnson, vice-president of the Winona Company. S.

SANTA BARBARA, CAL.—The City Council will receive bids up to October 21 for a street-railway franchise applied for by the Santa Barbara Consolidated Railway Company.

MARSHFIELD, ORE.—The Coos Bay Electric Railway Company has been incorporated here, with a capital stock of $150,000, by J. H. Flanagan, C. F. McColl and W. S. Chandler.

NORTH YAKIMA, WASH.—Manager Richards, of the street railway, has placed an order for $50,000 worth of equipment and will at once begin construction of five miles more of track west of the city.

WOODBURN, ORE.—The City Council has given the Oregon Electric Company a franchise to operate electric cars on the streets of Woodburn, with the provision that construction work begin in two mouths. U.

CINCINNATI, OHIO—A survey is being taken on the new electric road, which is to operate between this city, Lexington, Ky., Louisville, Ky., and Maysville, Ky. The road will cost in the neighborhood of $3,000,000.

TOLEDO, OHIO—The Riggs & Sherman Company, of Toledo, has been engaged to make the preliminary surveys for a proposed traction line between Columbus and Cincinnati. The company has not yet been organized and it is not known who is back of the project. H.

LOS ANGELES, CAL.—The Edwards & Wildey Company and others have made application to the Board of Supervisors of this county to have offered for sale an electric-railway franchise on Melrose Avenue from Heliotrope to Seward. Bids for the franchise will be received up to November 8.

OREGON CITY, ORE.—F. N. Swift, who is promoting the construction of an electric railway between this city and Silverton, has secured traffic arrangements with the Portland Railway, Light & Power Company to take charge of his freight and passenger business between Oregon City and Portland.

MONTREAL, QUE.—A project for the consolidation of the Quebec Railway and Light Company and the other electric-lighting and power companies of the city of Quebec is being discussed. As a result Quebec Railway stock during the past few days has advanced from 57 to 68, later reacting to 63.

VANCOUVER, WASH.—The Tum Tum Mountain Railway Company has been incorporated for the purpose of building an electric railway from Tum Tum Mountain through Chelatchie Prairie, Amboy and La Center to Riggfield. E. M. Marsh is president; P. O. Hilstrom, treasurer, and F. R. Whelan, secretary of the company.

TACOMA, WASH.—The Skagit, Cascade & Chelan Railway Company has been incorporated at this place by W. E. Everett, A. M. Richards, George Senoir and C. E. Phoenix, with a capital stock of $25,000,000, to build an electric railway from Rockport, via Lake Chelan, to Spokane. Power for the operation of the line will be generated at Thunder Mountain. The head offices of the company will be located at this place.

TOLEDO, OHIO—The Toledo & Findlay Railway Company has just secured articles of incorporation. The capital stock authorized is but $10,000, which it is thought will be increased. Incorporators were B. L. Kilgour, Anthony B. Dunlap, Morris McGrew and Frank H. Simpson. It is said that the new company will take over and consolidate the Toledo Urban & Interurban, and the Toledo, Bowling Green & Southern. The former was sold at receiver's sale in August. H.

FORT WORTH, TEX.—The Fort Worth, Mineral Wells and Western Railroad Company, composed of Fort Worth and Arkansas capitalists, contemplate constructing an electric interurban line between Fort Worth and Mineral Wells, Tex., a distance of sixty miles. This line will be the first division of a railroad between this city and Roswell, N. M., a distance of about 375 miles. The remainder of line will be operated by steam. Paul Gurley and L. C. Cole of Fort Worth are the principal stockholders in the company. D.

INDIANAPOLIS, IND.—The Indiana Railroad Commission in the case of the Pennsylvania Railroad Company against the Indianapolis, Columbus & Southern Traction Company, wherein the steam line evoked the power of the Commission to order a separation of the grade crossing of the two lines near South Port, has decided in the light of a recent court decision, holding that as the separation in question was not commercially practicable, the Commission would not order such separation since the court would review its action and quite likely adhere to its previous conclusion. The Commission, however, commended the Pennsylvania company for its efforts to abolish dangerous grade crossings with other railroads. The ruling is important to interurban lines since there is a disposition on the part of steam lines to force a separation of graded crossings with interurban lines, which calls for large sums of money. S.

SAN FRANCISCO, CAL.—It is announced from the office of Assistant Manager W. R. Scott, of the Southern Pacific Railroad Company, that bids will soon be asked for for eighty-four steel electric passenger coaches for use on the company's suburban lines on the east side of San Francisco Bay, which lines are now being electrified. The detailed plans for these cars have been completed by Electrical Engineer Babcock. Each car will be of steel throughout, will seat about 100 passengers and will be equipped with pantograph trolleys.

DAYTON, OHIO—The Dayton Street Railway Company has increased its capital stock $300,000 to meet the expense due to the proposed construction of a new northerly and southerly line extending from Athletic Park to Carrmont. This action was taken by the directorate before the franchise was secured from the City Council, though the right to build south of the city to Carrmont has been obtained from the County Commissioners. The Dayton Street Railway Company began the operation of its line about five months ago and it was successful from the start.

LANSING, MICH.—Articles of incorporation of the Detroit, Lansing & Grand Rapids electric line have been filed and a mortgage for $5,000,000, to secure a bond issue of equal amount, filed at the office of the Wayne County register of deeds. The Union Trust Company is trustee under the mortgage. Officers of the new road, as given in the articles, are: President, Dr. Oliver H. Lau; vice-president, Henry M. Wallace; secretary-treasurer, George Valentine. Plans of those interested contemplate the beginning of active construction work in the spring. It is the intention to build the line from Farmington to Lansing first.

LOGANSPORT, IND.—The South Bend & Logansport Traction Company, recently incorporated to build the proposed interurban railroad connecting South Bend and Logansport, Ind., has been given a franchise to operate in St. Joseph County by the County Commissioners. The contract, signed by the commissioners and officers of the company, provides that cars shall be in operation by June 1, 1911. Work must be started at once, according to the terms of the agreement. The new road will enter South Bend via South Michigan Street. South of the city limits the tracks will pass from the center of the street to private right-of-way. The line will parallel the tracks of the Vandalia Railroad to Marshall County line, crossing Center and Union townships.

PEORIA, ILL.—An application to increase the capital stock of the Illinois Traction System has been made at Augusta, Me., where the company was incorporated. The stock will be increased from $13,000,000 to $16,000,000, two-thirds common and one-third preferred. A number of improvements are in view, but the principal one is the extension north from Peoria to reach either the Joliet electric line or the Aurora, Elgin & Joliet, either one of which would give a connection direct to Chicago and would mean an electric line clear through from Chicago to St. Louis. The construction of belt lines about the cities of Springfield and Decatur and the rebuilding of some of the local street car lines and some of the lighting plants that the company owns are also contemplated. V.

TOLEDO, OHIO—The Toledo, Bowling Green & Southern Electric Railway has at last secured an entrance into Toledo over lines of its own. It has been operated into this city over the lines of the Toledo Urban and Interurban Electric heretofore, under a lease, which will probably be canceled. The company this week, acting through Henry Gibson, of Cincinnati, bought the property of the T. U. & I. from Special Master Harry W. Lloyd, who sold the holdings to satisfy the claim of the Union Savings and Trust Company. The consideration named was $400,000. It is understood that the old bondholders of the T. U. & I. company will exchange their holdings for bonds of the other concern, as soon as the sale is confirmed by the court, which will be about September 20. It is said that the line will eventually be extended on to Cincinnati from Findlay. H.

ATLANTA, GA.—The interurban trolley road between Atlanta and Macon will now be built and built immediately. The passage of a bill by the senate during the last hours of business made the road possible and President W. Jordan Massee announces that work will start as soon as the formalities of getting the money are completed. The bill referred to corrects what New York lawyers for a big trust company thought was a fault in the Georgia law and makes possible the consolidation of the Central Georgia Power Company, the Macon Railway and Light Company and the Atlanta, Griffin & Macon Electric Railway Company—otherwise known as the Atlanta-Macon interurban. As soon as the legal arrangements can be made, the three companies will be consolidated into one large corporation and bonds to the amount of about $10,000,000 will be issued.

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TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

TEKAMAH, NEB.—The Tekamah Telephone Company is preparing to rebuild its system.

TOWNER, N. D.—The county board has granted a franchise to the Towner Telephone Company.

KERKHOVEN, MINN.—A franchise has been granted to the Kerkhoven Telephone Exchange Company. C.

WHITE EARTH, MINN.—The White Earth Telephone Company will extend its line to Waubun and Ogema.

SCOTTS BLUFF, NEB.—The Dutch Flats Telephone Company has been incorporated, with a capital stock of $7,500.

McINTOSH, S. D.—The Corson County Telephone Company has been incorporated, with a capital stock of $25,000.

BROOKINGS, S. D.—The Brookings County Telephone Company has been incorporated, with a capital stock of $25,000.

ROUNDUP, MONT.—The Rocky Mountain Bell Telephone Company will probably build a telephone line to Kalispell. C.

HURON, S. D.—Construction has been commenced on a reinforced concrete exchange building for the Dakota Central. C.

APPOMATTOX, VA.—The Appomattox Telephone Company has amended its charter and increased its capital stock from $5,000 to $10,000. L.

CULBERTSON, MONT.—At a special meeting of the directors of the Montana Star Telephone Company the material for the line to Glasgow was ordered and work will be commenced as soon as it is received. C.

KAMAS, UTAH—The Kamas-Woodland Telephone Company has incorporated, with a capital stock of $20,000. This company will furnish telephone service to the towns of Woodland and Kamas and district surrounding. N.

WASHINGTON, N. C.—The Western Electric Company is installing the interior work and new switchboard requirements of the renovated telephone system here, while the outside work is being done by the Carolina Telegraph and Telephone Company. L.

SNOW HILL, N. C.—The East Carolina Electric and Realty Company has been chartered here, with a capitalization of $25,000, for the purpose of constructing telegraph or telephone lines, the interested parties including S. L. Lynch, Kingston, N. C.; W. H. Wells, Snow Hill, and others. L.

GREEN BAY, VA.—The rapid growth of the rural telephone system in the state continues. The last reported addition is the putting in of a line bringing a number of farmers in this section in touch with the toll lines of the Southern Bell Telephone Company at this place. L.

SALISBURY, N. C.—After a lengthy fight the town has granted a franchise to L. D. Coltrane, of Concord, and J. F. Hayden, of High Point, to install a number of long-distance stations, Salisbury to be the central point for independent exchanges at High Point, Lexington and half a dozen more towns of from 2,000 to 10,000 population. L.

ROCHESTER, N. Y.—The Rochester Telephone Company, an organization not controlled by the Bell corporations, has been granted by the Common Council of this city permission to increase telephone rates for business telephones from $48 to $60 a year. The telephone company had a contract with the city precluding a raise in rates which the Council has officially waived.

CHARLES CITY COURT HOUSE, VA.—The Charles City Telephone Company, which has been in operation for some time, has been formally incorporated, with H. S. Saunders, president; L. M. Nance, secretary-treasurer, and Dr. Ashton Harwood, vice-president. The company has put in telephones along the line of the company from Roxbury to Granville, while other extensions are contemplated. L.

TOLEDO, OHIO—Robert R. Lysle, formerly of Toledo, now of Chicago, has been awarded the contract for the erection of a $600,000 power plant, which is to be built near Fremont, Ohio, at the village of Ballville. The present plans of the Fremont Power and Light Company, which was incorporated four years ago and has been working on the big project ever since, contemplates the harnessing of the waterpower in the Sandusky River, to furnish electricity from a powerhouse with a capacity of 2,500 horsepower. It is said the scheme is being backed by Cameron & Company, of Chicago. Other plans of the concern include two electric railway projects. A massive concrete dam thirty-six feet thick at the base and 260 feet in length will be constructed across the river. The water from the dam will be carried to the powerhouse through an immense steel pipe, fourteen feet in diameter and 3,000 feet long, with a fall of forty-two feet from the dam to the powerhouse. H.

ELECTRICAL SECURITIES.

The expectation of tightening money conditions still overshadows anything else in the stock market. It is not thought that there will be any particular advance for some little while to come and transactions have during the past week narrowed a good deal, compared with a week or two ago. Electrical securities continue to gain in favor, and it may be remarked that there is a tremendous volume of stock issues of this kind being offered to and absorbed by the general public. In another part of this paper an interesting statement of the amount of industrial securities put out so far during the year as compared with the previous year is printed.

Chicago Railways earnings for October increased $5,000 daily the first week, indicating a record month. October 2 was the record day with $40,000.

The annual meeting of the shareholders of the Manhattan Railway Company will be held in New York city, November 10, at noon. Transfer books will close October 9 and reopen November 11.

Application has been made to the New York Stock Exchange to list the following securities: Westinghouse Electric and Manufacturing Company $2,720,000 ten-year five per cent collateral notes, due 1917. Keystone Telephone Company $1,443,000 first mortgage five per cent bonds, due 1935.

Gross earnings of Interborough Rapid Transit, for September, increased about $10,300 per day, or $310,000 for the month, making the largest month's gain in the company's history. For the quarter ended September 30, Interborough Rapid Transit Company's earnings increased approximately $800,000, which is nearly fifty per cent of the entire $1,616,093 increase for the fiscal year ended June 30 last. The September increase was, of course, made possible by the enormous riding incident to the Hudson-Fulton celebration.

Proxies are asked by the majority of the Commonwealth Edison directorate for the special meeting, November 8, to increase the stock $10,000,000 to $40,000,000 by an issue of stock at par to stockholders. The Commonwealth Edison annual meeting occurs November 8. The reason for the special meeting on the same day is the new provision in the Illinois corporation act requiring a special meeting for such action. Governor Deneen has vetoed this measure, but lawyers question the validity of his veto. The Commonwealth Edison Company's new stock issue will probably amount to $3,000,000, in quarterly payments, to begin early next year.

Subscription to the $12,500,000 four-and-one-half per cent thirty-year first mortgage bonds of the New York Telephone Company offered in this country by Kidder, Peabody & Company, of Boston and New York, have been with the issue heavily oversubscribed. The offering price was 95 and interest, a 4.80-per-cent income basis.

The annual meeting of the stockholders of the Allis-Chalmers Company will be held on November 4. Books close October 14 and reopen October 18.

H. T. Scott, president of the Pacific Telephone and Telegraph Company, states that "while the company is doing well, its business constantly improving, there is no reason to expect any dividend on the common stock for several years," and added he knew of nothing in the situation that would explain or justify the advance which has taken place in the price.

Application has been made to list $1,600,000 of the $2,000,000 outstanding common stock of the Ottawa Light, Heat and Power Company on the Montreal Stock Exchange. The stock pays six per cent dividends, and it is expected that seven per cent will be commenced January 1, 1910.

DIVIDENDS.

Brooklyn City Railroad Company; regular quarterly dividend of two-and-one-half per cent, payable October 15.

Mexican Telephone and Telegraph Company; semiannual dividend of two-and-one-half per cent on preferred stock, payable November 1.

Ottumwa Railway and Light Company; quarterly dividend of one-and-three-fourths per cent on preferred stock, payable October 15.

NEW YORK.	Oct. 11.	Oct. 4
Allis-Chalmers common	14½	15⅝
Allis-Chalmers preferred	52½	54¼
Amalgamated Copper	81⅛	84
American Tel. & Cable	*80	*80
American Tel. & Tel	142½	142¼
Brooklyn Rapid Transit	78½	80½
General Electric	164	167
Interborough-Metropolitan common	15½	16¼
Interborough-Metropolitan preferred	47½	50¼
Kings County Electric	128	135
Mackay Companies (Postal Telegraph and Cables) common	91¾	93¼
Mackay Companies (Postal Telegraph and Cables) preferred	73	75½
Manhattan Elevated	142	142
Metropolitan Street Railway	20	23
New York & New Jersey Telephone	123½	129
U. S. Steel common	87¼	92¾
U. S. Steel preferred	127	130¼
Western Union	76½	78¾
Westinghouse common	86	87¼
Westinghouse preferred	138	140

*Last price quoted.

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BOSTON.

	Oct. 11.	Oct. 4
American Tel. & Tel.	142½	142⅛
Edison Elec. Illuminating	252	..
General Electric	164	167
Massachusetts Electric common	17	18¼
Massachusetts Electric preferred	80½	81½
New England Telephone	135	..
Western Tel. & Tel. common	10¾	10½
Western Tel. & Tel. preferred	89	..

PHILADELPHIA.

	Oct. 11.	Oct. 4
American Railways	46	45¾
Electric Company of America	12⅛	12⅛
Electric Storage Battery common	59½	60¾
Electric Storage Battery preferred	59½	60¾
Philadelphia Electric	12½	12½
Philadelphia Rapid Transit	28	29
Philadelphia Traction	90	90
Union Traction	53¼	53½

CHICAGO.

	Oct. 11.	Oct. 4
Chicago Railways, Series 1	108	108
Chicago Railways, Series 2	36	36
Chicago Subway	5¼	7¼
Chicago Telephone	..	138
Commonwealth Edison	120	120
Metropolitan Elevated common	15½	15
Metropolitan Elevated preferred	50¼	51
National Carbon common	97	97
National Carbon preferred	118	118

PERSONAL MENTION.

HENRY M. BYLLESBY, president of H. M. Byllesby & Company, consulting engineers, was elected president of the Civic Federation of Chicago and chairman of its executive committee. B. E. Sunny, president of the Chicago Telephone Company, is also a member of this committee.

W. E. WICKENDON, formerly senior instructor in the electrical engineering department at the Wisconsin University, has been appointed assistant professor of electrical engineering at the Massachusetts Institute of Technology to succeed Associate Professor G. E. Shaad, lately resigned to accept the chair of the electrical department at the University of Kansas.

HARRY J. VANCE, of St. Louis, has accepted a position with the Illinois Traction Company and will have his office at the general offices of the company at Peoria. His official title will probably be that of general superintendent, a new office. Mr. Vance was formerly with the Traction Company in the claim department, but more recently in the construction department at St. Louis.

FRANK VAIL BURTON, of Bridgeport, Conn., and Miss Marion Andrew, daughter of Mr. and Mrs. Thomas Winter Andrew, of Swarthmore, Pa., were married in the Walnut Street Presbyterian Church in Philadelphia on Saturday afternoon, October 9. Mr. Burton is well known to the jobbing trade, especially throughout the East, in his capacity of eastern sales manager of the Bryant Electric Company and the Perkins Electric Switch Manufacturing Company. Mr. and Mrs. Burton will make their home in Bridgeport.

THOMAS A. BANNING, JR., who for the last two years has been associated with the Board of Supervising Engineers, Chicago Traction, has joined the technical staff of Banning & Banning, patent attorneys and counselors, at their offices in the Marquette Building, Chicago. Mr. Banning is a graduate from the electrical engineering department of Armour Institute of Technology and will devote himself largely to patent causes involving electrical features. He is a young man of exceptional ability and should prove a most valuable adjunct to the staff of this long-established firm.

PROPOSALS.

POST OFFICE, BELLEVILLE, ILL.—The office of the Supervising Architect will receive sealed proposals November 16 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Belleville, Ill., in accordance with the drawings and specification, copies of which may be had from the custodian of site at Belleville, Ill., or at the Supervising Architect's office.

POST OFFICE, NORTH ADAMS, MASS.—The office of the Supervising Architect will receive sealed proposals November 4 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at North Adams, Mass., in accordance with drawings and specification, copies of which may be had from the custodian of site at North Adams, Mass., or at the Supervising Architect's office.

FORT DODGE, IOWA—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 11 for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric wiring and conduits and standard clock system), of the U. S. Post Office at Fort Dodge, Iowa, in accordance with the drawings and specification, copies of which may be had from the custodian of site, Fort Dodge, Iowa, or at the Supervising Architect's office.

NEW HAVEN, CONN.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 15 for the construction (including plumbing, gas piping, heating apparatus, electric conduits, wiring and lift) of an extension, remodeling, etc., to the United States Post Office and Custom House, New Haven, Conn., in accordance with drawings and specifications, copies of which may be obtained from the custodian at New Haven, Conn., or at the Supervising Architect's office.

NEW PUBLICATIONS.

PROSPECTUS OF THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES—The prospectus of the Brooklyn Institute of Arts and Sciences for the year of 1909-1910 has recently been issued. It contains a complete list of courses, studies taken up and members of the faculty. Also a programme of the lectures to be delivered during the ensuing year.

ENGINEERING COLLEGE, UNIVERSITY OF MINNESOTA—The College of Engineering and the Mechanic Arts, University of Minnesota, has published a bulletin, announcing its various engineering courses for 1909-1910. There are given thorough courses in electrical, mechanical, civil and municipal engineering, and a general course in science and technology. The bulletin that describes these courses in detail has eighty pages. Copies may be obtained from the registrar of the University of Minnesota, Minneapolis, Minn.

NEW MANUFACTURING COMPANIES.

ST. LOUIS, MO.—The Rex Electric Company has been incorporated, with a capital stock of $50,000, to manufacture electrical appliances.

ALBANY, N. Y.—Leone Electrical Improvement Company, Manhattan. General contracting, electrical work; capital, $50,000. Incorporators: P. Leone, J. Coggiano, A. Castelli, F. Suriani, New York city.

PORTLAND, ME.—The International Electrical Manufacturing Company has been incorporated. Electrical machinery; capital $1,000,000. President, C. E. Eaton; treasurer, T. L. Croteau, Portland.

NEW YORK, N. Y.—The New Lamp Company, of Manhattan, N. Y., has been incorporated to manufacture lamps, lanterns and lighting devices. Capital, $50,000. Incorporators: Frederick C. Tompkins, Henry Heinemeyer, Thomas Butt, New York city.

FORT WAYNE, IND.—The Fort Wayne Manufacturing Company has filed articles of incorporation, with the object of establishing a plant for the manufacture of electrical machinery and supplies of all kinds. The capitalization is $10,000. F. L. Dulin, A. L. Sopshire, W. M. Fay and Perry Crawford, directors. S.

LEGAL NOTES.

AUTHORITY REQUIRED FOR MUNICIPALITY TO CONTRACT FOR OR FIX RATES—The Supreme Court of the United States says, in Home Telephone and Telegraph Company vs. City of Los Angeles, 29 Supreme Court Reporter, 507, that it has been settled by this court that the state may authorize one of its municipal corporations to establish, by an inviolable contract, the rates to be charged by a public service corporation (or natural person) for a definite term, not grossly unreasonable in point of time, and that the effect of such a contract is to suspend, during the life of the contract, the governmental power of fixing and regulating the rates. But for the very reason that such a contract has the effect of extinguishing pro tanto (to that extent) an undoubted power of government, both its existence and the authority to make it must clearly and unmistakably appear, and all doubts must be resolved in favor of the continuance of the power.

SUBSCRIBER TO MUTUAL COMPANY WITHOUT POWER TO COMPEL CONNECTIONS—The Ivanhoe Furnace Company, a stockholder or subscriber in the Wythe Mutual Telephone Company, presented a petition praying that a peremptory writ of mandamus be issued, directed to the Virginia & Tennessee Telephone Company, commanding and compelling it, among other things, to connect its lines and exchange service with the Wythe Mutual Telephone Company upon the same terms and conditions as it at that time connected with the Wytheville Telephone Company. The Supreme Court of Appeals of Virginia, however, holds, Ivanhoe Furnace Company vs. Virginia & Tennessee Telephone Company, 63 Southeastern Reporter, 426, that the plaintiff had no right to implead the defendant company upon the issues sought to be litigated by its petition. The plaintiff's status was merely that of a subscriber and patron of the Wythe Mutual Telephone Company, and in those relations it was entitled to demand of that company the same service that it rendered to other patrons of the same class, and none other. So, also, it could only require of the defendant company the use of its system in like manner and upon the same terms that it accorded to the public generally. The plaintiff was in no sense the repre-

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sentative of the Wythe Mutual Telephone Company, and possessed no authority whatever to dictate to that company, or to the defendant company, what physical connections they should make or what regulations they should adopt, if any, for the interchange of business. These were matters of business policy to be determined by the companies for themselves, subject only to the visitorial authority of the state.

RELATION OF MUNICIPALITIES TO PUBLIC UTILITIES —The Court of Appeals of Kentucky says, in Louisville Home Telephone Company vs. City of Louisville, 113 Southwestern Reporter, 855, that in this day efficient telephone service is so essential, not only in the conduct of private business in the cities, as well as in the rural districts, but is also so important in the management and conduct of the business and government of cities, that its proper installation, maintenance and service constitute a matter of decided public interest. Again the court says that because of their potency and usefulness in promoting and preserving the health, security and comfort of the public, and of the aid they afford in the conduct of the business and administration of the municipality itself, such utilities as water, light, and telephone service have long been regarded as essential governmental agencies and important aids to the police power. A municipality has the power and right to erect, maintain and operate plants, and use the public streets for furnishing such utilities for the municipality itself and to its inhabitants. Such power or duty it may discharge by having others perform them for it upon such terms as may be agreed upon in the form and manner prescribed by law. What is commonly termed the "granting" of a franchise by a city for one of these public utilities is therefore in the nature of a contract by the city with the grantee for the performance of a public service.

HEADLIGHT REQUIREMENTS FOR ELECTRIC CARS ON PUBLIC HIGHWAYS—The Supreme Court of Errors of Connecticut says, in the case of Currie vs. Consolidated Railway Company, 71 Atlantic Reporter, 356, that the use of a highway for electric street cars imposes no new servitude upon the soil. It is simply a new form of the original use. The owner of the car in running it is therefore governed by the same rules which apply to the management of any other vehicles. Being of greater size and weight than they commonly are, and capable of being moved at a very high rate of speed, the car must at all times be kept so well in hand as not to expose others to unreasonable hazard. When running at night, the car must be provided with such means of illumination as may be requisite, to enable the motorman to see far enough ahead to do whatever ordinary care may demand in order to avoid a rear-end collision with any other vehicle upon the railway track. The speed at which any vehicle can be driven over a highway at night must be determined partly in view of the distance ahead at which travelers upon or approaching the same highway would become visible. A street-railway company is not necessarily bound, as respects other travelers, to equip its cars with a particular kind of light, known, used and approved by those engaged in conducting the same business under like conditions. It may be using one that is much better. But evidence of what they commonly do and approve in that respect has a legitimate and not unimportant tendency to show that ordinary care would call for its conformity to an established practice.

INDUSTRIAL ITEMS.

THE AMERICAN BLOWER COMPANY, Detroit, Mich., has recently distributed a folder containing convincing arguments for prospective customers of its engines.

WASHBURN & GRANGER, 120 Liberty Street, New York, N. Y., is distributing catalogue "B," descriptive of Dean grates. This catalogue contains valuable information for anyone interested in the subject.

THE PACIFIC ELECTRIC HEATING COMPANY, Ontario, Cal., and Chicago, Ill., has issued the September number of its monthly publication, "Hot Points," which is devoted principally to the "El Tosto" toaster, manufactured by this company.

THE GOODWIN & KINTZ COMPANY, Winsted, Conn., has distributed a supplement to be used in connection with its catalogue No. 31. This supplement contains illustrations, description and prices of portable electric lamps fitted with highly artistic shades.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a new folder, entitled "Economy," and describing the Manson and Okonite tapes. The full directions given for making joints should render this booklet of considerable value to those called upon to do this class of work.

PASS & SEYMOUR, INCORPORATED, of Solvay, N. Y., announce a number of changes in the personnel of their sales department that were effective October 1. W. Brewster Hall has been promoted to the position of assistant sales manager, with headquarters at Solvay. The New York city office, at 39 Cortlandt Street, has been placed in charge of F. S. Baldwin, late of the Syracuse Supply Company. Mr. Baldwin has been engaged in the electrical jobbing business for the past five years, and so brings to the company the benefit of his experience from the distributor's standpoint.

THE THORDARSON ELECTRIC MANUFACTURING COMPANY, Chicago, Ill., has issued a folder and price list describing its various lines of small-capacity alternating-current transformers, for operating fans, small motors, miniature electric-railways, buzzers, induction coils, etc., lighting small lamps, ringing electric bells, and the like.

THE CENTRAL ELECTRIC COMPANY, of Chicago, is distributing several new flyers descriptive of dry batteries. These batteries are intended for open-circuit service and are claimed to give maximum service with minimum cost, owing to the use of the highest grade of material, best methods of treatment and modern machinery used in their manufacture.

THE DETROIT FUSE AND MANUFACTURING COMPANY, Detroit, Mich., is distributing revised price lists on its line of "Arkless" indicating fuses. In addition to containing complete list prices on National Code standard fuses, these price lists call special attention to the absolute guarantee placed on every "Arkless" fuse, and to the special features embodied in this line.

THE TREGONING ELECTRIC MANUFACTURING COMPANY, of Cleveland, Ohio, owing to a largely increased business, has removed its plant from 224 High Avenue to 418 West Prospect Avenue. The new factory is equipped with much additional machinery and equipment for the manufacture of the Tregoning specialties, which has been made necessary as a result of the constantly growing demand for these products.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a number of timely circulars descriptive of electric toasters, and plug clusters suitable for use with electric fans, flatirons, curling-irons, etc. Also a number of circulars descriptive of multi-catch pull sockets, attachment plugs, and a new type of fiber hand portable. Copies will be sent upon request to the company.

THE EXCELSIOR INSULATED WIRE COMPANY, New York city, has issued a pamphlet entitled "Points and Prices on Excelsior Insulated Wire." This wire is made on the Randall system of insulation, which is the result of a series of experiments made over a period of several years in the production of a cotton insulation adapted to resist moisture and abrasion. Two styles are made, braidless and braid-covered. Both varieties have been personally recommended by satisfied users.

THE GENERAL INCANDESCENT LAMP COMPANY, of Cleveland, Ohio, has once more started the distribution of the G. I. series of girl pictures taken from life. It sent out a very attractive set of five last season at different intervals. If the first one for this year is any indication of what may be expected of the others that are to follow, they surely will be appreciated by the recipients. This is a very attractive form of advertising and many of the pictures will doubtless be hung permanently on office walls.

THE CHARLES L. KIEWERT COMPANY, New York city, has issued a folder giving particulars of the advantages, construction and operation of the "Economy" pure carbon arc lamp for direct current. This lamp is very artistic in appearance, gives a steady, pure white light, is economical in operation and has many advantages over the common form of enclosed arc lamp. A price list is appended. The same company has also recently issued a card descriptive of the "Aurola" flaming-arc lamp, which is one of the most powerful and economical flaming-arc lamps now on the market.

HENRY F. FROSCH & COMPANY, San Francisco, Cal., announce the removal of their office and warerooms from 656-658 Howard Street to the Electric Building, 171-173 Second Street. The company represents the following firms on the Pacific Coast, and carries stocks for immediate delivery: Federal Electric Company, Chicago, Ill.; General Incandescent Lamp Company, Cleveland, Ohio; Albert J. M. Anderson Manufacturing Company, Boston, Mass.; Minerallac Electric Company, Chicago, Ill.; Crescent Company, Valparaiso, Ind.; Excello Arc Lamp Company, New York, N. Y.

THE WESTINGHOUSE MACHINE COMPANY, Pittsburg, Pa., has secured a contract from the Detroit United Railways for an additional Westinghouse turbine unit. The new turbine, which is 1,000 kilowatts capacity and which is to operate at 150 pounds steam, twenty-eight inches vacuum and saturated steam, will be installed at the Rochester station on the Detroit and Flint division. This station already contains engine-type units, but extensions of traffic have necessitated the installation of this new turbine unit. The Westinghouse company has also received an order from the Potlatch Lumber Company for a 600-kolowatt Westinghouse exhaust-steam turbine, to be installed in the company's central power plant at Potlatch, Idaho. There are at present located in this plant one rope-driven Corliss engine and a 100-kilowatt high-speed triple engine driving a generator. The low-pressure turbine will take steam at about

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fifteen pounds absolute from both of these units, and some other auxiliaries generating power for the operation of a new planing mill and box factory. Arrangements have also been made for the operation of this unit for lighting for the mill and the surrounding town. The equipment ordered also includes a Westinghouse-Leblanc condenser, designed for carrying a twenty-eight-inch vacuum.

ALLIS-CHALMERS COMPANY, Milwaukee, Wis., announces that with reference to rumors recently circulated, to the effect that large shop and foundry extensions are to be undertaken this fall by the Allis-Chalmers Company, it has been authoritatively stated by President W. H. Whiteside that no further additions to the West Allis Works are contemplated. However, an extension to the Cincinnati Works of the company is being made, which will give employment to about 1,000 additional men. Construction work and the installation of new equipment was commenced there some weeks ago.

THE AMERICAN DISTRICT STEAM COMPANY, Lockport, N. Y., has just published its Bulletin No. 115 on "The Financial Effect of Combining an Exhaust Steam Heating System with an Electric Light and Power Plant." This bulletin points out clearly the conditions favorable to central-station heating and the excellent returns from this class of business when properly conducted. Attention is also called to the benefits to central stations of district heating aside from the direct income, particularly in enabling them to provide light, heat and power for many patrons that would otherwise operate private isolated plants. The pamphlet also contains illustrated descriptions of many devices that make for efficiency in the heating installation.

THE ROCKWELL FURNACE COMPANY, New York, N. Y., has recently published a finely illustrated catalogue on furnaces and heating machines for manufacturing purposes, using any fuel. Among the devices illustrated are the following: Forging and dressing furnace, for oil or gas fuel; adjustable top slot forge, for oil or gas fuel; bench brazing forge, for oil or gas fuel; brazing table and forge, for oil or gas fuel; accurate temperature forging furnaces, for oil or gas fuel; rivet-heating furnaces, portable and stationary, for oil fuel, and for oil or gas fuel; wire brazing forge; tube brazing furnace; portable heater, compressed-air type (for crude or refined oil), and self-contained type (for kerosene oil); miscellaneous blacksmith forges, and many others.

THE INTERNATIONAL ACHESON GRAPHITE COMPANY, of Niagara Falls, N. Y., announces that another substantial and commodious building is to be added to its Niagara Falls, Ont., branch works. The structure is to be fifty feet wide by 105 feet long, and the contract has been awarded to W. S. Homan, of Niagara Falls, Ont. The facilities afforded by this addition will make the Canadian works of the Graphite Company quite complete in its ability to care for a rapidly-growing trade, made so by Canada's industrial growth. The building will contain a new grinding plant, in which the lubricating, electrotype and other grades of powdered graphite will be prepared for market. It will also contain a stock room for package goods, such as graphited greases, powders, etc., while a new shipping room will make it most convenient for promptly filling orders.

THE WESTINGHOUSE MACHINE COMPANY, East Pittsburg, Pa., has recently published Circular W. M. 503 on "Westinghouse Gas Producers," which is a notable contribution to the literature on the producer problem. The operation of the producer is convincingly explained with the aid of some fine illustrations, and a number of tests of the producer, with various kinds of coal and lignite for fuel, are given. The company expounds the producer problem in this publication with exceptional frankness, and no extravagant claims are made. Attention is drawn to the necessity for intelligent and thoughtful attention to the gas-producer plant, a statement which cannot be too well noted by prospective users, as the producer requires just as much skill for its efficient and economical operation as does the steam boiler. Anyone interested in the operation of the internal-combustion engine should possess a copy of this circular.

THE RELIANCE ELECTRIC AND ENGINEERING COMPANY (formerly the Lincoln Motor Works Company), Cleveland, Ohio, has recently issued Bulletin No. 101, entitled, "The Crank Shaper." This is the first of a series of bulletins dealing with the application of Lincoln variable-speed motors to different types of machine tools and gives very valuable information not only regarding the power required to drive crank shapers under different conditions of work, but also compares the productive efficiency of belt-driven and motor-driven shapers. A most valuable table is given on page 12, showing the power required for shaper drive for various sizes of machine. This table is divided into five sections, showing (1) average friction load in horsepower; (2) basis of classification for shaper duty, using cuts of various dimensions on cast-iron at an average cutting speed of forty feet per minute; (3) minimum motor capacity in horsepower; (4) maximum horsepower required at tool for different cuts on cast-iron at different cutting speeds; (5) factors for other metals. The bulletin is a perfect mine of information for the machine-shop foreman who uses electric drive, and the series will be an invaluable aid to efficient installation and operation of the electric motor in machine-shop service. The policy of the Reliance Company in publishing this valuable literature is to be commended from every viewpoint.

DATES AHEAD.

New York Electrical Show. Madison Square Garden, New York, October 11-21.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

Illinois State Electric Association. Annual meeting at Alton, Ill., October 26, 27 and 28.

American Electrochemical Society. Next meeting, New York city, October 28-30.

National District Heating Association. First annual meeting, Columbus, Ohio, November 10 and 11.

Alabama Light and Traction Association. Annual convention, Birmingham, Ala., November 15 and 16.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 to 18.

Boston Electrical Show. Mechanics' Building, Boston, November 15-25.

Empire State Gas and Electric Association. Annual convention, New York city, November 17 and 18.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual meeting, Lima, Ohio, November 19 and 20.

International Independent Telephone Association. Annual convention, Chicago, December 7, 8 and 9.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) October 5, 1909.

935,661. RECORDING MECHANISM. John M. Johnson, Ishpeming, Mich. Filed February 21, 1908. Includes an autographic recording mechanism in conjunction with an electric alarm.

935,705. STRAIN-RELIEVING MEANS FOR TERMINALS OF LAMP SOCKETS, ETC. Frederick A. Swan, Cliftondale, Mass. Filed April 15, 1908. The wire is wrapped around a strain-relief screw separate from the binding screw.

935,721. WIRELESS TELEGRAPH SYSTEM. Vincent C. de Ybarrondo, Los Angeles, Cal. Filed January 2, 1909. A central switchboard for a wireless system consists of a mid section in the opposite faces of which are grooves forming seats for the wires, a batten covering the grooves on one of these faces, and a section with binding posts and a switch on the opposite face of the board.

935,733. SOLENOID SWITCH. Arthur W. Berresford, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company. Filed June 5, 1905. The striking heads carried by the solenoid plunger are adapted to deliver a hammer blow to the blades of knife switches in opening or closing the solenoid switch.

935,746. MASSAGE VIBRATOR. Ernest Fahsbender, Chicago, Ill. Filed April 18, 1907. An electric motor drives a flexible shaft.

935,760. ART OF PHOTOGRAPHY. Joseph J. Johnson, Dayton, Ohio. Filed January 29, 1906. The shutter of a photographic apparatus suspended by a kite line is electromagnetically operated from the ground.

935,763. DRAFT-REGULATING APPARATUS. Cyprien O. Mailloux and Henry J. Westover, New York, N. Y. Filed February 7, 1907. A gas analyzer is electromagnetically operated and controlled.

935,766. EMERGENCY APPARATUS FOR CONTROLLING FLYING MACHINES. James Means, Boston, Mass. Filed Octo-

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ber 6, 1908. A motor-control circuit is opened and closed by an automatic self-righting device under the control of the operator for simultaneously changing the positions of the planes.

935,768. ELECTRIC BLOCK-SIGNALING SYSTEM. William F. Meschenmoser, Hoboken, and Cyrus H. Kinsman, Plainfield, N. J., assignors to the Kinsman Block System Company. Filed July 24, 1908. A setting track magnet and a restoring track magnet are placed at opposite ends of a block and shunt circuits are operated by passing cars.

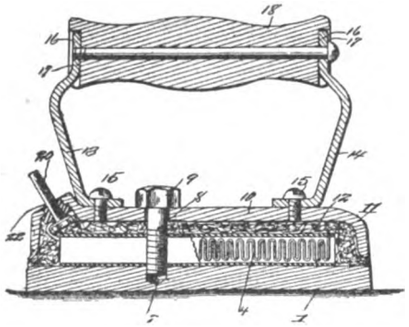
935,792. TELEPHONE RINGER. Nils P. Jensen, Waterloo, Iowa. Filed January 9, 1909. Resilient means in the hollow cores of an electromagnet are adapted to engage independently the adjacent ends of a rocking armature.

935,803. ELECTRIC SIGN. Thomas E. Murray, New York, N. Y. Filed October 24, 1908. Light rays are reflected through openings in a plate.

935,816. ELECTRIC HEATER. William A. Rankin and Willard M. Harwood, Hutchinson, Kan., assignors to Harwood Electric Heating Company, Hutchinson, Kan. Filed October 23, 1908. A plate has on one side an acting face and on the other a series of raised slots containing an insulated high-resistance element or elements of zigzag form.

935,818. MECHANISM FOR ELECTRICALLY OPERATING JACQUARDS WITHOUT PATTERN CARDS. August Regal, Jägerndorf, Austria-Hungary. Filed February 1, 1909. Contacts respectively engage devices which have portions of their faces electro-conductive and other portions non-conductive, and an electromagnetic switch corresponding to each device and its contact controls a branch circuit, etc.

935,838. REVERSIBLE FUSED AND SOLID TERMINAL. Richard H. Conway and Harry E. Bisbing, Philadelphia, Pa., assignors



935,816.—ELECTRIC HEATER.

of one-fourth to Lewis K. Marr, Philadelphia, Pa. Filed November 20, 1908. Two blocks, spaced apart, end to end, have screw threads at their adjacent ends, into which is screwed a plug having fused electric contacts at opposite sides.

935,852. TROLLEY WHEEL. Albert M. Levering, Philadelphia, Pa. Filed October 1, 1908. The central disk of the trolley wheel is pivotally connected to the rim of the wheel.

935,881. SINGLE-PHASE MOTOR. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed December 26, 1907. A reactive winding carried in the stator slots is arranged non-inductively to all the other windings and is connected to the exciting winding.

935,892. ELECTRIC SIGNAL FOR RAILWAYS. Augustus C. Carey, Boston, Mass. Filed November 21, 1907. Signaling apparatus and brake mechanisms (and their normally closed circuits) on the respective locomotives are maintained inactive when the locomotives are a predetermined distance apart, and are operated on the approach of two similarly equipped locomotives.

935,895. TROLLEY-WIRE SUPPORT. Royden O. Couch, Charleston, W. Va. Filed March 20, 1909. A clamp is adapted to grip the insulating base block of the support, and to support the trolley wire.

935,896. ARC LAMP. John T. H. Dempster, Schenectady, N. Y., assignor to General Electric Company. Filed May 1, 1905. A core is movable in line with the arcing points of the pair of main electrodes, and an L-shaped member has one end pivoted to this core and the other end normally held by gravity in engagement with the side surface of one of the electrodes.

935,897. MICROPHONE. Carl E. Egnér, Stockholm, and Johan G. Holmström, Saltsjöstorangen, Sweden. Filed March 27, 1908. A sealed casing has one wall formed by the vibrating diaphragm and contains the sound-transmitting mechanism in a hydrogen atmosphere.

935,908. ARC LAMP. Caryl D. Haskins, Schenectady, N. Y., assignor to General Electric Company. Filed February 18, 1907. Electrode material is fed forward to build up the electrode as it is wasted away at the arc.

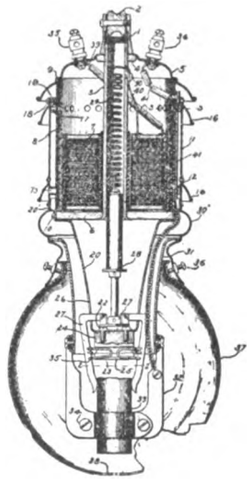
935,915. ELECTRIC SWITCH AND OUTLET BOX. Alpha H. Kling, Detroit, Mich. Filed April 16, 1908. The end plates and other units are furnished with knock-out plugs.

935,920. ARC LAMP. Edwin J. Murphy, Glasgow, Scotland, assignor to General Electric Company. Filed October 26, 1906. An electrode holder is provided with means for engaging an electrode-feeding clutch and holding it against displacement when the electrode is removed.

935,923. CONDENSER. Frank J. Newton, Schenectady, N. Y., assignor to General Electric Company. Filed November 8, 1906. A number of enameled metal plates are rigidly secured by non-conducting clamping devices which pierce them through, and lugs connect alternate plates to an electrical conductor.

935,935. ELECTRIC ANNUNCIATOR. Arthur J. Smith, Bath, Me., assignor to Electric Goods Manufacturing Company. Filed October 29, 1908. A magnet is mounted perpendicularly on a base which has also a drop catch swingingly mounted on it, and a drop moves longitudinally of the base.

935,937. ELECTRIC FURNACE. William A. Smith, Niagara Falls, N. Y., assignor to International Acheson Graphite Com-



935,896.—ARC LAMP.

pany, Niagara Falls, N. Y. Filed June 15, 1909. The furnace chamber has a wall which affords free passage for reaction gases.

935,939. ELECTRIC FURNACE TERMINAL. Eben C. Speiden, Niagara Falls, N. Y., assignor to International Acheson Graphite Company, Niagara Falls, N. Y. Filed June 17, 1909. The terminal comprises a number of graphite members assembled in electrical connection, one or more of these members being divided transversely of the current path.

935,941. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company. Filed August 13, 1908. The armature has uniform coils of a pitch adapted to prevent induction in the coils of one harmonic of the induced electromotive force and certain of the coils offset with respect to other coils in series with them by an amount adapted to eliminate another harmonic.

936,001. DRY-CELL TESTER. Edwin S. Lincoln, Brookline, Mass. Filed March 6, 1908. The strength of the dry cell is determined by its action on the core of a solenoid.

936,009. TELEPHONE STAND. Evert A. Metcalf, Forbes, Mo. Filed November 11, 1908. A receiver arm is mounted on the transmitter stand.

936,039. ELECTROLYTIC APPARATUS. Isaiah L. Roberts, New York, N. Y. Filed April 3, 1905. Porous diaphragms are made by forming of woody material an article of the desired shape and then partially carbonizing the same throughout to a non-conducting point.

936,055. TROLLEY GUARD. Samuel Stroup, Peru, Ind. Filed August 18, 1908. Guard members secured on opposite sides of the harp have their upper ends bent inwardly over the trolley wheel to retain the latter on the wire.

936,067. INCLOSED METER LOOP. Everett C. Wigham, Boston, Mass. Filed April 19, 1909. The meter-loop block has connecting bars with contacts for connection with service, meter and load, incased in insulating material with the poles

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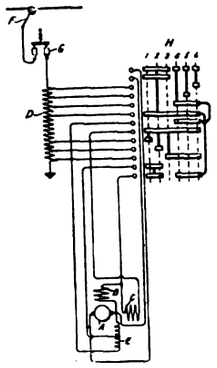
of opposite polarity insulated from each other by intervening layers of insulating material.

936,071. MOTOR CONTROL. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed December 17, 1907. In combination with an alternating-current motor of the commutator type having inducing and exciting windings on the stator are a reactive coil, and a controlling switch arranged in its starting position to connect the stator windings in series with each other with the reactive coil in shunt to the exciting winding, and in a subsequent position to impress a shunt excitation on the exciting winding and reactive coil in series.

936,074. ELECTRICALLY-OPERATED VALVE. Warren W. Annable, Grand Rapids, Mich., assignor to the Starter Manufacturing Company. Filed April 26, 1909. A magnet has an axial opening through it and a side passage communicating with this opening. The opening is provided with a valve to close it, and an armature moved by the magnet is adapted to open the valve. The passage is also provided with a non-return valve to permit fluid to escape.

936,100. TROLLEY WHEEL AND HARP. Frank L. Eager, Waterbury, Conn. Filed October 3, 1906. The rim of the wheel has a groove including parallel side parts (formed of a single piece) and a bottom sloping but slightly toward the center of the wheel and terminating in a channel having sides steeper than the bottom of the groove.



936,071.—MOTOR CONTROL.

936,116. SAFETY APPLIANCE FOR ELECTRIC ELEVATORS. Clarence S. Gilbert, St. Joseph, Mo. Filed December 28, 1908. Describes an attachment for an electrically-operated elevator to prevent accidental movement of the starting rope.

936,140. TELEGRAPH SYSTEM. William Leivesley, Springsure, Queensland, Australia. Filed August 7, 1906. Includes a switch comprising several divisions, a main circuit connected with two of such divisions, a key and principal relay in this circuit, a second circuit, a repeater and a battery therein, a third circuit controlled by the repeater, a local relay in the second circuit, a circuit controlled by the armature of such local relay, a contact controlled by the relay first mentioned, and means permitting current from the battery to operate the repeater when the contact is closed, such closing operation simultaneously short-circuiting the local relay.

936,156. ADJUSTER FOR ELECTRIC-LIGHT CORDS OR CABLES. Thomas A. Parker, Providence, R. I., assignor to Frank E. Walker and Arthur C. Walker, River Point, R. I. Filed November 12, 1907. A perforated block has a wedge-shaped member for gripping the parts of the cord in grooves in the hole.

936,163. RECEIVING SYSTEM FOR ELECTRICAL OSCILLATIONS. Erich Quäck and Fritz V. D. Woude, Berlin, Germany, assignors to Francis William Pixley and Herbert Allen, London, England. Filed April 27, 1908. Comprises a receiving antenna with a tuned secondary circuit inserted in it, a tuned oscillatory circuit inductively coupled to this circuit, a detector permanently included therein, a capacity, and means for connecting the capacity with the oscillatory circuit and disconnecting it therefrom intermittently.

936,175. PUSH-BUTTON SWITCH. Frank E. Seeley, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company. Filed April 21, 1909. The push button is hollow and a visible indicator within it moves with the switch spindle.

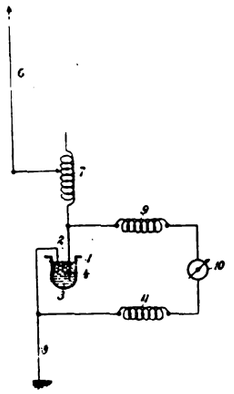
936,207. TELEPHONE TRANSMITTER. Clifford D. Babcock, New York, N. Y., assignor to United Wireless Telegraph Company. Filed April 17, 1909. The transmitter is provided with an element comprising in its composition an oxide of abnormally sensitive conductivity at a certain temperature.

936,208. ELECTRIC BRUSH. Max E. Bacon and Louis J. Meller, Deerfield, Kan. Filed October 19, 1908. The wires of the brush are connected in a certain manner tc a source of electric energy.

936,227. ELECTRICAL FUSE. Addison G. Fay, Highland Park, Ill. Filed October 26, 1908. Renewed August 18, 1909. The inner shell contains an explosive and electric wires leading into it, and the outer shell is filled with an asphaltum compound completely enveloping the inner shell.

936,252. METERING PANEL BOARD. Arthur C. McWilliams, Chicago, Ill. Filed October 23, 1907. Has sets of permanent conductor bars running transversely to each other and arranged in two superposed, separated, parallel planes, the bars of one of the sets being arranged in pairs with the two bars of a pair in alinement, the transverse bars being adapted to be electrically connected at their points of intersection and one set of bars running to the meter terminals and the other set to the consumption terminals.

936,254. ATTACHMENT FOR TELEPHONES. Newell B. Parsons, Chicago, Ill., assignor to Belden Manufacturing Company. Continuation of application filed June 22, 1906. This application filed January 6, 1908. Describes an attachment for a telephone-box door.



936,258.—RECEIVER FOR SPACE TELEGRAPHY.

936,258. RECEIVER FOR SPACE TELEGRAPHY. Wilhelm Schloemilch, Oberschöneweide, near Berlin, Germany. Original application filed October 3, 1903. Divided and this application filed January 3, 1906. Includes a receiving conductor, a source of electrical energy comprising an electrochemical cell associated therewith as a wave-responsive device, and a local circuit connected in shunt to the wave-responsive device and including a signal-translating instrument.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired October 11, 1909:

484,096. GALVANIC BATTERY. John W. Hoffman, Chicago, Ill.

484,120. SECONDARY BATTERY. Wm. L. Silvey, Lima, Ohio.

484,123. ELECRICALLY OPERATED RAILWAY SWITCH. Chas. A Stone, Newton, and Edwin S. Webster, Boston, Mass.

484,140. ELECTRIC FIRE-ALARM. Harvey Cortland, Toronto, Canada.

484,150. MAGNETIC TELEPHONE. Chas. S. Forbes, London, England.

484,182. METHOD OF ELECTRICAL REFRIGERATION. Mark W. Dewey, Syracuse, N. Y.

484,183. ELECTRICAL DEPOSITING METER. Thomas A. Edison, Llewellyn Park, N. J.

484,199. ELECTRIC ARC LAMP. Joel A. Hayes, Carson City, Nev.

484,206. DEVICE FOR PREVENTING ACCIDENTAL CLOSING OF ELECTRIC CIRCUITS IN SIGNAL BOXES. Wm. H. James, Boston, Mass.

484,208. SYSTEM OF ELECTRICAL DISTRIBUTION. Harry W. Leonard, New York, N. Y.

484,232. PORTABLE BURGLAR-ALARM. David D. Nolley, Wilson, N. C.

484,233. COMBINED ELECTRIC BURGLAR AND FIRE-ALARM. David D. Nolley, Wilson, N. C.

484,375. RAILWAY-TRAIN TELEGRAPH. Matthew S. Reiley, Washington, D. C.

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CONTENTS.

EDITORIAL:
The Smoke Question..... 771
The Right to Franchise Value..... 772
Comparative Power Costs in Two Turbine Stations..... 773
The New York Electrical Show..... 774
Chicago Electric Club..... 779
Illinois State Electric Association..... 779
American Institute of Electrical Engineers, New York Meeting..... 780
To Lengthen Subway Platforms..... 783
CENTRAL STATION PRACTICE:
Steam Heating in Connection with Central Stations..... 784
Performance of a Destructor Plant..... 785
Mechanical Draft..... 786
Industrial Smoke Prevention in Hamburg..... 788
Electrical Development in Brazil..... 789
ELECTRICAL ADVERTISING AND SELLING:
Central-Station Advertising..... 790
An Attractive Booklet..... 791
Advertising in Season..... 791
Chicago Electrical Show..... 791
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
New York Section, Illuminating Engineering Society..... 792
Counter Electromotive-Force in the Electric Arc..... 792
Test of Color Value of Moore Tube..... 792
The Ryan Scintillator..... 793
Cleanliness of Light Sources..... 794
INDUSTRIAL POWER:
Installation, Operation, Care and Repair of Electric Motors in Industrial Operations.—I..... 795
Government Goes Into Electric Power Business..... 798
The Cost of Power..... 798
Determining Stresses by Electricity..... 798
New York Meeting of the American Electrochemical Society..... 799
Pittsburg Section, American Institute of Electrical Engineers..... 799
QUESTIONS AND ANSWERS..... 800
Annual Report of the Allis-Chalmers Company..... 801
FINANCIAL REPORTS OF ELECTRICAL COMPANIES:..... 802
INDUSTRIAL SECTION:
The A. A. Automatic Kitchen..... 804
Weber Gas Engine Company Reorganized..... 804
Pittsburg Exhibit of the Western Electric Company..... 805
Unctuous Acheson Graphite..... 805
Remarkable Performance by a Motor-Driven Automatic Screw-Machine..... 806
A New Portable Testing Set..... 807
Curtis Turbine Used as Regulator..... 807
Lidgerwood Electric Hoist..... 808
A Motor-Driven Wall-Paper Trimmer..... 808
CURRENT ELECTRICAL NEWS..... 809
RECORD OF ELECTRICAL PATENTS..... 816

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THE SMOKE QUESTION.

The emission of smoke from steam locomotives, factory and power-plant chimneys, and the like, has long been a recognized evil, and latterly the abatement of this nuisance has become a question of paramount importance. The pall of smoke over a city shuts out the sunlight and causes much sickness and depression. It blackens and corrodes the exteriors of buildings and deteriorates the interior furnishings, thus entailing much additional expense for their upkeep. In the vicinity of smelters the smoke and fumes destroy the crops. In short, smoke is an unmitigated nuisance and should be abolished as far as possible.

Most of the smoke emitted from chimneys is due to the burning of "soft" or bituminous coals. These coals contain a large amount of readily volatilizable matter, and it is from this mainly that the smoke is due. "Hard" coal, or anthracite, contains but little volatile matter, and consequently emits little or no smoke when burnt. But anthracite is generally expensive, and in most places, except in those localities in which it is mined, its cost is prohibitive. Therefore, most factories and power plants, especially in the western parts of this country, are reduced to the necessity of burning semibituminous, bituminous, and lignitic coals. Thus, the question arises, is smoke preventable? The answer is given unqualifiedly, it is.

In many districts laws have been passed to prevent factories from belching forth huge volumes of black smoke, but the general result has not been altogether satisfactory. Many manufacturers have preferred to pay small fines from time to time rather than go to the expense of remodeling their plants; and again it has been found difficult in some places to convince magistrates that it was a good thing to penalize the owners and operators of factories and power plants to whom was due in no small measure the prosperity of the surrounding district. Legislation will accomplish much, however, if solidly backed by public opinion. This latter is the deciding factor, as witness the present agitation in Chicago in the matter of railroad electrification.

The whole question of smoke prevention resolves itself into two essentials. These are: (1) Efficient firing and stoking; (2) proper draft.

More than 100 years ago James Watt laid down the correct principles for burning bituminous coal. This fuel should be burnt on the coking system. In the practical operation of this system the fresh coal should be placed on front of the fire on the furnace deadplate so that the volatile portions may first

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be driven off and burnt further back in the furnace. Then this partly coked coal must be pushed back on the grate and replaced by a further supply of green fuel on the deadplate. Air must be supplied not only under the grate but also above the grate to insure the complete combustion of the volatile products from the fresh coal. This is without a doubt the only proper method to follow in dealing with bituminous fuel, and it is unquestionably superior to the so-called sprinkling system. These principles may sound elementary. In truth they are quite well known. But their importance cannot be emphasized too strongly.

The question of proper draft is one which cannot be given too much prominence, and herein lies the opportunity for the skilled investigator. Whether the draft be effected by the aid of a cumbersome expensive chimney, or whether some method of mechanical draft be employed, the general principles to be observed are much the same. After the boiler and its accessories are correctly designed and manufactured, the greatest skill and attention must be used in their proper installation. Finally, the fireman or attendant must be well versed in his calling to insure good results in operation. Too little air will cause smoke and consequent lack of efficiency. Entire absence of smoke on the other hand does not necessarily mean correct draft; there may be too much air, with resulting inefficiency. More discussion on this point will be found in an article on "Mechanical Draft" in another part of this issue. Without a doubt the chief element in a hand-fired plant is the fireman or firemen. With well-designed mechanical stokers and proper precautions for draft regulation the question of efficient firemen is not so urgent, but even with automatic stokers efficient attendance is an absolute indispensability.

Turning to the problem at large, other remedies in addition to the above might be suggested. The electrification of railroads will contribute in great measure, of course, toward smoke abatement. But the railroads are not the only offenders. Smoke prevention in existing plants cannot be too strongly emphasized. Anything that may be done on a large scale can, as a rule, be done much cheaper and more effectively than in a number of isolated cases. This immediately suggests the centralization of power distribution and the abolition of the isolated plants with their separate chimney stacks distributed all over the community. Meanwhile it behooves the operators of existing central stations so to improve their plants as to point the moral.

Municipal or even state legislation might also be effected and enforced; but in drafting proper reforms it would be well to call engineers and plant operators into consultation. Even without such universal action, or at least until it comes to pass, as eventually it must, operators of individual plants can of themselves do much to banish the smoke evil by observing elementary precautions, and the sooner they realize that smoke means inefficiency and waste, in every sense and in all aspects of the situation, the sooner will something be done in the matter.

In conclusion, attention is drawn to another article in this present issue, entitled "Industrial Smoke Prevention in Hamburg," wherein is given some excellent information by which all can profit who have to do with the care or operation of steam boilers.

THE RIGHT TO FRANCHISE VALUE.

Where public-service properties such as bridges, dams, waterworks and electric plants have been taken by eminent domain, the courts have upheld the right to payment for the franchise value as well as that of the structures themselves.

In estimating the values of such franchises the earnings resulting from their use have repeatedly been indicated as the most important factor. Under the general rule in eminent domain, the earnings of tangible property taken cannot be shown in evidence to enhance its value, but earnings that result from the use of a franchise are admitted for its valuation.

One of the earlier cases, where it was held that the owner of a public-service structure is entitled to the value of the franchise when the structure is taken by public authority, involved a toll bridge over the Schuylkill River that was taken by Montgomery County. The contention of the county in this case was that compensation to the bridge company was to be measured merely by the cost of building a new bridge, but the opinion of the court on this point was as follows:

"The bridge structure, the stone, iron and wood, was but a portion of the property owned by the bridge company, and taken by the county. There were the franchises of the company, including the right to take toll, and these were as effectively taken as the bridge itself. Hence, to measure the damages by the mere cost of building the bridge would be to deprive the company of any compensation for the destruction of its franchises. The latter can no more be taken without compensation than can its tangible corporeal property."

As to the method of estimating the value of the bridge franchises the opinion ran thus in the above case:

"Their value necessarily depends on their productiveness. If they yield no money in return over expenditures, they would possess little, if any, present value. If, however, they yield a revenue over and above expenses, they possess a present value, the amount of which depends, in a measure, upon the excess of revenue. Hence it is manifest, that the income from the bridge was a necessary and proper subject for inquiry before the jury." Montgomery County *vs.* Schuylkill Bridge Company, 110 Pa. State 54. Decided 1885.

Even in a case where Congress provided that a lock and dam belonging to a private corporation should be taken in the interest of navigation and that no compensation should be made for the franchise of the corporation to take toll, it was held by the Supreme Court of the United States that compensation for this franchise must be made. On this point Justice Brewer said:

"We are not, therefore, concluded by the declaration in the Act that the franchise to collect tolls is not to be considered in estimating the sum to be paid for the property. * * * * If a man's house must be taken, that must be paid for; and, if

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the property is held and improved under a franchise from the state, with power to take tolls, that franchise must be paid for, because it is a substantial element in the value of the property taken. So, coming to the case before us, while the power of Congress to take this property is unquestionable, yet the power to take is subject to the constitutional limitation of just compensation. * * * * How shall just compensation for this lock and dam be determined? * * * * The value of property, generally speaking, is determined by its productiveness, the profits which its use brings to the owners. * * * * The value, therefore, is not determined by the mere cost of construction, but more by what the completed structure brings in the way of earnings to its owner. * * * * The prices which may be exacted under this legislative grant of authority are the tolls, and these tolls, in the nature of the case, must enter into and largely determine the matter of value." Monongahela Company *vs.* United States, 148 United States 312.

A later case in the Supreme Court of the United States shows how valuable a public-service franchise may come to be in comparison with the tangible property by means of which it is used. In this case the city of Brooklyn took the plant, property and franchises of a water-supply company, and the commissioners appointed to value these items awarded the sum of $370,000 for the tangible property of the company, and $200,000 for its franchises and contracts. The basis of franchise valuation was stated as follows, and this was sustained:

"To recapitulate what has just been said, we have valued the franchise upon the assumptions (1) that at present the water company alone has the right publicly to purvey water in the Twenty-sixth Ward; (2) that the exclusiveness now incident to its right may at any time be taken from it by the Legislature, or by local authorities acting under legislation; but (3) that neither the Legislature nor local authorities would, in determining whether to take from the company the exclusiveness of its right, fail to have such due regard as is demanded by ample and fair public policy, to the past investment, risks and services of the company and to the reasonably just expectations which those who have invested money in its work had in mind when so investing." Long Island Water Supply Company *vs.* Brooklyn, 166 United States 685.

COMPARATIVE POWER COSTS IN TWO TURBINE STATIONS.

The results of the first year of operation in two recently completed steam-turbine central stations furnish data of suggestive emphasis upon the importance of cultivating a large day load. The plants are seventy-five miles apart, but each is located in a city where the textile industry is the chief source of occupation of the community. Each station illustrates the best skill of experienced organizations frequently occupied in designing new and efficient plants. The same make of generating units is used in each case, direct-connected to the same kind of turbines. In one city, however, the power business has never been developed much beyond the natural unsolicited demand of the community, while in the other instance all the resources of a progressive, commercial management have been successfully employed to create a first-class motor load. In the first case, which may be called that of plant A, the only competition which the company faces in the power field is that of the isolated plant, burning coal under much less favorable conditions than the central-station organization has to meet. Plant B, on the other hand, has to fight against waterpower facilities of long-established usefulness in the community, and yet its power business has become sixty-one per cent of the total kilowatt-hour sales, compared with a power business of 20.2 per cent in plant A.

The equipment of plant A consists of one 500-kilowatt and two 1,000-kilowatt Curtis turbines delivering current to the system at 2,300 volts, with steam supplied from four Babcock & Wilcox water-tube boilers of 350-horsepower each, at 165 pounds pressure. The auxiliaries are motor-driven and the equipment is thoroughly representative of good practice in type and arrangement. The station of Company B is equipped with one 1,500-kilowatt Curtis turbine, and on an adjoining portion of the property, with 4,700 horsepower in seven condensing engines and generators of assorted character. The old plant is being displaced as fast as possible by the new station, which is designed for an expansion capable of meeting the demands of many years to come. The old boiler plant is equipped with thirteen Scannel horizontal return tubular units of 1,651 horsepower rating, total, and the new station with three Stirling boilers of 1,578 horsepower rating, operating at 180 pounds each. The division of the load between the old and new portions of the plant is not stated, but from the results obtained and the character of the old equipment it appears that the larger part of the work was done by the turbine installation.

The cost of coal in plant A was $3.83 per ton, and in plant B $4.35. The station with the good power load thus suffered a disadvantage in the fundamental factor of power production, being obliged to handle its coal by rail while the other company utilized tide water. Bituminous coal of New River quality was used by each station. The operating results at the switchboard were a total manufacturing cost of 1.12 cent per kilowatt-hour in plant A and 0.94 cent in plant B. The fuel cost per unit of output was 0.53 cent in plant A and 0.63 cent in plant B. The station wages cost per kilowatt-hour was 0.35 cent in A and 0.24 cent in B. The total cost of production at the switchboard was about $47,100 in plant A and $94,400 in station B. The total energy generated was 4,226,887 kilowatt-hours in station A and 10,042,010 kilowatt-hours in B. The power sales were 648,234 and 4,705,934 kilowatt-hours, respectively.

It is probable that when the old equipment is entirely superseded by the turbine outfit in plant B, a further gain in economy will result, but the figures here presented show with unmistakable emphasis the value of gross energy sales and gross station output in reducing the unit cost of production.

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The New York Electrical Show.

The third annual New York Electrical Show, which was opened at Madison Square Garden on the evening of October 11, was the most successful exhibition of this kind that has ever been held in New York city. The show was open every day and evening, and closed with a great demonstration on October 21. Both the lighting and general decorative scheme have been carried out on such a magnificent scale as has never been seen in this well-known auditorium. Throughout the structure there was a prevailing note of harmony in the arrangement of the booths, the illumination, and all features that attract the eye. The great roof of the Garden was successfully draped with a mass of soft gold and white bunting, which was continued over the walls of the building and its balcony.

The illumination of the ceiling was carried out by a large number of beautiful electroliers carrying colored lights. Liberal use was made of tungsten lamps for this purpose, both of the twenty-five-watt and forty-watt sizes. The arrangement of the booths and the general effect is well shown by the accompanying pictures. The decorative scheme was designed by M. A. Singer. It has elicited admiration from all the visitors to the show, who declared that it was an unqualified artistic success.

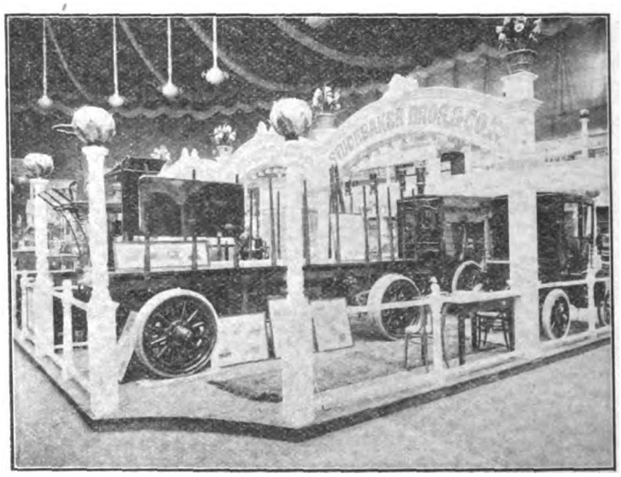
The exhibits at the show, although not bringing out much that was absolutely novel, were, as might be expected, of a character to appeal particularly to the multitude and to show the advantages of the use of electricity both in the home and factory. There was a larger display of motor-driven devices than heretofore, but the matter of electric lighting and domestic applications still predominated.

Excellent displays were made by the four electric-lighting companies in the New York district. The exhibits of the New York Edison Company, the United Electric Light and Power Company, the Edison Electric Illuminating Company of Brooklyn, and the Public Service Corporation of New Jersey were along the lines of popularizing the electric current in every conceivable manner. The exhibits of the three former companies, which were quite extensive, were located along the sides and rear of the Garden.

A concerted effort was made by the most representative manufacturers of electrical devices to make a fine display of their products in the central booths of the show. The balcony was given over principally to the display of electric irons and other household electrical utilities.

During the progress of the show many special events took place and several large social gatherings were held. On Tuesday evening, October 19, the New York Edison Company tendered an entertainment and smoker to the electrical contractors of New York city, in the concert hall of the Madison Square Garden and on the closing night, October 21, the Sons of Jove were scheduled to hold a rejuvenation.

Westinghouse Electric and Manufacturing Company.



Studebaker Brothers & Company.

Charles L. Kiewert Company.

Excello Arc Lamp Company.

SOME PROMINENT BOOTHS AT THE NEW YORK ELECTRICAL SHOW.

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On each afternoon and evening throughout the show an excellent musical programme was rendered by d'Aquin's Military Band.

Following are brief descriptions of the exhibits made by the various exhibiting companies and firms:

The New York Edison Company space covered the entire length of the Garden along the north side of the building, and attracted probably more attention than any other exhibit. It was primarily an exhibition of the advantages of electric power for industrial purposes. Here demonstrations of motor-driven industrial machinery of various sorts were made by skilled operators. There were included a number of printing presses, sufficient for a good sized print shop, all in operation; cigarette making and candy making equipments; a complete electric laundry; an electric chicken incubator, which attracted general interest; and many other electrical applications.

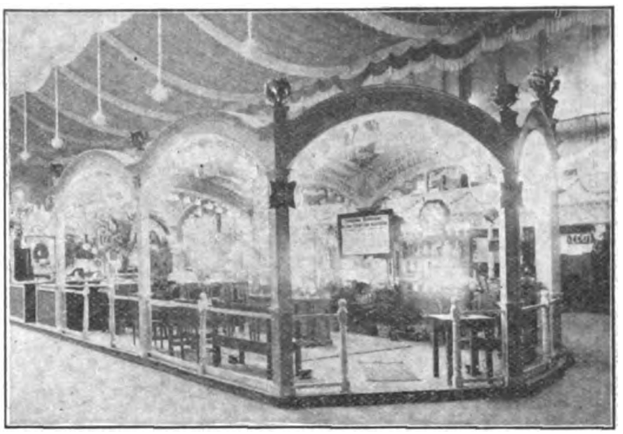
The exhibit of the United Electric Light and Power Company extended along the entire south side of the Garden and showed a great variety of interesting applications of alternating current for lighting and power purposes. There were exhibited a number of spectacular novelties, medical and dental apparatus, household devices; all kinds of electric incandescent, arc and vacuum lamps; store, factory and building construction motor-driven machines. Making displays of their products in this space were the following companies: Stow Manufacturing Company, electric buffer and breast drill; Lincoln Electric Company, motor and motor-generator set; Cooper-Hewitt Electric Company, mercury-vapor lamp; Adams-Bagnall Electric Company, an A-B regenerative flame arc lamp and a standard A-B enclosed arc lamp; J. H. Hallberg, stereoptical outfit and moving-picture exhibit; A. A. Automatic Manufacturing Company, showing an A. A. automatic kitchen.

The Edison Electric Illuminating Company, of Brooklyn, in a series of booths which occupied the entire eastern end of the building, had a very handsome and extensive working display of electric lighting, heating and small motor appliances, particularly adapted for use in the various branches of household economy. The exhibit of cooking utensils was particularly complete, as was also that of labor-saving kitchen and laundry appliances.

The booth of the Public Service Corporation of New Jersey faced the main entrance and was used principally as a reception room. A number of maps and photographs showing the great system of the company were in evidence.

The Excello Arc Lamp Company, of New York, had a display of its various types of flaming arc lamps, both for direct-current and alternating-current circuits. One set comprised four lamps suitable for operation in series on 220-volt alternating current. An interesting feature was the first quartz lamp that has been shown in America. A number of Excello

General Electric Company.



National Electric Lamp Association.

Sunray Electric Lamp Manufacturing Company.

Otis Elevator Company.

CONSPICUOUS EXHIBITS AT THE NEW YORK ELECTRICAL SHOW.

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flaming arc lamps were in use in other booths, and eight of these arcs were used for lighting up the arcade at the Madison Avenue entrance to the Garden. On the evening of October 18 this company made a great "hit" by sending up a balloon from the roof of the Garden to a height of about 1,000 feet. Hanging a short distance below the balloon were twelve Excello flaming arc lamps arranged in a circle and burning brilliantly. This created a great deal of favorable comment.

The Empire Vacuum Cleaner Company, of New York, made a fine display of its Imperial cleaner.

The German-American Electric Company, of New York, showed a number of the Grant flaming arc lamps and Grant tungsten lamps in operation. A number of automatic lamp suspension devices were also exhibited.

The Manhattan Electrical Supply Company, of New York, showed an extensive line of general supplies. Included were: Electric light specialties, telegraph and telephone sets, medical apparatus, massage vibrators, jump spark coils, door openers, etc. The wireless telegraph equipment was also shown in operation at two stations in the Garden.

The Como Electrical Company, of Spring Lake, N. J., had on exhibition a number of Hickley electrolytic, alternating-current rectifiers. The company builds rectifiers of various types, the largest type being intended for charging a twenty-four-cell vehicle battery, another type is intended for garage use in connection with six six-volt batteries on a 110-volt alternating-current line. Several smaller types suitable for charging batteries or for running small motors, such as are used in railroad signal work, were displayed. These rectifiers, it is claimed, will operate on any frequency from ten to 133 cycles and at any voltage up to 1,000.

The General Electric Vehicle Company, of Long Island City, N. Y., had on display two electric vehicles—one of which was an electric light company's delivery wagon of 1,000 pounds capacity, and the other a wagon of express-body type of 2,000 pounds capacity. It was said these vehicles could run fifty miles on a charge at an average speed of ten miles per hour. The company also makes vehicles for any capacity and any class of commercial service.

The American Metal Hose Company, of New York city, occupied a booth on the gallery and showed flexible metal conduits in steel, brass and copper, suitable for cord for window lighting; flexible metal conduit, waterproof, for underground work; flexible metal hose for highest steam pressures, oil, compressed air; seamless flexible copper hose for gasoline, flexible metal hose to stand a pressure up to 10,000 pounds per square inch; flexible arms for electric-light fixtures, etc.

The Electric Cleaner Company, of Chicago, showed an extensive line of portable electric vacuum cleaners known as the "Positive" and the "Reliable." Both these types of machines were demonstrated by the company's representatives, who explained all their features with care.

Dossert & Company, of New York, exhibited a complete line of solderless connectors, cable taps and terminals for electric cables and wires. A new feature was a cable tap for connecting aluminum and copper cables. This tap gives an aluminum contact at the point of connection with the aluminum cable and a copper contact at the point of connection with the copper cable. The method of making rapid transformer connections with Dossert connectors was also shown.

The Baltimore Enamel and Novelty Company, of New York, showed porcelain-enameled-iron reflectors for arc lamps

GENERAL VIEW OF THE THIRD ANNUAL NEW YORK ELECTRICAL SHOW.

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and incandescent lamps; battery jars and other porcelain products were also shown.

The Lansden Company, of Newark, N. J., exhibited two of its electric vehicles, representing widely different lines of construction; one was a standard 1500-pound closed panel delivery wagon, the other was an industrial truck, which has been developed for use in factories, mill yards, steamship piers, railroad terminals, etc. The vehicle is said to possess features which make it particularly applicable for such work. It is low and easily loaded, and on account of its peculiar construction can be maneuvered through narrow passageways. The machine is constructed either as a three-wheel or four-wheel truck.

The Electric Storage Battery Company, of Philadelphia, showed an element of type H-131 Exide battery, as installed at the Sixteenth Street station of the New York Edison Company; nine standard sets of vehicle batteries; Exide sparking duplex and emergency sparking batteries; car-lighting batteries; automobile electric head lamps operated by Exide sparking batteries; and a casting mold electrically operated for casting souvenirs consisting of lead disks bearing the imprint of the company.

The Electric Home Supply Company, of New York, exhibited goods made by the Vulcan Electric Heating Company, of Chicago, manufacturers of soldering and branding coppers, can sealing devices and the "electrocurl" which is an electrically-heated curling iron. The company also exhibited the products of the Dielite Manufacturing Company, of Philadelphia, Pa., manufacturer of "Dim-a-lite" regulating sockets. Wirt regulating rheostats and dimmers, as well as the Dielite insulating joints. A feature of the exhibit was a ten-room, completely equipped and electrically lighted doll house and a case containing an electric cooking outfit, intended for a child.

The Goulds Manufacturing Company, of New York, had as the chief feature of its exhibit a single-acting triplex-power plunger pump mounted on a bedplate with an adjustable belt idler and belt connected to a 220-volt, three-fourths horsepower Crocker-Wheeler motor.

The International Correspondence Schools, of Scranton, Pa., showed bound volumes of their numerous engineering courses and specimens of students' work.

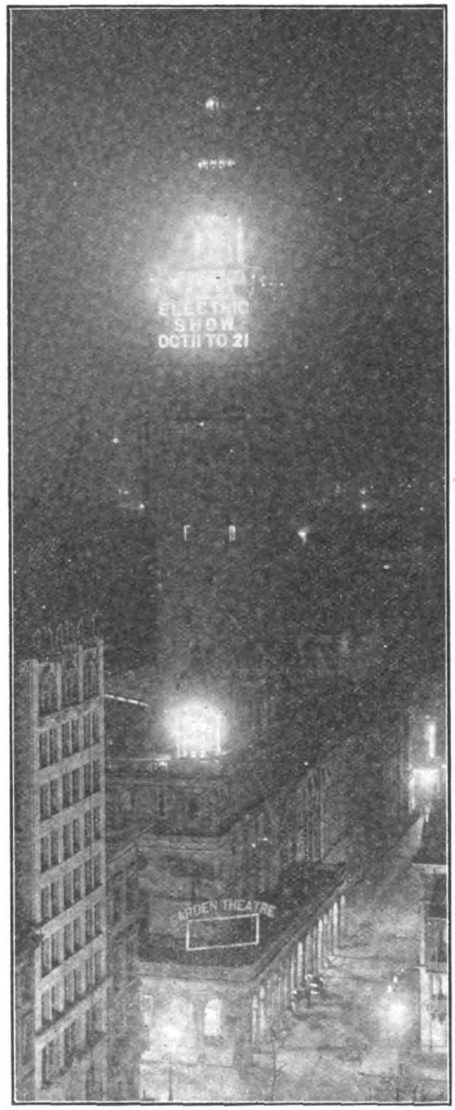
The Crane Company, of Chicago, showed a number of electrically operated gate valves, cast-steel valves and headers and an operating exhibit of the "Cranetilt" steam traps.

Hoover Suction Sweeper Company, of New Berlin, Ohio, had a number of its vacuum sweepers in operation.

The General Compressed Air and Vacuum Machine Company, of St. Louis, exhibited a number of Thurman portable electric vacuum cleaners.

The Storage Battery Supply Company, of New York, showed its Hudson-Fulton storage battery intended for Christmas-tree outfits and similar uses. Battery testing appliances, etc., were also shown.

The Studebaker Brothers Automobile Company, of New York, placed on exhibition three representative 1909 electric vehicles. One was a coupé, combining all the latest features of control and refinement in the manufacture of pleasure vehicles. Another was a panel body delivery wagon representative of the type of vehicle which is in general use by large retail stores, such as Rogers-Peet and Oppenheim-Collins, in New York city. There was also shown a five-ton stake truck which is the largest of this complete line



EXTERIOR LIGHTING OF MADISON SQUARE GARDEN FOR ELECTRICAL SHOW.

of commercial vehicles, and which are taking the place of two or three-horse-drawn vehicles each, and thereby producing great increase in transportation economy.

The General Electric Company's booth was in the central part of the Garden. The exhibit included displays of the latest developments in heating apparatus and tungsten and tantalum lamps, including a case of miniature and sign lamps. Ten of the most attractive designs in copper and silver, of the line of S. Sterneau & Company's chafing-dishes, teakettles and coffee percolators equipped with the G. E. encased disk universal heating elements, elicited very favorable comment, and gave promise of an excellent "Electrical Christmas" trade. A new line of soldering irons embodying the spiral wire handle idea marked an innovation in cool flexible handles and removable tips in soldering tools. Other new heating devices were the solder melting pot, sealing-wax heater, automatic flatiron, "cast in" unit frying pan and teakettle, and foot-warmer. There was also shown a line of flaming arc lamps, intensified arc lamps and a multiple automatic cut-out hanger, with rope suspension. An interesting feature was the motor-driven braiding machine in operation, showing the method of making cord for G. E. heating devices. In the center of the booth were General Electric motors operating Ingersoll-Rand drills and the Bridgeport Safety Wheel Company's grinder. A line of small motors not in operation permitted close inspection. A complete line of fan motors, rheostats, compensator panels, circuit-breakers, meters and instruments was shown; also a multiple rectifier, a 10,000-volt lightning arrester and a display of automobile accessories.

The Moore Electrical Company, of Newark, N. J., had, besides the permanent installation of a yellow tube in the lobby of the Garden, a small white light unit used for color-matching work and the sorting and selection of precious stones, especially diamonds. This unit, which operates on 220 volts, sixty cycles, is semi-portable and is claimed to give uniformly accurate results as a duplication of average diffused daylight.

The exhibit of the Westinghouse Electric and Manufacturing Company was representative of the complete line of small-power motors and electrical heating apparatus, intended for domestic use, manufactured by this company, omitting the extensive and well-known products of electrical machinery for lighting, power and traction. Among the electrical heating devices were shown the new Westinghouse toaster stove, steel-top hot plate, flatirons, tailor irons and luminous and non-luminous electric radiators. The new automatic tailor iron exhibited is arranged so that it heats only when it is placed on the stand, and therefore does away with the objectionable trailing cord. The company had four demonstrators at its exhibit. One operated the toaster stove and steel hot plate, toasting bread and cooking cereals, etc. One demonstrated the family sewing-machine motor, one of which drove a sewing machine on which a regular seamstress made little garments, which after the show were to be donated to one of the orphan asylums in New York. Another demonstrator ironed the garments which had been made by the seamstress. The tailor's iron was demonstrated by a man who brought clothes from his tailor shop and did the actual work of pressing them at the exhibit. The booth was illuminated by festoons of low-voltage, twenty-five-watt tungsten lamps with Holophane

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reflectors. Two large arches were lighted by tungsten lamps of various sizes, from twenty-five watts to 250 watts, one arch showing the entire line for 110 volts, while the other arch showed the 220-volt lamps. Tungsten sign lamps, both of the V and regular types, were shown in large letters.

Stanley & Patterson, of New York, displayed their wireless battery system, which consists of means for connecting dry cells in circuit without wires. Floor boxes and stage pockets were also shown.

The C. H. Wheeler Manufacturing Company, of Philadelphia, displayed a "Rotrex" vacuum pump and centrifugal circulating pump, and a suction, valveless, double-acting, high-vacuum pump.

The H. Krantz Manufacturing Company, of Brooklyn, displayed its extensive line of panel boards, switches, connection strips, outlet boxes and marine fixtures.

The DeVeau Telephone Manufacturing Company, of New York, exhibited various lines of telephone apparatus, including intercommunicating telephone systems, apartment-house telephones, branch exchanges, mine telephones and the Woodruff carriage-call system.

The American Electric Lamp Company, of Philadelphia, displayed views of its factory. On each side of the booth was a large case of lamps, one containing tungsten and tantalum lamps and the other carbon and metallized-filament lamps. A complete collection of miniature lamps was effectively shown.

The Otis Elevator Company, of New York, exhibited a working model of an Otis automatic push-button elevator. In order to show the working and parts of this type of elevator, a steel tower thirty feet high was used. At the top of the four posts of this tower were large electric globes, and underneath these enclosing the sheaths and governor were the words "Otis Elevator Company." The car was equipped with the usual call buttons and elevator electric lamp signals. The elevator used in this exhibit was the regular Otis, type "O," direct-current machine, with full automatic controllers mounted on the bedplate, and equipped with safety devices. Other features of the exhibit were models and illuminated photographs of prominent buildings equipped with Otis elevators, the most notable being an official model of the Metropolitan Life Insurance Company Building, the model being 1/100 of the actual size of the real structure, and equipped with Otis elevators.

The Watson-Stillman Company, New York, had on exhibition twin volute turbine pumps direct-connected to motors and pumping water for house-tank purposes against a pressure of from twenty-five to fifty pounds. A shaft straightener for straightening four-inch steel rods, a hydraulic punch, a hydraulic jack, hydraulic motor lift and a sixty-pound hydraulic broaching press operated by a motor were featured.

The Tucker Electrical Construction Company, New York, featured in its booth a seven-foot model of the Manhattan Bridge across the East river as it appeared during the Hudson-Fulton celebration. The Tucker company contracted for all the public work in the five boroughs and the bridge is illuminated by 350 eleven-volt, two-candlepower lamps.

The Shelton Electric Company, Chicago, exhibited a small hand hair-drier which furnishes either hot or cold air by merely touching a button and which weighs two-and-three-fourths pounds. Three kinds of vibratory massage machines designed for physicians, barbers and hairdressers and for home use were featured. A new pedestal hair-drier which gives large volumes of hot or cold air, and takes all the weight from the hand, attracted no little attention.

The Automatic Electric Washer Company, of Newton, Ia., had on exhibition two of its latest type motor-driven clothes washers and wringers. The noticeable feature abcut these machines is the mechanically reversible wringer, whereby clothing can be readily released from the rolls; also the raw-hide pinion and cut-gear drive, providing a simple, positive transmission. The entire machine is mounted on ball-bearing casters, and is claimed to occupy less space for equal capacity than any other washer on the market.

The Pelouze Electric Heater Company, of Chicago, made a very attractive exhibit of its various irons. One of the new features of the Pelouze line was the new twenty-pound tailor's-goose with three heats, adjustable while in operation. The low heat while heating the entire bottom surface of the iron is arranged to keep the iron at proper working temperature while left standing. The temperature can be controlled by a simple movement of the switch changing from one heat to another, the three heats being 200 volts, 400 volts and 800 volts. This iron has the well-known features of the four, six-and-one-half and nine-pound irons.

A prominent display was that made by the Sunray Electric Lamp Manufacturing Company. The Sunray arc lamp, using pure carbons, is an ingeniously designed and very simple piece of mechanism. Its claims for long life, short arc travel, minimum globe deposit and high efficiency were seemingly borne out. At the back of the booth were six Sunray lamps showing various progressive stages of the arc life. Above was a 120-hour Sunray lamp which was burned twelve hours per day during the entire show without retrimming. In the center of the booth was a table showing the parts of the lamp and one lamp assembled complete except for the casing. Above this were four lamps fitted with decorative dome shades. At the right of the booth was a set of instruments that could be connected to the circuit of any of the many lamps shown to determine its current consumption and regulation. Over the panel board controlling the various lamp circuits was shown a Sunray high-voltage arc for 240-volt circuits; this lamp is said to take about 150 volts at the arc and to be unusually efficient for this class of service. Attractive pamphlets describing the Sunray arcs were distributed.

The Metropolitan Engineering Company, of Brooklyn, had on display, in the booth of the New York Edison Company, its patented panel board, showing meter connection, and also various styles of its electric signs.

The Heany Lamp Company, of New York, occupied a double booth. A display of fireproof asbestos wire, tipless lamps of both carbon and tungsten filaments and the Heany arc lamp were included in the exhibit.

Sibley & Pitman, 26 Warren Street, New York city, showed a line of beautiful art-glass shades, portables and fixtures.

The Hurley Machine Company, of Chicago, made a fine exhibition of its well-known Thor and Chicago electric washing machines. These attracted much attention. In connection with the Thor machine was shown a universal rod capable of connecting to an ice-cream freezer, meat chopper, mangle and other household machines. An electrically driven ice machine having a capacity of freezing twenty pounds of ice in twenty minutes was also on display.

The Radio Reflector Company, of New York, showed a number of cabinets illustrating the advantages of its reflectors. One of these contained carbon incandescent lamps without shades or reflectors of any kind. Adjoining it was a similar cabinet having the same type of lamp, but equipped with Radio reflectors. A flashing sign containing 100 lamps was operated alternately with certain of the lamps equipped with reflectors, and others without, so as to show the advantages of the reflector.

The Vacuum Engineering Company, of New York, showed two vacuum cleaning equipments, one being a direct-connected single-sweeper apparatus, and the other a double-sweeper, chain-driven. These are designed for installation in the basements of large buildings with a system of pipes running to convenient points for connection to rubber-hose extensions.

The Chas. L. Kiewert Company, of New York and Milwaukee, showed in a very systematical arrangement the efficient lighting of a show window with Trucolor arc lamps. This lamp is of a slanting-carbon type, but uses pure carbons having no luminous chemicals and produces a clear white light, which is diffused by a prismatic hemisphere. Two Alba flaming arc lamps using vertical carbons, two Aurola, inclined-carbon, flame lamps and one Triplex lamp were effectively displayed on a fifteen-foot arch. Eight of the Alba lamps were used to illuminate the main tower of the Garden and were favorably commented upon for their powerful white light and broad distribution.

The New York Electrical School made an exhibit in the form of photographs showing the work that is carried out in its courses. Samples of drawings made by its students were also exhibited.

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The Collins Wireless Telephone Company, of Newark, N. J., showed a variable tuning transformer, an auto-transformer and a rotating oscillation arc. This equipment was used, it is said, in the wireless-telephone experiments conducted between New York and Philadelphia.

The Economical Electric Lamp Company, of New York, showed an extensive line of Hyle and Economical turn-down lamps of the pull-string, turn-bulb and long-distance styles. Automatic flashers were used to turn the lamps up and down.

Fox Brothers & Company, of New York, showed their well-known Polar flame arc lamp and a set of miniature enclosed arc lamps and accessories. The latter were very complete. A new type of lamp, known as the Delta, was shown. The latter is capable of giving either white, yellow or golden color by proper selection of the electrodes, which are of special construction. A new form of Radiante miniature enclosed arc lamp was shown. It has a life of 100 hours at one trim, and is suitable for use on either 100 ten-volt circuits or two in series of 220 volts.

The Duntley Manufacturing Company, of Chicago, showed a variety of pneumatic cleaners, a novel scrubbing machine for renovating carpets, and a small gasoline-engine-driven generator having a capacity for lighting eight lamps and providing current for operating the sweeping machine.

The Murphy Electricity Rectifier Company, of Rochester, N. Y., showed one of its rotary disk type rectifiers, and also one of the stationary electrode type. The latter is self-starting and has no moving parts except a small synchronous motor. The Murphy rectifier is particularly adapted for charging of electric storage batteries and similar devices requiring direct current from an alternating-current source.

The Electrical Testing Laboratories, of New York, made a very interesting exhibit in which were particularly featured three of the numerous classes of tests made by them. Color booths illuminated by different light sources were shown to give their characteristic color values. A striking exhibit of the advance in the efficiency of lamps was made by comparison screens illuminated by the various types of incandescents. An extensive exhibit of testing machines and instruments for conducting tensile, torsion and elasticity tests, as well as conductivity and insulation tests, were shown.

The National Electrical Lamp Association booth occupied a very prominent position and this, coupled with the general attractiveness of design and decoration employed, prompted favorable comment from visitors. In the center of the booth all the regular types of tungsten, tantalum and Gem lamps were displayed in glass cases. On racks placed in the rear of the booth were exhibited lamps of the regular tungsten 110 and 220-volt type, tungsten street series and five-watt sign lamps, 220-volt tantalum and the new tantalum street-car lamp. A particularly interesting feature of the exhibit was a collection of historic incandescent lamps.

F. L. Smidth & Company, engineers and manufacturers of cement-grinding machinery, showed a novel belt drive called a "Lenix Drive." A ten-horsepower motor with a six-inch diameter pulley was belted to an eighty-four-inch diameter superposed pulley, with belt centers of not more than sixty-six inches. The arc of contact between the belt and the large pulley was approximately 266 degrees and for the small pulley 200 degrees. This is accomplished by means of the Lenix roller, having its bearings in a curved arm turning on the axis of a cast-iron stand.

Roger Williams, New York agent of the Simplex Electric Heating Company, showed over 200 different Simplex heating devices. The latest article is a toaster which is all nickel-plated and designed to close up while toasting so as to save the heat and toast faster. There were also complete lines of flatirons, water cups, heating pads of the very flexible type, curling-irons, chafing-dishes, percolators, teakettles, saucepans, blazers, double boilers, sterilizers, soldering irons, gluepots, and numerous other articles. In the exhibit was a photograph of the ironing room of the Star Shirt Factory, Bridgeport, Conn., where 200 electric irons are in use. A complete Simplex range was in operation in the Brooklyn Edison exhibit, with a heater for heating water for washing dishes. In the sewing-room exhibit of the New York Edison Company, Simplex irons were used; a small section of the electric ovens used for baking "Shredded Wheat" biscuits was also shown; of these 20,000 have been supplied by the Simplex company. In various other exhibits Simplex electric-heating devices were shown, making candy, and other dainty edibles.

Chicago Electric Club.

On October 13, following the regular Wednesday midday luncheon, E. P. Warner, of the Western Electric Company, addressed the Chicago Electric Club on the subject, "Electricity and Magnetism from a Yachtsman's Standpoint." Mr. Warner's thirty years' yachting experience makes him peculiarly fitted to discuss this subject.

Aboard a yacht electricity is used principally for lighting purposes, and Mr. Warner began his address by relating particulars of an electric-light installation that was made aboard a yacht some fourteen years ago. Generating units and storage batteries were installed, the latter being at that time comparatively new. Much trouble was experienced in keeping the batteries in order, it being necessary to have an expert make several long trips to the yacht in order to keep them in repair. At the end of the yachting season the batteries had given in all only about four nights' continuous service and the expense was enormous. Mr. Warner then reviewed the rapid advancement of the manner in which electricity has contributed toward the comfort and safety of pleasure sailing.

Regarding magnetism the various difficulties encountered with the mariner's compass were given. The troubles of variation and deviation of the compass needle were explained, and Mr. Warner pointed out that serious trouble often resulted from the variation of the compass when in certain localities. Deviation is generally caused by local conditions aboard the ship, and a number of experiences were cited showing that a great deal of care must be taken by yachtsmen in keeping magnetic substances away from the vicinity of the compass.

Among the experiences related in connection with this subject was one wherein an experienced yachtsman sailed completely out of his course by reason of a companion's standing near the compass with a magnet about his person.

A number of incidents regarding electric phenomena in connection with storms were related. Mr. Warner told of his experience on a northern cruise, during a severe storm, when immediately following a heavy discharge of lightning the uppermost points of the masts, flagpoles, etc., were suddenly lighted by a small bluish flame. This phenomenon is well known among sailors, and is generally taken as a sign that the storm will soon cease.

Mr. Warner related a number of typical fog stories, and concluded his address by summing up the various systems of lighting yachts, and expressed an opinion that eventually electricity will be the foremost illuminant in this field.

Illinois State Electric Association.

The next annual convention of the Illinois State Electric Association will be held, as already announced, on October 26 to 28, at Alton, Ill. In preparing for the convention, Secretary H. E. Chubbuck is making a special effort to increase the membership of the association. He has published a list of 122 cities and villages of Illinois in which there are central stations that are now members. If these members will exercise a little effort they can make the Illinois association the largest of any of the state electrical associations.

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AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

TELEGRAPH AND TELEPHONE SYSTEMS AS AFFECTED BY ALTERNATING-CURRENT LINES.

The two-hundred-and-thirty-ninth meeting of the American Institute of Electrical Engineers was held on Friday evening, October 8 last, at the Engineering Societies Building, New York city, President L. B. Stillwell in the chair. After the meeting was called to order by the president, Acting Secretary F. L. Hutchinson presented his report of associate members elected (ninety-four) and associate members transferred to the grade of members (six).

The president then proceeded to introduce the speaker for the evening, J. B. Taylor, of the Railway Engineering Department of the General Electric Company, Schenectady, N. Y., who was to read a paper entitled "Telegraph and Telephone Systems as Affected by Alternating-Current Lines." The president commented tersely on the question of "right-of-way," which has arisen in the shape of degree of damage caused by electrolysis of existing sub-surface structures due to the utilization of the earth as a return circuit by electric railways and other electrical interests. Although the points raised in this connection had not as yet been fully adjudicated, Mr. Stillwell opined that future decisions in the courts would be along the same lines as those in general already given, substantially that no individual interest can own the earth, that adjustment must be sought along reasonable lines, and that the principle of give and take must be recognized. Scientists must first ascertain the facts and then proceed to find a cure or a preventive rather than permit the conflicting interests to take the dispute into the courts. If this is impossible, then the principles of justice and fair play may be relied upon to effect a final adjustment. The opposite policy, as instanced by the stand the American Water Works Association had taken in the matter, was much to be deplored, amounting, as it did in effect, to a declaration that no electric railway should be permitted to use a grounded return, that they should keep off the earth, and should double-trolley everything. J. B. Taylor was then introduced to read "the first paper before the Institute on this interesting apparent conflict between the etheric vibrations utilized by the telegraph and telephone systems and those caused by the alternating-current lines."

The president's remarks were greeted with an outburst of applause, whereupon Mr. Taylor proceeded to read his paper, an abstract of which follows:

The purpose of this paper is to give a general statement of power transmission and telegraph and telephone conditions as they exist, with special reference to combinations which may make trouble if simultaneous operation is attempted in too close proximity. It should be borne in mind that induction between circuits is a mutual affair, the principal distinction being that a high-voltage transmission line conveying perhaps 1,000 to 5,000 kilowatts is not disturbed by, nor even able to detect, a few extra volts derived by induction from a telegraph line on the other side of the highway. The converse of this proposition is by no means true, and this points to the desirability of power-transmission systems doing everything possible to keep the stresses and strains in the ether within the boundaries of their own right-of-way, and the equal importance of telegraph and telephone apparatus and lines being so constructed and maintained that they will be as far as possible independent of stresses and strains which may be unavoidably introduced into the portion of the ether which they occupy. An adequate consideration and solution of the problem necessarily involves an intimate study of the characteristics and sensibilities of telephone and telegraph instruments as well as a calculation of disturbing electromotive-forces and currents induced in their circuits with values depending upon all the various features of construction and operation of the power lines. The author proceeded to discuss, with the aid of circuit diagrams, the various types of telegraph systems. Results of some tests were given in detail and oscillograms were given showing the current in the main line relay and in the local sounder with twenty-five-cycle alternating current superimposed on the line. Special apparatus was then described by the aid of diagrams, showing how improvement may be effected in cases where the telegraph disturbance is slight. The methods of doing this are as follows: Increasing impedance of line; increasing working current; shunting apparatus with condensers or non-inductive resistance; placing short-circuited secondary winding on relay; placing neutralizing winding on relay; using back contact of relay with reversing sounder. The devices considered just above are only palliative remedies. When the amount of power transmitted, length of line, or small separation of the two circuits is such as to make the disturbance severe, definite neutralizing conditions must be introduced. If we can introduce into a telegraph circuit voltages equal and opposite to those derived by electromagnetic induction, and at the same time supply to the line the charge demanded by electrostatic induction, we shall succeed in neutralizing the inductive effects. Some of the methods of doing this were discussed, with the help of a diagram. In spite of all of the arrangements of alternating-current circuits which may be employed to eliminate or reduce disturbing inductive effects, in some situations it may be cheaper or more desirable to make use of a metallic circuit for the telegraph. Any form of metallic-circuit telegraph will be less sensitive than a circuit with earth return, but the full benefit of the metallic circuit is to be derived only when following the "balancing" principles used in telephone service. Several telegraph circuits with wire returns were diagrammatically illustrated, and each considered in detail. Proceeding with the subject of telephones, the author began by stating that nowadays practically all telephone circuits employed a return wire instead of using a single conductor with an earth return. The whole science of having a perfectly quiet telephone line is dependent on the Wheatstone bridge principle, that no current will flow in the wire or instrument connecting two points at the same potential, even though these two points are on conductors carrying currents of considerable magnitude. The practical application of this principle requires that each wire of a telephone circuit shall have the same resistance, the same inductance, the same capacity, and the same insulation resistance; and more exactly, that these conditions of equality shall hold, not only for the circuit as a whole, but for each and every short section of the circuit. Still more exactly, these conditions of equality must hold for the entire range of frequency to which the apparatus is sensitive and for currents of any magnitude that are likely to be introduced into the circuit. In practice these ideal conditions can be attained only approximately, even after making numerous transpositions of the two conductors. The author described various telephone systems in detail with regard to these points and with the aid of diagrams and figures from practice. He went into the question of the frequency of speech currents for commercial telephone quality and referred to some results given by Lord Rayleigh (Theory of Sound, Vol. 1, page 473) and Mr. Fowle (Transactions A. I. E. E., Vol. 22, page 659), diagrammatically shown by curves of sensibility to different frequencies. Some curves were given in the paper relating to this subject, as were also some oscillograph records of the vowel sound *i* (as in machine) taken from two different makes of receiver. Physiological phenomena bearing on this question of telephone sensibility were briefly discussed. Forms of telephones for high-tension transmission-line service were next considered and a form of telephone insulating transformer (tested to 25,000 volts) was illustrated and described. The author emphasized the fact that eternal vigilance on any telephone system is the price of first-class service. Alternating-current systems formed the next section of the paper. A historical introduction was first given, and descriptions of various systems in present use, with diagrams, were given in some detail. Harmonics and irregularities were next analyzed and oscillograms of currents and electromotive-forces of transformers, single-phase trolley systems and telephone systems were shown. The single-phase railway was then taken up and typical diagrams were given showing the transformation and distribution arrangements. In discussing this question the author said that, while it would be possible, it is by no means easily practicable to have a double-trolley, single-phase railway system; and, considered inductively, such a system would be on a par with any of the other metallic-circuit, alternating-current systems. Various distribution arrangements requiring additional conductors were then examined in detail with the aid of diagrams. In one of the schemes shown, by having the neutralizing wire as close as possible to the trolley wire, no calculations or experiments are necessary, and the same wire will neutralize equally well for various telephone lines, even if on opposite sides of the track and at various distances. The paper concluded with sections on the calculation of inductive disturbances and a comparison of electromagnetic and electrostatic effects. The author's conclusions,

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given as a summary, are as follows: (1) All working conductors are surrounded by electromagnetic and electrostatic fields. These fields induce electromotive-forces and charges in neighboring conductors. With an ideal metallic circuit, external fields are a minimum. Similarly, an ideal metallic circuit may be in fields of any strength without being disturbed. (2) Practical considerations prevent these ideal conditions from being realized. Hence currents will be induced in any conductors wherever placed as a result of currents and potentials on other conductors. Disturbance results only when these induced currents are of sufficient magnitude to be objectionable. (3) Commercial telephone lines have little margin to meet disturbing conditions more severe than normal. An increase of telephone currents to three or four times their present values would doubtless result in great disturbance to other wires in the same telephone system and require new standards of construction and maintenance. The same statement applies to telegraph systems. (4) Theoretically a balanced telephone line can be operated in proximity to alternating-current wires. This is not true of a telegraph line, as there is no way of balancing a circuit using earth return. (5) Where trouble is experienced on a telephone line it may be possible to clear same by putting the system in first-class condition. Where trouble is experienced on a telegraph line, some change in the apparatus or circuit arrangements will be necessary. (6) For any given case, all the features of the power system and signaling system should be taken into account with a view to arriving at the proper procedure to reduce or to eliminate the disturbances.

The president characterized the paper as an exceptionally interesting and important one, and proceeded to call upon Charles F. Scott to open the discussion.

Mr. Scott, in telling of a single-phase railway system in his experience, said that the electromagnetic induction was considered to be the most serious element and that he set about to devise some method of counteracting it. As the load on a railway is shifting, there must be many sections, and even then the induction in the telegraph wire will change gradually as the train moves, while the induction in the transformer changes instantly when the train passes it. Moreover, the induction in the telegraph line is not proportional to the current in the trolley wire, but depends also upon the proportion of current which flows in the rails and that which flows in the earth. This variable proportion is dependent upon the number of tracks, the distance from the train, and other conditions. After some consideration he proposed to wind the primary of the transformer differentially by including certain turns in series with the trolley and other turns in series with the rail, so as to make the electromotive-force induced in the transformer more nearly equal to that induced in the line. While this did not offer a complete remedy, it appeared to be a step in the right direction and worthy of a trial. He turned the matter over to A. J. Sweet, asking that he work out the design of a transformer for trial test. In a few days he reported that he had studied out a modification which would overcome the fundamental objections of the transformer with double primary coils. He then described the method, which was later adopted on the telegraph circuits paralleling the electrified portion of the New York, New Haven & Hartford Railroad, which is briefly told. A neutralizing circuit having practically the same exposure as the telegraph wire is employed as the primary circuit for supplying the neutralizing transformer. This in turn gives a secondary electromotive-force, which is practically equal to that induced in the telegraph wire. The two are connected in opposition. In order to appreciate more fully the intricate problem which is presented it is interesting to note the principal variables which have an effect upon the electromotive-force produced in an adjacent wire: (1) The current in the trolley wire, the amount of which varies with the load; (2) the current in the rails; (3) the current in the earth and the effective position of this current; (4) the phase of the current which is not the same in the trolley, the track, and the earth; (5) the length of exposure, which depends upon the varying position of moving trains; (6) the distance from the railway or primary circuit to the telegraph wire, which in a road with two or more tracks is liable to change without notice. By taking a suitable number of turns the electromotive-force on the secondary is made practically identical with the electromotive-force in the telegraph wires. The tendency for alternating current to flow in the telegraph circuit is therefore eliminated. As the secondary coil carries no alternating current, the transformer acts as if on open circuit. The transformer may therefore carry a number of secondary coils, each connected to its own telegraph circuit. It is found that the secondary coils introduce but little impedance into the telegraph circuits and that the increased mutual induction between telegraph circuits is inappreciable. The arrangement and capacity of the neutralizing transformer is adapted to the particular conditions in which it is to be placed. The neutralizing circuit is grounded just beyond the ends of the exposed section. If this is long, two or more neutralizing transformers may be installed, and the neutralizing circuit may preferably be grounded midway between adjacent transformers. Some time before the electric service was inaugurated on the New Haven road, the engineers of the telegraph company made inquiry in regard to the conditions which might be anticipated. These were discussed, and the above-described system of neutralizing transformers was explained. An order was placed for a number of transformers about a year before the electric service was started. The transformers were built and installed and are now operating as originally designed. The transformer is of the simplest type and is adequate for handling a large number of telegraph circuits. The transformers along the New Haven road are arranged for the accommodation of thirty telegraph wires. It was found that the electrostatic effect upon the telegraph wires, although paralleling a 10,000-volt trolley for a long way at a distance of only a few feet, appears to be nil on the New Haven system. This is presumably due to a considerable number of telephone wires, which probably distributed the charge among themselves, and, as these wires are grounded in regular service, the effects due to electrostatic induction have introduced no serious effects, and, indeed, have failed to be discovered. Mr. Scott concluded his remarks with a critical review of some of the points raised by Mr. Taylor in his paper.

A. W. Copley described some tests made on the single-phase installation on the New York, New Haven & Hartford Railroad, for the determination of the nature of disturbances in neighboring telegraph lines caused by current in the power circuit and the causes of and the remedies for such disturbances. Bad weather conditions were approximateed by placing leakages between lines and ground. Several different adjustments were made on the telegraph instruments by a telegraph expert, when there was no alternating current in the line, these adjustments being made to correspond with what might be met with in practice. After each adjustment, alternating current was introduced into the circuit in increasing amounts, until it began to affect the working of the instruments. The ratio of the alternating-current voltage to the working direct-current voltage was then taken. This was tried for alternating current of both twenty-five and fifteen cycles, and on simplex, duplex and quadruplex circuits. The first tests made on simplex circuits were made with box

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relays in the circuit. These are relays which act as sounders, and with them no local circuit is necessary. It was found that these relays showed the effects of the alternating voltage at very low values, the signals becoming uneven, and mushy. The box relays are seldom used in actual circuits, and therefore no figures were taken under this condition. The usual simplex circuit uses neutral relays which close local sounder circuits. Tests made with these relays gave the ratio of allowable alternating voltage to direct current, working voltage as about 0.5 for twenty-five cycles, and 0.4 for fifteen cycles. Duplex circuits are less sensitive, the ratio in this case averaging 0.9 for twenty-five cycles, and 0.7 for fifteen cycles. Quadruplex circuits are by far the most sensitive, and show a great deal of variation, but average values of 0.2 and 0.15 were obtained for the ratios at twenty-five and fifteen cycles, respectively. Results on actual lines checked closely with the above results. Mr. Copley pointed out the fact that although the allowable fifteen-cycle voltage is only about seventy-five per cent of the allowable twenty-five-cycle electromotive-force, the voltage induced by a given amount of current at fifteen cycles, is only 0.6 of that induced at twenty-five cycles, and therefore the telegraph lines are slightly better off with the lower frequency. It is seen then that disturbance can be overcome if only the working direct-current voltage is made high enough. This is quite an effective method as long as the direct current is not increased above allowable limits. The method is substantially the same as the second remedy given by Mr. Taylor, *i. e.*, increasing the working current. If it is undesirable to increase the current, but increase of voltage is allowable, a combination of his first and second methods may be used, increasing the impedance of resistance of the line, and at the same time the direct-current voltage, holding the current constant. The last remedy he mentions, the bug-trap arrangement, devised by Edison in the early days of the quadruplex, might be emphasized. Tests made with this device showed that it was possible to work a simplex line in which the alternating induced electromotive-force had several times the value of the direct-current voltage, but it was found to be inapplicable to cases where the alternating voltage varied. If the induced electromotive-force is steady, the arrangement is quite efficient, but if not the relays must be constantly adjusted.

In regard to the calculation of inductive disturbances, Mr. Taylor has indicated the importance of a knowledge of the values and the positions of the currents in the various parts of the circuit. In particular, it is necessary to know the amount and effective position of the earth current. From theoretical statements, it appears that part of the return current would be found in the rails and a part at the image of the trolley wire. But tests made on the New Haven road and at other places indicate that the effective position of the earth current is far below this image; in fact, its depth is in the order of ten times the depth of the image.

W. S. Murray said in part: I think the best way to discuss this subject—at least, from the railroad point of view—is to get down as closely as possible to the actual facts of the situation. While the first installation of the single-phase system, as arranged on the New Haven road produces a maximum induction, it is not uninteresting, however, to note that as extensions of it go into effect, by reason of power stations delivering current virtually dividing itself in equal amounts and in opposite directions along the right-of-way, the inductive effects will tend to eliminate themselves, and the future will be more free from them than the preesnt, Mr. Murray proceeded to tell in detail of a conference held recently by officials and engineers of the New Haven road with regard to the induction problem. In conclusion, referring to this road, he said: "Our records for the month of July, 1909, show that the electric-locomotive mileage was 14,000 miles per engine failure, while for steam the figure was 6,238 miles per engine failure. Thus the steam record was less than forty-five per cent as good as the electric."

Mr. Hutchinson at this point handed in a written discussion sent in by L. C. Nicholson, of Buffalo. Mr. Nicholson wrote in part as follows: The five-phase, 60,000-volt, twenty-five-cycle transmission lines of the Niagara, Lockport & Ontario Power Company from Niagara Falls to Syracuse run parallel and closely adjacent to the same company's private telephone lines for a distance of 200 miles and to Western Union telegraph and telephone circuits for 125 miles. The separation between the power lines and the private telephone line varies from 150 feet to ten feet, the average distance being about fifty-six feet, and between the power lines and Western Union lines the average distance is about seventy feet, though frequently not more than thirty feet. The power lines are transposed only where they are parallel to Western Union circuits. The private telephone line is a copper circuit, on separate poles on the power-line right-of-way. The wires are transposed ten times per mile. The Western Union circuits consist of one continuous two-wire telephone circuit transposed twice per mile, and eighteen telegraph ground-return circuits using from seventy to 250 volts storage-battery current. Originally and before voltage was put on the power line paralleling the Western Union circuit, transpositions were carefully put in to prevent induction effects. In a distance of 105 miles thirty 120-degree transpositions, or ten total transpositions, were placed at intervals varying from three to five miles. After more than a year's operation of this line transmitting some 6,000 horsepower, during which time no disturbance of any kind arising from normal operation was felt on the adjacent telephone or telegraph lines, eighteen of the thirty transpositions were changed so that the upper conductor was no longer transposed, but remained the upper conductor for a distance of fifty-seven miles. The two lower conductors were transposed 180 degrees at the original transposition points. The remaining twelve 120-degree transpositions covering forty-eight miles were unchanged. Evidently the 180-degree transposition scheme gives a circuit equivalent to a non-transposed single-phase circuit, the two conductors of which are in a vertical plane with, in this case, six feet separation. During two years' operation of this line with loads as high as 15,000 horsepower no disturbance is felt on adjacent parallel telephone and telegraph circuits, during normal operation. In view of this experience, transpositions of the power wires are considered entirely unnecessary, and in subsequent lines which have been built contiguous to foreign circuits no transpositions have been made. As stated above, neither the private telephone system nor the Western Union telephone or telegraph circuits can detect the presence of the power circuits when operating normally. However, when a ground occurs on one phase of the power line the electrostatic unbalancing causes chattering of telegraph instruments and sometimes blows fuses in the telegraph or telephone circuits. These disturbances are always of short duration, being usually less than twenty seconds.

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which is the maximum time a ground can remain on any part of the system before being automatically cut off. Electromagnetic effects of a ground are felt only slightly, on account of a high resistance placed in the neutral connection to earth of the sending transformers, which allows the passage of approximately thirty amperes earth current. Formerly when the system was operated with a thoroughly grounded neutral, the electromagnetic effects were considerable on account of short-circuit currents to earth, sometimes burning out fuses, relays and lightning arresters. Other forms of abnormal operation have been experienced, and their effects upon parallel circuits noted. Single-phase power transmitted over two wires of a three-phase line causes no disturbance. The combination of transmitting three-phase power approximately one-half the total distance and single-phase power the remaining distance, has never caused any inductive disturbance of any kind. Transmitting power three-phase over duplicate lines separated from each other several miles, using two conductors of one line and one conductor of the other line to make up a single three-phase circuit, causes disturbances which appear to be due entirely to electromagnetic induction. Thus, normal voltage on only one wire of either line causes no trouble unless considerable three-phase load is delivered (using two wires of the other line), showing that the purely electrostatic effect is negligible under conditions of normal voltage. When, however, a ground occurs on one phase, causing full line potential to exist between the other two phases to ground, the electrostatic effect shows up in a mild form, as mentioned above. In general, experience shows that with separation between power and telephone lines, as mentioned above, transposition of power wires is unnecessary; that transient electrostatic and electromagnetic effects accompanying grounds on the power line are mild and of slight consequence; that the only class of disturbances that will cause trouble to telephone or telegraph instruments is caused by heavy electromagnetic effects induced by short-current currents passing through the earth for considerable distances, as may occur in star-connected, high-power, high-voltage systems which operate with a grounded neutral.

Dr. C. P. Steinmetz, after generally commending the paper, said in part: I cannot agree with Mr. Taylor's explanation of the greater frequency of ground and arc circuits as being due to higher voltage. After giving his reasons, Doctor Steinmetz said that it has become the almost general custom where arcs are operated from alternating-current systems to separate the arc circuit by the transformer from the primary distribution system; that is, to use constant current transformers. Furthermore, he did not quite agree with Mr. Taylor in the harmlessness or improbability of trouble from the third harmonic generator wave in the telegraph and telephone circuit. The engineers of the General Electric Company had some years ago tried the idea in regard to the high-voltage transmission, of grounding the generator neutrals. The telephone line was put out of service absolutely, and they were obliged to take off the ground and then the line operated again. At that time they took an oscillograph of the neutral generators and found the third harmonic very greatly surmounted by the minor circuit. Since the circuit was forty and the third harmonic 500 it conformed fairly close to the maximum of the car for frequency. This illustrates what Mr. Taylor has said that one may expect more trouble from the higher harmonics of the generator, since these higher harmonics have a greater physiological equivalent in the car than the fundamental. The speaker then went into the question of the image conductor, which he said was frequently misunderstood. He said that there is need of a Faraday to give us such a clear conception of the electrostatic field, as we have it of the electromagnetic field, that it can deal with the lines of electrostatic force.

In conclusion, Doctor Steinmetz remarked that in calculating capacities from inductance by the velocity of light, the error is that the actual velocity is slower than that of light due to the energy loss in the electric circuit which retards the velocity, but if in the induction we do not use the total inductance of the conductor —that is, the external inductance and not the numerical part—then we eliminate the relation due to the loss and get the correct relation.

The President then called on Mr. Taylor to close the discussion. Mr. Taylor replied briefly to the various points raised without departing radically from the position he had assumed in his paper. He proposed to look over the list of Mr. Murray's questions later, and possibly to contribute something more to the record of the discussion on this account.

Mr. Scott spoke of Secretary Pope's trip through the West, and the president, before adjourning the meeting, thanked all the speakers for their efforts. In conclusion, he said: "I would also say that at any time when members of the Institute are contemplating visits to the West or to the South—the more remote sections of the country—that they will let the officers of the Institute know it in order that we may utilize the peripatetic services of our members in this manner, as we believe it will certainly work out to the ultimate good of all concerned."

Kings County Electric Bond Issue.

Announcement is made that the directors of the Kings County Electric Light and Power Company, of Brooklyn, have voted to recommend to the stockholders the authorization of an issue of $5,000,000 convertible debenture bonds, bearing interest at six per cent, convertible into stock of the company, at the option of the holders, after three years, the bonds to be payable in twelve years. Application will be made at once to the Public Service Commission for approval.

It is believed that the first issue of bonds will be offered to the stockholders of the company on or about January 1.

To Lengthen Subway Platforms.

The New York city Board of Estimate voted recently the $1,500,000 asked by the New York Public Service Commission last spring for the lengthening of the Interborough subway stations. The requisitions call for $1,150,000 for the lengthening of the subway platforms from the Brooklyn Bridge northward, and $350,000 for similar improvement between the Brooklyn Bridge station and the Atlantic Avenue terminal in Brooklyn. The express stations are to be changed so as to accommodate ten cars instead of eight, and the local stations so as to accommodate eight cars instead of six. The work will be begun in the near future, but will take some time, as it will have to be done without interrupting the service.

Wireless Talk with Honolulu.

The army transport Buford, which arrived recently from Manila at Honolulu, reports that wireless communication was established with the Pacific Coast four days before the vessel made this port. This means that messages were interchanged over a distance of 3,300 miles.

The Buford is supposed to have the most powerful wireless equipment afloat in the Pacific Ocean.

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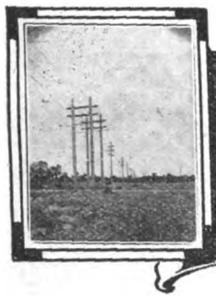

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

Steam Heating in Connection with Central Stations.[1]

District steam heating is coming into more and more prominence, but is still neglected in many localities where it would be found most profitable. In such cases the electric-light company could install a low-pressure steam-heating plant along the lines that have been so well tried out during the last twenty years. In the case of an old plant which had reached its limit of efficiency, and yet is unsatisfactory in comparison with modern equipment, the investment necessary for a district steam system would be lower than that necessary for modern equipment, and the results obtained would favorably compare with, and probably exceed, those of a thoroughly modern plant without a district steam system. In connection with the modern plant, a steam-heating system has been found in many cases to pay for the entire coal bill of the plant, and leave a substantial balance besides.

What is generally conceded today to be the best practice, is a system, the extent of which is such, that the exhaust steam from the plant will meet the average demand in ordinary weather. Then in extreme weather, live steam, in necessary quantities, may be added to help out.

In starting a steam-heating system in connection with an electric-light plant, a steam-heating company should be organized and merged with the electric company, so that the right to sell live steam cannot be questioned, if live steam is necessary when the system grows to the extent that it is required to supply the demand. Thus merged, the company is well equipped to meet competition, and to obtain business from office buildings, theatres, apartment houses, hotels, municipal and school buildings, which otherwise could not be prevented from operating or installing isolated plants of their own.

The care of the street installation is quite easy and inexpensive, if designed and installed by careful and experienced engineers. No cheap installation can be expected to give good results, and if the best material and construction known is not used it is for the best not to install any until it can be afforded. The work must all be done carefully and to grade, so that the whole system will drain its condensation to points where it may be readily trapped off. There must be no low spots without traps, where the condensation will accumulate. The bottom of the trench also requires special attention and should consist of broken stone or coarse gravel, in which one or two drain pipes should be laid, that the ground around the main shall have a good drainage and be as dry as possible. In some installations an effort has been made to get a return of the trapped condensation to the plant, but the cost of this is prohibitive in anything but a small, very compact system located in close proximity to the plant. At the plant the exhaust steam should be passed through a separator before entering the mains, for the purpose of removing the condensation and oil that passes with it from the engines.

The usual season for the demand for steam is from the middle of September to the first or middle of June. Depending on the conditions, however, some companies find it profitable or desirable to keep steam on during the summer months. This will cost but little in non-condensing plants, and a neat business may be built up, as well, by being able to furnish a continuous supply of steam for hot-water tanks in hotels, restaurants, flat buildings, barber shops, laundries, steam lunch-tables, dish-washing machines, coffee urns, etc.

In hilly districts the mains should be carefully trapped at frequent intervals to do away with a down-hill rush of condensation. Care must be taken in locating these main traps.

Services are usually installed from the mains into buildings at cost. The company usually furnishes at cost the reducing valves, cooling or economy coil, and trap, which are necessary, except in those buildings piped on the "atmospheric" system, in which case economy coils are not needed. It is always best, particularly in meter installations, to get consumers to install a separator.

Flat rates should be avoided, if possible, and if given at all should be on office buildings, where the maximum demand for heat is for only twelve hours. They are based on the total square feet of radiation connected or else on the cubical space heated. A flat-rate customer as a rule will practice no economy at all, and, when the house gets too hot, will invariably throw open doors and windows rather than take the trouble to turn off the steam. From thirty cents per square foot up, for direct radiation, and from forty cents per square foot up, for indirect radiation per year, is the usual flat-rate charge when based on radiation. This varies in different localities, due principally to the cost of coal.

On metered condensation the charge is made at so much per 1,000 pounds of steam condensed. The rates that I have record of in this state vary from forty cents to seventy-five cents either for all the condensation or for the first 10,000 pounds. A number of companies use a sliding-scale rate, which is a very good plan, as it is only right that in steam, as in other commodities, the large consumer should get lower rates than the small. The lowest rate I have received is a sliding scale from Johnstown, Pa. It starts with forty cents for the first 10,000 pounds of condensation per month.

The opinion of the various companies in this state, from which information was received, is certainly in favor of the almost total use of the condensation meter, as it produces many ideal conditions. After the first few bills have been received it speedily stops all waste, and the consumer very suddenly acquires the habit of turning off the steam instead of opening windows. They are more willing to cover bare pipes, and it in general educates them so that they take greater in-

[1] Abstract of a paper by Paul Mueller, of Erie, Pa., and others, presented at the second annual convention of the Pennsylvania Electric Association, Eagles Mere, Pa., September 8, 9 and 10.

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terest and better care of their heating apparatus. The benefit of the meter is best illustrated by a plotted curve of steam consumption of a plant before and after meters are installed. There will be gradual peaks in the morning and evening and some falling off at night, on the flat-rate chart. In comparison with this the same curve, with meters used, will show a marked decrease in total steam consumption with much more prominent peaks. There will be a sharp rise in the morning, as people turn on steam when they get up, to warm the house after it has cooled off during the night, and this will gradually fall off by 10 o'clock, as the day gets warmer. It will gradually pick up again after 3 o'clock, when the sun goes down, and the cold of the evening begins. From this peak it will fall off pretty rapidly as the steam is shut off before people retire for the night.

The condensation meter itself here deserves a little attention. Its principle is very simple, being that of a balance. On each side of the balance is a receptacle or cup that holds just a given weight of water, according to the size of the meter. The condensation always flows into the cup that is up, and when it receives its full weight it overbalances and goes down and empties, the cup on the other side going up, and into it the condensation then flows. The balance is connected to a dial gearing, which registers the number of pounds discharged. Occasionally, however, one will be stopped by rust or scale from the steam pipes. As a rule, it is best to employ the meter readers during the summer, while the heat is off, to inspect each meter, thoroughly clean, test, and readjust it and put it back ready for the fall season.

As it is usually considered advisable for electric-lighting companies to leave interior work to local jobbers, and not shoulder the responsibility for its later satisfaction, so is it advisable for the steam-heat company, aside from having clearly defined rules and regulations regarding piping, to go no farther than installing service, connecting it up, and installing the meter. Before the steam is turned in to the consumer's apparatus it is essential that all of his system be carefully inspected. If on a flat rate, all piping should be covered, or else included in the total radiation on which charge is based. On meter, care should be taken to point out to the consumer all things which will tend to increase the steam consumption. If these matters are clearly pointed out to him in advance, many complaints are saved.

After a season or two of use the consumer will appreciate the many advantages of city steam with which actual experience was necessary to show him its value.

Some of these advantages frequently overlooked are as follows: (1) In a new house or building, no boiler is required, and if a hot-water system had been considered, a saving of about forty per cent in the amount of radiation necessary to install would be accomplished. (2) With no boiler, the danger of boiler explosion and trouble of boiler inspection disappears, and in some cases a lower rate of fire insurance has been obtained. (3) Increased cleanliness about the house, cellar and grounds, as there is no coal and ash dust to blow about. (4) No repairing of boiler, or boiler to give out in the middle of winter, and any troubles the customer does have are assumed by the steam-heating company, which employs competent men to take care of them. (5) Janitor service greatly reduced, if not entirely done away with. (6) Steam is always there, day and night, and always ready for use when required, and an even temperature can be maintained at all times.

The successful and most economical operation of a power house using its exhaust steam for heating is a thing that has to be carefully worked out for each individual case, the point aimed at, of course, being to generate both steam and electricity as cheaply as possible. The demand of one must be balanced against the demand of the other, and a happy medium arrived at, by operating only the equipment best suited to the conditions, with no aid or as little as possible from live steam. A good illustration of this follows:

An electric-light plant, also furnishing steam for heating purposes, was operating one winter day with thermometer ten degrees above zero. Two engines were running which, by reason of the electric load, developed 200 horsepower, and this necessitated the use of a certain amount of live steam to keep the pressure on the steam mains constant. A third engine was started and a portion of the electric load transferred to its generator. Seemingly strange, the pressure at once increased on the steam mains, and one boiler could be shut down. This plant also demonstrates that they use more coal when their electric load is lightest and live steam has to be resorted to, than they do when carrying the peak. The matter of back pressure on engines should here be taken up. From the experience gained at Erie, Pa., during the last ten years in the heating business, it has been found that the back pressure is the most profitable load the engines carry. Ten years ago a man that attempted to operate a high-speed engine maintaining a back pressure of any amount in excess of five pounds, would speedily have his reputation as an engineer at stake; but today engines are operated in one plant where the initial pressure is 150 pounds with thirty-five pounds back pressure. Furthermore, at the present time you can place an order for an engine which the builders will guarantee to operate successfully at a back pressure of twenty pounds and at the same time develop a full load. The value of the back-pressure load of the engines at Erie, Pa., is rated so high that, in the author's opinion, an electric-light plant furnishing steam heat can afford as a matter of economy to run simple engines, belted or direct-connected to generator, and dissipate or throw away, through the medium of a large rheostat, into a stream of water, the electric output of the generator and to use the exhaust steam for heating purposes. Furthermore, this is being done profitably at that station, and it is a common occurrence to start an engine with but a friction load in order to get exhaust steam to turn into the mains. This certainly is a very broad statement in regard to the merits of exhaust steam versus live steam, and I hope we can have a very interesting discussion later on this point, and that there will be light thrown on the theory involved. There is no doubt that the point has been reached where we have the right to wonder whether it is the steam or the electricity that is the by-product.

Performance of a Destructor Plant.

The following particulars have been published of the performance of the destructor plant supplied to the Prahran Municipality, Victoria, by Meldrum Bros., Ltd., of Temperly, near Manchester, Eng.: Total weight of refuse burned for the month of July, 661 long tons and 231 pounds; electricity generated in British thermal units, from 33.36 to 48.30 per ton; total kilowatt-hours generated, 27,870, averaging 42.6 per ton of refuse, and 114.69 per hour; revenue for the month at one cent per kilowatt-hour, $278.70.

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MECHANICAL DRAFT.

BY CHARLES L. HUBBARD.

Among the advantages to be derived from mechanical draft is the ability to produce the required draft without regard to the outside weather conditions or the temperature of the flue gases. This makes it especially adapted for use in connection with economizers where a considerable portion of the waste heat in the chimney gases may be utilized for heating the feed water. A saving of ten to twenty per cent is often made in this way.

In the case of new plants mechanical draft does away with the building of tall and expensive chimneys, unless the plant is so located that the escaping gases must be discharged at a considerable height on account of the surroundings. In old boiler plants the power may be considerably increased by the use of forced draft at an expense considerably less than that required to install new boilers. It is claimed by the makers of apparatus of this kind that the capacity of a boiler plant may be increased from thirty to forty per cent for continuous working and considerably more for short runs. This is often taken advantage of in electric power stations where the maximum load is only required for a short time each day. It must be borne in mind that forcing a boiler beyond its normal capacity lowers its efficiency, but for short periods this is more economical than to increase the size of the plant.

Among other points in favor of mechanical draft are ease of regulation and ability to burn a cheaper grade of fuel.

The rate of combustion under ordinary conditions in the case of stationary boilers usually runs from twenty to thirty pounds of coal per square foot of grate surface per hour.

If the rate of combustion be increased in the case of a boiler running at maximum efficiency, while the grate area remains the same, the rate of evaporation per pound of coal will be reduced; but if the grate be made of such size that the total quantity of fuel burned per hour remains constant, a certain increase in efficiency will be noticed. This is accounted for by the more thorough mixture of the air with the coal and also the deeper fires which are carried. As a greater proportion of the air fed to the fire is consumed, it follows that the total quantity is reduced, which results in a hotter fire and a greater radiation of heat to the boiler surfaces. It has been found by experience that under ordinary conditions the most satisfactory results are obtained with a combustion of about 0.3 pound of coal per square foot of heating surface per hour.

This same condition should be carried out when applying mechanical draft, by reducing the size of grate as the rate of combustion is increased, thus keeping the total amount of fuel the same.

Table I gives the square feet of grate surface per horsepower required for different rates of combustion for both fire-tube and water-tube boilers. In computing this table fifteen square feet of heating surface per horsepower has been assumed for fire-tube boilers and ten square feet for water-tube boilers.

TABLE I.

Pounds of Coal Burned Per Square Feet of Grate Per Hour.	Square Feet of Grate Surface Per Horsepower. Fire-Tube Boilers.	Water-Tube Boilers.
15	0.30	0.22
18	0.25	0.19
21	0.22	0.16
24	0.20	0.14
27	0.17	0.12
30	0.15	0.11

Theoretically, about twelve pounds of air are required to burn one pound of coal. In actual practice it is impossible to do this owing to the difficulty of bringing the air in contact with all parts of the fuel, so that it is customary to supply about twice this amount in the case of natural draft and about eighteen pounds in the case of mechanical draft.

The strength of draft required in any particular case depends upon the kind of fuel, the length and size of the smoke passages and the number of bends. In the case of ordinary stationary boilers this commonly runs from one to two inches of water column.

Thurston gives the following as the average draft pressures necessary to burn different grades of fuel.

TABLE II.

Kind of Fuel.	Inches of Water.
Good steam coal	0.4 to 0.7
Ordinary slack	0.6 to 0.9
Very fine slack	0.7 to 1.1
Semi-anthracite	0.9 to 1.2
Anthracite slack	1.3 to 1.8

The three systems of mechanical draft in most common use with stationary boilers are the steam jet, forced draft, and induced draft.

In the first case the draft is produced by blowing steam and air into the ash pit. This is the most wasteful method of producing a draft, but has the advantage in the case of cheap coals high in ash, of reducing the amount of clinker formed. This is due to the decomposition of the steam into hydrogen and oxygen in the bed of the fire. A considerable amount of steam is required to operate this system.

In the case of forced draft the air is discharged into the ash pit under pressure by means of a fan. This system is most easily applied to existing plants where it is desired to increase the draft for burning cheaper grades of fuel. The air should be so introduced as to distribute the pressure evenly, otherwise air holes will be blown through the bed of the fire. The air is usually delivered through openings in the bridge wall or bottom of the ash pit near the front, the same being provided with deflecting dampers for spreading the air as it enters. One objection to this system is that the pressure within the ash pit and furnace tends to blow ashes and flame into the fire room if forced too hard, but little trouble will be experienced from this if the damper in the blast pipe is closed before opening the fire or ash pit doors.

In the case of the induced-draft system a reduced pressure is maintained in the furnace by means of an exhaust fan placed in the smoke flue between the boiler and the chimney. This produces the same effect as the natural draft of a chimney, is easily controlled and does not blow flame and dust into the fire room when the furnace doors are opened. The fans used for producing a mechanical draft are of the ordinary steel plate type with steel casing. They are commonly driven by a steam engine, either direct-connected or belted, as most convenient. The speed of the engine is regulated by the boiler pressure by means of a throttle valve in the steam pipe.

Tables III and V, published by the writer in *Power* some time ago, give the size and speed of fan, quantity of air delivered, and horsepower required for maintaining different pressures in the ash pit, when the fan is located reasonably near the boiler. Table III is for forced draft, and the air quantities are based on a velocity, through the fan outlet, of 2,000 feet per minute, and are for fans so proportioned that the width is 0.52 of the diameter, as given below in Table IV:

Should the required air volume come between the quantities given in Table III the speed of the fan may be increased or diminished for small differences, but if the variation is of considerable magnitude the width of the fan may be changed, in order to maintain the pressure.

The necessary change in width is

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easily made by dividing the air volumes given in Table III by the fan widths in Table IV to determine the volume of air delivered per inch of width, and from this the required width to deliver any volume of air is readily computed.

A practical example will make the use of the tables clear.

It is desired to burn 2,400 pounds of coal per hour under a battery of boilers using a forced draft of 1.5 inches of water column. What size and speed of fan will be required and what will be the horsepower of the engine for driving it?

Pounds of coal per minute = 2,400 ÷ 60 = 40, which requires 40 × 230 = 9,200 cubic feet of air. Looking in Table III, we find that a four-foot fan will deliver 10,000 cubic feet of air at this pressure when running at a speed of 440 revolutions per minute, and require 5.4 horsepower.

In practice, we should use a fan of this diameter and standard width, and depend upon the engine regulator to run it at the proper speed to maintain the required pressure.

Suppose a case where it was desired to furnish 25,000 cubic feet of air per minute, at a pressure of 1.25 inches of water. Looking in the second column of Table III, we find a seven-foot fan will deliver 28,880 cubic feet at this pressure when running at a speed of 230 revolutions per minute and requires fourteen horsepower. From table IV we find a standard fan of this diameter is forty-three inches in width, and therefore delivers 28,800 ÷ 43 = 670 cubic feet per inch of width. As the required amount is 25,000 cubic feet, the width of fan should be 25,000 ÷ 670 = thirty-seven inches.

Theoretically, the horsepower varies as the volume of air moved, but actually the friction of the fan forms a considerable part of the load, and this would be affected but little by any slight change in width, so in practice it is best to take the horsepower directly from the table without change.

When induced draft is used, the gases reach the fan at a high temperature; hence a greater volume must be handled for a given weight, thus making it necessary to use a larger fan for the same sized plant.

Should any given fan used for supplying a forced draft be changed so as to produce an induced draft of the same intensity, the following changes would take place: (1) The speed would have to be increased in order to maintain the same pressure; (2) the power necessary to drive the fan at the increased speed would be greater than before; (3) the volume of air supplied to the furnace would be reduced.

For a flue-gas temperature of 500 degrees Fahrenheit the correction factors are as follows: Volume × 0.75; speed × 1.35; horsepower × 1.35.

TABLE IV.

Diameter of Fan Wheel in Feet.	Width of Fan Wheel in Inches.
2.5	16
3.0	19
3.5	22
4.0	25
4.5	28
5.0	31
6.0	37
7.0	43
8.0	50
9.0	56
10.0	62

For example, a six-foot fan when used for forced draft will deliver (say) 21,400 cubic feet of air at a temperature of sixty degrees and at a speed of 290 revolutions per minute will maintain an ash-pit pressure of 1.5 inches of water, and requires 11.5 horsepower. What will be the volume of air drawn into the ash pit by the same fan when used for induced draft, and what speed and horsepower will be required to maintain the same pressure?

Using the factors given above, we have: Volume, 21,400 × 0.75 = 16,050 cubic feet. Speed, 290 × 1.35 = 391 revolutions per minute. Horsepower, 11.5 × 1.35 = 15.5.

TABLE III.

Fan Dimensions, Quantity of Air and Horsepower for Maintaining Various Pressures in Ash Pit. For Forced Draft, Temperature of Air 60 Degrees Fahrenheit.

Diameter of Fan in Feet.	Cubic Feet of Air Delivered to Furnace Per Minute.	Pressure in Inches of Water. 0.5 Revolutions Per Minute.	0.5 Horsepower.	0.75 Revolutions Per Minute.	0.75 Horsepower.	1.00 Revolutions Per Minute.	1.00 Horsepower.	1.25 Revolutions Per Minute.	1.25 Horsepower.	1.50 Revolutions Per Minute.	1.50 Horsepower.	2.00 Revolutions Per Minute.	2.00 Horsepower.	2.50 Revolutions Per Minute.	2.50 Horsepower.
2½	4,200	510	1.6	560	1.8	600	1.9	640	2.1	710	2.3	780	2.5	850	2.7
3	5,800	430	2.2	460	2.4	490	2.6	530	2.8	590	3.1	640	3.4	710	3.8
3½	7,800	360	3.0	400	3.3	420	3.5	450	3.8	500	4.2	550	4.6	610	5.1
4	10,000	320	3.9	350	4.2	370	4.4	400	4.9	440	5.4	480	5.9	530	6.5
4½	12,400	290	4.8	310	5.2	330	5.6	360	6.0	400	6.7	430	7.3	470	8.0
5	15,200	250	5.9	270	6.4	290	6.8	310	7.4	350	8.2	380	8.9	420	9.8
6	21,400	210	8.3	230	9.1	250	9.6	260	10.4	290	11.5	320	12.5	350	13.9
7	28,800	180	11.2	200	12.2	210	13.0	230	14.0	250	15.5	280	16.8	300	18.7
8	37,200	160	14.4	170	15.7	190	16.7	200	18.1	220	20.1	240	21.8	270	22.5
9	46,800	140	18.1	160	19.8	170	21.1	180	22.7	200	25.3	220	27.4	240	30.3
10	57,400	130	22.2	140	24.3	150	25.8	160	27.9	180	30.1	200	33.6	210	37.2

Table V has been computed from Table III in the manner above described and may be used for induced-draft plants where the average flue-gas temperature is around 500 degrees. The use of Table V is practically the same as Table III. The volumes in the second column are for an air supply at a temperature of sixty degrees, computed in the same manner as for forced draft, while correction factors have been made for volume, speed and horsepower.

For example, a boiler plant is to be supplied with 20,000 cubic feet of air per minute; a pressure of one-inch water column is to be maintained by induced draft. What will be the required size and speed of fan, and the horsepower of the driving engine?

Looking in Table V we find that a standard seven-foot fan will draw 21,000 cubic feet of air into the ash pit and produce a pressure of one inch when running at a speed of 283 revolutions per minute. The horsepower required under these conditions is 17.5. Similar reasoning will find any other unknown.

TABLE V.

Fan Dimensions, Quantity of Air and Horsepower for Maintaining Various Pressures in Ash Pit. For Induced Draft, Temperature of Air 500 Degrees.

Diameter of Fan in Feet.	Cubic Feet of Air at 60° Drawn Into Furnace Per Minute.	Pressure in Inches of Water. 0.5 Revolutions Per Minute.	0.5 Horsepower.	0.75 Revolutions Per Minute.	0.75 Horsepower.	1.00 Revolutions Per Minute.	1.00 Horsepower.	1.25 Revolutions Per Minute.	1.25 Horsepower.	1.50 Revolutions Per Minute.	1.50 Horsepower.	2.00 Revolutions Per Minute.	2.00 Horsepower.	2.50 Revolutions Per Minute.	2.50 Horsepower.
2½	3,000	688	2.2	756	2.4	810	2.6	864	2.8	958	3.1	1,053	3.4	1,147	3.6
3	4,200	580	3.0	621	3.2	661	3.5	715	3.8	796	4.2	864	4.6	958	5.1
3½	5,700	486	4.0	540	4.5	567	4.7	607	5.1	675	5.7	742	6.2	823	6.9
4	7,300	432	5.3	472	5.7	500	6.1	540	6.6	594	7.3	648	8.0	715	8.8
4½	9,300	390	6.5	418	7.0	445	7.5	486	8.1	540	9.0	580	9.8	634	10.8
5	11,100	337	8.0	364	8.6	391	9.2	418	10.0	472	11.1	513	12.0	567	13.2
6	15,600	283	11.2	310	12.3	337	13.0	351	14.0	391	15.5	432	16.9	472	18.7
7	21,000	243	15.1	270	16.5	283	17.5	310	18.9	337	20.9	378	22.6	405	25.2
8	27,100	216	19.4	230	21.2	256	22.5	270	24.4	297	27.1	324	29.4	364	30.4
9	34,200	180	24.4	216	26.7	230	28.5	243	30.6	270	34.1	297	37.0	324	40.9
10	41,900	175	30.0	190	32.8	202	34.8	216	37.6	243	41.8	270	45.3	283	50.2

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INDUSTRIAL SMOKE PREVENTION IN HAMBURG.

BY JOHN B. C. KERSHAW.

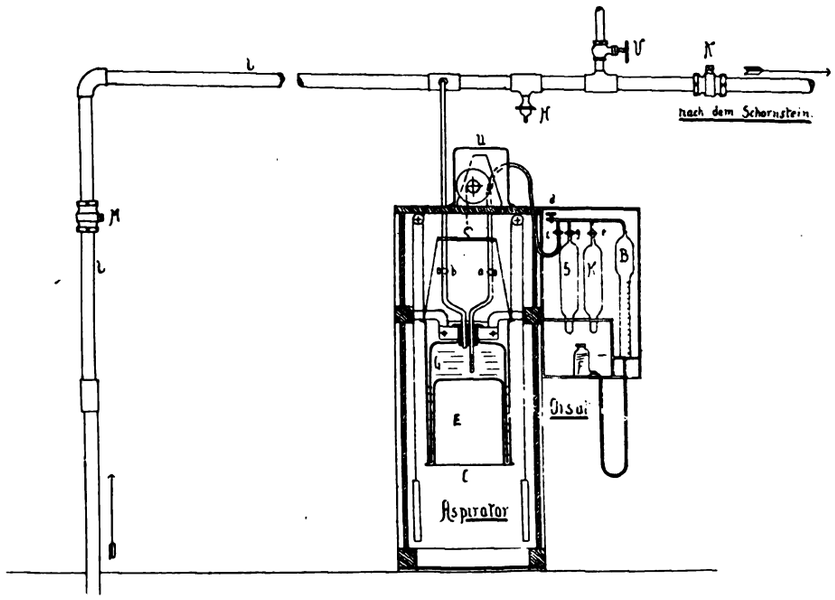
It is somewhat strange that although the United Kingdom and the United States have always led the way in sanitary science, the industrial smoke problem—which is certainly largely a health problem—has so far defied all their efforts to solve it.

If one wishes to read or hear at the present date of the most successful organized attempts to minimize the evils arising from factory smoke, one must have recourse to the publications and reports of foreign countries. Smoke-abatement societies exist, it is true, in London, and in many of the larger industrial cities of England and America. These societies draw their membership, however, not from the manufacturing element, who ought to support them, but from the professional, artistic, and literary world outside of the manufacturing industries, and the efforts of these societies toward the suppression of smoke are confined, usually, to prosecutions (too often abortive) of the most conspicuous offenders.

When our city authorities or chambers of commerce discuss the question of smoke and its evils, the reason that so little real progress has been made in clearing our atmosphere from this evil, is revealed. The larger number of fuel users in both countries still believes that smoke means wealth, and that to produce less smoke would add to the cost of running their mills and factories.

Individual manufacturers with a scientific bent of mind have no doubt freed themselves from this fallacy, and have demonstrated to their own satisfaction that a smokeless chimney does not signify either inefficiency or loss. The general body of fuel users, however, is still permeated with the idea that it cannot suppress black smoke without increasing wages or fuel bills, and with a lamentable indifference to the health and happiness of the community obliged to live within the blighting range of their factory chimneys, it continues to burn fuel on the unscientific rule-of-thumb methods, handed down from the last generation.

These reflections upon the smoke problem have been aroused in the mind of the writer by the recent appearance of



SAMPLING APPARATUS FOR FLUE GASES, USED IN HAMBURG.

two reports on this subject, one hailing from America and the other from Germany.

The first, a well-printed octavo volume of 187 pages, is Bulletin No. 373 of the United States Geological Survey.

The subject of the bulletin is "The Smokeless Combustion of Fuel in Boiler Plants," by D. T. Randall and H. W. Weeks.

The second report is equally valuable, though different in character, being the sixth annual report of the Hamburg Smoke Abatement Society. This society is a voluntary association of fuel users who own steam-raising or heating plant within or in the vicinity of the city of Hamburg. The objects of the society are: (1) To improve the efficiency of the fuel-burning plant; (2) to minimize the emission of black smoke from the chimneys of the works owned by its members. The scientific supervision of the plant by a staff of chemical engineers especially trained for this work, and the education of the stokers in the proper performance of their duties, are the two chief branches of the society's work.

The success which has attended its efforts is proved by the steady progress it has made since its birth, seven years ago.

The past twelve months has seen an accession to the register of sixty-nine new members owning 410 heating installations, and the year closed with a membership of 325, operating a total of 1,052 boilers and 148 other heating installations. The operations of the society have extended into Elsass Lothringen and Finland during the past year, forty-three of the new members owning plant outside the boundaries of the city of Hamburg. The steam-raising and heating appliances owned by the city authorities were placed under the control of the society in the year 1906-07, and this arrangement has now been confirmed by the Senate and Burgershaft of the city, an annual payment of 5,000 marks (about $1,200) being assured during the next three years, in return for the services rendered.

A new feature of the past year has been the delivery of a public course of lectures upon fuel and its combustion, by the chief engineer of the society; these lectures will shortly be published in volume form. At the instigation of the society, the Hygienic Institute in Hamburg has commenced to take records of the amount of soot and dirt in the air of the city, and it is hoped that shortly reliable and definite information and figures will be available showing the improvement in the atmosphere of the city. The body of the report contains details of a large number of the tests of the members' boiler plant, carried out before and after the overhaul and control by the society's officers and stokers.

Improved efficiencies ranging from twelve up to twenty per cent are recorded in these pages. The chief engineer emphasizes the need for constant and regular control of the operations of the firemen in order to obtain the best results, and states that over one-third of the boiler installations under their charge are now equipped with a special form of aspirator, for checking the composition of the waste gases.

The automatic CO_2 recorders are not

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looked upon with favor by the society, and its engineers have adopted this special form of aspirator and testing apparatus for the control of boiler and furnace firing, in preference to the more generally employed automatic CO_2 recording apparatus, for the following reasons: (1) Automatic recording apparatus is often complicated in construction and easily gets out of order. (2) The percentage of CO_2 alone is not sufficient to enable the engineer to judge of the completeness of the combustion, or of the absence of unburnt hydrocarbon gases and of carbon monoxide.

The sampling and testing apparatus in use at Hamburg has been thoroughly tried, and is now installed on nearly 400 of the boilers under the control of the society, with most excellent results. The apparatus is shown in diagrammatic form in the accompanying illustration. The sample of gas is drawn constantly (using natural or artificial draft) from the exit flue by means of the pipe *L*, and as it passes over the aspirator *C*, a small portion of the gas flow is sucked down into this by the action of clockwork on the bell *E*. The aspirator above this bell is filled with water covered with a film of paraffin oil, and the rate at which the bell sinks and the gas is sucked into the space *G* above it, is controlled by a pendulum and simple clockwork arrangement at *U*, the speed of which can be varied to suit the length of firing shift. At the end of eight or twelve hours (*i. e.*, when the firemen change) the clockwork is stopped, and the average sample of gas stored in the space *G* is tested for carbon dioxide and for oxygen, by aid of the Orsat apparatus shown on the right-hand side of the aspirator, a rubber tube being employed to connect the aspirator and Orsat apparatus.

Two tests of the average sample of gas are made, and the aspirator is then emptied by raising the bell *E*, and by opening the taps *A*, *C* and *d*.

By closing *A* and opening *B*, and by starting the pendulum of the clockwork again, the apparatus is set for taking the next average sample, no attention being required for eight or twelve hours, according to the length of the working shift.

The pipe *L* is kept free from soot and rust deposits by blowing steam or compressed air through it at regular intervals by means of the tap at *V*, and snap samples of the exit gas can be taken when desired without stopping the aspirator, by connecting the cock at *H* with the tap in the Orsat apparatus at *d* by means of a thick rubber tube. The solutions in the Orsat apparatus are caustic potash for the CO_2 and an alkaline solution of pyrogallic acid for the oxygen—these solutions require renewal every three or four weeks. *B* is the measuring tube, *K* the caustic-potash pipette, and *S* the pyrogallic-acid pipette in the diagram.

The percentage of unburned hydrocarbons and of carbon monoxide in the exit gases, is calculated from the total percentage of carbon dioxide and oxygen, the total percentage of these two constituents, when perfect combustion has occurred, fluctuating between 19.0 per cent and 19.5 per cent, according to the kind of coal used.

The following tables show the working of the method in practice, with the basis upon which the bonus for good work and fines for bad work, are calculated:

Date.	Time.	Shift.	Fireman.	Boiler No.	Average Per Cent of CO_2.	Av. Per Cent CO and O.
June 22, 1907	6:30 a. m. to 5:30 p. m.	Day.	Muller	1 and 2	11.3	19.4
June 22 and 23	6:00 p. m. to 6:30 a. m.	Night.	Lange	2	11.0	19.5

BONUS TABLE FOR GOOD PERCENTAGES OF CO_2.

Fuel burnt, about 7,000 kilogrammes in twelve hours at sixteen marks per 1,000 kilogrammes. Temperature of the exit gases, 290 to 320 degrees centigrade.

Average Per Cent of CO_2.	Fuel Saved, in Kilogrammes.	Value of Fuel Saved, in Marks.	Bonus Addition to Wages, in Marks.
8.0	...	....	...
8.5	165	2.60	.15
9.0	360	5.75	.30
9.5	490	7.85	.40
10.0	645	10.30	.50
10.5	740	11.85	.60
11.0	900	14.45	.70
11.5	1,005	16.20	.80
12.0	1,120	17.95	.90
13.0	1,260	20.20	1.00

FINES TABLE FOR INCOMPLETE COMBUSTION.

Average Percentage of CO_2 and Oxygen.	Fuel Burnt Unnecessarily, in Kilogrammes.	Value of Fuel Wasted, in Marks.	Fine, in Marks.
19.4	..	....	...
19.0	80	1.25	.10
18.7	225	3.10	.15
18.4	315	5.00	.25
18.1	460	7.35	.35
17.8	610	9.75	.50

Similar tables can be worked out for each boiler installation, taking into account the class of fuel and the amount used per shift. With the aid of these tables the labor involved in calculating the bonus or fine for each stoker's work is reduced to a minimum, and the men are given a very real incentive to saving fuel and preventing waste. The system is stated to yield most satisfactory results.

It is greatly to be regretted that the Hamburg society's example of friendly cooperation between all the fuel users of one locality has not been copied in some English or American center of manufacturing industry, for the writer is persuaded that it is by working on these lines the solution of the industrial smoke problem will be attained. The manufacturers, however, must themselves become convinced that black smoke means inefficiency and loss, before any real progress can be made, and the rubbing-in of this truth is the first step toward the solution of the problem.

Electrical Development in Brazil.

Many of the industrial establishments in Brazil, notably those in and around Rio de Janeiro, are rapidly changing to electric power, says a recent United States consular report, as a result of the development of hydroelectric energy from a river near Rio de Janeiro. There are similar notable establishments near Sao Paulo, and to some extent near Bahia. The availability of this power is gradually working a revolution in present industrial establishments, changing them from small power, often purely handwork, to modern power establishments. The availability of electricity also is doing away with the general power problem, which has always been in the way of industrial development in Brazil. Power from fuel in Brazil has always been expensive. The country has no coal deposits worthy of the name, none able to compete with imported fuel, and imported fuel after a 7,000-mile haul is costly. Transportation and other elements added to the high cost of fuel have prevented that measure of industrial development in the country which might naturally have been expected as a result of its own local demand for products which are of ordinary manufacturing possibility in this country. With the advent of electricity much of this unfavorable condition is modified. The matters of transportation, raw materials, and cheap and efficient labor are yet to be disposed of, but some of these problems are gradually being solved.

The Aftermath.

The Interborough Rapid Transit Company, of New York, has sent a check for $5,000 to Police Commissioner Baker, as a contribution to the Police Pension Fund, in recognition of the assistance furnished the company by the police, in handling the crowds during the Hudson-Fulton Celebration.

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ELECTRICAL Advertising *and* Selling

CENTRAL-STATION ADVERTISING.[1]

BY J. O. LITTLE.

II.

A form of newspaper advertising that should be given more attention is that which is classified as indirect, consisting of accounts of electrical invention, progress and activity. It is easy to prepare and distribute items of this sort. They make interesting reading, and most newspapers are not averse to running them free of charge as fillers. The omission of the central-station's name from such items does not lessen their advertising value, for if they succeed in creating a demand for more current, the business belongs perforce to the central station.

Just a word in passing about other circulating mediums. The great volume of advertising carried by magazines indicates the esteem in which they are held.

THE STREET CAR.

Street-car advertising is perhaps the closest rival of the magazine. One may cover the entire country with street-car cards or may use the cars of a single community only. This feature of localization makes the street car very attractive to the central station. It permits a display of color, it puts all advertisers on an equal basis, since all the cards are uniform in size and all are spread out in a row, and it enables the advertiser to change copy as often as desired.

Street-car rates vary from less than a cent-and-a-half to three cents per car per month, according to the locality, the number of cars used, and the length of time the contract is to run. Street-car advertising is undoubtedly one of the most profitable sources for the central station to employ, as is borne out by the results obtained by many now using space. Central stations which control trolley lines have an advantage over others in that they can reserve space for their own use when making a contract with a street-car advertising agency. This, however, is something that many have overlooked. Those who have should not fail to remedy the oversight when renewing their contracts. But whether the space is reserved or bought outright, it is undoubtedly valuable space to have. Much depends upon the attention that is given to the copy. It should be attractive and to the point. The fewer words the better, for one will remember a single sentence the first time he sees it if it is short and terse, whereas he will have to see your advertisement many times before he takes the trouble to read a whole cardful of argument in fine type.

[1] Abstract of paper read before the sixth annual convention of the Michigan Electric Association, Detroit, August 19.

THE DEMONSTRATION.

The special demonstration is considered by manufacturers of household appliances very generally as an effective means of introducing a new article. In the household department of the large department stores there is almost always some sort of a demonstration going on. The department store has but one advantage over the central station: customers are coming and going continually. To get them to come, the central station must advertise the demonstration through the newspapers, the street cars, or by sending out invitations or by a combination of these methods.

A good plan is to conduct part of the demonstration in the window, or all of it if the window space is large enough. Demonstrations have been made use of by a great many central stations, and the reports are generally favorable. Outside of the actual sales made, a demonstration possesses the additional advantage of making people better acquainted with your company and what it has to offer, and setting them to thinking about it.

An article like the electric iron may be carried around by the solicitor and demonstrated as he goes, but this form of demonstration is limited to existing customers, while the demonstration in the display room makes it appeal to those whose houses are not wired as well. You can't expect them at once to order their houses wired for the sake of an electric iron or a sewing-machine motor, but keep on showing what a house that is not wired is deprived of, and some day they will be won over.

HOUSE ORGANS.

Many central stations publish monthly house organs or private magazines. Some of these magazines are individual; others are bought from a syndicate which prints the same periodical for a number of stations, leaving certain portions to be filled in with local items. This plan is, of course, much more economical than the other, but the individual organ is considered by the larger central stations the better proposition of the two.

An individual magazine may be conducted along very economical lines. One of the biggest items of expense is the illustrations, and appropriate illustrations may generally be had from the larger manufacturers for the asking. Articles may be procured in the same way. An investigation of the advertising relations existing between manufacturers and dealers in other lines, as hardware, for instance, shows that the dealer depends to a large extent upon the manufacturer for advertising matter of all kinds, not only matter printed ready for display and circulation, but illustrations and reading matter, for the advertising literature printed by the dealer himself.

The central station should look to the manufacturer of electrical apparatus in the same manner and should see to it that it does not miss any of the good things that it can make use of. This applies to street-car cards, newspaper copy and illustrations and to advertising matter in general, as well as to material for the house organ. A central station that has no advertising department of its own can, by adopting this method, have at its disposal the best advertising matter going.

A house organ, to be successful, should not have its mission made too prominent, but it should have interspersed with its advertising matter items of a general nature, especially items designed to put its readers in good humor. A reader remembers this feature, and, instead of throwing away the next number as "another one of those advertising dodges," he'll more than likely put it aside to glance through at his leisure.

The success of a house organ depends

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in a great measure upon its distribution. It should not be restricted to the list of existing customers, but a special list of prospective customers to receive it should be made up.

DIRECT MAILING.

Literature for special campaigns and for distribution in the regular correspondence takes many different forms, as the booklet, the brochure, the large mailing card, the regulation size post card, the folder, the envelope slip. Results depend more upon the literature's attractiveness than the name that it goes by. It is well, however, to watch the styles, to keep in touch with the book shops and art stores and make your advertising matter in its artistic treatment conform as much as possible to the forms of art that people pay money for. The poster picture, for instance, is in great demand at the present time; therefore the poster style applied to advertising has a strong tendency to keep it out of the waste-basket and prolong its life.

Post cards are now the rage, and so a post card of attractive appearance and of the regulation size, with your message printed in small type, has a better chance of surviving than a large mailing card. If it is attractive or unique, it stands a good chance of finding a place in somebody's collection. (There is at least one member of every family who collects post cards, is there not?) If it is sent with a letter in the place of an envelope slip or stuffer, the receiver if attracted by it is quite likely to mail it to somebody else.

Outside of campaign mailings, it is always well to have some attractive slip or card to enclose with the regular correspondence. It doesn't increase the postage, and is for this reason a very economical form of advertising.

Chicago Electrical Show.

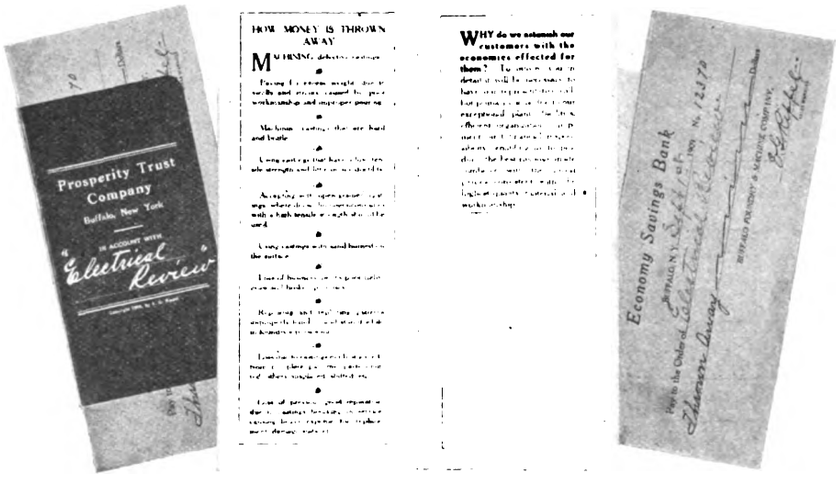
The Electrical Trades Exposition Company announces the dates for the 1910 Electrical Show, which will be held in the Coliseum, Chicago, January 15 to 29, inclusive, 1910. This show will be under the same management as the four previous annual successes, and plans are under way for booths, decorations and lighting effects which will surpass the beautiful effects of previous shows. The benefits to manufacturers, contractors and dealers derived from this annual trade booster have been thoroughly demonstrated, and indications are that the 1910 show will be participated in by all of the leading firms in the electrical field.

An Attractive Booklet.

It has been pointed out time and time again that one of the prime requisites of advertising literature, distributed through the mails, is attractiveness. A booklet, a folder, or a catalogue may contain the desired message, expressed in the most convincing terms, and should it be read would probably create the interest necessary to develop a customer, yet on account of being unattractive it will escape the notice of those to whom it is sent.

The Buffalo Foundry and Machine Company, of Buffalo, N. Y., has recently distributed a booklet, illustrations of which are shown herewith, which will undoubtedly attract attention on account of its unique style.

As may be seen in the illustrations, the booklet represents a bank book having a number of checks inserted between the pages. The covers represent those of an ordinary bank book both in size, in color and in the reading matter thereon. The outside reading pages extend out from the cover and are about the size of the regular bank checks, the first page being an exact reproduction of a check.



ATTRACTIVE ADVERTISING BOOKLET.

To add to the realistic appearance the name of the firm or person to whom this booklet is sent, is inserted in the customary place on the cover and on the check.

Aeroplane Inventions.

The American Aeroplane Company, of Wilmington, N. C., has been incorporated by some of the leading business men of that town, to manufacture an aeroplane invented by local inventors. It is announced that the official test of the new machine of the Wilmington inventors will be made on the occasion of President Taft's approaching visit. L.

Advertising in Season.

It is incumbent on central stations not only to solicit new customers, but also to increase the revenue from old ones. In connection with this phase of new business campaigns, an account of the method in use by the Denver Gas and Electric Company of Denver, Colo., may prove to be a valuable suggestion.

Each month they send out to their customers an attractive calendar for the current month containing a timely advertisement of a domestic appliance, such as portable stoves in October and November; suggestions of Christmas gifts in December, and electric fans in summer. Accompanying the first calendar of the series is a letter calling attention to the fact that a calendar is to be sent each month, and also advising the recipient to co-operate with the company in the matter of improving the service. As is also mentioned in the letter, the pictures on the calendars are the work of some of the leading artists, making the souvenir an article which should win a permanent place in the homes of the customers.

Emerson says, if you make a better mouse trap than has ever been made before, no difference if your cabin be in the backwoods, the world will make a beaten path to your door.

This is true, provided you find some method of letting the world know about it; in other words—advertise.

The Edison Light and Power Company, of Wichita, Kan., some time ago advertised "Electric Burglar Insurance, 50c a month," this being two two-candlepower lamps installed over the front and rear porches, respectively, to burn all night. The scheme proved very profitable.

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ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

New York Section, Illuminating Engineering Society.

The first fall meeting of the Illuminating Engineering Society was held on Thursday, October 14, at the Engineering Societies Building. The papers read at the recent convention were presented in abstract and discussed. Upon taking the chair, E. L. Elliott stated that the meeting on November 11 would be given over to a discussion of the subject as to the status of illuminating engineering and the report of the committee on division of membership would be presented at that time.

The first of the convention papers to be discussed was that by H. Thurston Owens on "The Progress of Illuminating Engineering in Europe." In reply to a question by Mr. Rowe, the author stated that high-pressure gas was being gradually introduced in buildings and that a number of large installations were already in use. Mr. Lansingh desired to know as to whether window-lighting, especially in London, had been improved during the past year, and the author replied that the lighting was quite in keeping with the window dressing, which could not compare in any way with the American standard.

Mr. Marshall's paper on "Diffusing Mediums" was then taken up, and Mr. Owens stated that the best way to overcome the cold light from an enclosed arc lamp with an opal globe was to change the luminant rather than the glassware, and that both flaming and magnetite lamps were in use now in New York city, and the color value could readily be compared.

In the discussion of Mr. Ives' paper on "Allowable Frequencies in Incandescent-Lamp Work," Mr. Millar stated that from tests made some time ago it was found that with a 100-watt tungsten lamp at twenty cycles the flicker was not any more objectionable than with a twenty-five-watt lamp at twenty-five cycles. Further, that a lamp on low frequency in the line of vision was not as bad as one hung so that the light reached the eye at a large angle. The critical frequency increases with an increase in voltage. Mr. Sweet then called attention to the number of elements entering into the question of flicker, and considered it an all-important topic, owing to the many cases where it was desirable to utilize current of low frequency. Mr. Millar stated that it is proposed to run Moore tubes on different phases and that some time ago a carbon lamp was sent to him for test with three filaments to be operated on a three-phase circuit.

The next paper taken up was that by Dr. Louis Bell on "Principles of Shades and Reflectors," and in discussing this the chairman stated that the fallacious theory that reffectors could be designed upon the laws of geometric optics without respect to the material with which the reflector was made, was still believed in and that if anyone wished to make calculations along these lines it would be well for him to obtain a copy of De Grand's patent, which is now over a hundred years old. He also called attention to the fact that a fluted surface will not reflect as much light as a smooth one, owing to the absorption, but notwithstanding this fact reflectors are being placed upon the market constructed in this manner.

The next paper brought up was that by A. J. Sweet on the "Standard Relation of Light Distribution," and the discussion covered a wide range, owing to the fact that the author had made a plea for more work of real value to the layman and also an attempt on his part to present some data.

Those entering the discussion were Messrs. Wohlauer, Lansingh, Owens, Millar, Marshall, Elliott, Codman and Rowe.

The paper by L. B. Marks on "Factory Lighting" and that by A. L. Eustice on "Operating Efficiencies of Commercial Installations" were also discussed, and although the meeting was only attended by a comparatively small number, the discussion on these papers had to be curtailed owing to the lateness of the hour before these subjects were reached.

Counter Electromotive-Force in the Electric Arc.

In the *Physical Review* for September, C. D. Child, of Colgate University, contributes an article under the above heading, of which the following is the author's summary:

"A review of the literature on the subject of the counter electromotive-force of the electric arc shows that this expression has been used with several different meanings, and the most recent meaning is not the same as that given to the expression when applied to a cell or an electric motor.

"A review of the literature on the residual electromotive-force of the arc shows that the majority of experimenters have found such an electromotive-force, whose value was somewhat less than one volt. This electromotive-force has been explained as being due to the difference in temperature of the electrodes. This was tested by cooling the anode by three different methods and the results were in harmony with such an explanation."

Test of Color Value of Moore Tube.

During the month of June last a series of tests of the color value of the Moore carbon-dioxide tube were made by Dr. H. E. Ives at the Bureau of Standards, Washington, D. C. These tests showed that the light of this tube contained relatively more blue than the light from the sky near the horizon, and very much less blue than the light from the zenith when the sky is clear. It follows from this that the Moore carbon-dioxide tube would be found to contain the same proportion of blue to red as the light from the sky at some altitude between the horizon and the zenith when the sky is clear, the particular altitude depending upon how dry the atmosphere is at the time of the measurement. In other words, the carbon-dioxide tube is nearly the average of the light from the clear sky, but as this varies from time to time, according to the clearness of the sky and the dryness of the atmosphere, it is impossible to give the value of average daylight in exact figures.

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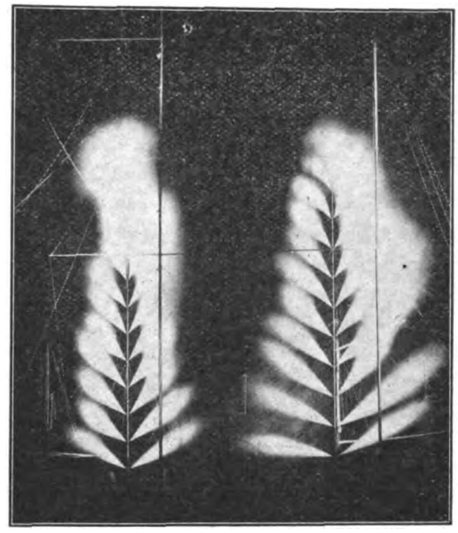
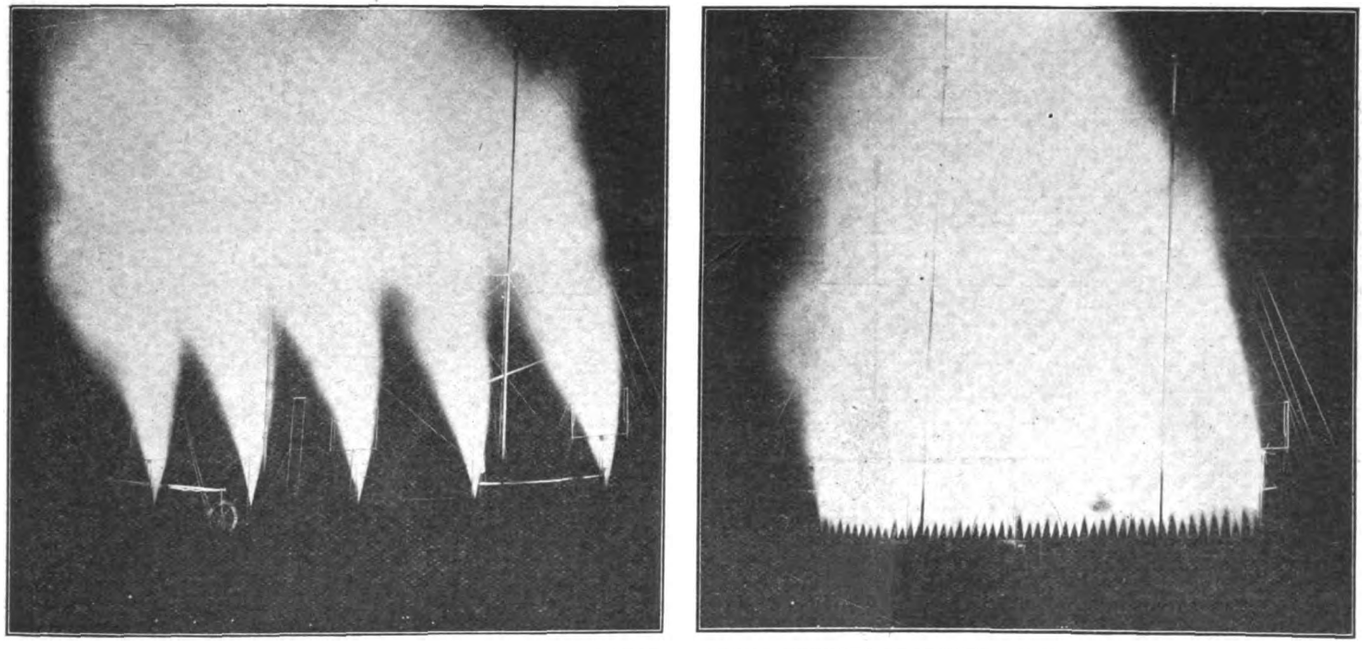
The Ryan Scintillator.

Of all the striking features of the Hudson-Fulton Celebration that was just held in New York and other cities along the Hudson River, the most spectacular and at the same time the most beautiful and original display was that which was made nightly by the Ryan scintillator equipment that was installed in New York on Riverside Drive at 155th Street overlooking the Hudson.



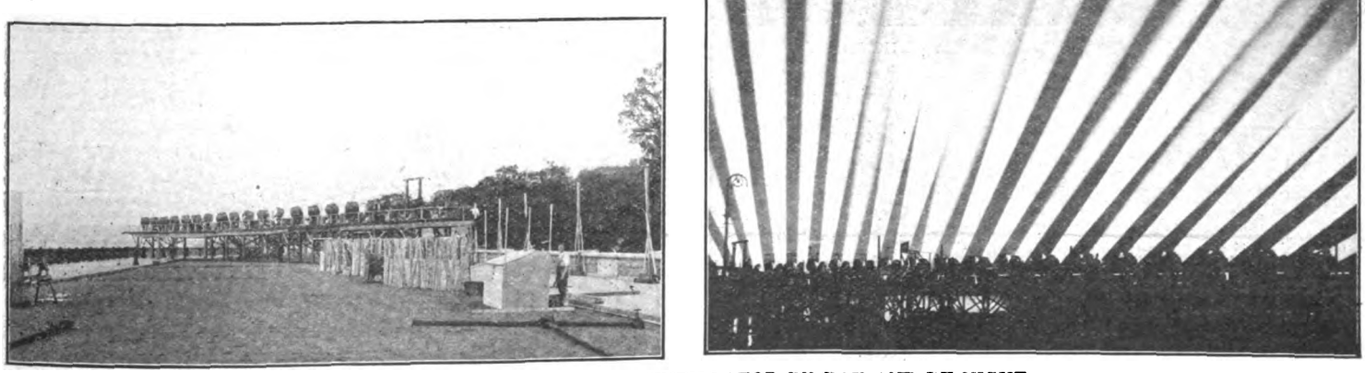
By installing the long row of searchlights at a prominent point in the roadway some 120 feet above the adjoining railroad yards, opportunity was afforded for an unobstructed field of action so that the brilliant display could be observed for miles along and on both sides of the Hudson. The result was that immense crowds of people were entertained nightly without discomfort and to the best advantage.



THE STEAM CURTAIN OF THE RYAN SCINTILLATOR, SHOWING EFFECTS PRODUCED BY VARIOUS NOZZLES.

The general arrangement of the searchlights is shown in the accompanying day view of the installation. Adjoining each arc projector was mounted a set of color screens on a rotatable disk on the principle made use of in electric fountains. In fact the scintillator is an adaptation of the electric-fountain idea but on a very much grander scale and making use of clouds of steam and light smoke instead of sprays of water on which to throw the powerful beams from the arc lamps. The screen produced by the steam could be varied in a great many ways by using selected sets of pipes containing a great many nozzles. This is shown by some of the views. The equipment of steam pipes consisted of both horizontal and vertical pipes, some of the latter being 100 feet high. The pipes were placed about 100 feet in front of the projectors. Steam was supplied from a separate 200-horsepower boiler. Besides using steam the curtain was augmented by burning powder near the nozzles and by the explosion of bombs.

For supplyng the direct current at seventy volts for the arc projectors a set of step-down transformers and two 200-kilowatt rotary converters were specially installed by the New York Edison Company. The control of the lamps was much more perfect than that of the steam and smoke curtain. Occasionally gusts of



NEAR VIEWS OF THE RYAN SCINTILLATOR BY DAY AND BY NIGHT.

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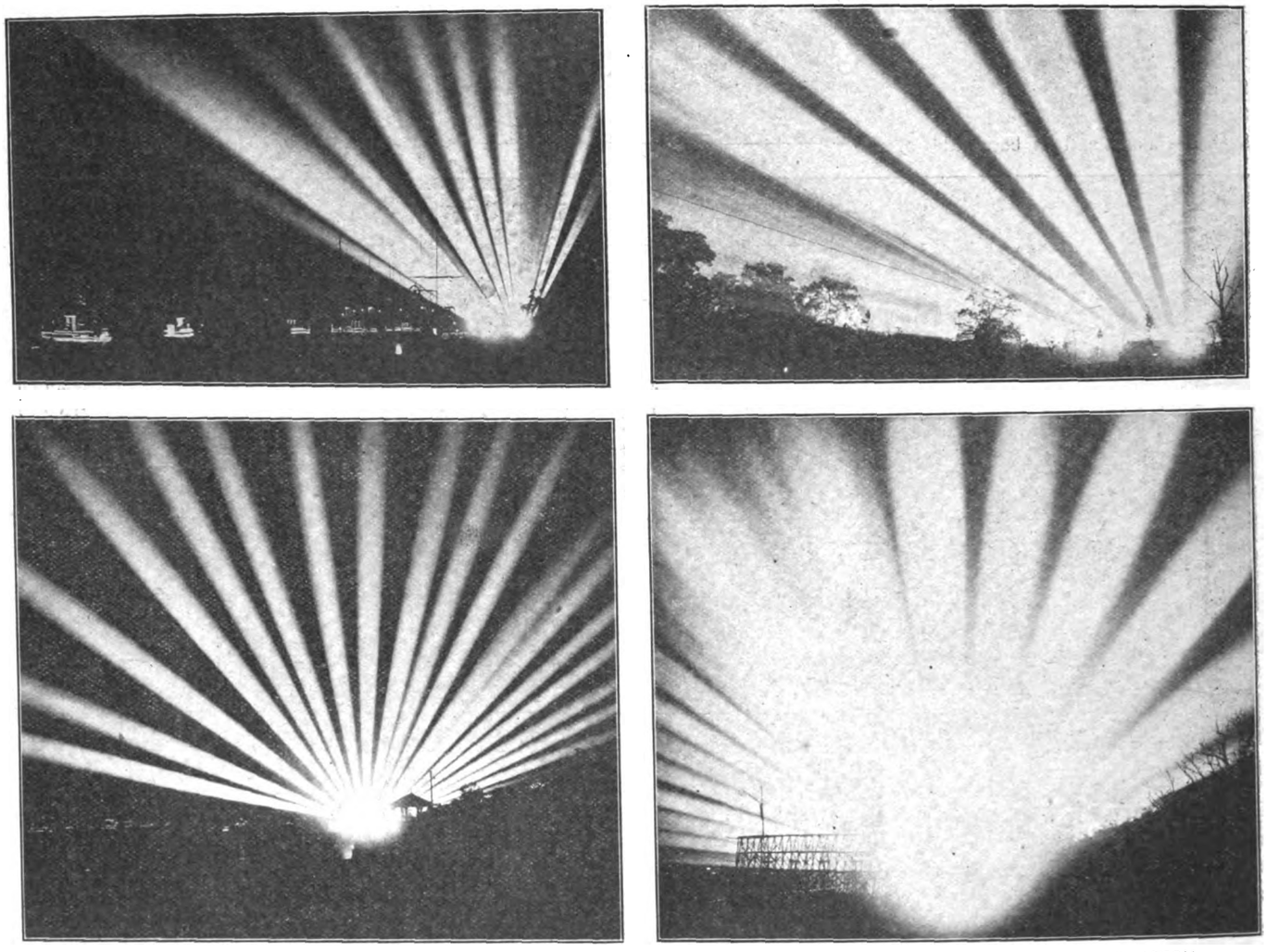
wind would break its continuity and thus slightly mar the resultant effect.

A number of set pieces, including a reproduction of Hudson's ship, the Half Moon, were features of the programme that was carried out hourly every evening during the week of the New York celebration. Some of the most beautiful effects were obtained by the skillful manipulation of the color screens. From a riot of color would be produced a perfect blending and harmony of hues. A striking feature was the production of magnificent auroral effects, some of which are illustrated here so as to give a suggestion of what was witnessed near by.



SOME OF THE AURORAL EFFECTS PRODUCED BY THE RYAN SCINTILLATOR AT THE HUDSON-FULTON CELEBRATION.

The first use of the Ryan scintillator was made at Niagara Falls about two years ago. Since then it has been improved by its inventor, W. D'A. Ryan. Its recent use in New York has shown its great possibilities as a spectacular entertainer of magnificent proportions to a degree not heretofore recognized. Already plans are being made for its use in connection with other great carnivals and electrical displays.

Cleanliness of Light Sources.

In the paper on "Diffusing Mediums" that was read by Albert J. Marshall before the recent annual convention of the Illuminating Engineering Society in New York, Mr. Marshall casually referred to the great importance of keeping light sources clean, but did so in such a convincing manner that his words deserve repetition:

Did you ever stop to think how much attention is given to the cleaning of windows (not to mention other articles) in an office building, the combined area of which would perhaps represent several hundred thousand square feet of surface to be cleaned, and how little attention is given to the cleaning of the artificial lighting units, the combined area of which is many times smaller than the window area? It seems odd, doesn't it? Windows are cleaned for two principal reasons: First, appearance; and second, so that they will permit light rays to enter the space in which they are used. If so much thought is given to the appearance of windows, why should not similar thought and effort be given to the appearance of artificial luminants? The existence of dirt in either case is about equally apparent and objectionable. As to the second reason for cleaning of windows, it should be considered that natural daylight is about as free as the air one breathes, and if so much attention is given to saving something which costs so little, why should not as much attention be given to the care of artificial luminants, which cost actual dollars and cents to produce and maintain? In residences, there seems to be no good reason why the glassware on a buffet or the pictures on the wall should receive any greater favors as to cleaning than the luminant and its accessories, especially when it is remembered that the luminant is the medium which permits of seeing the objects in the room at night. It is remarkable, though, how little attention, even in homes, is given to the cleaning of lighting units. In offices and public buildings it should be the duty of some person or persons to see that the lighting equipment is regularly and systematically cleaned.

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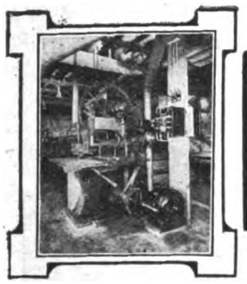
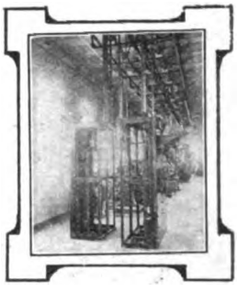


Industrial Power



INSTALLATION, OPERATION, CARE AND REPAIR OF ELECTRIC MOTORS IN INDUSTRIAL OPERATIONS.[1]—I.

BY C. E. DANIELS.

Electric motors of small and moderate capacity are nearly always shipped from the manufacturers' works completely assembled, ready to set on the foundations. The small sizes are boxed and the moderate sizes crated. Large sizes, too heavy to handle conveniently as complete machines, are shipped in sections with complete instructions for assembling.

When unpacking and handling the machines or parts, they should be carefully guarded from severe shocks or blows. Completely assembled machines, above the very small sizes, are generally provided with eyebolts, or bails, and whenever possible these should be used for lifting the machines in preference to slings placed elsewhere. Castings at very low temperature are easily broken; it is better to raise their temperature above the freezing point of water before handling them.

All electrical machinery not especially constructed to resist injury by moisture should be kept dry. If a machine has been inadvertently exposed to moisture, the windings should be thoroughly dried before being subjected to the full stress of normal working conditions. This is true of nearly all machines that have been in storage or have been idle for some time and is particularly true of new machines that have been long in transit. Small motors can be baked in ovens, and all sizes can be dried by passing a limited current, say one-half the normal current, through the windings. This current can be adjusted by means of rheostats or other similar resistances.

Location.—For best results an electrical machine must be located in a clean, dry, well-ventilated place, easily accessible and in plain sight. These ideal conditions are not always possible; nor are all of them absolutely essential to successful operation, but all are desirable. The machines must not be placed under steam or water pipes or otherwise exposed to dripping moisture. They must be kept as free as possible from grease and dirt unless special provision is made in the motor construction to prevent injury from these sources. Freedom from acid fumes is essential, and the machine must not be exposed to excessively high surrounding temperature.

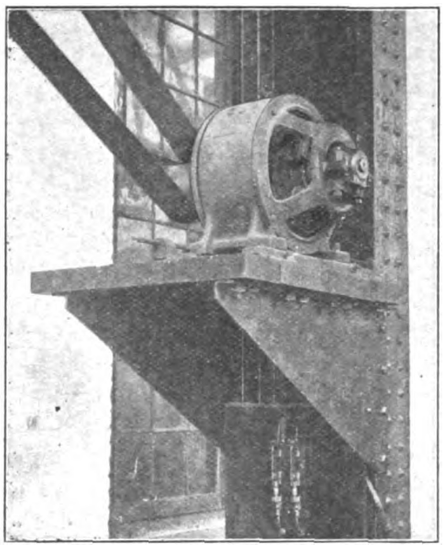


FIG. 1.—BELTED DIRECT-CURRENT MOTOR. SHELF IS UNNECESSARY AS THE MOTOR FRAME COULD HAVE BEEN TURNED IN THE BRACKETS AND THE FEET BOLTED TO THE VERTICAL SUPPORT.

Foundation.—The foundation must be solid enough to prevent vibration. Solid masonry or concrete makes the best foundation, but wood framework or timber can be used. Opinions differ as to the wisdom of insulating the motor frame from ground; where this is required, the slide rails or bedplate should be bolted to a timber framework which in turn is bolted to the foundation. The heads of all wood-frame holding bolts must in this case be countersunk in the timber, and those on the upper side must be covered with insulating compound. All timber or woodwork used for insulating purposes must be well coated, or filled, with moisture-repelling wood filler and must be kept clean and dry. Wall or ceiling supports for motors must likewise be rigid. Iron or wood uprights or stringers are generally used.

Erection.—A crane or chain hoist is usually essential for all machines weighing more than one or two hundred pounds. A chain hoist can be attached to the framework of the building or to suitable trusses. By means of the eyebolts or bails, or if necessary, by slings, set the machine on its foundation and line up the driving connection. Driving and driven shafts must be parallel; pulleys must be in line so that the belt will run true; the driving pinion and the gear must mesh properly, or if direct-connected, the shafts must be in line. Full assurance that the pulleys are properly alined can be obtained by temporarily installing the belt and turning the pulleys by hand where this is possible. When the alinements are accurate, securely bolt the slide rails, bedplate or the machine itself, to the foundation.

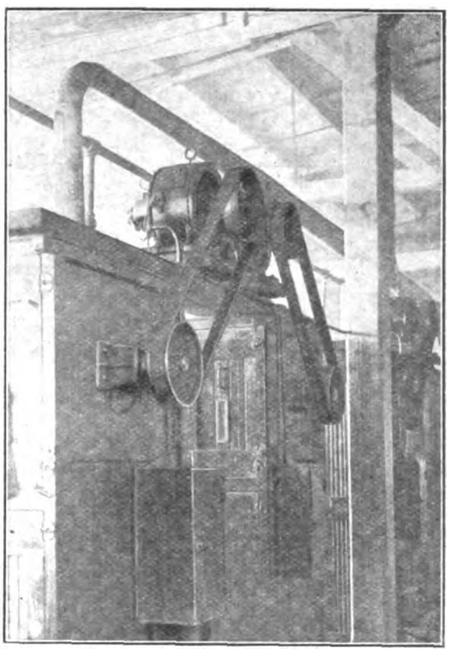


FIG. 2.—DIRECT-CURRENT MOTOR BELTED TO HOSIERY DRYER IN KNITTING MILL.

Wall and Ceiling Mounting.—Motors

[1] The writer is indebted to the courtesy of the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., for the photographs used to illustrate this article.

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intended for mounting on the floor, wall or ceiling, at the option of the user, generally have bearing brackets or housings which can be turned through ninety or 180 degrees, respectively. The motors are shipped for floor mounting unless otherwise specified. For wall or ceiling mounting the bearing brackets or housings must first be turned through the corresponding angle. In most cases the bedplate or slide rails should be attached to the motor, which should then be hoisted and bolted into place. If head room is limited or hoisting facilities poor, it may be better to fasten the rails or bedplate to the supports before hoisting the motor to the place where it is to be secured.

Vertical Motors.—In general, all vertical motors must be mounted so that the inclination of the shaft from vertical is not over twenty to twenty-five degrees, and must be securely bolted to the foundation. In some cases no inclination whatever is allowable, and in case of doubt the manufacturers should be consulted. Especial care must be exercised in alining the motor shaft with the driven shaft, so as to prevent binding of the motor shaft in the guide bearings and to bring equal pressure to bear on all the balls of the thrust bearing.

Bearings.—An inferior quality of oil or grease must not be used to lubricate the bearings; such will endanger the safety of the bearings and prove far more expensive than good lubricant. Good lubricant, even at slightly higher first cost, but resulting in reliable motor service, is much more profitable than a cheap poor quality and overheated and possibly ruined bearings. The best grade of oil to use depends somewhat on the temperature in which the motor operates, heavier oil being preferable in very warm places.

Bearings of the ring-oiling type should be filled to the top of the overflow plugs with a good grade of dynamo oil. If possible turn the shaft by hand and see that the oil rings rotate. Openings are usually provided in the tops of the bearing housings through which the bearings can be filled and the rings observed. These openings are fitted with lids which should be kept closed under normal operating conditions. Extreme care should be taken to keep all gritty substances, dust, dirt, etc., out of the bearings and oil wells. This caution is especially necessary if the bearings are dismantled for any purpose.

Bearings using oil and waste must be packed with a high-grade wool waste which should fit closely against the shaft; cotton or cheap wool waste soon becomes soggy and settles away from the shaft. The waste must be thoroughly saturated with oil, preferably by immersing it for at least forty-eight hours and then allowing it to drip on a rack for ten or twelve hours. Too much free oil in the waste results in overflow and accumulation of

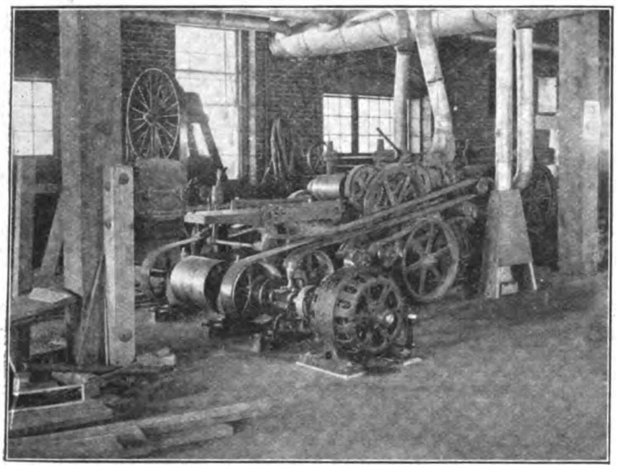

FIG. 3.—FLOOR-MOUNTED ALTERNATING-CURRENT MOTOR DRIVING A PLANER AND MATCHER.

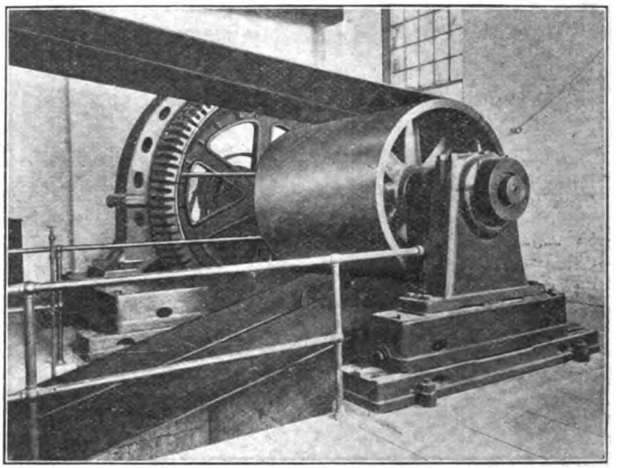

FIG. 4.—600-HORSEPOWER ALTERNATING-CURRENT MOTOR BELTED TO AIR COMPRESSOR.

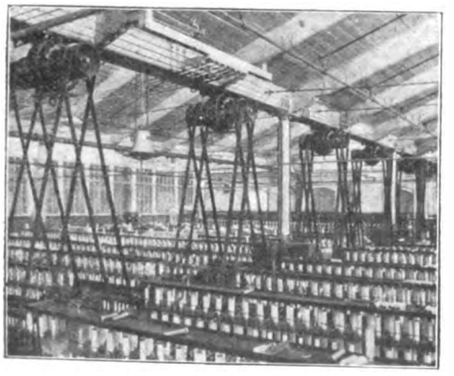

FIG. 5.—CEILING-SUSPENDED ALTERNATING-CURRENT MOTORS, EACH BELTED TO FOUR SPINNING FRAMES.

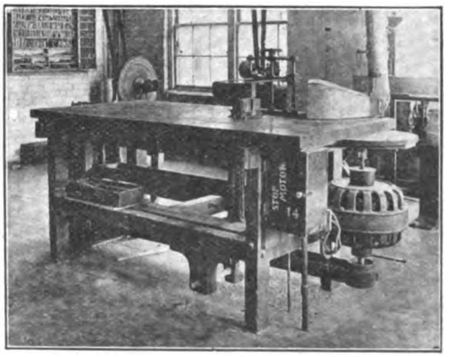

FIG. 6.—VERTICAL ALTERNATING-CURRENT MOTOR OPERATING A SHAPER.

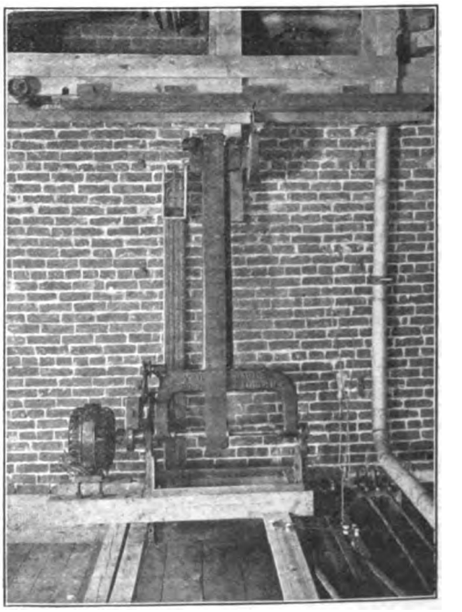

FIG. 7.—CEILING-SUSPENDED ALTERNATING-CURRENT MOTOR OPERATING CUT-OFF SAW.

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oil on the equipment or possibly oil in the motor. Bearings using grease should be filled with a good quality of grease which should be free of dirt or gritty substances.

Vertical thrust bearings should always be of a type in which the bearing surfaces are liberally flooded with oil. With the exception of small motors, ball thrust bearings are the rule for vertical motors. The balls usually run in an oil bath. Provisions should also be made for keeping the guide bearings liberally supplied with oil.

Belting.—If possible the lower side of the belt should be the driving side. The distance between pulley centers should be great enough to allow some sag in the upper side of the belt, or an idler pulley

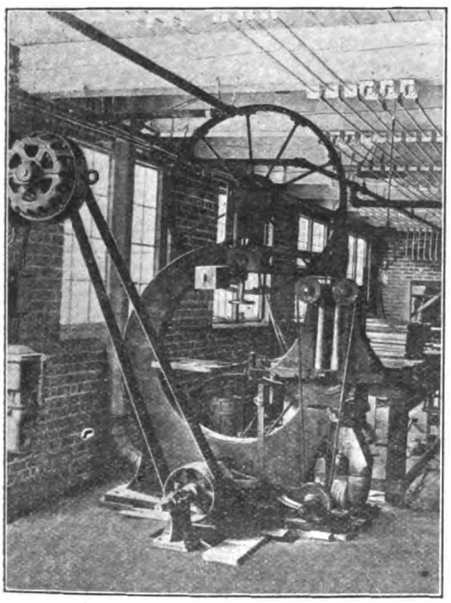

FIG. 8.—WALL-MOUNTED ALTERNATING-CURRENT MOTOR BELTED TO BAND SAW.

should be used to increase the arc of contact. The following general rules from Kent's Mechanical Engineers' Pocket-Book will serve as a guide, although these rules are very conservative, and many exceptions to them will be found in good practice:

1. Narrow belts over small pulleys—Fifteen feet between pulley centers, the loose side of the belt having a sag of one-and-one-half to two inches.
2. Medium-width belts on larger pulleys—Twenty to twenty-five feet between pulley centers, with a sag of two-and-one-half to four inches.
3. Main belts on very large pulleys—Twenty-five to thirty feet between centers, with a sag of four to five inches.

If the distance is too long the belt will flap unsteadily, resulting in unnecessary wear of both the belt and the bearings; if too short, the severe tension required to prevent slipping will cause rapid wear of bearings and may cause them to overheat. Very short belts can be made to work satisfactorily by the aid of idler pulleys, which increase the arc of contact.

The most desirable angle of the belt direction is not over forty-five degrees from horizontal; the belt should never run vertical, if possible to avoid it, since the advantage of sag to increase the arc of contact is then lost. The pulley should be a little wider than the belt.

Belts should be run with the least tension required to prevent slipping or flapping. The slack side should have a gently undulating motion. Lateral movement of the belt on the pulley indicates poor pulley alinement or unequal stretching of the edges of the belt. Belt joints should be as smooth as possible, and a lapped joint should trail rather than lead over the pulley. Belts should be kept clean and dry; if any belt dressing is applied let it be very sparingly.

Electrical Connections.—A diagram of external connections and full instructions for making them are generally supplied with each motor and with the starter where such a device is required; if these instructions are not supplied with the apparatus, they can almost always be obtained of the manufacturers on request. All connections should be made mechanically and electrically secure. The terminal wires must be securely soldered into the connectors when these are supplied with the motors and starters, and the connectors must be firmly bolted or clamped together. If no connectors are supplied, especial care must be used in joining the wires securely together and in soldering and taping the joint.

The National Electrical Code rules require that each motor and its starter be protected by fuses or a circuit-breaker and controlled by a switch which must plainly indicate whether "on" or "off." The switch and cut-out (fuses or circuit-breaker) are preferably located near the motor and in plain sight of it. All wiring should be neat and workmanlike and the wires should be run in conduit wherever possible.

All switches should be open and the starters or controllers in the off position when the motor is not running. Circuit-breakers should usually be set to open at a current about fifty per cent greater than the full-load current of the motor, although this setting must be varied to suit special conditions.

Operation and Care.—In general, electric motors must be kept clean and dry; cleanliness and freedom from dripping water, oil, grease, dirt, etc., are very important. Keep all such articles as tools, bolts, oil cans, etc., in their proper places and not lying loosely around the motor or on the motor frame.

After the motor is mounted and all mechanical and electrical connections are completed a final careful inspection should be made before starting. When satisfied that all instructions have been fully complied with, the motor should be started either without load or with light load. Instructions for starting and stopping are supplied with the motor or with the starter. Unsatisfactory operation, electrically or mechanically, when first starting is the signal that some error in assembling, mounting or connecting has been made, and the error should be found and corrected at once.

When first starting a motor particular attention must be given the bearings to see that they are well supplied with oil or grease. In bearings of the ring-oiling type, the rings should revolve and carry oil to the tops of the journals. Vertical motors should not be started until oil from the oil cups has passed through the bearings and begins to drip from the drain pipe. It is well to allow a new motor to run for an hour or two with light load, watching the bearings closely for any indications of overheating. The bearings of good modern motors with proper care, will seldom give trouble from heating. They can, however, be made to overheat by any of the following causes: (1) Excessive belt tension; (2) insufficient lubrication, which may be owing to poor lubricant, insufficient lubricant, failure of oil rings to revolve, or poor grade of waste in oil and waste bearings; (3) poor alining or leveling causing excessive end thrust or binding; (4) rough bearing surface which may be caused by careless handling or the presence of dirt or gritty substances in the oil; (5) bent shaft.

A motor bearing is usually safe if it operates at a constant temperature below the boiling point of water. The rapid rise of temperature toward this limit, however, is a danger signal calling for prompt attention. In the absence of a thermometer, a dangerously hot bearing can be detected partly by the sense or feeling (though it is usually safe when hot enough to burn the hand held continuously against the outside a few seconds), and partly by the smell of burning oil and the

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appearance of smoke. It will seldom be necessary to do more than to supply the bearing with an abundance of fresh, clean lubricant, observing that the oil or grease reaches the bearing surface, and perhaps to move any excessive belt tension. If relief is not thus afforded, pour a heavy lubricant directly on to the journal, if possible. Remove some or all of the load, if necessary, but keep the rotating part in motion enough to prevent the bearing from becoming set or "frozen."

In normal service the old oil should be withdrawn from ring-oiling bearings occasionally and fresh oil substituted, running enough of the fresh oil through the bearings to wash out all sediment. The old oil, as well as that used for rinsing, can be run through a good filter and used again. A good oil filter is a necessity in every plant where much machinery is in use. The frequency with which the bearings must be refilled depends so much on local conditions, such as the severity and continuity of the service, the room temperature and state of cleanliness, etc., that no definite instructions can be given. Oil and waste bearings must also be cleaned and filled with fresh waste occasionally, as the old waste gradually becomes glazed. If such a bearing becomes overheated it should usually be repacked at once. The chief care with grease lubrication is to keep the cups well filled with clean grease and to see that the grease feeds properly to the bearings.

[To be continued.]

Government Goes into Electric Power Business.

Secretary of the Interior R. A. Ballinger has approved a contract whereby the United States Reclamation Service agrees to furnish to Spanish Fork City, Utah, electricity for lighting purposes in amount not to exceed 65,000 kilowatt-hours per month at the rate of eight-tenths of a cent per kilowatt-hour. This lighting will be furnished from surplus power developed at the power plant of the service on Strawberry Valley irrigation project. The power plant is located at a drop in one of the main canals on the project and was built primarily for the purpose of developing power for utilization in the excavation of Strawberry Tunnel.

The government has also started delivering power to the Pacific Gas Electric Company from the Roosevelt dam for the lighting of Phœnix. This company is the first patron of the government for power, the proceeds going to the fund of the Salt River Reclamation Project.

The Cost of Power.

Here is a bald statement of facts as published in the *Courier* of Bristol, Tenn. The statement and quotation from the paper follow:

Electricity is rapidly displacing steam for power purposes in Bristol, since it has been shown by actual tests of disinterested parties that it is about fifty per cent cheaper, besides eliminating the expense of depreciation of machinery and repair bills. It possesses greater efficiency, cuts down the insurance rate and is vastly more economical. The consumer pays for the exact amount of power used and no more. Besides costing only about half what steam power costs, it possesses advantages over steam or other kinds of power in a dozen ways.

The Bristol Gas and Electric Company now has one of the finest electric plants in the South, with mighty turbine engines and a duplicate plant that precludes the possibility of delays. Many steam plants have already been taken out and replaced by electricity and it will only be a short time until practically all of the power in Bristol will be electric.

The company has just received the following interesting letter, which demonstrates all that is claimed for electric power:

Bristol, Va., Oct. 4, 1909.

Mr. S. M. Vance, General Manager Bristol Gas and Electric Company, Bristol, Tenn.

Dear Sir:—Relative to your inquiry regarding the installation and cost of operation of our electric plower plant, which we installed about a month ago, we herewith submit you the following data:

We were operating a steam engine to drive our entire foundry and machine shops. We displaced this engine with electric motors, and we find that with the installation of the electric motor drive, all dirt, dust and noise relative to such a plant has been eliminated.

As to our cost of operation we beg to state that the results are far beyond our expectations. Below we give you cost of operation for one month, showing the difference between the cost of operating steam power and the cost of operating with electric power:

STEAM POWER.

Engineer	$36.40
Coal	26.00
Oil and waste	5.00
Total	$67.40

ELECTRIC MOTOR POWER.

Total cost of power consumed	$25.60
Oil and attention	12.00
Total	$38.10

The above shows a saving of nearly fifty per cent in favor of the electric motor installation.

We are well pleased with the outfit and will be glad to show our plant in operation, at any time, to any persons using power.

Yours very truly,
Dixie Foundry and Machine Works.

Determining Stresses by Electricity.

At the recent Copenhagen congress of the International Association for Testing Materials, E. Rasch described a method for determining elastic stresses and the elastic limits of metals by thermo-electric measurements. This method, which has been worked out during the last few years at the Royal Testing Laboratory, Gross Lichterfelde, near Berlin, makes temperature determinations of specimens under test by means of thermo-couples.

The author mentioned that he has used couples of silver-constantan, copper-constantan, and iron-constantan, consisting of wires about a metre in length and half a millimetre in diameter, soldered with a soft solder or with silver. A sensitive galvanometer of small period and comparatively small resistance is required, a mirror galvanometer being quite suitable.

A special thermopile has been provided for practical work. It consists of an ebonite box which is clamped with its front to the surface of the rod. This front is formed by a plate of soft rubber, fitted with a longitudinal slit in the center. Within this slit the nine thermo-junctions are so arranged in series that they do not come in contact with the surface of the rod; otherwise the soldered junctions would be short-circuited by the rod. The cold junctions are connected with the binding screws at the back of the box to which the galvanometer leads are joined.

Some astonishing results were obtained with this device, which recorded distortions of test specimens not sensibly recorded by the usual forms of autographic stress-recording apparatus. The thermo-electric method has proved effective in determining fiber stresses in beams, etc., extended fibers being recognized by a fall, and compressed fibers by a rise, in temperature.

Great Britain had, at the close of 1908, a total of 204.5 miles of electrified steam-railroad track operated solely by electricity, and in addition 200.5 miles partly operated electrically.

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New York Meeting of the American Electrochemical Society.

The autumn meeting of the American Electrochemical Society will be held in New York city from October 28 to 30, that is, the last Thursday, Friday and Saturday in October.

The convention will be opened by a professional meeting in the Chemists' Club in the afternoon of Thursday. Besides a number of papers to be presented and discussed, there will be a general experimental lecture by Prof. Edgar F. Smith, of the University of Pennsylvania, on recent developments in electro-analysis.

On Saturday morning and afternoon, two sessions devoted to the reading and discussion of papers will be held at Columbia University.

The whole of Friday will be devoted to an excursion to Bayonne, N. J. Members and guests (without ladies) will meet in the waiting room of the station of the Central Railroad of New Jersey, in Jersey City, at 8:30 a. m. (This station can be reached from New York by ferries either from Liberty Street or Twenty-third Street, not in any other way.)

A special train will take the party to the Constable Hook Section in Bayonne, where the forenoon will be spent. In the afternoon, plants in the Newark Bay Section of Bayonne will be visited.

At noon luncheon will be served at one of the shore resorts on the Kill von Kuhl. The mayor of Bayonne, Hon. Pierre P. Garven, will there welcome the society to Bayonne.

So far the following companies have given permission to visit their plants:

Standard Oil Company.

National Sulphur Company (refining of sulphur).

Pacific Coast Borax Company (manufacture of borax and boric acid).

Gröndal briquetting plant at the works of the General Chemical Company. (This is the first American installation of the Gröndal process for briquetting ore, etc.)

Babcock & Wilcox Company (water-tube boilers and adjuncts).

Electro-Dynamic Company (interpole motors for wide speed variation).

Electric Launch Company (submarine vessels, etc.).

Industrial Oxygen Company (oxy-acetylene welding and cutting apparatus).

The excursion committee is confident that permission for visiting one or more other important plants will still be obtained. This will be announced later.

It is to be clearly understood that while the above-named companies have given permission to the society as a whole to visit their works, members interested in a competitive process are expected not to visit that particular plant. Thus the Standard Oil Company has given permission under the condition that no one connected with the refining of oil will be allowed to visit its works. Similar conditions have been made by the Babcock & Wilcox Company and the National Sulphur Company. The different plants to be visited, however, are of such a diversified character that every member will find enough of interest to take part in the excursion. The party will return to New York by special train.

In the evening of Friday a banquet will be held at the Hotel Cumberland. On the evening of Saturday, the society will be the guest of the New York Chemists' Club at a smoker in its clubhouse.

Very elaborate arrangements are being made for the entertainment of visiting ladies. These, as well as the titles of the papers to be presented, will be announced later.

Dr. Leo H. Baekeland is president of the society and Dr. J. W. Richards, Lehigh University, South Bethlehem, Pa., is the secretary. In order to make detail arrangements for the special train and luncheon on Friday, it is of greatest importance that anyone who wants to participate in the excursion should send early notice to Dr. Richards.

Changes in Patent Classification.

The Department of the Interior, United States Patent Office, Washington, D. C., makes the following announcement under date of October 5, 1909:

The following changes in the classification of inventions are hereby directed, to take effect immediately:

In Division XXXIV, class 104, Railways, abolish subclass—

76. Detector bars.

The patents contained therein having been transferred to a subclass hereinafter established in class 246, Railway Signaling.

In same Division, class 188, Railway Brakes, abolish subclasses—

78. Trip controlled—
79. Frangible devices.
80. Track circuit controlled.

The patents contained therein having been transferred to subclasses of the same title hereinafter established in class 246, Railway Signaling.

In Division XLII, class 246, Railway Signaling, establish subclasses—

Interlocking—
57. Detector bars.
58. Track circuit controlled.
59. Trip controlled—
60. Frangible devices.

The patents forming these subclasses are taken from the above abolished subclasses in classes 104, Railways, and 188, Railway Brakes, respectively.

The above appeared in the *Official Gazette* of the Patent Office.

Pittsburg Section, American Institute of Electrical Engineers.

The Pittsburg Section of the American Institute of Electrical Engineers met on the evening of October 12 in the lecture room of the Carnegie Institute to hear and discuss a paper by C. B. Auel, manager of the railway and control department of the Westinghouse Electric and Manufacturing Company, on "Arc and Incandescent Welding." This subject is one of very considerable interest to the steel and other metallurgical industries of Pittsburg, and was ably handled by Mr. Auel.

F. Theodore Nagel, of the Crucible Steel Company, Geo. H. Wood, of the Homestead Steel Works, Frank G. Galbraith, of the Mesta Machine Company, C. F. Scott, of the Westinghouse Electric and Manufacturing Company, and Julian Kennedy took part in the discussion which followed the reading of the paper.

Venezuelan Telephone Service.

Consul Isaac A. Manning, of La Guaira, forwards a directory of the Venezuela Telephone and Electric Appliances Company, an English concern with $500,000 invested, and reaching numerous towns, with Caracas as a center. The manager states that the company will soon begin the installation of metallic circuits on all lines.

The company holds no time concession from the Government, therefore no monopoly of the telephone rights, but it grants the Venezuelan Government a free service, governmental and municipal, and in return is immune from direct taxation and has the privilege of importation at fifty per cent discount from regular duties.

Second Annual Railroad Convention.

The Indiana Railroad Commission has sent out notices for the second annual convention of division superintendents, general managers and operating and dispatching employes of the railroads in the state for November 10 at the State Capitol building. The purpose of the meeting is the consideration of the railroad accidents that have been reported to the commission during the past year and to consider the proper steps to prevent such accidents. The commission announces that the number of accidents on railroads has been gradually decreased since the commission was given statutory authority to take precautionary action to reduce the number of railroad accidents. S.

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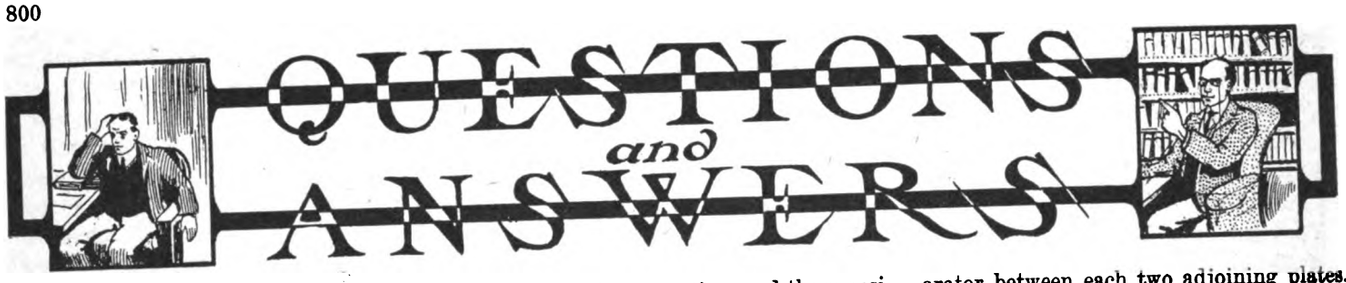
Vol. 55—No. 17



SMALL REFRIGERATING MACHINES.—(1) What is the average cost of a quarter-ton ice machine for family use? (2) What is the horsepower of the motor used for driving such a machine? (3) About what does it cost to manufacture 500 pounds of ice with a machine of this type, not figuring the cost of the current?—T. F. B., Presho, S. D.

(1) The average cost of a quarter-ton household ice-making and refrigerating machine is about $500 to $550. (2) The motor required should have a capacity of three-fourths to two horsepower, depending upon the type of machine used and the place where it is to be installed. For instance, in the southern states, where condensing water is apt to be very warm a larger size motor would be necessary. (3) This particular question is difficult to answer because the items of cost other than electric power are comparatively small. It is necessary to recharge the machine with ammonia possibly about once every twelve or eighteen months. Such a charge will cost in the neighborhood of $30. There is required eleven to fifteen gallons of water for condensing purposes for each hour the machine is in operation. A small amount of oil is also necessary. It has been calculated that the average cost of operation, including that for current furnished at three cents a kilowatt-hour, is a little over $3 per month.

CONSTRUCTION OF AN IGNITION BATTERY.—Kindly give me the proper formulas for constructing a sixty-ampere-hour, six-volt storage battery.—J. V. B., Chicago.

The construction of this battery, which is evidently intended for ignition purposes, is not such a small proposition as the inquirer evidently imagines. Unless he desires to build it merely for the experience of so doing, it will probably cost him considerably more than if he bought it ready made. A large number of storage batteries for this purpose are now on the market and have been so perfected as to give very excellent service. The first thing needed for making a storage battery is the building of the plates. It is customary to use lead grids pasted with a mixture of litharge and red oxide of lead. It will be necessary to have at least seven plates, four negatives and three positives for each cell. These may be, for the sake of simplicity, of the same construction, which provides a series of pockets for the retention of the paste or so-called active material. In one of the best known types of this kind of battery there are provided seven plates about four-and-three-quarter inches square and three-sixteenths inch thick; in an experimental battery it would be better to make plates at least one-fourth inch thick. The plates must be provided with a suitable lug, as an electrode terminal, for attachment to the connecting strap of each set. The paste referred to above is made by mixing the oxide with a small amount of dilute sulphuric acid to a stiff consistency and is applied to the plates in such a manner as to fill the pockets completely. After this the plates are allowed to dry. They must then be formed. This had better be done by connecting those plates which are to be positives, as positive electrodes in individual cells, on either side of which plate is a plain or dummy plate used together as negative electrodes. Those plates which are to be made into negatives must be connected in an opposite manner, that is, with a dummy positive plate on either side. The entire set of forming cells should be placed in series and connected with a source of low-voltage current capable of supplying up to two or three amperes. When the forming is to be begun, each cell is filled with sulphuric acid of about 1.150 specific gravity, and a low forming current sent through the set. After some sixty hours, more or less, the forming may be found completed, but it should be continued until the positives have assumed the characteristic dark brown color of lead peroxide, and the negatives the gray color of sponge lead. The plates must then be assembled with a separator between each pair. Perforated and corrugated rubber may be used for this purpose, or ribbed cherry wood of a thickness not in excess of one-eighth inch. A lead connecting strap must be lead-burned to the lugs on each set of plates in such a manner that the positives alternate with the negatives and there is room left for the separator between each two adjoining plates. Since the voltage of the battery desired is six volts, three such cells should be made up. The plates, when completed and assembled, should be placed in their respective hard rubber jars, and the positive strap of the first should be connected with the negative of the second, and the positive of the second with the negative of the third cell. These connections must be by means of lead strips lead-burned to the terminal straps. The electrolyte to be used in the battery should have a specific gravity, when the battery is fully charged, of not over 1.3, or as it is commonly designated, 1300. The battery, when provided with terminals and filled with electrolyte, is ready for charge and use. It is well to mount all three cells in a wooden containing box so as to keep the set intact without disturbing the connections between the cells. All these directions are given only in bare outline, and the details of the procedure are beyond the limits of a short article.

USE OF CORED CARBONS WITH ALTERNATING-CURRENT ARC LAMPS.—Why is it necessary to use a cored carbon for one of the electrodes in an alternating arc lamp?—M. D. C., Houston, Tex.

With every alternation of the alternating current the current has a zero value. At this moment the tips of the carbons tend to cool off and to break the arc. This cooling would be quite rapid on account of the high temperature of the carbon points attained at the peak of the wave. As the current re-established itself in the opposite direction carbon must be again volatilized to establish the arc. If the carbon tips have cooled off appreciably, however, this volatilization is not sufficient to establish a stable arc. In order to prolong the existence of the volatile arc beyond the zero value of the current, it has been found that use of a cored carbon is quite effective. The material in the core volatilizes quite readily and maintains its volatile condition easier than the pure carbon of the solid electrode. Therefore the arc, when a cored carbon is used, is maintained quite steadily and does not flicker as it would if solid carbons alone were used.

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Annual Report of Allis-Chalmers Company.

The eighth annual report of the Allis-Chalmers Company for the fiscal year ended June 30, 1909, has been issued from the general offices at Milwaukee, Wis., under date of October 7. The following are extracts from the annual statement of President W. H. Whiteside to the stockholders:

The total earnings for the year ended June 30, 1909, after deducting cost of manufacturing and selling, taxes, insurance and other general expenses, dividends on preferred stock outstanding of the Bullock Electric Manufacturing Company and provision for doubtful accounts, were $1,809,009.37.

Less:		
Expenditures for maintenance, repairs and renewals on buildings, machinery, plant, tools, etc.	$668,218.17	
Reserves for depreciation on buildings, machinery, plants, tools, etc.	284,776.83	
Interest on bonds and notes payable	720,582.62	
		$1,673,577.62
Net earnings for the year		$ 135,431.75

During the past year your company suffered, with other industrial corporations, from a business depression, which, existing with fluctuating severity for three-quarters of the preceding year, continued, with little change, throughout the first half of the fiscal year ended June 30, 1909. This condition was reflected in the volume of your company's sales, which compelled your works to be operated during the year at about fifty per cent of their normal capacity, and, although improved methods decreased the cost of production, yet the fixed charges (interest, taxes, insurance, depreciation, etc.) necessarily continued nearly constant, and prevented your company from showing for the year larger net earnings.

New business booked commenced to show substantial gains in January last, and for the last half of the year averaged per month nearly sixty-five per cent more than the monthly average for the first half. This increase with advancing prices has continued to the present time.

Liberal sums have been appropriated out of earnings for maintenance and betterments of the several works of your company, with careful provision against fire risks. All expenditures for the development and patent protection of the newer lines of machinery, which formerly were carried forward as deferred charges, have been deducted this year from earnings.

An unusually large number of important patents covering inventions of our engineers were granted to the company during the year.

The uniform success met with in the sale and operation of our gas engines, steam turbines, hydraulic turbines and electrical apparatus, noted in the seventh annual report, continues, and the expectations therein expressed are being realized. With an efficient and harmonious organization, and the restoration of normal business conditions now evidenced throughout the country, there is reason to expect an increasingly heavy volume of orders of a steady and profitable character.

In a supplementary report President Whiteside says:

For the three months of the current fiscal year our expectations expressed in our annual report of an "increasingly heavy volume of orders" have been realized to the extent of a regular increase in amount for each month. In September the total amount of business booked exceeded every month but one since the organization of the company, and for the present month there is an equally favorable prospect.

Noteworthy in the reports of the treasurer and comptroller is the gain of over $1,000,000 in working capital, which now stands at $8,715,640.55. In the last quarter of the fiscal year there were sold $828,000 par value of first mortgage bonds, to reimburse the treasury on account of capital expenditures at the West Allis and other works.

The consolidated balance sheet of the company as of June 30, 1909, is as follows:

ASSETS.

Capital assets—		
Real estate, buildings, plant, machinery, patterns, drawings, good-will, etc., as at June 30, 1908	$37,496,887.30	
Additions thereto during the year ending June 30, 1909, consisting of West Allis extensions and additions to other works	51,165.36	
		$37,548,052.66
Investments (at cost)		260,000.00
Development and patents account—		
For the development and purchase of rights for the manufacture of new lines of apparatus, including steam and hydraulic turbines, gas engines and other machinery		1,318,091.93
Discount and commission on bonds.		2,683,189.25
Current assets—		
Notes and accounts receivable (less reserves)	$4,721,052.32	
Inventories of work in process, manufactured stock, general stores and supplies, at cost or market, whichever the lower	5,580,446.61	
Cash	2,299,017.40	
		12,600,516.33
		$54,409,850.17

LIABILITIES.

Capital liabilities—		
Allis-Chalmers Company:		
Preferred stock...(Dividends at the rate of 7 per cent per annum accumulated from Feb. 1, 1904.)	$16,150,000.00	
Common stock	19,820,000.00	
		$35,970,000.00
The Bullock Electric Mfg. Company:		
Preferred stock...(Dividend at 6 per cent per annum guaranteed by Allis-Chalmers Company.)	$ 1,170,000.00	
Common stock...(The $1,499,300 remainder of the total authorized issue of $1,500,000 is owned by Allis-Chalmers Company and deposited with the American Trust and Savings Bank, Chicago, trustee, under the mortgage securing the bonds of the Allis-Chalmers Company.)	700.00	
		$ 1,170,700.00
First-mortgage 5 per cent gold bonds issued	$13,010,000.00	
Less:		
In treasury, $1,726,000.00		
Redeemed and canceled	136,000.00	
	1,862,000.00	
		11,148,000.00
Current liabilities:		
Loans and notes payable	$ 2,400,000.00	
Accounts payable	1,206,500.78	
Accrued bond interest	278,375.00	
		3,884,875.78
Reserve:		
For depreciation		1,714,845.35
Surplus, balance June 30, 1909		521,429.04
		$54,409,850.17

The consolidated profit and loss account for the year ended June 30, 1909, is given below:

Balance, June 30, 1908, as per last annual report		$385,997.29
Profit on operations of the fiscal year after deducting expenses of manufacturing and selling, dividends on preferred stock of the Bullock Electric Manufacturing Company, and provision for doubtful accounts	$1,809,009.37	
Deduct:		
Charges for maintenance, repairs and renewals on buildings, machinery, plant, tools, etc.	668,218.17	
Depreciation on buildings, machinery, plant, tools, etc.	284,776.83	
Interest on bonds, loans and notes payable	720,582.62	
	1,673,577.62	
Net profit for the year		135,431.75
Surplus, June 30, 1909, as per balance sheet		$521,429.04

Long Island Railroad's Extension Nearly Finished.

Work on the Long Island Railroad tunnels has advanced rapidly in the last month, and the progress made seems to indicate that trains will be running between Jamaica and the New York terminal of the company at Seventh Avenue and Thirty-first Street about the first of the year. The tunnels themselves are practically completed, and workmen are now laying the rails and ballasting. Considerable work remains to be done between Jamaica and Long Island City, but along part of the way the third rail is now being placed in position.

At the start of the service it will not be possible to maintain a full schedule, for two reasons. Lack of cars is one of them, and the other is that the New York terminal is not far enough advanced to permit it. There will be no difficulty in handling the service to be maintained at the start at the New York terminal.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

Stone & Webster, of Boston, report as follows the earnings of companies managed by them, for the month of August and the twelve months ended August 31:

GALVESTON-HOUSTON ELECTRIC COMPANY.

August:	1909.	1908.
Gross earnings	$ 111,294	$ 101,707
Net earnings	48,318	46,607
Surplus after charges	26,639	26,080
Twelve months:		
Gross earnings	1,181,350	1,065,863
Net earnings	499,074	439,163
Surplus after charges	244,578	198,549

BLACKSTONE VALLEY GAS AND ELECTRIC.

August:	1909.	1908.
Gross earnings	$ 74,404	$ 68,340
Net earnings	34,334	33,373
Surplus after charges	10,232	.....
Twelve months:		
Gross earnings	925,240	872,382
Net earnings	441,006	396,543

JACKSONVILLE ELECTRIC COMPANY.

August:	1909.	1908.
Gross earnings	$ 38,782	$ 36,271
Net earnings	17,489	17,129
Surplus after charges	7,970	7,897
Twelve months:		
Gross earnings	460,586	413,225
Net earnings	198,230	162,083
Surplus after charges	86,861	55,278

EL PASO ELECTRIC COMPANY.

August:	1909.	1908.
Gross earnings	$ 46,446	$ 41,398
Net earnings	17,901	10,509
Surplus after charges	9,642	3,433
Twelve months:		
Gross earnings	567,905	531,943
Net earnings	198,364	159,079
Surplus after charges	105,038	77,440

HOUGHTON COUNTY TRACTION.

August:	1909.	1908.
Gross earnings	$ 32,925	$ 25,951
Net earnings	17,337	13,179
Surplus after charges	11,121	8,577
Twelve months:		
Gross earnings	305,705	257,651
Net earnings	139,930	109,006
Surplus after charges	70,374	52,129

NORTHERN TEXAS ELECTRIC.

August:	1909.	1908.
Gross earnings	$ 109,421	$ 92,503
Net earnings	51,528	38,972
Surplus after charges	34,339	21,538
Twelve months:		
Gross earnings	1,203,508	1,058,200
Net earnings	535,906	441,191
Surplus after charges	337,910	258,069

PUGET SOUND ELECTRIC RAILWAY.

August:	1909.	1908.
Gross earnings	$ 194,383	$ 158,594
Net earnings	80,515	62,749
Surplus over charges	31,716	19,821
Twelve months:		
Gross earnings	1,785,614	1,625,058
Net earnings	594,833	606,065
Surplus over charges	46,742	98,318

MINNEAPOLIS GENERAL ELECTRIC.

August:	1909.	1908.
Gross earnings	$ 77,508	$ 74,411
Net earnings	40,612	39,997
Surplus after charges	10,584	7,906
Twelve months:		
Gross earnings	1,075,046	968,202
Net earnings	615,834	533,030
Surplus after charges	244,710	173,170

DALLAS ELECTRIC CORPORATION.

August:	1909.	1908.
Gross earnings	$ 128,749	$ 94,738
Net earnings	40,531	31,185
Surplus after charges	11,883	2,356
Twelve months:		
Gross earnings	1,281,685	1,144,891
Net earnings	473,900	374,830
Surplus after charges	132,189	20,986

TAMPA ELECTRIC RAILWAY.

August:	1909.	1908.
Gross earnings	$ 48,468	$ 45,474
Net earnings	19,664	15,751
Surplus over charges	15,070	10,612
Twelve months:		
Gross earnings	579,095	542,906
Net earnings	227,156	171,844
Surplus over charges	171,294	147,213

SEATTLE ELECTRIC COMPANY.

August:	1909.	1908.
Gross earnings	$ 610,815	$ 382,741
Net earnings	298,696	163,082
Surplus over charges	190,109	68,248
Twelve months:		
Gross earnings	5,409,932	4,398,897
Net earnings	2,267,003	1,792,275
Surplus over charges	1,059,804	748,398

FORT WAYNE & WABASH VALLEY.

The report of the Fort Wayne & Wabash Valley Traction Company for the month of August and two months ended August 31 compares as follows:

	1909.	1908.
August gross	$133,412	$125,586
Expenses	74,254	66,400
August net	$ 59,157	$ 59,186
Two months gross	905,613	856,257
Expenses	537,474	492,495
Two months net	$368,138	$363,762

NEW YORK TELEPHONE BONDS.

Allotment letters to the subscribers to the $12,500,000 four-and-one-half per cent thirty-year New York Telephone Company bonds have been mailed by Kidder, Peabody & Company. On the average, subscribers will get about ten per cent of the amount asked for.

Baring Bros. & Company, Ltd., who offered £2,500,000 of the same bonds abroad, have also made allotments, and subscribers to the sterling bonds will get about ten per cent of the amount for which they put in subscription.

SUSQUEHANNA RAILWAY, LIGHT AND POWER.

The Susquehanna Railway, Light and Power Company's report for the year ended June 30, 1909, compares as follows:

	1909.	1908.
Receipts, subsidiary companies, interest on bonds, own., etc.	$612,362	$551,479
Interest on bonds and dividends on stock subsidiary companies	247,656	244,980
Balance available for divs.	$364,706	$306,499
Dividends, preferred stock	204,610	131,632
Undivided surplus	$160,096	$174,867

ALBANY & HUDSON.

The report of the Albany & Hudson Railroad Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total operating revenues	$ 61,401	$ 56,281
Total operating expenses	41,924	39,618
Net operating revenue	$ 19,477	$ 16,662
Net revenue from outside oper.	13,530	10,164
Total net revenue from oper.	$ 33,007	$ 26,827
Taxes accrued	5,573	7,097
Gross income	27,434	19,730
Total deductions from gross income	29,066	22,653
Net corporate deficit	$ 1,631	$ 2,922

FONDA, JOHNSTOWN & GLOVERSVILLE.

The report of the Fonda, Johnstown & Gloversville Railroad Company for the month of August and two months ended August 31 compares as follows:

	1909.	1908.
August gross	$ 85,754	$ 83,200
Expenses	31,953	34,376
August net	$ 53,801	$ 48,824
Two months gross	170,961	164,477
Expenses	63,549	68,688
Two months net	$107,412	$ 95,789

PORTLAND ELECTRIC.

The Portland (Me.) Electric Company reports earnings for August and twelve months ending August 31, 1909, compared as follows:

	1909.	1908.
August gross	$ 25,503	$ 22,539
Expenses	10,640	9,045
Net	$ 14,863	$ 13,494
Twelve months gross	339,740	304,950
Expenses	130,693	124,870
Twelve months net	$209,047	$180,080

GARY & INTERURBAN BONDS.

Cram, Mulliken & Company are offering $350,000 of Gary & Interurban Railway Company first mortgage, five per cent, twenty-year gold bonds at ninety-four-and-one-half.

These bonds mature in 1929 and are callable at 105 and interest. They are part of an authorized issue, under a closed mortgage, of $500,000, and are issued in coupon form of $500 denomination. The electric railway upon which they are a lien is incorporated with a capital stock of $1,000,000 and has a fifty-year franchise to operate on the principal business street of Gary, Ind., the new steel city. It extends north and south from the gates of the Steel Corporation's mills and east and west through the city for seven miles.

Earnings of the line for the six months ended with August were $19,827, of which operating expenses consumed $14,842 leaving net of $4,984. The company estimates earnings for April, 1910, when the line from Gary and the extension to Hammond shall have been completed, at $4,500 net, and the net for twelve months after completion at $54,000. Deducting $17,500 for interest on these bonds leaves a balance of $36,500.

The company's line on the main street of Gary is now in operation, while another line is nearing completion. The power plant is finished and supplying current for operation of forty modern cars. With six steam-railroad connections, the company anticipates a heavy tide of travel, and with the growth of Gary it expects to be called upon to construct additional lines.

MASSACHUSETTS LIGHTING.

The Massachusetts Lighting Company's earnings for August compares as follows:

	1909.	1908.
August gross sales	$54,556	$48,650

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of Au-

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gust and eight months ended August 31 compares as follows:

	1909.	1908.
August gross	$ 641,062	$ 592,702
Expenses	262,479	281,707
August net	$ 378,582	$ 310,995
Preferred dividends, charges and taxes	140,250	128,667
August surplus	$ 238,332	$ 182,328
Eight months gross	4,531,222	4,181,925
Expenses	2,162,532	2,095,436
Eight months net	$2,368,690	$2,086,489
Charges, taxes and preferred dividends	1,108,259	1,006,455
Eight months surplus	$1,260,430	$1,080,033

COMMONWEALTH POWER COMPANY.

The Commonwealth Power Company, of Jackson, Mich., has issued its annual report for the year ended August 31, 1909, which compares as follows:

	1909.	1908.
Gross receipts	$583,090	$536,815
Expenses	283,735	259,420
Net earnings	$299,356	$277,395
Charges	145,323	139,745
Net income	$154,033	$137,649
Dividends (preferred)	76,200	75,570
Surplus	*$ 77,833	$ 62,079

*Equal to earning 5.2 per cent on $1,500,000 common stock.

Gross receipts of the company for a period of four years compares as follows:

Year ended August 31:			
1909	$583,090	1907	$414,248
1908	536,815	1906	323,838

WESTINGHOUSE AIR BRAKE.

The annual report of the Westinghouse Air Brake Company for the year ended July 31, 1909, makes the following showing:

	1909.	1908.
†Net sales	$5,286,021	$5,308,016
Expense	3,246,748	3,293,260
Net earnings	$2,039,273	$2,014,756
‡Charged off	118,715	43,960
Surplus for year	*$1,920,557	$1,970,796
Cash dividends	1,374,481	1,787,110
Surplus	$ 546,076	$ 183,686
Previous surplus	4,911,674	7,477,987
Total surplus	$5,457,750	$7,661,673
Stock dividend, 25 per cent	.....	2,750,000
Profit and loss surplus	$5,457,750	$4,911,673

*Equal to earnings 13.71 per cent on $14,000,000 capital stock. †Net sales, brakes, etc., total income. ‡Charged off for depreciation, patents, etc.

AMERICAN LIGHT AND TRACTION.

The report of the American Light and Traction Company for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$ 288,631	$ 246,048
Expenses	7,785	4,000
September net	$ 280,846	$ 242,084
Nine months gross	2,306,122	1,851,505
Expenses	79,190	36,000
Nine months net	$2,226,932	$1,815,805

CHICAGO RAILWAYS.

The report of the Chicago Railways Company for August and seven months ended August 31, 1909, compares as follows:

	1909.	1908.
Passenger earnings	$1,062,159	$959,167
Miscellaneous	26,050	20,999
Total gross	$1,088,209	$980,166
Operating expenses, maintenance and taxes	650,632	650,128
Balance	$ 437,576	$330,038
Thirty per cent of gross	326,462	294,049
Interest on property, 5 per cent	193,385	144,251
Net earnings	$ 133,077	$149,798
City's share, 55 per cent	73,193	82,390
Company's share, 45 per cent	59,884	67,408

Seven months: Gross earnings, $7,122,698; expenses, $4,711,035; balance, $2,411,664; thirty per cent of gross, $2,136,809; five per cent interest on valuation of property, $1,239,158; net income, $897,651; company's share forty-five per cent $403,943, and city's share fifty-five per cent $493,708.

AMERICAN TELEPHONE AND TELEGRAPH.

The American Telephone and Telegraph Company has issued a statement of earnings covering the nine months ended September 30, which compares as follows:

	1909.	1908.
Dividends	$11,036,612	$10,034,016
Interest and other revenue	7,980,364	7,297,154
Telephone traffic (net)	3,184,839	2,711,607
Real estate	72,866	120,134
Other sources	1,050,728	566,415
Total	$23,325,410	$20,729,329
Expenses	1,829,969	1,571,755
Net earnings	$21,495,441	$19,157,573
Interest	5,428,761	5,714,637
Surplus	$16,066,679	$13,442,935
Dividends paid	11,963,758	9,289,624
Surplus	$ 4,102,921	$ 4,153,311

Associated Bell Operating Companies of the American Telephone and Telegraph Company, not including the long-distance lines of the American Telephone and Telegraph, report for eight months ended August 31 compared as follows:

	1909.	1908.
Gross	$88,372,114	$82,208,034
Operating maintenance and taxes	64,288,375	59,092,296
Net earnings	$24,083,739	$23,115,738
Interest	4,531,285	5,144,252
Surplus	$19,552,454	$17,971,486

In 1909 all maintenance and depreciation is charged against expenses monthly, instead of being partly provided for by an extraordinary charge in December, as heretofore. The 1908 figures include in expenses for each month one-twelfth of the extraordinary provision which was made in December, 1908.

ONTARIO POWER COMPANY.

The report of the Ontario Power Company, of Niagara Falls, for the month of September and three months ended September 30, 1909, follows:

	Sept., 1909.	July 1-Sept. 30, 1909.
Gross receipts	$54,500	$159,888
Expenses	14,641	44,164
Net earnings	$39,859	$115,723
Interest	27,167	81,305
Surplus	$12,691	$ 34,418

MEXICAN TELEPHONE AND TELEGRAPH.

The report of the Mexican Telephone and Telegraph Company for the month of August and six months ended August 31 compares as follows:

	1909.	1908.
August gross	$ 39,836	$ 31,180
Expenses	18,232	16,357
August net	$ 21,604	$ 14,823
Six months gross	226,878	185,163
Expenses	107,616	104,016
Six months net	$119,262	$ 81,147

UNITED RAILWAYS OF ST. LOUIS.

The United Railways of St. Louis, Mo., for the twelve months ended June 30, 1909, report as follows:

Gross earnings	$10,821,180
Operating expenses and taxes	6,262,593
Net earnings	$ 4,558,587
Deductions:	
Depreciation	$ 88,562
Interest charges	2,807,820
	$ 3,346,382
Net income	$ 1,212,205
Preferred dividend	849,160
Surplus for year	$ 363,045

MICHIGAN STATE TELEPHONE.

The Michigan State Telephone Company reports for the seven months ended July 31, 1909, as follows:

RECEIPTS.	
Exchange earnings	$1,663,234
Toll earnings	437,609
Miscellaneous revenue	61,271
DISBURSEMENTS.	
General expenses	$ 113,814
Operating expenses	577,883
Maintenance expenses	696,666
Rentals	103,507
Miscellaneous expenses	96,687
Bond interest	267,117
Common dividends	51,877
Preferred dividends	79,894
Total disbursements	$1,986,946
Undivided profits	175,168

EDISON ELECTRIC ILLUMINATING.

The Edison Electric Illuminating Company, of Boston, has issued its annual report for the year ended June 30, 1909, which compares as follows:

	1909.	1908.
Gross	$4,111,342	$4,229,239
Expenses and taxes	2,737,496	2,658,929
Net	$1,373,846	$1,570,310
Miscellaneous income	45,360	38,442
Total income	$1,419,205	$1,608,751
Interest, etc.	86,845	54,989
Balance	$1,332,360	$1,553,762
Dividends	1,424,389	1,390,796
Deficit	$92,029	*$162,967

*Surplus.

Lamps and motors connected as of June 30 compare as follows:

	1909.	1908.
Incandescent lamps	1,040,613	938,670
Arc lamps	9,282	9,867
Motors, horsepower	44,065	39,422

CHICAGO CONSOLIDATED TRACTION.

The receivers of the Chicago Consolidated Traction Company report for June as follows: Gross earnings, $221,841; expenditures and taxes, $180,801; net earnings, $41,039; interest, dividends, betterments, etc., $63,508; deficit, $22,469.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The A. A. Automatic Kitchens.

The A. A. Automatic Manufacturing Company, of New York, N. Y., is placing on the market a labor-saving machine for performing such operations as coffee-grinding, dough-mixing, food-chopping, egg-beating, ice-cream freezing, butter-churning, etc.

These machines, named "automatic kitchens," are being very favorably received and should offer to central stations a good field for increasing their sale of current.

For household use, the automatic kitchens are made in three styles, a view of each style being shown herewith. In Fig. 1 is shown a style adapted for use in small apartments, where space is limited. Style No. 2, shown in Fig. 2, has the advantage over No. 1 in that either one or two utensils may be operated at the same time, the machine being provided with two flexible arms, one running at a slow speed, the other at a fast speed. Fig. 3 is a view of style No. 3. Like No. 2, it is equipped to operate two utensils at a time and has an additional convenience of all of the utensils being at all times clamped to the table top, in their proper positions. When a change from the use of one or two utensils to one or two others is desired, it is simply necessary to revolve the table top until the utensils next to be used are brought to their proper positions opposite the flexible arms.

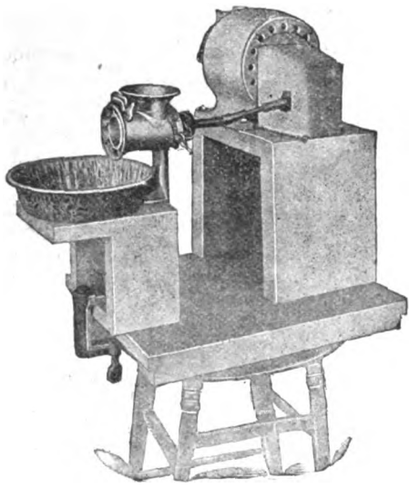

FIG. 1.

In addition to these three styles, the manufacturers are marketing a large machine for use in hotels and restaurants.

Weber Gas Engine Company Reorganized.

The Sheffield Gas Power Company, of Kansas City, announces that it has purchased the entire assets, factory and good will of the former Weber Gas Engine Company at the bankruptcy sale thereof. The factory has been in continuous operation throughout the term of the receivership, and has been continued in operation by this company without interruption, with the result that it is in position to furnish, without delay to any customer, the entire line of Weber gas engines and gas producers.

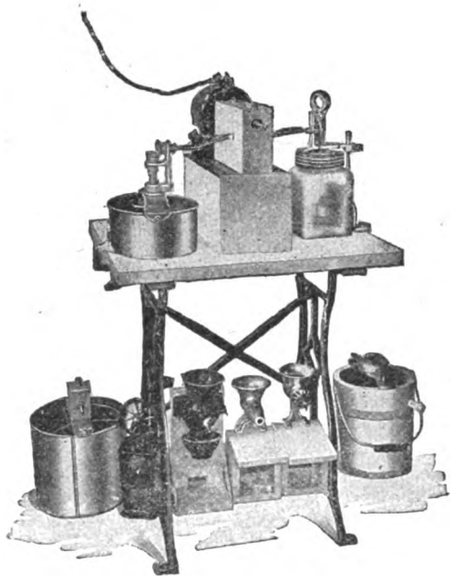

FIG. 2.

The management of the business, as well as the sales and factory departments, are in entirely new hands. George M. Hawes, the president of the company, is a graduate of the Massachusetts Institute of Technology and has been interested in machinery and electrical work for a number of years, giving particular attention to central-station power plants. He has also devoted much time to gas engine and producer design. Freeman Field, vice-president and treasurer, has devoted the past twelve years exclusively to the gas-engine business, both in the manufacturing and selling branches, and for the past seven years has been connected with the Olds Gas Power Company as general sales manager and western manager. W. H. Spiller, assistant manager of the company, studied at Harvard and Brown universities along the lines of electrical and mechanical engineering, and is thoroughly posted on power-plant installations, having installed both steam and gas power in many different industries. During the past six years he has been affiliated with gas power interests in both the selling and manufacturing lines, and is especially fitted to supervise the works and see that all the numerous details of construction in the high-grade gas power plants are carried out with care and precision. The engineering department has also been entirely rejuvenated and a new era of prosperity is now predicted for the company.

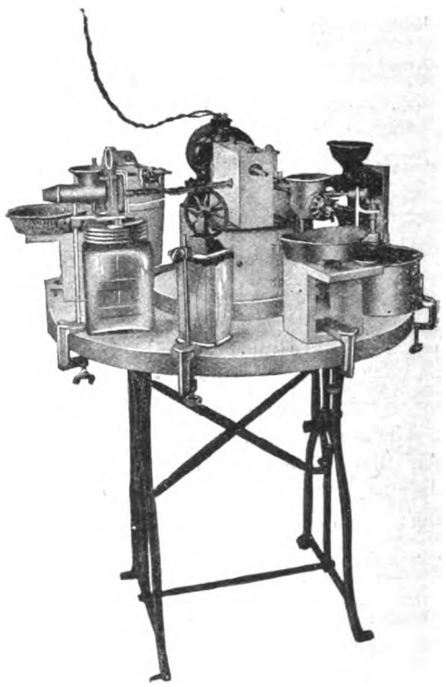

FIG. 3.

More Awards.

The Alaska-Yukon-Pacific Exposition has awarded grand prizes (highest award) for insulated wires and cables to the General Electric Company and John A. Roebling's Sons Company.

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Pittsburg Exhibit of the Western Electric Company.

At the twenty-first exhibition of the Pittsburg Exhibition Society, held September 1 to 21, in Mechanics' Hall, Pittsburg, one of the booths which, due to considerable originality, attracted attention was that occupied by the Western Electric Company. The section blazed day and night with electricity supplied by a 220-volt, alternating-current motor and a 110-volt, direct-current generator. Fifteen hundred lamps of all sizes and descriptions from the Hawthorn flaming arc to the smallest Sunbeam lamps lighted the way to the section for the 750,000 visitors from all parts of Pennsylvania who attended the exhibition.

In the center of the exhibit was a unique cabin, the only part of which not Western Electric make was the bark roof. The sides were formed of Western Electric fir cross-arms, interspaced with glass insulators, and the door-posts of bark-covered, untrimmed rural telephone poles. Sunbeam lamps on Western Electric metal

PITTSBURG EXHIBIT OF THE WESTERN ELECTRIC COMPANY.

mountings, shone forth the initials "W. E. Co." on the front of the cabin.

Another feature was the free telephone communication offered to any part of the city or to the building.

A standard Western Electric switchboard was installed in the section and connected up to the booths of the two hundred or more exhibitors. Trunks from the nearby telephone exchange were run to the board, thus affording private-branch connection for exhibitors and public telephone service for visitors.

The flashing signal lamps on the switchboard attracted an audience of their own, and the activity of the operator preached a sermon on courtesy that made a deep impression.

The annual exhibition of the business men of Pittsburg is one of the most popular features of the fall activities. Excursions are run daily to the city from all parts of Pennsylvania, and those residents of small towns who have business to transact visit the exhibition every afternoon and evening.

This year the Russian Royal Band opened the series of concerts, followed by the Prior Band, which preceded Walter Damrosch and his orchestra.

The rivalry in originality among the exhibitors is exceedingly keen. The palm this year, by general consent, is awarded R. M. Morris, sales manager of the Western Electric Company, for the decorations shown in the picture.

Unctuous Acheson Graphite.

Carefully prepared statistics show the mined production of crystalline graphite in the United States in 1908 was 3,433,033 pounds, valued at $149,763, while the same authority states that the output of electric furnace graphite in 1908 was 7,385,511 pounds, valued at $502,667.

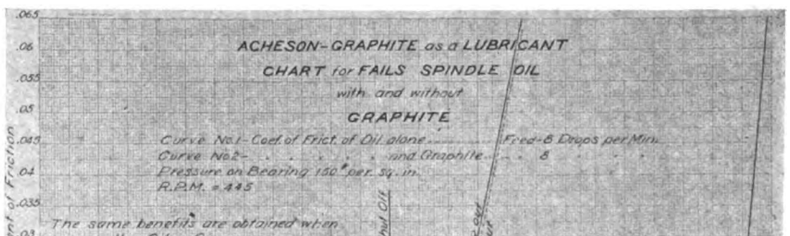

CHART SHOWING RESULTS WITH AND WITHOUT GRAPHITE.

These figures are most interesting in that they define how man, aided by science, has developed a process that gives to the world more graphite every year than is mined in the United States. The graphite artificially made is an electric-furnace product, and unctuous, pure graphite, in the various forms in which it is available, has become a popular and efficient lubricant.

When considering the problem of lubrication, the fact should be borne in mind that the surfaces of the metals composing even the highest finished bearings, when examined with the magnifying glass, are found to be quite irregular, presenting microscopic cavities and projections. If the graphite be a natural one, in crystalline or compressed flake form, it is conceivable that these more or less hard and tough flakes may become impaled on the microscopic points. In fact the surprising claim is made that flake graphite performs its service of lubrication through the fact that it does become so impaled. If impaled, it is evident that the metal points must have penetrated or pierced the flake.

If the graphite used be unctuous, pure and soft, not crystalline nor hard, it will adjust itself with great ease to the microscopic irregularities of the surface, filling up the hollows and burying the points, thereby producing a mirror-like surface of great density, quite capable of withstanding continued wear and affording the highest form of lubrication. The filling up of the hollows and the burying of the points is the climax to be sought in graphite lubrication, and beyond question the longer unctuous, pure graphite is used, the better will be the results.

Brightness or blackness in graphite is no indication of quality or relative purity. Brightness in a graphite is evidence of ability to reflect light, and to do this requires a particle of some measurable size, and of a compact, homogeneous nature. Hard, tough, flaky graphite is far less valuable as a lubricant than unctuous, pure, soft graphite that possesses great spreading, covering and polishing power.

Both natural and electric-furnace graphite are reduced to powder form in pulverizers or similar apparatus, while deflocculated graphite is unctuous, pure, Acheson graphite reduced to practically a molecular condition, the finest state of subdivision, by a process invented by Dr. E. G. Acheson, president of the International Acheson Graphite Company, of Niagara Falls, N. Y. This deflocculated graphite is rendered so fine that it remains suspended in oil or water and may be passed through the finest filter paper made.

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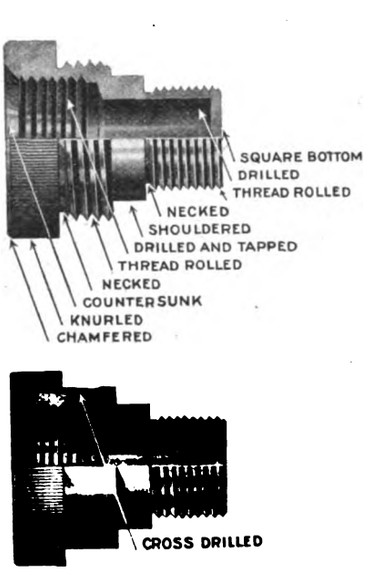
Remarkable Performance by a Motor-Driven Automatic Screw-Machine.

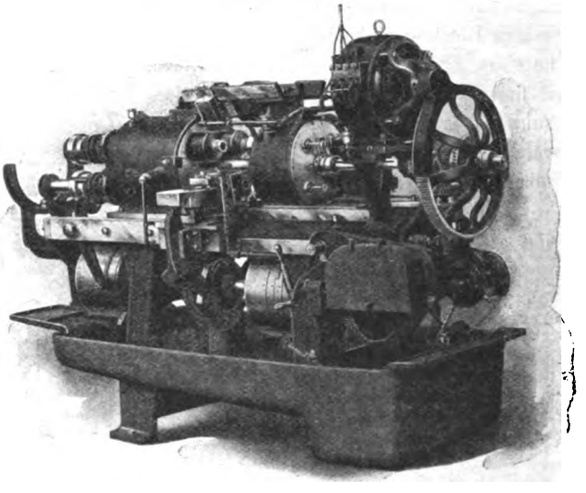
It would be an utter impossibility to convince an old-time machinist, say one who had departed this life a generation ago—were it possible for the nonce to bring him back to life—that the brass spud, shown in half-sectional elevation in the upper left-hand corner of the accompanying illustration, could be made by a machine tool in a single operation; but it is true nevertheless that this mechanical marvel is quite possible of accomplishment, and the "Acme" automatic multiple-spindle motor-driven screw-machine, made by the National-Acme Manufacturing Company, of Cleveland, Ohio, and illustrated herewith, is the machine by which the spud, or any of an infinite number of similar pieces ordinarily involving a series of more or less complex operations, can be and has been made.

The brass spud illustrated under the spud already referred to, shows cross-drilling which could be substituted for the rolled thread in the upper picture, and it is worthy of note that the whole of the operations necessary in turning out the upper spud on the machine were completed in the time required to drill the small hole only in the lower spud. The upper spud, made by the machine, was cut from the bar without being handled, all the tools necessary to make it having operated on it automatically and simultaneously. The inner thread was cut, the outer ones rolled. Incidentally it may be noted that a roll will frequently make a thread that is impossible to form by cutting. As regards cut threads, the Acme screw-machine will cut fine and coarse threads with equal ease and accuracy, and of course all intermediate sizes between the extremes within the range of the machine.

The Acme screw-machine illustrated herewith is only one of several types of similar machines made by the National-Acme Manufacturing Company, but it is believed that this motor-driven machine is one of the most typical of up-to-date practice in this line of work. A brief description of the illustrated machine follows:

The four spindles of the Acme automatic screw-machine carry four rods or bars of metal. Eight tool positions (four from the sides and four from the end) allow an exceptional number of operations. The stop for the stock feed does not occupy one of the tool positions. Tools are the same in number and similar in design to those generally used on screw-machines. Where the advantage in time or finish warrants, extra tools are used. Although the tool positions of the Acme provide for only eight operations, more are frequently possible by a combination of tools in one or more of the positions, or the use of special attachments. Accuracy of alinement is maintained by a positive locking of the spindle-carrying cylinder, compensation for wear being provided. All rotary movements on the machine are continually in one direction, consequently the strain of reversing due to the inertia of the revolving parts is completely eliminated, and all the spindles (both tool and stock) are directly driven by shaft and gears.





NATIONAL-ACME AUTOMATIC MOTOR-DRIVEN SCREW-MACHINE, AND SAMPLES OF BRASS SPUDS, THE UPPER ONE MADE BY THE SCREW-MACHINE IN A SINGLE OPERATION.

Feeding of the stock is accomplished by means of positive cam-controlled movements against a rigid gauge stop, which does not occupy one of the tool positions. The length of the cam throw and position of the stop are readily adjusted for length of feed. The threading operation is accomplished while the stock is stationary, the threading tool being rotated at the speed best suited to the size of the piece, the pitch of the thread, and the cutting qualities of the stock, the lead of the tools being governed entirely by the pitch of the thread. A positive start for the thread is provided by a lever movement.

Owing to the method of tooling employed, the threading is usually one of the shorter operations, and is allowed all the time necessary to perform whichever of the other operations consumes the most time. Due to this fact, a self-opening die is rarely used to advantage. Cam and lever movements are controlled by a series of gears, combinations being provided to cover the entire range of work possible on the machine. All the tools are flooded with oil when in operation, insuring thorough lubrication.

The absence of multiple belts simplifies the application of power to the machine, and makes the relation between the revolutions of the stock and the lead of the tools constant and positive, making possible accurate timing of changes from so-called idle movements (withdrawal of tools, indexing cylinder, etc.) to the cutting movements. The maximum use of the high speed is made possible, resulting in a larger production. The cost of maintenance and repairs is reduced; operation is simplified and made more convenient.

Several classes of work previously requiring rehandling, owing to the fact that they have not been satisfactorily and economically finished on automatic machines, can be completed on the Acme without in any way retarding the output. Special attachments, which in most cases are readily applied, are used for this purpose.

Independent motor drive may be applied to any of the Acmes. The substitution of a driving gear in place of the driving pulley and the addition of motor platform and support with motor and controller, being the extra equipment required. Either alternating-current or direct-current motors of any standard make may be used. Machines thus equipped

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have all the facilities and conveniences of the best modern motor-driven tools, being entirely self-contained—taking the same floor space as without motor, and are symmetrically compact in appearance. They are conveniently independent of power transmission other than electric wires.

The Acme-National Manufacturing Company is at present distributing a letter calling attention to the remarkable performance mentioned above, and a concrete example of the spud itself, five-eighths of an inch long, is attached by a string to an eyelet secured at one end of the envelope.

A New Portable Testing Set.

A testing set of the dial decade type with several unique features for facilitating quick and accurate measurements is being put on the market under the name of the L. & N. Dial Decade Set. It combines lightness, compactness, and a full range of measurements, which include resistance measurement from .01 ohm to 10,000,000 ohms, and fault location by the Murray and Varley loop tests. This set is designed particularly for the class of measurements which are necessary in maintaining telephone and telegraph lines, and in clearing trouble in them. The manufacturers of this set, the Leeds & Northrop Company, have had extensive experience in producing this class of apparatus, and assert that the new model has many features which are decided improvements. The preliminary models were submitted to several eminent telephone and telegraph engineers for test, and valuable suggestions made by them were embodied. The improvements are such as bring about great convenience and simplicity of manipulation and calculation, and such robustness of construction as to insure permanent accuracy and reliability.

The general form of this set is improved by making the case shallow, only five inches deep, so that it will carry easily, in contrast to those that are almost square. The battery is fastened by two screws to the rubber plate and controlled by a knife switch. This makes it very easy to lift out the rubber plate intact, with battery, galvanometer, and coils all in plain view and easily accessible. The galvanometer is completely protected and made dustproof by a strong metal case, so that no dirt can enter when the set is opened.

The dial switches can be rotated continuously and no backward motion is necessary in going from the 9 point to the 0 point. The laminated brushes used in these switches are not bent square at the contacts, but at a slight angle, thus making a brush contact that, instead of wearing a groove in the studs, tends to simply clean the whole surface. The set is built on the four-coil decade plan. There is therefore no crowding of parts and the coils may be easily replaced by the operator if one should be burned out. The coils are constructed of manganin wire wound on brass spools, silk insulated and thoroughly baked in shellac.

The galvanometer in this set is of the suspension type, the old style pivot and jewel instrument having been entirely discarded on account of its susceptibility to jars, which blunt the pivots and make the pointer stick. The instrument will stand more rough use than an ordinary portable voltmeter on account of the spring suspensions; moreover, the galvanometer will deflect for the most minute current that can be put through it, there being no initial friction to overcome. Its sensibility is ample for all ordinary work.

LEEDS & NORTHRUP DIAL DECADE SET.

The arrangement of ratio coils is an original feature. These are controlled by a single rotary switch that makes contact on ratio studs as follows: 0, .01, 0.1, 1, 10, 100, and 1,000. The rheostat reading is then simply multiplied by the value indicated by the dial switch, and one is never in doubt as to whether to multiply by arm "A" or arm "B." This gives a range as large as can be accurately used with any set of this type. The contact resistance, which is so minute as to be negligible and will remain so, is in the battery circuit, so that even should it be high, it would not affect the galvanometer sensibility.

A marked feature in this set is the absence of all flexible cords. All connections for the loop tests, for outside battery and for outside galvanometer are made simply by throwing knife switches located on the rubber plate of the instrument. These eliminate the battery cords found on some sets, which have to be connected after the lid is open and, while in use, project outside the set.

CURTIS TURBINE USED AS REGULATOR.

BY W. J. DAVIS, JR.

An interesting example of the effectiveness of a Curtis steam turbine when used as a regulator on a large power system is found in the new Oakland power house of the Pacific Gas and Electric Company, of San Francisco.

The installation consists of a 9,000-kilowatt vertical type Curtis turbo-generator manufactured by the General Electric Company, eight 750-horsepower McNaull water-tube boilers and a Worthington condenser outfit having a cooling surface of 20,000 square feet.

The 60,000-volt transmission system of the Pacific Gas and Electric Company entering Oakland is delivering more than 100,000 kilowatts during maximum demand. Of this amount, 20,000 kilowatts maximum are supplied to Oakland and immediate vicinity, the load factor being about sixty per cent.

While the new plant is of great value in carrying the local peak load during hours of maximum demand, it is almost continuously kept connected to the transmission system on account of the steadying effect on the voltage and consequent improvement in the lighting service. When acting as a regulator, the duty is especially severe, the turbine taking sudden momentary swings in load from 500 to 9,000 kilowatts. In a word, the action of this turbine on an alternating-current system is equivalent to that of a large storage battery on a direct-current system.

The ability of the Curtis turbine to successfully take these sudden fluctuations in load is due to the large flywheel effect (about ten times that of a reciprocating engine of equal capacity), close speed regulation, large radial clearances between moving and stationary steam-using elements, and sturdy mechanical construction.

This use of a Curtis steam turbine is particularly interesting on account of the high economy obtained under varying load. Even when the turbine is operating as a regulator the over-all economy of the plant is exceptionally good.

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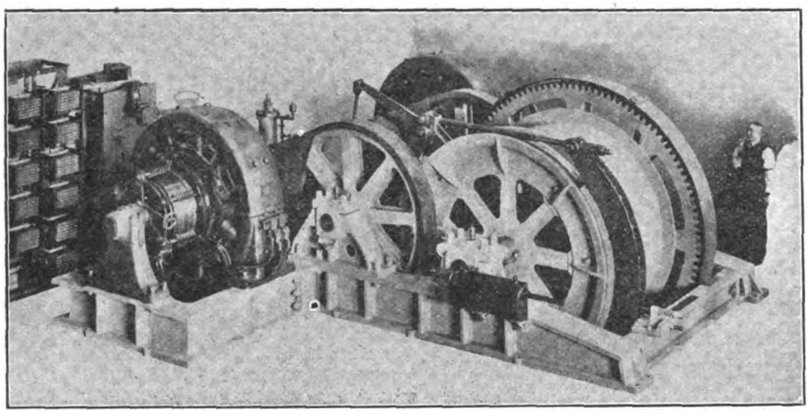
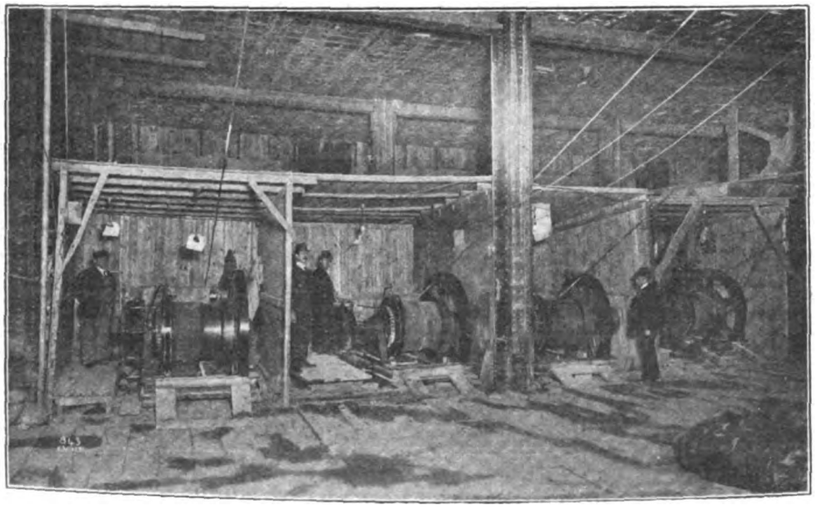
Lidgerwood Electric Hoist.

The coal shipping terminal at Sewells Point, near Norfolk, Va., is operated in a novel manner and contains some very interesting machinery, including a 1,000-horsepower electric hoist, designed and built for the purpose by the Lidgerwood Manufacturing Company, of New York.



LIDGERWOOD ELECTRIC HOIST FOR HANDLING PIER CARS.

The operation of getting coal from the cars that bring it to tidewater into the hoppers from which vessels are loading comprises two operations. In the first of these the cars are allowed to drift down by gravity, one by one, to where a barney car can pick them up and carry them up a short incline to a dumper. The dumper picks each car up bodily, tips it to an angle of sixty-five degrees, so that the coal is poured out into a special conveyor car of larger capacity, to be taken to the hoppers on the pier. As soon as each conveyor car is loaded it is taken in hand by the hoist, which, by means of a barney car, draws it up a twenty-five per cent incline at a speed of 480 feet per minute.



BATTERY OF LIDGERWOOD ELECTRIC BUILDING HOISTS.

The Lidgerwood hoist, shown herewith, complete with its two motors, weighs 180,000 pounds. It hauls the conveyor cars up the incline, using only one motor at a time, the other being provided to insure constant operation. The motors are of General Electric Company's make, and are rated at 550 horsepower. The drum of the hoist is eighty-four inches in diameter with a face of forty-two-and-one-half inches in width, grooved for a one-and-three-fourths-inch main cable and having also a section with a seven-inch face grooved for a three-fourths-inch tail rope, for insuring the return of the barney car. The drum has powerful post brakes which are controlled by solenoids through the medium of compressed air. The compressed air is supplied at a pressure of eighty pounds to the inch by an electric compressor which forms part of the hoist outfit.

The general operation of the hoist is controlled by an operator near the barney-car pit, 350 feet distant from the hoist. The hoist is also provided with an emergency limit switch which makes certain that it cannot overwind in either direction. The brake is set by a weight of 14,000 pounds acting upon a suitable lever. When the current is turned on the solenoid acts, and by means of the compressed air releases the brake. When the current is cut off, whether by intent or accident, the solenoid drops, releases the air, and the weight brings the brake into action, holding the load safely in any position.

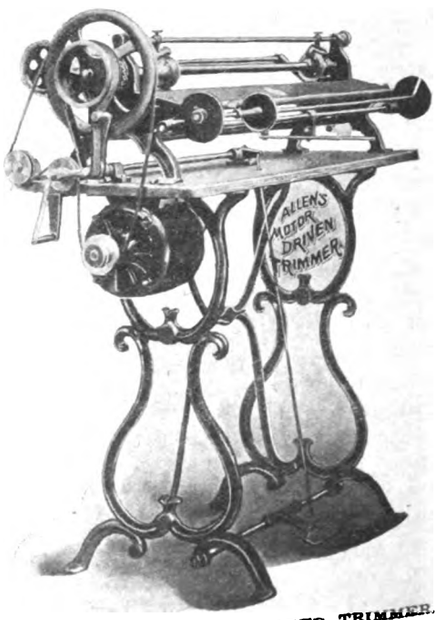
To meet the demand that has arisen for handling with rapidity and accuracy the vast amount of material required in the construction of tall buildings, the Lidgerwood Company is also manufacturing a line of high-speed builders' hoists.

In the accompanying illustration is shown a battery of these hoists in operation, erecting the Fifth Avenue Building in New York city.

A Motor-Driven Wall-Paper Trimmer.

The development of a means for further increasing the usefulness of wall-paper trimmers has recently been successfully completed by the addition of a small electric motor to drive a modified form of the hand wall-paper trimmer, manufactured by A. Allen & Company.

It is but an exemplification of the fact that small motors are being utilized to drive all manner of machines, formerly driven by hand or foot power, and in many instances are responsible for the developments of entirely new machines not possible without the motor. The outfit is sold by A. Allen & Company, 2001-5 Carpenter Street, Philadelphia, Pa.



MOTOR-DRIVEN WALL-PAPER TRIMMER.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, OCTOBER 8.—The apparently small sum for which the Marconi wireless stations are being purchased by the British government, viz., $88,000, has given rise to some speculation as to why the Marconi company should have agreed to what would appear to be a one-sided bargain. Inquiries at the company's office, however, show that no such feeling exists there, inasmuch as, by the sale of their coast stations, the company have got rid of at least one very embarrassing agreement with Lloyd's shipping agency, under which they were compelled to do two things for two different people, which were diametrically opposed to each other. On the one hand, they were forced to supply all shipping news to Lloyd's, and, on the other, respect the wishes of the ship owners that certain classes of information was for the use of the companies only. Again, under a clause in the agreement, it appears that Lloyd's claimed that the Marconi company was bound to erect another wireless station for their own exclusive use at the North Foreland, quite close to one already existing and erected by the Marconi company. The disappearance of these difficulties alone, which have been the cause of much expensive litigation, the Marconi company seem to feel would justify them in transferring their stations to the government on the terms mentioned, but the question of the tenure of their license is also an important factor. I believe the present license has three years more to run, and it is common knowledge that the government was not prepared to renew it. At least that has been the impression given by the speeches of the postmaster-general in the House of Commons.

An interesting fact in connection with wireless telegraphy is that the original patent granted to Marconi, which protected the general principles of the Marconi system, expires on June 2 next year, but as this has long since ceased to have any practical value the company have not deemed it necessary to set aside any sum for depreciation. A very large number of other patents protecting every detail of the system have since been taken out. In fact, the company owns about 500 patents.

An instance of the methods which retard the extension of electric lighting, at any rate, for street purposes, has arisen at Finchley, a large suburb in the north of London. The Council some time ago decided to adopt electricity for street lighting and prepared a scheme, which, as usual, light for light, was cheaper than gas. Considerable opposition was offered to the proposal by the gas company, who claimed to be able to do the work for less capital expenditure and less maintenance cost. As usual, however, the two schemes were not strictly comparable, and when the Local Government inquiry relative to the loan was held, the Council refused to submit an alternative estimate for doing the work by gas. The Board has now refused to grant the loan until such alternative estimate is provided, but the Council is taking a very firm stand on the principle that it is not the function of the Board to dictate the particular system to be used. Failing the receipt of the Board's sanction for a loan the necessary capital is being taken from the rates.

The application of electricity to mines bids fair to be the outstanding topic of the coming year. In Scotland a mine manager is to be prosecuted, criminally, for allowing his installation to get into a bad state of repair, whereby an explosion was caused, resulting in the death of two or three workmen. The case promises to be almost sensational, for electrical experts are to be called on both sides, and long arguments may be expected upon the interpretation of the mines regulations, under which the proceedings are being taken. All this is typical of the extreme interest which is now being taken in the subject, an interest which has been quickened by a suggestion that the coal owners of the northeast district of England should be petitioned to take out all electrical apparatus, owing to its danger to the men. The new institution of mining electrical engineers is taking the question up, and although only just inaugurated, a special committee has been appointed to investigate the use of electricity in mines from the employes' point of view. The Home Office Committee to consider an amendment of the existing rules relating to electricity in mines has not yet been appointed, and a good deal of curiosity is being displayed as to its composition, the general feeling being that it should not consist, as did the previous committee, of Home Office officials, with one independent engineer thrown in. The whole question of inspectorships will, most probably, have to come under review shortly. Some dissatisfaction is being expressed that the existing electrical inspector of mines has never been a practical mining engineer, and it is even alleged that he had never been down a mine prior to his appointment a short while ago. Further, to have one electrical inspector for the whole of Great Britain is regarded as absurdly inadequate, and it is felt that with sufficient supervision and inspection many of the accidents which have been happening lately would not have occurred.

It is quite refreshing to notice that even our great technical training institutions are beginning to lay stress upon the necessity of a business training for engineers. Dr. J. A. Fleming, in a discourse at the University College, London, this week drew attention to this, and a recommendation of this character, coming from so high a quarter, in relation to the training of electrical engineers, will doubtless have a great effect upon the arrangement of the curriculum in the future.

It is stated that the Post Office authorities are experimenting with an apparatus for typing telegrams, instead of having them written. This is an electrical apparatus, but the cost of its use is somewhat of a drawback at present.

The Engineering Standards Committee has issued a new specification dealing with ammeters and voltmeters. The object, of course, is to secure uniformity, in order to save trouble in tendering. Three degrees of accuracy are provided for, named sub-standard, first grade and second grade. The first must have an accuracy of within plus or minus 0.2 per cent for voltmeters and 0.5 per cent in the case of ammeters. The figures for second-grade instruments are 2 per cent and 4 per cent, respectively. An important part of the specification is the schedule of standard scale readings, which have been selected with a view to cheapening production by reduction of the number of patterns which have to be kept in stock, while at the same time keeping the buyers' wants in view. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, OCTOBER 9.—There are to be two new electric-railroad lines installed in the region of the Fleimstal Valley, Austria, as it is desired to connect this extensive valley with the main railroad lines. In order to carry this out there were formed two independent syndicates, each of which had a separate project, but at present the two syndicates have consolidated, so that the work will be carried out in common. The first project called for an electric-railroad line starting from Cavalese, midway in the Fleimstal Valley, and proceeding as far as Neumarkt, which is a station on the South Austrian Railroad line. According to the second project, the line ends at Lavis, another point in the valley, lying fifteen miles south of the former. Seeing that the two syndicates are united, the line will have a greater length, as both projects are to be carried out. The electric line will be one-meter gauge and will have four per cent maximum gradients.

A new submarine telegraph cable has been laid between Borkum and Tenerife by the German-South American company. It was opened for international service on August 26.

The large canal which is already established in the region of Verona for irrigation purposes is now to be used as a source of power, and the Canale Milani company is taking measures to erect a hydraulic plant on the canal. The station is to contain five turbine groups, which work upon a ten-meter head of water. Coupled to the wheels are three-phase alternators, built at the Havre works of the Westinghouse Electric Company. The machines are of the 2,000-kilowatt type and deliver current at 3,000 volts. This is stepped up to 40,000 volts for transmission purposes. In connection with the turbine station there is erected a steam plant which contains a 2,000-kilowatt group, with a three-phase alternator and delivering 3,300 volts.

At Budapest steps are being taken to extend the subway known as the Franz Josef line, and it is to be lengthened at both ends. The project is to be carried out by the municipality in connection with the Budapest Electric Traction Company. The inner extension will be in subway, while the outer addition will use overhead construction, and will thence connect with the traction companies' lines. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., OCTOBER 16.—According to a prominent Canadian broker, Belgians have nearly $50,000,000 invested in the so-called Pearson stocks—Sao Paulo, Rio, Mexican Power and Mexican Tramway stocks.

The Canadian Pacific Railway Company has now in operation a telephone wire from Cartier, Ont., to Brandon, Man., a distance of 1,045 miles. This is the nucleus of a system that will

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stretch from the Atlantic to the Pacific with telephones along the company's branches.

The Mexican Power directors paid the regular 1 per cent quarterly dividend on the 15th inst. This is the second declaration since the Necaxa dam disaster, which was expected to put the company out of the dividend-paying business.

The first power from the Montreal river into the Cobalt silver camp is now being delivered by the Cobalt Power Company. The two larger competing companies, the Cobalt Hydraulic and the Mones Power Company, are hustling along their work very rapidly and expect to be in operation before the end of the year.

A deputation representing corporate interests has waited upon the Dominion government and asked that the power law of the Ontario government be vetoed, or the petitioners given authority to take it to the Supreme Court of Canada on the ground that it is ultra vires of the local Legislature. It was argued that, as the Niagara River is an international stream, the provincial government has no authority to vest power rights in the Niagara commission. It is also contended that the provincial legislation constituted an injustice to the electrical development companies which have invested millions of dollars in plants, and that the effect of the legislation was to injure Canada in the eyes of British financial people who desire to invest their money in the enterprises of this country. The ministers promised consideration of the matter.

The complications arising out of the power franchises on the Kaministiquia River have been adjusted by the Hydro-Electric Power Commission, which will supply cheap power to Port Arthur, Ont. The commission has contracted for 10,000 horsepower from the Kaministiquia Power Company. To secure this the storage dams at Dog Lake were arranged for some time ago. Fort William, however, is tied up to the power company for several years, and therefore cannot deal, at present, with the commission. The terms arranged for Port Arthur are: For the first 2,000 horsepower, $17 per horsepower, and between 2,000 and 4,000 horsepower, $16 per horsepower. Over 4,000 horsepower, $15 per horsepower. In addition, the city must pay its share of a small transmission line, the stepping-down station and the operating expenses, on a basis of 4 per cent interest. This will bring the cost to about $20 per horsepower. The city will take 5,000 horsepower to begin with, and the distributing plant is installed. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, OCTOBER 16.—The C. P. R. R. has working a telephone wire between Brandon, Man., and Cartier, Ont., a distance of 1,044 miles. For the present this wire will be used for emergency purposes and not for the dispatching of trains. Every train running between these points will be fitted with apparatus enabling the conductors to make connection with the telephone wire at any point along the line. Officials of the company say the system has already proved most beneficial in several ways and is the nucleus of a telephone system which the company intends to build from the Atlantic to the Pacific. B. S. Jenkins, Winnipeg, Man., is general superintendent of the telegraph and telephone branches of the company.

At Weyburn, Sask., the Weyburn Rural Telephone Company has put in operation its line to the south of that town and has started work on several other lines radiating from Weyburn. Already a sufficient number of subscribers have been secured to make the venture a financial success.

The engineers in charge of the hydroelectric development for the city of Winnipeg at Point du Bois report that excellent progress is being made. It is anticipated the plant will be in operation by the beginning of 1912. Cecil B. Smith, C. E., Toronto, Ont., is the supervising engineer.

The Cobalt Power Company, of Cobalt, Ont., has awarded a contract to the General Electric Manufacturing Company of Sweden for the supply of sixty transformers and switchboards, in sizes of 160 kilovolt-amperes. Kilmer, Pullen & Burnham, of Toronto, Ont., are the Canadian agents of the Swedish firm.

The joint railway board at Port Arthur, Ont., has decided that four additional street cars are required for May delivery. Address J. J. Carrick.

The Alberta government telephone system has been connected wth a number of other telephone systems, and a conversation can now be carried on between Edmonton, the capital of Alberta, and Spokane, Wash. R.

LIGHTING AND POWER.

(Special Correspondence.)

MURRAY, IDAHO—An electric-light plant is proposed for this place.

HAZELTON, N. D.—George Zirbes is figuring on installing an electric-light plant.

DELMONT, S. D.—The city is considering the installation of an electric-light plant. C.

MINNEAPOLIS, MINN.—Henry W. Benton, Dr. Leo M. Crafts and Jos. S. Webster, an electrical engineer, have incorporated the Lake Minnetonka Public Service Company, with a capital of $150,000, to supply villages along the shore with electric light. C.

MARLIN, TEX.—The electric-light plant of I. J. Nathan has been destroyed by fire.

WATERTOWN, S. D.—Ferris Bros. have made application for an electric-light franchise.

MADISON, S. D.—The machinery will shortly be installed in the new electric-light plant. C.

TYLER, MINN.—Work has been commenced on the foundation for the electric-light station. C.

CARLISLE, ARK.—Allain & Crow have purchased the local electric-light plant from J. E. Tunis.

HAMLIN, TEX.—The Hamlin Electric Light and Power Company has been incorporated in this city.

McKINLEY, MINN.—Bonds for $5,000 for the construction of an electric-light plant have been voted. C.

HILLSBORO, MO.—This city will shortly vote on the issuance of $15,000 in electric-light bonds.

SNOHOMISH, WASH.—The Snohomish Electric Company is remodeling its plant, to double the voltage.

MANKATO, MINN.—It is proposed to take a vote on the establishment of a municipal lighting plant. C.

SUPERIOR, WIS.—The Great Northern Railroad will electrify the machinery at the Ohio coal dock No. 5. C.

COZAD, NEB.—Bonds for the erection of an electric-lighting plant and waterworks system have been voted. C.

BURDETTE, ARK.—The Three States Lumber Company will install an electric-lighting system for this town.

AURORA, MINN.—The Hartley Electric Company, of Virginia, Minn., has asked for an electric-light franchise here.

GRINNELL, IOWA—The Grinnell Electric and Heating Company will install 150 100-kilowatt tungsten lights. C.

PITKIN, COLO.—A. E. Reynolds, manager of the Gold Links tunnel, mines and mill, will install a hydroelectric plant. U.

SIOUX FALLS, IOWA—If a franchise is voted the Interstate Power Company will put up a $500,000 power plant here.

LOS ANGELES, CAL.—A $40,000 issue of electric-lighting bonds of the city of Glendale has been awarded to W. H. Holliday.

NEVADA, IOWA—The Nevada Electric Company has commenced work on the construction of a fireproof electric station. C.

ELK CITY, OKLA.—This city is to vote on the proposition to issue bonds for $35,000 with which to buy the electric-light plant.

DAYTON, WASH.—The survey for the power plant of the Walla Walla & Columbia Traction Company at Tukanon has been completed. U.

WOODBURN, ORE.—The Portland Railway, Light and Power Company will construct a transmission line from Mt. Angel to Woodburn.

WAYCROSS, GA.—There will be an election on October 15 on a proposed $45,000 bond issue to build a municipal electric-lighting plant. L.

IONE, WASH.—The Ione Water and Light Company has been granted a franchise by the county commissioners, to run for twenty-five years. U.

HAMILTON, MONT.—W. O. Fisk announced recently that a new generator will be purchased and installed in the electric-light plant as soon as possible.

POLSON, MONT.—Construction has been commenced by the Northern Idaho and Montana Power Company on an electric-light plant to cost $30,000. C.

ANDERSON, IND.—The American Steel and Wire Company will enlarge its mills in this city and equip the plant throughout with electric power and light. S.

WATERTOWN, S. D.—The Kirini-Gray electric-light plant has been sold to Ferris Bros. and the Council has granted a franchise to the new company. C.

MARSHALLTOWN, IOWA—H. W. Darling offers to either rehabilitate the Jones & Hovey electric-light plant or build a new one if granted a franchise. C.

WHITE BEAR, MINN.—H. M. Billseby & Company, of Chicago, have taken an option on the electric-light plant owned by the Fulton estate and George Reif. C.

INDIANAPOLIS, IND.—The Fish System Company has filed articles of incorporation, capitalized at $50,000. The company's declared purpose is to establish and equip a plant for the man-

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ufacture and sale of electrical and power apparatus and supplies. George L. Fish, R. C. Davis, H. F. Huster and E. A. Leeson, directors. S.

YUBA CITY, CAL.—The Pacific Gas and Electric Company has recorded deeds to a right-of-way for an electric transmission line between this city and Sutter City.

ALBUQUERQUE, N. M.—The City Council has granted an electric-lighting franchise to M. P. Stamm, F. G. Pratt and D. A. Porterfield, who will build a plant at once.

SAN FRANCISCO, CAL.—The West Side Power Company has been incorporated here, with a capital stock of $25,000, by George Pollock, E. A. Clausen and G. S. Barkley.

LOS ANGELES, CAL.—The contract for lighting the new district of East Hollywood has been awarded to the Pacific Light and Power Company by the board of supervisors.

SEATTLE, WASH.—The Seattle Lighting Company will extend its mains in the district east of Green Lake station, also on the west side of the lake as far as Mountain View station. U.

NORTH YAKIMA, WASH.—The Yakima Valley Power Company has plans in the hands of an engineer for the new power house and office building, which the company is about to erect.

BEDFORD, IND.—The Bedford Power Company, which is building a power dam in White River to generate electricity, has been granted a franchise to supply Bedford electric light and power. S.

ST. PAUL, MINN.—The St. Paul Gas Light Company will enlarge the capacity of its electric-generating plant. A new gable roof and crane will be installed at a cost of $9,500 and machinery to cost $50,000. C.

MARYSVILLE, CAL.—A three-wire electric-power line is being strung from the Colgate power house of the Pacific Gas and Electric Company to the California Mother Lode Mining Company's property at Indiana Ranch.

HICKORY, N. C.—The Thornton Light and Power Company will begin using Southern Power Company current about November 1, and will expend $5,000 in making the change, disposing of the old steam plant and generators.

HELENA, MONT.—Until Monday at 12 o'clock, October 18, the city of Helena, Mont., will receive sealed proposals in accordance with specifications, for furnishing, f. o. b. Helena, Mont., the equipment for an electric-light plant.

FAIRVIEW, UTAH—A mass meeting of the citizens of Fairview was held recently with a view of purchasing the plant of the Fairview Electric Light Company. The arrangements will be completed some time in November. N.

ROCKINGHAM, N. C.—The Rockingham Power Company is ready to reinaugurate work on the Blewitt's Falls hydroelectric plant, the works now being in the hands of Mr. W. A. Leland, receiver. About 1,000 men will be required. L.

HIGH POINT, N. C.—The Town Council has closed a contract with the North Carolina Public Service Corporation for 100 arc lights for street-lighting, the corporation in turn securing current from the Southern Power Company. L.

NORTH YAKIMA, WASH.—President Strahorn, of the North Coast Railway, is reported to be behind a project launched for the purpose of purchasing Priest Rapids on the Columbia River, where it is possible to develop 100,000 horsepower.

TOLEDO, OHIO—H. S. Swift, auditor of the Toledo Railways and Light Company, was this week elected president of the accountants' association of the American Street and Interurban Railway Association, at the session held in Denver. H.

RICHMOND, IND.—The Pilot Motor Car Company has announced that it will equip a large factory in this city with the latest electric machinery for power and other purposes. C. H. and H. M. Keramer and George Seidel are the directors. S.

SAN FRANCISCO, CAL.—It is reported from Oregon City, Ore., that the Southern Pacific Company is to build a power station at Cazadero, Ore., with an initial capacity of 50,000 horsepower and a possibility of developing 150,000 horsepower.

TOLEDO, OHIO—The city of Ottawa, Ohio, will soon be completely lighted by electricity. The electric-light company is now at work installing arc lights on Main Street and placing seventy-nine 100-candlepower tungsten lights on various other streets. H.

TOLEDO, OHIO—Work will soon begin on the actual construction of the big power plant to be erected at Ballville, Ohio, near Fremont. J. H. Cameron, P. F. Magenheimer and J. S. Taylor, of Chicago, representing the financial interest backing the project, were in Fremont this week, closing up the preliminary details. H.

BAKERSFIELD, CAL.—J. F. Stratton, general manager of the West Side Electric Company, states that the foundations of the company's power house are now about completed and that the machinery, including Westinghouse 2,300-volt generators, is en route. The company will establish its headquarters at Maricopa, Cal.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., has recently distributed a post-card showing a view of the new Peoples Gas, Light and Coke Company's building, Chicago, Ill., in which "Sherarduct" conduit has been installed exclusively.

TULARE, CAL.—The Mount Whitney Power Company has bought the electric-lighting system of the Consolidated Heat, Light and Power Company in this place. Heretofore the latter company has been buying current from the Mount Whitney Power Company.

MINNEAPOLIS, MINN.—The Great Northern Development Company, of Duluth, Minn., has secured land on both sides of the Mississippi between Anoka and Coon Creek Junction for the erection of a million-dollar power plant, with a capacity of 15,000 hydroelectric horsepower. C.

CHILLICOTHE, MO.—This city has called a special election, to be held October 23, for the purpose of voting on the proposition of issuing $150,000 bonds for a new waterworks and electric-light plant. The Fuller-Coult Company, Chemical Building, St. Louis, Mo., are the engineers.

NEW ALBANY, IND.—The Robison & Norton Company announces that the large factory recently destroyed by fire will be rebuilt. The entire plant was operated by electricity and the new plant will likewise be thoroughly equipped and every machine operated with electricity. S.

JACKSON, CAL.—The General Electric Power Company, of California, has filed notice here of the appropriation of 20,000 inches of water from the Mokelumne River, together with claims to a power site of 800 acres and to a right-of-way for a ditch from the river to the power site.

DAWSON, ALASKA—Heathcote Thurston, manager of the Northern Light and Power Company, says that the company will next year spend $80,000 in erecting coal bunkers at Coal Creek Landing, where a concrete power house is to be erected. Work on the transmission system has been started.

EAST POINT, GA.—The opening of the new $85,000 electric-lighting and water plant in this town was the occasion of note. Mayors from nearby towns and officials from Atlanta were included on the programme, followed by an old-fashioned barbecue dinner. The plant is modern in every respect. L.

TOLEDO, OHIO—At the regular October meeting of the Toledo section of the American Institute of Electrical Engineers, held last night in Builders' Exchange Hall, George E. Kirk delivered an interesting address on wave and current principles in electricity. The meeting was well attended. H.

REDDING, CAL.—The Sacramento Valley Power Company has begun construction work on the extension of its transmission line from Red Bluff to Chico. The company has applied for a lighting franchise in the latter town, and the desired franchise has been offered for sale on November 2.

LAFAYETTE, IND.—The Indiana Electric Transmission Company has notified the secretary of state that the company had changed its principal office from Lafayette to Terre Haute, Ind. The company is preparing a bond issue to secure finances to carry out a big undertaking. H. S. Hyatt is secretary. S.

GREENVILLE, S. C.—The Monoghan Cotton Mills is expending some $30,000 for electrical machinery to operate its extensive textile machinery. The power will be supplied by the Southern Power Company, Charlotte, N. C., the power being transmitted from the Great Falls plant of the company on the Catawba River. L.

PEORIA, ILL.—The Peoria Gas and Electric Company has about completed the underground work and is connecting the consumers to that source of supply themselves. This has been a large undertaking, as all services were formerly overhead and the new connections have been made entirely in conduit, with lead-covered wire. V.

LEROY, ILL.—The Leroy Electric Light, Power and Heating Company has taken down the old open series arc lights formerly used for street lighting and has replaced them with series tungstens, running eleven and twenty-two in series on the secondary of one hundred and ten volts and two hundred and eight volts, respectively. V.

NOBLESVILLE, IND.—It is reported that the hydraulic dam and electric generating plant just being completed, north of this city, has been sold by the Noblesville Hydraulic Company to the Indiana Union Traction Company, which will use the power to run its cars in addition to the sale and distribution of the current to cities and towns. S.

GRAHAM, N. C.—To develop a waterpower on Haw River, supplying power for the operation of a new cotton mill, the state has chartered the River Falls Cotton Mill Company, with $200,000 capital; J. W. Menefee, president and treasurer, and R. N. Cook,

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secretary. The company will build an extensive cotton mill plant and develop its own hydroelectric power. L.

WINONA, MINN.—Owing to the determination of the Winona Railway and Light Company to withdraw direct-current service an independent plant may be installed. C.

FERGUS FALLS, MINN.—The Otter Tail Power Company offers to furnish the city with electricity on a ten-year contract at two-and-one-half cents per kilowatt, two-and-one-fourth cents for the second 200,000 kilowatts, delivered at the city switchboard, provided the city will not engage in the business of furnishing power for ten years. C.

OGDEN, UTAH—The board of directors of the Davis and Weber Counties Canal Company has decided on the erection of a 5,000 horsepower plant on the Ritter farm, five miles south of Ogden. The company's canal will be cemented for a distance of nine-and-one-half miles and its reservoir in East Canyon will be enlarged by raising the dam thirty feet.

MUNCIE, IND.—C. E. Ruger, receiver for the Muncie Light Company, has filed his first report with the federal court, which shows a net earning of $86.05 during the month of August. The receipts for the month were $3,263.42 and the expenditures $3,117.37. The master in chancery recommends that the plant be sold to satisfy the mortgage indebtedness. S.

SOUTH BARRE, PA.—Work has commenced on the new power house for the Barre Wool Combing Company and completion is expected within two months. It will contain the most up-to-date equipment for generating electricity by which the mill is operated, and it is to be worked in conjunction with the valuable water privileges already partly developed.

ELECTRIC RAILWAYS.

(Special Correspondence.)

MANITOWOC, WIS.—Surveyors are working on the survey for an interurban line through Mishicott to Green Bay, for the Northwestern Hydro Company. C.

STEVENS POINT, WIS.—Appletree Barnes, of Waupaca, states that construction and grading on the electric line to Portage will be commenced this fall. C.

PITTSBURG, PA.—The New Castle plant of the Standard Steel Car Company will be rebuilt on a much larger scale for the purpose of engaging exclusively in the building of all-steel street cars.

SANTA BARBARA, CAL.—The City Council has passed an ordinance granting to the Pacific Improvement Company a franchise for the construction and operation of certain electric lines in the city.

GREENSBURG, IND.—Mayor Thompson, George Littell, William Flemming and others are promoting a traction line from this city to Batesville. The purpose is to ultimateiy extend the line to Cincinnati, O. S.

COLUMBUS, IND.—The Indianapolis, Columbus & Southern Traction Company has decided to purchase and string a "fournought" trolley wire between this city and Indianapolis, a distance of forty-one miles. S.

HARRISBURG, PA.—A charter has been issued to the Bedford, Fulton & Franklin Electric Railway Company to build a fifty-mile line between Bedford and Chambersburg, Pa. The road has a capital of $300,000. M. J. Murphy, of Pittsburg, is president.

MERRILL, WIS.—The Merrill Street Railway has completed the laying of new track over the entire system here. Much of the roadbed was reconstructed. Several new cars are to be purchased and the old ones are being repaired and painted. The improvements will cost about $15,000. M.

MADISON, IND.—The City Councils and Town Boards of this city, Hanover and other towns have granted franchises to the Cincinnati, Madison & Western Traction Company to operate cars through the streets. Work will be begun on this line as soon as the survey, which is well along, is completed. S.

LEBANON, PA.—A franchise has been granted the Ephrata & Lebanon Street Railway Company by the Lebanon City Council's passing finally the ordinance giving the company permission to establish a terminus in the heart of the business section of the city. Lebanon and Lancaster capitalists will provide the money.

SEATTLE, WASH.—Control of the United Railways Company and the Ruth Trust Company, of Portland, Ore., has changed as a result of the deal between J. H. Hurlbert, a capitalist of Fontanelle, Ia., and C. T. Dunbar, a capitalist and heavy timber owner of Vancouver, B. C., on the one hand, and Moritz Thomsen and W. D. Hoflus, of Seattle, and T. L. Greenough, of Missoula, on the other, Hulburt and Dunbar purchasing the five-ninths interest in both concerns held by the last three persons named. The purchase price was not made public, but it is known to lie between $2,500,000 and $5,000,000. The United Railways Company has an authorized capital of $3,000,000 and an authorized bond issue of $5,000,000. It at present operates a line of railway running west from Portland toward Forest Grove and Hillsboro, through which towns it is to be extended into a wonderfully rich section of the state.

HAGERSTOWN, MD.—At the annual meeting of the stockholders of the Washington County Railway Company the following directors were elected: J. Clarence Lane, Edward W. Mealey, John W. Stonebraker, of Hagerstown; Clinton E. Miller, of Weverton; Oscar G. Murray, W. H. Matthai, C. W. Woolford, of Baltimore.

HORNELLSVILLE, N. Y.—Papers have been filed with the secretary of state at Albany for the consolidation of the Hornellsville Electric Railway Company, the Hornellsville & Canisteo Railway Company and the Canisteo Valley Electric Railway Company into the Hornell Traction Company, capitalized at $120,000.

JANESVILLE, WIS.—The Chicago-Wisconsin Valley Railroad Company has been organized at Portage, Wis., to construct an electric road from here to Merrill, Wis., touching six county seats—Madison, Lodi, Briggsville, Friendship, Grand Rapids, Stevens Point, Wausau and Merrill. A. J. Behmeyer, Indianapolis, is secretary of the company. C.

COLLEGE STATION, TEX.—The people of Bryan are working up interest now in the proposed trolley line between Bryan and the A. and M. College of Texas. It is believed that such a line would pay well on the investment. The college is a community of itself, and except for the grocery store of W. C. Boyett & Son, all mercantile accommodations must be secured at Bryan.

DELPHI, IND.—E. W. Bowen, J. C. Smock and M. G. Haun, directors of the recently incorporated Delphi, Flora & Burlington Traction Company, have secured the services of Will R. White, of Monticello, to take active charge of the financing and construction of the road. The people are a unit for the road and the plan is to have cars running by the middle of the coming year. S.

FRANKFORT, IND.—Satisfactory progress is being made toward the construction of the Indianapolis, Frankfort & Logansport Traction Company's line between here and Michigantown. Material is being received for track laying and since the Clover Leaf Railroad has installed Streng gas-electric cars on its road between Frankfort and Marion it is rumored that this type of cars will be used by the interurban line now constructing. S.

DAYTON, O.—This city will soon have a fine new interurban terminal depot if plans now being considered by the various interurbans and the Chamber of Commerce do not miscarry. There are eight lines entering the city from different parts of the state, and nearly all have different terminal facilities. Representatives of the various roads, together with a committee from the Chamber of Commerce, have been considering the matter.

OTTAWA, ILL.—Another electric-railway proposition is arousing interest in this locality, and more particularly in Livingston County. The proposed new road is styled the "Corn Belt Line," and the route marked out, beginning at Chicago, will take in the following towns in the corn belt: Plainfield, Plattsville, Lisbon, Seneca, Ransom, Budd, Blackstone, Cornell, Streator, Flanagan, Gridley, El Paso, Kappa, Hudson, Herrick, Normal, Bloomington, Mackinaw and Peoria.

FOSTORIA, O.—Incorporation papers for the Fostoria and Fremont Railway Company have been issued at Columbus. The line will parallel the L. E. W. and will connect the Lake Shore Electric which will furnish the power and the Western Ohio, of which F. D. Carpenter is general manager, over the Fostoria, Findlay and Toledo. The proposition is fully financed, much of the right-of-way secured and Chief Engineer J. W. Riegel will begin within ten days and the grading will be done this fall. The offices will be in Fostoria.

NEW ALBANY, IND.—The Louisville, Blue River & French Lick Traction Company has filed articles of incorporation with the secretary of state. The capital stock of $10,000 will be increased in a short time. The company proposes to construct street and interurban railroads in and between New Albany and French Lick and the intervening towns of Mooresville, Galena, Greenville, Palmyra, Fredericksburg, Hardinsburg, Chambersburg, Paoli and West Baden. The directors are Jacob H. Fawcett, Chas. D. Kelso and Wallace A. Gadient. S.

ASHEVILLE, N. C.—At least $500,000 in bonds will be asked by the promoters of the Asheville and East Tennessee Railway (electric), $200,000 from Buncombe County, $100,000 from Asheville and $200,000 from Mitchell and Yancey counties, toward the completion of this projected electric highway from Weaverville to connect with the Carolina, Clinchfield & Ohio, to the east. The various counties and Asheville will hold elections if the proper petitions are presented to the authorities asking for them, and several have already promised to call such elections if necessary. The proposed line would handle both freight and passengers; in this same connection the Weaver Power Company

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has begun work on a new power plant near Marshall, on the French Broad River, where the river is bounded on either side by high mountains, making such a plant feasible. This company has an agreement with the Asheville and East Tennessee Company to supply power at reasonable rates. This new line will run about forty miles, at the lowest estimate, to Galax, in Mitchell County, to connect with the C., C. & O. Railroad, giving Asheville a direct connection with the Virginia coal fields, and those of West Virginia. L.

MARSHFIELD, ORE.—The Coos Bay Electric Railway Company has just been incorporated with a capital stock of $1,500,000. The incorporators are James H. Flanagan, W. S. Chandler and F. C. McCollom. Those connected with the movement say their plans are not sufficiently developed to make any statement of the purpose of the company. Mr. Flanagan is a local banker and Mr. Chandler is a San Franciscan interested extensively in Coos Bay. He was formerly receiver for the railway in this county purchased by the Southern Pacific.

NEW YORK, N. Y.—The maps and profiles for the first trolley line from Flushing through Whitestone to the central north shore sections of the Borough of Queens have been approved by the city and working permits have been issued to the New York and North Shore Traction Company. Ground was broken last week at Broadway, Prince and State streets for the roadbed. At this point connections will be made with the lines of the New York & Queens County Railroad, which will transport north shore passengers over the Queensboro Bridge to Manhattan.

TERRE HAUTE, IND.—The trial and argument in the suit by the city to oust the Terre Haute, Indianapolis & Eastern Traction Company from the streets have been completed and a decision is expected in ten days. The company has no franchise to operate interurban passenger and freight cars in the streets of Terre Haute and the traction officials complain of the city authorities exercising a passive attitude until after it had expended $4,500,000 in interurban lines and terminals and then hold it up for a big price for a new franchise. The case has been stoutly contested. S.

IOWA FALLS, IOWA—The City Council is considering the proposed electric-light and street-railway franchises which the Interstate Power Company is asking for a period of twenty-five years, and, if found acceptable in the ordinances submitted by the company, to issue a call for a special election for the people to vote on the granting of the two franchises. It is stated the company proposes to invest a half million dollars or more in a big waterpower plant here, and that among the details are a thirty-foot dam across the Iowa river a short distance below the Oak Street bridge. It is estimated the plant will develop between 2,500 and 3,000 horsepower.

BOONTON, N. J.—Permission to construct, maintain and operate a trolley line through certain streets here has been obtained by the Morris County Traction Company. The trolley line which the Morris County Traction Company is to construct must be finished and cars running by July, 1910. The committee, consisting of members of the Common Council and the Business Men's Association, appointed last June in regard to securing the right-of-way for the trolley between Boonton and Denville, reported that it had secured the right-of-way for most of the distance, but there were two or three exceptions that the trolley company would have to deal with directly.

INDIANAPOLIS, IND.—Further proposals for the completion of the Indianapolis, New Castle and Toledo Traction, for nearly two years under receivership, between here and New Castle, have been submitted to Judge Vinson Carter, of the Superior Court, showing that D. M. Parry, William M. Stevenson, Indianapolis; Eugene Bundy and Charles S. Hernly, New Castle, the original promoters, have become conditional purchasers of the claims against the company. They have made partial payment and agree to settle the remainder in 1910. The amount required to complete the road is $390,000, which it is proposed to raise by the sale of receiver's certificates for $460,000 at eighty-five cents on the dollar, payable in three years, bearing six per cent interest. The Union Trust Company, of Indianapolis, receiver, has agreed to buy the entire issue and it is likely that the completion of the road will be authorized at once.

PEORIA, ILL.—It is expected that within the next thirty days the Illinois Traction Company will have track laid in St. Louis, Mo., from Broadway and Salisbury Streets to Twelfth Street and Lucas Avenue. The big bridge is expected to be finished by the middle of December and with that the company will inaugurate through trains from this part of the state to St. Louis, putting on a sleeper service both ways. The improvements in St. Louis will cost $5,000,000. There will be a passenger station at Broadway and Salisbury Street, a passenger station at Ninth, Eleventh, Branch and Palm streets, a passenger station and freight depot at Twelfth, Thirteenth, Gay and Linden streets. Among the plans to be carried out is the building of a large passenger station near Broadway and Washington Street and the securing of the Clark syndicate lines crossing the downtown loop to use the same station, which will bring all the interurban lines to a central point. V.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

NAPOLEONVILLE, LA.—This city is going to rebuild its electric-light plant.

CLINTON, LA.—This city has voted $15,000 in bonds for an electric-light plant.

OLTON, TEX.—The Olton Independent Telephone Company has been incorporated.

FESTUS, MO.—This city will vote on a bond issue of $15,000 for an electric-light plant.

NEW IBERIA, LA.—This city is about to begin the construction of an electric-light plant.

McKINLEY, MINN.—Bonds for $5,000 for the construction of an electric-light plant have been voted.

BILLINGS, MONT.—J. B. Arnold and others are planning the building of an electric line to Laurel.

WILLS POINT, TEX.—The Wills Point Telephone Company has been incorporated, with a capital stock of $16,500.

CHARLESTON, OKLA.—The Home Rural Telephone Company has been incorporated by F. Z. Winchell and others.

LUBBOCK, TEX.—The Lubbock Light, Power and Ice Company has been incorporated, with a capital stock of $25,000.

AUBURN, CAL.—The Pacific Telephone and Telegraph Company will spend $35,000 in improving its system at this point.

SEATTLE, WASH.—The Oregon and Washington Long-Distance Telephone Company has been incorporated, with a capital of $1,500,000.

GILBERT, MINN.—The Mesaba Telephone Company, of Duluth, will install an exchange in the Dowling printing building on Broadway. C.

BELLINGHAM, WASH.—The Home Telephone Company, of Puget Sound, will expend $10,000 to $15,000 for improvements and betterments in this city. C.

SANTA CRUZ, CAL.—The Pacific Telephone and Telegraph Company will erect a three-story telephone exchange building in this city, at a cost of $100,000.

BADGER, MINN.—The Independent Telephone Company, H. S. Halverson, secretary, organized by farmers in the Pine Creek settlement, will extend the line to this village in the spring. C.

IRWIN, IOWA—H. Harmon will erect a building, 22x32, as a telephone office for the Farmers' Mutual Telephone Company. C.

MICHIGAN, N. D.—Work will shortly be started by the Michigan City Telephone Company on the construction of its line. Connections will be made with the Tri-State at Petersburg and the Sheyenne line at Mapes. C.

BANGOR, ME.—The Warren Telephone Company has been organized at Warren, for the purpose of conducting, operating and maintaining telephone lines. Officers: President, C. A. Webb, of Warren; treasurer, G. D. Gould, of Warren.

NEW HAVEN, CONN.—A special meeting of the Southern New England Telephone Company will be held November 1 at 2 p. m., to accept an amendment to the charter of the company permitting an increase in the directorate from nine to fifteen members.

SULLIVAN, IND.—The Sullivan Independent Telephone Company has purchased and taken over all the property and holdings of the Bell Telephone Company in this city and county and will combine the two systems. The consideration is reported to have been $100,000. S.

FORT WAYNE, IND—The Home Independent Telephone Company has made a number of contracts to install private branch exchanges on its system. The manufacturers and other concerns are realizing the advantages to be gained by having private branch exchange connections. S.

SAN FRANCISCO, CAL.—The Home Long-Distance Telephone Company has been incorporated in San Francisco, with a capital stock of $10,000,000, of which $300,000 is paid in by L. S. Beedy, A. S. Keeler, Jas. Lanagan, H. G. Holobird, A. Coxhead, Guy Knupp and J. E. O'Brien. The company plans stretching long-distance telephone lines from the northern to the southern boundaries of the state.

TOLEDO, OHIO—An amended bill was last week filed at Toledo in the United States Circuit Court, in the big telephone controversy which has been waged relentlessly for some time by the United States Telephone Company against the Central Union Telephone Company and the American Telegraph and Telephone Company. The amendment was filed by permission of Judge Taylor, who last May gave a decision against the plaintiff, on the ground that the telephone business was a simple one and that 99-year contracts could not be enforced. The new pleading sets up all the former argument, and in addition alleges that the

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business is more complicated than the express or railway business, both of which have made long-time contracts which were upheld by the courts.

ALBANY, N. Y.—The stockholders of the Independent Union Telephone Company, of this city, which controls the independent toll exchanges in this section here, authorized the directors to sell their assets and long-distance service. It is understood they will be purchased by a new company to be incorporated at an early date and which plans to control the long-distance service of all independent companies in the country.

WORCESTER, MASS.—The large new car manufacturing plant of Osgood Bradley & Sons will be built in Greendale. Approximately fifty-two acres of land situated on the Boston & Maine tracks between Brooks and Mountain streets have been conveyed to John E. Bradley. On this land Mr. Bradley will build one of the greatest car manufacturing plants in the East, and employ about 1,000 men. It means an expenditure of $500,000.

RICHMOND, VA.—An important announcement is made to the effect that the Atlantic Coast Line Railway will experiment with the telephone over a route from this city to Rocky Mount, N. C., the telephones to be used exclusively in the operation of trains. The Richmond, Fredericksburg & Potomac Railway is also said to be watching the experiment of the Coast Line, with a view to adopting such a system if feasible. This is perhaps the first attempt in North Carolina to operate trains by telephone. There will also be service between moving trains and all stations on the route. L.

DES MOINES, IOWA—The Iowa Telephone Company, by its vice-president and general manager, George E. McFarland, announces the purchase of the Mutual Telephone Company of Des Moines, by securing possession of the majority of stock held by Charles and Clyde E. Brenton, bankers, of Dallas Center, Iowa. The deal was negotiated by Casper E. Yost, president of the Nebraska Telephone Company, who owns a controlling interest in the Iowa Telephone Company. The price paid for the controlling interest only was $600,000. The value of all property owned by the Mutual company is $1,100,000. The company was capitalized at $1,600,000 in 1896.

INDIANAPOLIS, IND.—The Indianapolis and the New Telephone companies have brought suit against A. W. Hatch and the Federal Union Surety Company to recover $20,000 in damages. The suit grows out of the injunction proceedings brought by Hatch to enjoin the city from granting the companies a new franchise. The Surety Company furnished the bond for Hatch when several changes of venue were taken. The companies won and secured the franchise, but the cost of the litigation, appraisements, etc., cost complainants the sum they seek to recover. The attorneys for Hatch admitted that the Bell Telephone Company was back of the injunction suit. S.

ALBANY, N. Y.—The largest mortgage ever registered in Westchester County, if not in New York state, was turned over to Registrar Edward B. Kear in the Court House last week. The amount involved is $75,000,000 and the mortgage is given by the New York Telephone Company to the Farmers' Loan and Trust Company and John H. Parsons, of Montclair, N. J., as trustees. The mortgage covers many printed pages and is considered one of the most remarkable documents of its kind that has ever been filed in the Westchester County Registrar's office. The total amount of the mortgage tax which the New York Telephone Company will pay the state of New York is $125,000. The mortgage is registered in Westchester and New York counties simultaneously.

GRAND RAPIDS, MICH.—The stockholders of the Citizens' Telephone Company have authorized an increase in capitalization from $3,500,000 to $5,000,000. This is to provide for the expansion movement which has been carried on for years past, and which is being continued. The reports of Secretary E. B. Fisher and General Manager Tarte were received with favor by the stockholders. The former board of directors was returned and is: Charles F. Rood, Edward Fitzgerald, E. B. Fisher, W. J. Stuart, Philip Graham, John B. Martin, Cyrus E. Perkins, Robert D. Graham, J. B. Ware, L. J. Rindge and G. W. Perkins. The board of directors has re-elected the following officers: C. F. Rood, president; Edward Fitzgerald, vice-president; E. B. Fisher, secretary; W. J. Stuart, treasurer.

OBITUARY.

WILLIAM I. BUCHANAN, of Buffalo, N. Y., former American minister to the Argentine Republic and Panama, met a tragic death in London on October 17. Mr. Buchanan, who was in London on a mission for the United States government in connection with the Venezuelan claims, was at one time prominently connected with the General Electric and Westinghouse interests. He had held many important diplomatic posts, having been United States minister to the Argentine Republic and the first United States minister to Panama. While serving in the former capacity, Mr. Buchanan was instrumental in settling the boundary dispute between the Argentine Republic and Chile.

ELECTRICAL SECURITIES.

The tendency in the security market is somewhat inclined to be downwards on account of the tightness of money. Reiteration will not make this feature any more than the stereotyped habit at this time of year. Returns, however, from the leading electrical companies show that business is improving right along. Most of them are getting back to where they were, and many of them are doing a great deal better. Financial reports of industrial corporations will repay perusal.

The Chicago Railways Company's annual meeting will take place on October 28.

The Commonwealth Edison's net income for September was the largest in the company's history.

The New York Stock Exchange has received notice from the Philadelphia Company of the increase of $5,000,000 in its common stock.

The North Shore Electric Company, of Chicago, will issue $400,000 new stock to shareholders at par. Since organization in 1902 the capitalization has been increased from $1,000,000 to $4,000,000, improvements and extensions being capitalized instead of bonded. Samuel Insull is president of the company, which is controlled by the Commonwealth Edison interests.

The Boston Suburban Electric Companies will receive tenders of the stock for cancelation until 3 p. m. October 27 at the Boston Safe Deposit and Trust Company. The tenders will be opened October 28, and will be acted upon not later than 2 p. m. November 5. In a circular to the stockholders the treasurer says that the trustees are ready to expend cash to an amount not exceeding $600,000, and to issue notes of the trust to an aggregate amount not exceeding $2,000,000, for the acquisition of preferred and common shares upon terms deemed advantageous to the trust, the number of common shares acquired not to exceed the number of preferred shares. The notes will be four per cent ten-year coupon, dated December 1, 1909, with interest payable semi-annually.

The governing committee of the New York Stock Exchange has listed the following securities: United Railways Company of St. Louis, $1,500,000 additional first general mortgage four per cent bonds, due 1934; Michigan State Telephone Company, $300,000 additional first mortgage twenty-year five per cent bonds, due 1924; Westinghouse Electric and Manufacturing Company, $2,720,000 ten-year five per cent collateral notes, due 1917; Keystone Telephone Company, of Philadelphia, $1,045,000 additional first mortgage five per cent thirty-year bonds, due 1935.

The Central District Telegraph Company advises its stockholders that after October 15 and before November 15 stock of the Central District Company may be exchanged for shares of American Telephone, on the basis of fifteen shares of American for sixteen shares of Central District stock. The privilege of exchange will expire November 15.

DIVIDENDS.

Havana Electric Railway; quarterly dividends of $1 on the common and $1.50 on the preferred stock, payable November 13.

Michigan State Telephone Company; quarterly dividend of one-and-one-half per cent on its common stock, payable December 1 to stockholders of record November 15; also quarterly dividend of one-and-one-half per cent on its preferred stock, payable November 1 to stockholders of record October 18.

Milwaukee Electric Railway and Light Company; regular quarterly dividend of one-and-one-half per cent upon preferred capital stock, payable on November 1 to all stockholders of record at the close of business on October 20.

Minneapolis General Electric Company; dividend rate on the $1,500,000 common stock increased from four to six per cent and quarterly dividend of one-and-one-half per cent declared, payable November 1 to stockholders of record October 22.

Railways Company General; quarterly dividend of one per cent, payable November 1. This is the initial dividend on a regular dividend period basis.

The Rio de Janeiro Tramway, Light and Power Company; first quarterly dividend of one per cent, payable November 1.

NEW YORK.

	Oct. 18.	Oct. 11.
Allis-Chalmers common	14¾	14½
Allis-Chalmers preferred	83⅛	82½
Amalgamated Copper	*80	*80
American Tel. & Cable	142	142½
American Tel. & Tel.	78	78½
Brooklyn Rapid Transit	163½	164
General Electric	16½	15¼
Interborough-Metropolitan common	48⅝	47½
Interborough-Metropolitan preferred	128	128
Kings County Electric		
Mackay Companies (Postal Telegraph and Cables) common	92⅜	91⅝
Mackay Companies (Postal Telegraph and Cables) preferred	74	73
Manhattan Elevated	141	142
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	123½	123½
U. S. Steel common	91⅞	87⅛
U. S. Steel preferred	128⅝	127
Western Union	78	76½
Westinghouse common	86½	86
Westinghouse preferred	140	138

*Last price quoted.

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BOSTON.

	Oct. 18.	Oct. 11.
American Tel. & Tel.	142	142½
Edison Elec. Illuminating	248	252
General Electric	163½	164
Massachusetts Electric common	17½	17
Massachusetts Electric preferred	81	80½
New England Telephone	136	135
Western Tel. & Tel. common	10½	10¾
Western Tel. & Tel. preferred	88	89

PHILADELPHIA.

	Oct. 18.	Oct. 11.
American Railways	45¼	46
Electric Company of America	12½	12½
Electric Storage Battery common	59½	59½
Electric Storage Battery preferred	59½	59½
Philadelphia Electric	13¼	12½
Philadelphia Rapid Transit	28	28
Philadelphia Traction	88¾	90
Union Traction	53¼	53¼

CHICAGO.

	Oct. 18.	Oct. 11.
Chicago Railways, Series 1	106	108
Chicago Railways, Series 2	35½	36
Chicago Subway	7¾	5¼
Chicago Telephone	136	....
Commonwealth Edison	120	120
Metropolitan Elevated common	16	15½
Metropolitan Elevated preferred	52½	50½
National Carbon common	99	97
National Carbon preferred	118	118

PERSONAL MENTION.

MAYOR FRED A. BUSSE, of Chicago, Ill., has been making a practical study of the electrification of steam-railway terminals in New York city during the past ten days, having gone to New York for the purpose of verifying the various reports and figures submitted to him in Chicago.

L. G. KIBBE has resigned as treasurer of the Wheeler Condenser and Engineering Company, of Carteret, N. J., in order to take an active part in the management of the Warren Steam Pump Company, of Warren, Mass. Mr. Kibbe will be located at the head offices of the latter company at Warren.

HENRY MANSON BYLLESBY, who, as announced briefly in last week's issue, has been elected president of the Chicago Civic Federation and chairman of its executive committee, is one of the leading consulting engineers of the Central West. He was born in Pittsburg close to fifty years ago and is a graduate of the engineering courses at Lehigh University. His technical experience has been quite varied and has extended to the experimental, operating and manufacturing branches of the electrical industry as well as to strictly designing engineering. In the early days of the electric-lighting business he was associated with Thomas A. Edison. Later he was connected with the old Thomson-Houston Company and then with the Westinghouse Electric and Manufacturing Company, of which he was at one time vice-president. He also had considerable to do with the British Westinghouse Company. Several years ago he established the now well-known consulting engineering firm of H. M. Byllesby & Company, of which he is president. Mr. Byllesby is a member of the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Western Society of Engineers, and many other similar organizations, as well as civic bodies and clubs. As president of the Chicago Civic Federation he will direct into the most useful channels the great influence of this organization for the political and moral uplift of the city.

NEW PUBLICATIONS.

INDUSTRIAL PROGRESS—The monthly, "Industrial Progress," published in Milwaukee, Wis., for October contains a number of interesting articles, including "The New Steam Turbine Plant of the Linoleum Company," "An Electrically Driven Copper Mill," "The Treatment of Steel in Electric Furnaces," "Electricity in Steel Mills," etc.

MINES AND METHODS—A new monthly, called "Mines and Methods," has made its initial appearance with the September number. It is edited and published by Claude T. Rice, and the publication office is in the Tribune Building, Salt Lake City, Utah. This new paper has a number of very good articles descriptive of mining and smelting installations and methods in vogue in the great mining country of which Salt Lake City is the natural center. These articles are written by practical men, who have had actual experience in this work. A novel feature of this publication is that in its initial issue it carries no advertising whatever.

PAPERS BY PROF. C. A. ADAMS—A number of papers, of which Prof. Comfort A. Adams, of Harvard University, was author, or joint author, have been reprinted in convenient pamphlet form from the Proceedings of the American Institute of Electrical Engineers. These include the following: "Voltage Ratio in Synchronous Converters with Special Reference to the Split-Pole Converter," "Electromotive-Force Wave-Shape in Alternators," "Pole-Face Losses."

TERRESTRIAL MAGNETISM AND ATMOSPHERIC ELECTRICITY—The September number of the quarterly journal of "Terrestrial Magnetism and Atmospheric Electricity" contains a continuation of the article by Paul T. Passalskij on "The Distribution of Magnetism Over the Earth's Surface." Three very interesting and illustrated articles relating to the launching, departure and other features of the new magnetic survey ship "Carnegie" are also included.

CALIFORNIA JOURNAL OF TECHNOLOGY—The monthly publication of the students of the College of Applied Science at the University of California for the month of September contains an account of the work done by the summer school of engineering, articles on the "Strength of Compression Members," "Increased Size of Motive Power for Railroads," "Non-inflammable Substances," "The Relation of the Character of Coals to the Prevention of Smoke," and other interesting topics.

PUBLIC SCHOOL LECTURES, NEW YORK CITY—The Department of Education of the city of New York has issued in pamphlet form its announcement of public lectures that are to be given this season in about eighty lecture centers, located principally in the public schools in the boroughs of Manhattan and the Bronx. The subjects comprise a great many topics in literature, history, biography, economics and civil government, fine arts, astronomy, physics, electricity, chemistry, geology, biology and other sciences, various industries and descriptive geography.

INDUSTRIAL ITEMS.

THE SUNRAY ELECTRIC LAMP MANUFACTURING COMPANY, 109 West Forty-second Street, New York, N. Y., manufacturer of the well-known Sunray electric lamp, is distributing a booklet which reviews the history of the electric lamp, describes the Sunray lamps in detail and contains much valuable technical information regarding electric lamps in general.

THE NEW PROCESS RAW HIDE COMPANY, of Syracuse, N. Y., has prepared a catalogue describing its New Process noiseless pinions and the advantages resulting from their use. Among the good points that have been found by the many users of these pinions are the freedom from noise, excellent wearing qualities, reduction of vibration, and ability to mesh accurately with metal gears formerly used. These and other points have justified the company in speaking of these pinions as the ideal motor drive.

THE UNIVERSAL MANUFACTURING COMPANY, Chicago, Ill., manufacturer of the Universal flat-rate controller, held its annual meeting last week. A. C. Kraft was re-elected president of the company, and Thomas P. Evans was re-elected treasurer. F. Kirchhoff was elected vice-president, and William C. Gohde, secretary. The above gentlemen, with A. Pophal, J. L. Adams and Charles H. Menzel, constitute the board of directors. The Universal company is about to begin an active campaign to bring its controller to the attention of every possible user. The company anticipates a large business within the next few months. Its product has been adopted by a great many lighting companies all over the country.

THE KELMAN ELECTRIC AND MANUFACTURING COMPANY, Los Angeles, Cal., and PIERSON, ROEDING & COMPANY, San Francisco, have completed arrangements whereby the latter firm acquires the Pacific coast agency for the Kelman high-voltage oil switches and circuit-breakers. This company has branch offices in Los Angeles and Seattle, the latter office especially covering a large territory, which includes Oregon and Washington, as well as British Columbia and Alaska, and is particularly well qualified to handle this line, having already secured several large orders. In view of the extensive power developments now under way and projected, it is believed this arrangement has been made at an opportune time for increasing the sales of this well-known apparatus.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., had an attractive exhibit of its various types of storage batteries used in signal work at the annual convention of the Railway Signal Association, conspicuous among which was its 7-S "Exide" type, of which 40,000 are in use for automatic rock signal work on the Harriman lines, and its Missouri Pacific type of portable "Exide" batteries, consisting of five cells 7-SS installed in one box. Among the "Chloride" accumulator types, this company exhibited cells of D-5, complete in glass jars E-7, and their various couple types, BT, CT, ET and PT. The company was represented by Godfrey H. Atkin, manager of the Chicago office; H. H. Beck, operating engineer, Chicago, and R. I. Baird, of Chicago, and Chas. W. Terry, of Cleveland.

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DATES AHEAD.

Western Association of Electrical Inspectors. Annual meeting, Detroit, Mich., October 26, 27 and 28.

Illinois State Electric Association. Annual meeting at Alton, Ill., October 26, 27 and 28.

American Electrochemical Society. Next meeting, New York city, October 28-30.

National District Heating Association. First annual meeting, Columbus, Ohio, November 10 and 11.

Alabama Light and Traction Association. Annual convention, Birmingham, Ala., November 15 and 16.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 to 18.

Boston Electrical Show. Mechanics' Building, Boston, November 15-25.

Empire State Gas and Electric Association. Annual convention, New York city, November 17 and 18.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual meeting, Lima, Ohio, November 19 and 20.

International Independent Telephone Association. Annual convention, Chicago, December 7, 8 and 9.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) October 12, 1909.

936,283. DWARF RAILWAY SEMAPHORE-SIGNAL. Harry M. Abernethy, Cleveland, Ohio. Filed December 31, 1906. The semaphore blade is unlocked and moved in one direction, electrically, the blade being moved in the opposite direction by gravity.

936,284. FRICTION-CLUTCH ELECTRIC CONTROL. Harry M. Abernethy, Cleveland, Ohio. Filed April, 1908. A non-revoluble armature surrounding an independent shaft (alined with a revoluble shaft carrying a clutch member) is adapted to be attracted by a stationary magnet coil surrounding the clutch member.

936,292. INDUCTION-MOTOR. Sven R. Bergman, Lynn, Mass., assignor to General Electric Company. Filed March 22, 1909. The starting device for a squirrel-cage motor comprises means for varying the reactance of an end ring of the secondary winding.

936,304. TRANSMISSION OF ELECTRICAL POWER. Charles M. Chisholm, Marysville, New Brunswick, Canada. Filed January 9, 1908. Tuning forks at a transmission station are each caused to vibrate for a predetermined time period, and an electric circuit is controlled by a microphonic element common to all the forks and actuated by them, so as to influence a distant receiving apparatus having means tuned to a characteristic frequency.

936,305. ELECTRIC ARC LIGHT. Frederick P. Cobham, Jamestown, N. Y., assignor of one-third to Fred E. Windsor and one-third to Lewis Schmutz, Warren, Pa. Filed January 10, 1908. The magnet coil for actuating the movable carbon has within it a movable core piece comprising an inner casing of magnetic material and an outer casing of non-magnetic material, and between the creasings finely divided pieces of magnetic material.

936,325. MEANS FOR CONTROLLING THE MOVEMENT OF RAILWAY VEHICLES. John H. Just, Syracuse, N. Y. Filed February 3, 1908. A valve in the inlet passage for the motive fluid of the brake system is controlled by an electromagnet which in turn is operated from the road bed.

936,329. ELECTRICALLY-OPERATED AUTOMATIC SWITCH. William A. Lacke, Chicago, Ill. Filed May 29, 1908. Describes a form of compound electric switch.

936,340. TROLLEY-CLIP. John C. Michaelson, Charleston, W. Va. Filed July 2, 1908. Describes a clamp for trolley wires.

936,341. TROLLEY. George G. Miller, Baltimore, Md. Filed November 3, 1908. Has a device extending over the trolley wire to hold the trolley wheel in engagement therewith.

936,360. INDUCTION-MOTOR. Conway Robinson, Schenectady, N. Y., assignor to General Electric Company. Filed February 14, 1906. A starting switch for an induction motor and acting by the centrifugal force of a conducting fluid in a rotary casing operates by short-circuiting the rotor conductors.

936,370. HANGER FOR WIRES. Frank L. Sessions, Columbus, Ohio, assignor to the Jeffrey Manufacturing Company. Filed July 17, 1902. Describes an insulating hanger for electric wires or the like.

936,373. SELECTIVE RINGING-KEY. Charles A. Simpson, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company. Filed June 8, 1905. Describes a form of selective calling device for telephone switchboards.

936,374. TELEPHONE TRUNKING SYSTEM. Charles A. Simpson, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company. Filed March 18, 1907. A trunk for connecting telephone lines of different switchboards terminates in a plug and a jack at each end. Associated with the plug at each end is a signal and means are provided for displaying one of the signals whenever a connection is established with the jack at its end of the trunk.

936,379. ADJUSTABLE LAMP-BRACKET. Charles E. Stevens, South Bend, Ind., assignor of one-third to George W. Loughman and one-third to James H. Loughman, South Bend, Ind. Filed March 5, 1909. The normally vertical standard consists in effect of a number of ball-and-socket joints held in contact by a spring, so that it may be bent into any convenient position and remain so.

936,403. PROCESS OF MAKING FILAMENTS FOR ELECTRIC INCANDESCENT LAMPS. Werner von Bolton, Charlottenburg, Germany, assignor to Siemens & Halske, A. G., Berlin, Germany. Filed October 2, 1906. Refractory metal powder is inserted into a tube of ductile material and the tube is then worked into filamentary form. Finally the tube is removed.

936,405. WIRELESS RAILWAY SIGNAL SYSTEM. Edward R. Brodton, Mobile, Ala., assignor of thirteen-thirtieths to George H. Fonde and thirteen-thirtieths to Ernest E. Wagar, Mobile, Ala. Filed June 29, 1908. Groups of two or more overlapping trains of electric waves operate respective receivers which in turn control circuits inter-related to each other.

936,421. SHADE-HOLDER. John H. Dale, New York, N. Y. Filed August 26, 1908. The frusto-conical shade for an electric lamp is gripped at its upper (smaller) end by the spring tongue sections (constricted by a spring wire) of the holder.

936,432. TELEPHONE. Henry Eccles, Laclede, Mo., assignor to Samuel L. Van Akin, Jr., Syracuse, N. Y. Filed March 21, 1907. Describes a form of stand for a telephone transmitter and receiver.

936,443. TRAIN-CONTROLLING MECHANISM. Orlando Gibson, Hollidaysburg, Pa., assignor of one-fourth to C. H. Glazier, Huntingdon, Pa., fifty-five one-hundredths to C. E. Foster, Pittsburg, Pa., and twenty one-hundredths to William S. Taylor, Huntingdon, Pa. Filed April 5, 1909. A lever on the train for applying the air brakes can be tripped by an electrically operated device in the track.

936,463. CLUSTER LAMP-SOCKET. Herman J. S. Lewis, New York, N. Y., assignor to John H. Dale, New York, N. Y. Filed May 27, 1908. A transversely divided insulating ring, with threaded shells secured thereto, is provided with means between its sections affording center contacts around the outside periphery of the ring.

936,472. MECHANICAL ARRANGEMENT FOR ELECTROPLATING OBJECTS. Wilhelm Pfanhhauser, Leipzig, Germany. Filed June 18, 1909. The electrolyte is applied to the material by a mechanism connected with one pole of a circuit and connected with the other pole are means for moving the material with respect to the mechanism.

936,488. SYSTEM AND DEVICE FOR INDICATING TRAIN MANIPULATION. Lewis B. Stillwell, Lakewood, N. J. Filed February 3, 1906. A device indicates the time occupied in braking the (electric) train, and a switch automatically actuating this device is closed by the air operating the air-brake mechanism.

936,490. TELEGRAPHONE. Harve R. Stuart, Wheeling, W. Va., assignor to American Telegraphone Company, a corporation of the District of Columbia. Filed March 21, 1908. Two magnets simultaneously move relatively to the recording disk, on the same side of it but on opposite sides of its center, one magnet from a position on the disk of high speed toward a position of low speed, and the other vice versa.

936,495. TELEPHONE SYSTEM. Frank C. Unger, St. Louis, Mo. Filed October 22, 1908. "Central" is notified by means (under the control of a subscriber) causing a circuit to pass through an alternating-current ringing machine and line drop.

936,499. ASEPTIC DEFLECTOR-LAMP. George C. Werner, New York, N. Y. Filed April 11, 1907. A long narrow battery in a suitable casing is connected by wires to a holder having an

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electric lamp at one end and containing a rheostat operated by a revolvable plug.

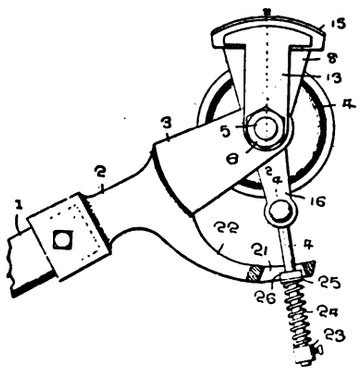
936,503. MAGNETIC REGULATOR FOR AUDIPHONE-RECEIVERS. Charles E. Williams, Natick, Mass. Filed January 4, 1908. An audiphone receiver is regulated by moving a soft iron screw toward or away from the other core of the electromagnet which co-operates with the diaphragm of the receiver.

936,507. SPARK-PLUG. James C. Anderson, Washington, D. C. Filed March 20, 1909. The plug has a central movable electrode and the other electrode is comprised of the inner end of the shell which is turned in at an angle to its axis.

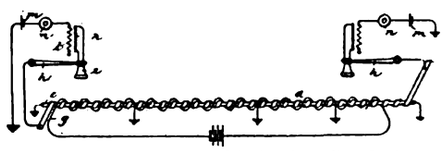
936,512. CLUSTER LAMP-SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company. Filed April 14, 1904. The bowl-shaped metallic casing has circularly arranged openings and encloses the electrical conducting parts of the cluster.

936,518. TURN-KEY FOR LIGHT-FIXTURES. Robert M. Bryce, Indianapolis, Ind. Filed December 31, 1907. The clasp member is formed of a strip of thin metal bent into shape to furnish engaging side walls.

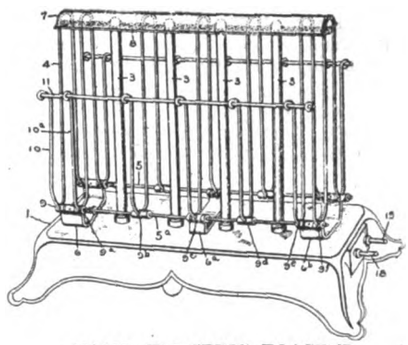
936,530. PERMANENT MAGNETIC METAL. Samuel E. Gertler, New York, N. Y., assignor to Charles F. Splitdorf, New York, N. Y. Filed March 9, 1909. Comprises tungsten (5.25 per cent), carbon (0.65 per cent), silicon (0.15), manganese (0.25), chromium (0.20), sulphur and phosphorus (0.02 per cent or less), aluminum (2.50), and the rest iron.



936,341—TROLLEY.



936,538—CIRCUIT FOR PROPAGATING WAVE-FORMS.



936,597—ELECTRIC TOASTER.

936,538. CIRCUIT FOR PROPAGATING WAVE-FORMS. Dugald C. Jackson, Madison, Wis. Filed September 23, 1901. A wave-conducting circuit comprises a conductor and a magnetic core about which the latter is disposed to produce inductance to counteract capacity. The core is included in the circuit and means are provided to increase the inductance.

936,556. ELECTRIC LAUNDRY-IRON. Harry C. Newman, Los Angeles, Cal., assignor of fifty-one one-hundredths to J. J. Jenkins, Los Angeles, Cal. Filed July 20, 1908. The heating element comprises a coiled wire with suitable coil spacers.

936,564. TIMER FOR IGNITERS OR SPARKERS. Harrry Rose, Three Rivers, Mich., assignor to Sheffield Car Company, Three Rivers, Mich. Filed June 18, 1908. The operating shaft carries a brush holder within a contact holder.

936,577. ELECTRICAL CONTROLLING MEANS FOR PLANERS AND OTHER MACHINES. Abram P. Steckel, New York, N. Y. Filed February 10, 1909. Electrical means are provided for controlling a motor and also transmission devices operated by the motor but oppositely to it.

936,578. ELECTRIC CIRCUIT INTERRUPTER. Harve R. Stuart, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 24, 1906. The air gap between core members is adjustable.

936,584. ELECTRIC CIRCUIT CONTROLLER AND INTERRUPTER. Curtis A. Tucker, Edgewood Park, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 3, 1906. The movable contact member of a double-throw switch is automatically returned to mid position under predetermined conditions by a pair of pivoted, spring-connected dogs.

936,594. ELECTRIC CIRCUIT-BREAKER. Christian Aalborg, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed May 2, 1906. A bracket pivoted to a movable flexible contact-member engaging with stationary circuit terminals, may be adjusted and fixed in position with reference to the contact-member.

936,597. ELECTRIC TOASTER. William S. Andrews, Schenectady, N. Y., assignor to General Electric Company. Filed November 21, 1908. A number of heaters operating at a radiant heat are surrounded by an openwork support for the material to be toasted.

936,601. SWITCH. Clarence Carson, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed December 27, 1906. Describes a form of pendant switch.

936,615. ALTERNATING-CURRENT MOTOR. Friedrich Eichberg, Berlin, Germany, assignor to General Electric Company. Filed April 19, 1907. Has two sets of brushes displaced at an angle of ninety degrees, the first set for short-circuiting the rotor winding on the line of magnetization of the inducing winding (on the stator), connections for impressing a constant voltage on the rotor winding between one brush of the second set and the short-circuiting brush, and means for supplying to the rotor winding through another brush of the second set and the short-circuiting brushes a current proportional to the current in the inducing winding.

936,622. COIL-SUPPORT. Israel L. Griffith, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 10, 1908. A coil support for electrical apparatus has an L-shaped body member, a removable side member and clamping bolt through corresponding ends of these members.

936,639. MOLDING FOR ELECTRIC WIRING. William H. G. Kirkpatrick, Philadelphia, Pa. Filed October 27, 1908. A longitudinal wire-receiving groove has at intervals retaining portions for the wire, projecting within it.

936,648. ROCKING SOLENOID-SWITCH. Albert T. Marshall, Hartford, Conn., assignor to the Automatic Refrigerating Company. Filed October 1, 1908. Each of two circuits, controlled by a thermostat arm, energizes the solenoid to shift the solenoid core to either side.

936,656. ELECTRICAL DISCHARGE APPARATUS. Newitt J. Neall, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 24, 1906. A block composed of electrical conducting bodies has individual coatings of insulating material and is bound together by other insulating material in which they are embedded.

936,666. SWITCHING DEVICE. Otto Rennert, London, England. Filed January 12, 1903. Two circuits in parallel, with conductors common to both and connected to a battery (included in one of these conductors being a manually operated circuit-closing device), are associated with a bell and annunciator magnet, the latter coacting with an armature lever arranged to hold a switch lever in one position to close contact springs, etc.

936,669. ELECTRICAL COIL. Maurice C. Rypinski, Pittsburg, Pa., assigner, by mesne assignments, to Westinghouse Electric and Manufacturing Company. Filed November 18, 1907. Two disks at one end of a cylindrical coil of wire have radial slits and projections at the sides of the slits for connecting to terminals of the coil and to an external circuit.

936,682. MOTOR-CYCLE RAILWAY SYSTEM. James N. Vandegrift, Bryn Mawr, Pa. Filed March 9, 1905. The device described has an armature and a surrounding field comprising an outer field-magnet-supporting portion, an end integral therewith and an end separable therefrom, the line of separation being waved.

936,684. RECEIVING SYSTEM FOR HIGH-FREQUENCY ELECTRICAL OSCILLATIONS. Frederick K. Vreeland, Montclair, N. J., assignor to Wireless Telegraph Exploitation Company. Filed November 4, 1905. Dissimilar coils are wound in close inductive relation and connected in parallel and in the same sense in a circuit traversed by the oscillations, a support for the coils permits their relative movement, and a diaphragm effected by such relative movement of the coils produces audible signals.

936,692. COMMUTATOR-BRUSH. Vincent G. Apple, Dayton, Ohio. Filed July 7, 1906. Carbon blocks, crenelated on one side to fit together, are joined together on opposite sides of a thin metal separating strip of similar crenelated outline to form a composite block of rectangular section.

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936,724. ELECTROMAGNETIC SWITCH. John D. Ihlder, New York, N. Y., assignor to Otis Elevator Company. Filed October 11, 1907. Comprises an electromagnet, switch arms, stationary contacts, a combined lock and pivot shaft for the switch arms, and a locking key for the stationary contacts.

936,775. ELECTRIC SWITCH. Harold D. Grinnell, New Bedford, Mass. Original application filed March 21, 1908. Divided and this application filed March 23, 1909. An internal gear-wheel fixed on the switchboard comprises alternately insulated and contact-making sections, and a manually controlled switch shaft has on it an arm carrying a pinion in mesh with the gear-wheel.

936,840. ELECTRIC INSULATOR. John A. Wells, Detroit, Mich. Filed April 12, 1909. An annular insulating joint has a flange member at one extremity.

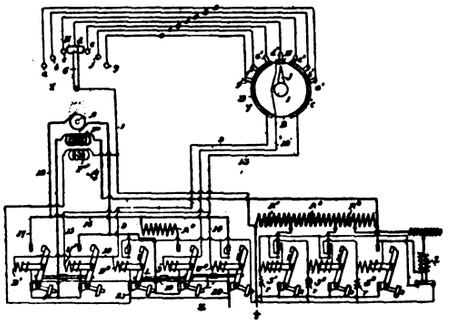
936,847. COMBINATION HARNESS AND WARP STOP-MOTION. Henry Anner and Michael J. Marnel, Phillipsburg, N. J. Filed December 19, 1908. Describes an electric stop-motion for looms.

936,849. PRINTING-TELEGRAPH. John C. Barclay, New York, N. Y. Filed April 3, 1907. Character members operating printing means are controlled by selector bars provided with electromagnetic restoring means.

936,869. ELECTRIC-LIGHT BRACKET. Ernest I. Drent, New Orleans, La. Filed February 20, 1909. A bulb socket is mounted between the spaced extensions of the body.

936,870. ELECTRICAL DRILL. William O. Duntley, Chicago, Ill., and Henry J. Kimman, Cleveland, Ohio, assignors to Chicago Pneumatic Tool Company. Filed May 3, 1905. An electric motor operates the drill through a planetary gear.

936,871. METHOD OF PREPARING MOLDS FOR ELECTROTYPES. George E. Dunton, New York, N. Y. Filed March 3, 1909. The formed, cooled mold has its surface first shaved, and then polished with a heated device.



936,878—AUTOMATIC CONTROLLER.

936,878. AUTOMATIC CONTROLLER. Frederick R. Fishback, Cleveland, Ohio, assignor to the Electric Controller and Manufacturing Company. Filed January 23, 1909. An electric motor drives a switch member having a series of fixed contacts co-operating with it, and a setting switch has fixed contacts corresponding to the first-named fixed contacts. A braking switch is provided for connecting the motor armature in a closed braking circuit, and a contact on the setting switch for governing the braking switch.

936,914. ELECTRIC ALARM FOR INCUBATORS. Charles L. Kulp, Sunbury, Pa., assignor of one-third to David Howerter, Sunbury, Pa. Filed March 3, 1909. A battery and alarm in an electric circuit are associated with a trip arm and contact block, the trip arm being located in the path of a damper-controlling lever.

936,948. SHOE-BRUSHING MACHINE. George E. Russell, Long-beach, Cal. Filed October 21, 1908. An electric motor drives the brush through a flexible shaft.

936,950. CHRONOMETRIC ELECTRICAL SWITCH. Joseph L. Scheuble, St. Louis, Mo. Filed April 16, 1909. Comprises a motor-driven rotary clamp engaging the key of a rotary snap-switch, and a rotary contact-arm (revolved by a clock movement) provided at its extremity with a U-shaped contact spring which contacts with an adjustable contact post (seated at the base of one of the ratchets on a dial mounted on the clock movement) to close the motor circuit.

936,952. CONTROLLER FOR ELECTRIC MOTORS. Oscar F. Shepard, Jr., Cincinnati, Ohio, assignor to the Warner Elevator Manufacturing Company. Filed January 15, 1906. The controller comprises resistance sections having circuit connections, magnetic devices insertable in a circuit of the motor to be controlled and controlling the circuit connections of the respective resistance sections, and a number of retarding means, one for each of the magnetic devices, for timing the operation thereof.

936,993. ELECTRIC WATER-PURIFIER. Mathew R. Frei, Kansas City, Mo. Filed May 1, 1909. An electrolyzing chamber with suitable electrodes is associated with a water filter.

937,018. SYSTEM OF ELECTRICAL DISTRIBUTION. Frank G. Beetem, Philadelphia, Pa., assignor to the Electric Storage Battery Company. Filed February 12, 1908. In combination an electric circuit is a storage battery in operative relation thereto, also an armature having an appropriate commutator and field structure, two sets of brushes bearing upon the commutator whereof one set is electrically interconnected and the other set is provided with connections for controlling the current from the storage battery, a winding on the field structure adapted to produce a magnetic field and an electromotive-force across the interconnected brushes, and a regulator for controlling the current in the winding and arranged to respond positively to the load on the circuit.

937,032. PRINTING-TELEGRAPH. John C. Barclay, New York, N. Y. Filed September 21, 1908. A telegraph printer comprises a rotary type wheel, rotating and controlling means for this comprising an escapement wheel in mechanical driving connection with the type wheel, an escapement anchor and a magnet for operating the same, a movable carriage, a carriage escapement controlling motion thereof and comprising a controlling magnet, and control means for the magnets adapted for complete operation by current alternations of one strength.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired October 18, 1909:

484,386. ELECTRIC FIRE ALARM. Joaquin J. D'Almeida and Jose Y. Da Silva, Lisbon, Portugal.

484,416. APPARATUS FOR REFINING METALS BY ELECTRICITY. Charles R. Fletcher, Boston, Mass.

484,449. LANTERN FOR ELECTRIC LIGHTING. Daniel S. Page, Malden, Mass., and Joseph L. Bertsch, Cambridge, Mass.

484,450. ELECTRIC LIGHT FIXTURE. Daniel S. Page, Malden, Mass.

484,466. LIGHTNING ARRESTER. Lewis Searing, Denver, Colo.

484,479. ELECTRIC LIGHTING SYSTEM. Barton B. Ward, New York, N.. Y.

484,522. ELECTRODE FOR MEDICINAL PURPOSES. Edward H. McBride, Springfield, Mo.

484,530. ELECTRIC ARC LAMP. Carl Coerper, Coeln, Germany.

484,532. ELECTRICAL CURLING-IRON. Andrew D. Gardner, Lynn, Mass.

484,535. APPARATUS FOR ELECTROPLATING. Frank H. Howard, Irvington, N. J.

484,543 and 484,544. ELECTRICAL INDUCTORIUM. Lazarus S. M. Pyke and Edward S. Harris, London, England.

484,545. ELECTRIC FUSE BOX. William Stanley, Jr., and John H. Kelman, Pittsfield, Mass.

484,549. SYSTEM OF ELECTRICAL DISTRIBUTION. De Witt B. Brace, Lincoln, Neb.

484,553. ELECTRODE AND INCANDESCENT ELECTRICAL CONDUCTOR. Lewis L. Jones, Brooklyn, N. Y.

484,565. MAST ARM FOR ELECTRIC LIGHT POLES. Alonzo B. Allison and Gabriel B. Scott, Pittsburg, Pa.

484,611. REGULATOR FOR DYNAMO-ELECTRIC MACHINES. Charles E. Scribner, Chicago, Ill.

484,612. MULTIPLE-SWITCHBOARD SYSTEM. Charles E. Scribner, Chicago, Ill.

484,613. SUBSTATION APPARATUS FOR TELEPHONE SYSTEMS. Charles E. Scribner, Chicago, Ill.

484,614. ELECTRICAL RAILWAY SIGNAL. Benjamin C. Seaton, Nashville, Tenn.

484,618. ELECTRIC APPLIANCE FOR CANES. Stephen D. Smith, Milwaukee, Wis.

484,626. TELEPHONE-EXCHANGE APPARATUS. John J. Carty, New York, N. Y.

484,637. APPARATUS FOR ANNEALING WIRE OR METALLIC RODS BY ELECTRICITY. Joseph H. Hunter, Pittsburg, Pa.

484,724. ELECTRIC MOTOR OR DYNAMO. Albert W. Smith, San Francisco, Cal.

484,762. ELECTRIC BELL. John E. Thron, Philadelphia, Pa.

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CONTENTS.

EDITORIAL:
Central-Station Economies ... 819
Electricity in Mines ... 820
The Story of an Electric Plant ... 821
Chicago Electric Club ... 822
Live-Wire Hazard in Indiana ... 823
Annual Meeting of the Sons of Jove ... 823
Joint Meeting of Sections of the American Institute of Electrical Engineers and Western Society of Engineers ... 823
Illinois Central Railroad Again Balks at Electrification ... 824
Mr. Insull at the Chicago Press Club ... 824
Electrical Exports for August ... 825
New York Electrical Show Entertainments ... 825
Navy Department Supplies ... 825
Economy Light and Power Company Decision ... 825
Newly Elected Associates and Members of the American Institute of Electrical Engineers ... 826
Meeting of the Technical Publicity Association ... 827
Standardization of Electrical Equipment in Mines ... 828
Wisconsin Supreme Court Decides Exceptional Telephone Case ... 828
Fulton Light and Power Company is Awarded $299,000 ... 828
Peat and the Fuel Question ... 829
The Spark Test for Steel ... 831
Use of Rowland Printing Telegraph Machines Temporarily Discontinued ... 837
CENTRAL-STATION PRACTICE:
Central-Station Economies ... 832
Architects' Wiring Specifications ... 834
Buying Coal on a Heat-Unit Basis ... 835
McCall Ferry Power Company ... 835
ELECTRICAL ADVERTISING AND SELLING:
Advertising, Direct and Indirect ... 836
A Large Telephone Merger Rumored ... 837
The New Telephone Newspaper ... 837
TELEGRAPHY, TELEPHONY AND WIRELESS:
The Bellini and Tosi Directional Wireless System; the New Experiments ... 838
Proposed Wireless Across the Russian Empire ... 841
Restricted Telephone Development in Great Britain ... 841
ELECTRIC TRACTION:
First Trackless-Trolley Car Around London ... 842
New York City Interborough ... 844
Electrical Facilities for Getting Perishable Freight to Market ... 844
INDUSTRIAL POWER:
Installation, Operation, Care and Repair of Electric Motors in Industrial Operations ... 845
Direct Electrical Operation of Large Wood-Pulp Grinders ... 846
"Hydroelectrics" in Switzerland ... 847
BOOK REVIEWS ... 848
To Care for Chicago Subway ... 849
FINANCIAL REPORTS OF ELECTRICAL COMPANIES ... 850
INDUSTRIAL SECTION:
Tungsten Shock Absorber ... 852
Speer Carbon Exhibit at Denver ... 852
The Wrigley Toggle Bolt ... 852
Special Hydraulic Valves ... 853
An Improved Line of Pocket Meters ... 853
Mill Motors ... 854
The Paragon Ground Cone ... 855
The Adaptable Lamp Changer ... 856
CURRENT ELECTRICAL NEWS ... 857
RECORD OF ELECTRICAL PATENTS ... 864

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CENTRAL-STATION ECONOMIES.

There is no branch of the electrical industry that is not interested in the production of cheap electrical energy. Cheap electric supply means the extension of electric service in a great many channels where low energy cost is of almost as much importance as the great inherent convenience, safety and other advantages attendant on the use of electricity. The further popularizing of electricity, with its greatly extended use in all lines of industrial and domestic activity, means increased business for the manufacturer of electrical appliances and machinery, the central-station producer of the current, as well as electrical engineers and all others interested in electrical matters.

Among the electrical and mechanical engineers associated with the central-station industry of this country there are few as competent to pass on the subject of central-station economies as Mr. W. L. Abbott, of the Commonwealth Edison Company, of Chicago. A paper which he presented a few days ago at a joint meeting of electrical engineers in Chicago is given in abstract on other pages of this issue. It is worth calling attention to some of the points that Mr. Abbott brings up.

It is recognized in most industrial lines that the utmost economy can be attained by any manufacturing company when it produces its own raw materials and makes the utmost possible use of the entire by-products in its manufacture. An excellent illustration of this is in the packing industry as conducted by the larger concerns. Mr. Abbott points out that by the control of some coal mines and coal-carrying railroads, or by the friendly co-operation with corporations so engaged, a large central station may achieve material reduction in the cost of its raw material, and at the same time would be assured of an abundant supply. The importance of reducing fixed charges is now becoming fully realized as the chief way by which the cost of electric current can be materially reduced. There is no innovation in the generating equipment during the past years that has had a greater bearing on the reduction of fixed charges, increase in efficiency and increase in the size of units and of plants as the steam turbine.

Another matter that should receive greater attention is the utilization of the latent heat of the exhaust steam. This is a by-product for which a ready market exists and which should be made a decided revenue producer. Near the business centers of our large communities it should be possible to erect central stations, the exhaust steam from which could be used advan-

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tageously for heating the office buildings, stores, hotels, etc., which form such a large proportion of the central-station load, and which, if they would be provided with heat as well as light and power, would become almost without exception central-station customers. A plant so located, of course, is one more expensive, both in maintenance and in initial cost, than one located without regard to nearness to the great bulk of the load. But, on the other hand, the large revenue possible from a well-equipped central-station heating system would very likely more than offset this extra burden, and, moreover, would result in a vast increase in the central-station load.

ELECTRICITY IN MINES.

The question of the use of electricity in mines is at present receiving much attention, both in the United States and in England, especially in the latter country. At the recent Goldfield meeting of the American Mining Congress, a preliminary report was presented dealing with the standardization of electrical equipment in mines, although up to the present but little progress has been made in this work beyond forming a tentative programme or outline of the methods to be employed in finding the necessary data upon which to begin. In England the issue is a very live one. A new society has recently been formed with the name and title of The Institution of Mining Electrical Engineers, and our bright and enterprising contemporary, *Electrical Engineering,* of London, has decided to publish every month a special supplement devoted to the application of electricity in mines.

The reactionaries have also been busy in England and a violent agitation to abolish completely the use of electricity in coal mines has made considerable headway among the miners. Though much of this adverse attitude is due to the natural conservatism of the insular north-countrymen, who as practical miners are equaled by few and excelled by none, yet the pugnacious antagonism that has recently developed has been due largely to the recent disasters in fiery mines, attributed and perhaps largely due to defective electrical installations in the mines where the accidents have occurred. The explosion at the West Stanley mine brought matters to a head, and at a recent meeting of the Durham Miners' Association a resolution was brought forward which called for the removal of electrical apparatus, and presumably the complete electrical installation in each case, from mines, inasmuch as it was considered a source of great danger. This resolution was shelved, however, on the understanding that the matter be considered by a select committee. A similar resolution was also considered at the Newcastle meeting of the Miners' Federation of Great Britain.

There is no doubt that if such resolutions were adopted, the progress of electrical development in mines would be materially arrested for many years. It is therefore the duty of electrical men to establish confidence in electricity for mine use, and to do something quickly to stop the panic which seems to be taking hold of the miners in regard to their attitude toward electrical installations.

The chief, if not the only, causes of accidents in mines attributed to the use of electricity (although many of these were undoubtedly due to other causes) are: (1) Defective installations; (2) neglect of continuous inspection; (3) lack of education among the operatives; (4) inefficient and unskillful attendance of the electrical installations.

There are now so many excellent examples of well-equipped and operated electrical installations in mines that the advisability of the continued use of electricity in mines is absolutely beyond question to anybody but the most hide-bound partisan of the older, antiquated, and, one might say, obsolescent methods so strongly advocated by the ignorant and uninformed. Compressed air, of course, has its advantages in certain cases, as in remote and poorly ventilated headings, but even here the advantage of electricity for driving the pneumatic tools is obvious, and for haulage and lighting, the convenience, utility and economy of electricity are unquestionable. These points are, however, usually conceded, the opposition chiefly centering on the dangers involved, of shock to the workmen and of the chance of sparking or arcing setting fire to the inflammable gases or coal dust present in the air.

Most modern electrically equipped colliery plants in England use the three-phase system, which, for many reasons, is considered to be superior to direct-current installations. The danger from shock in this system is greater than with direct current, and one point to be decided upon by mining electrical engineers is a method to render the three-phase system as safe as possible from leakages. In a paper read before the (British) Institution of Mining Engineers last month, Robert Nelson, electrical inspector of mines in Great Britain, strongly recommended earthing the neutral on three-phase installations in mines, as a result of careful and prolonged investigation on this point. This recommendation, by the way, is not approved by all mining electrical engineers, although the majority seem to be in favor of it. Many representative electrical men consider that armored cables continuously bonded and effectively earthed should be used in mines, and yet again other competent men affirm that in certain cases they would not hesitate to adopt a diametrically opposite policy.

One of the points mentioned above cannot be too strongly emphasized—the necessity of experienced supervision. Each colliery should have at least one competent, and therefore well-paid, electrical engineer in charge of the electrical equipment. Cases of workmen fixing conduit with nails driven through the protective covering—and these have actually occurred—would then become impossible. It is absurd and even criminal to put an expensive and more or less intricate installation under the care of a handy man or an electric bellhanger, and such a misguided policy will undoubtedly prove expensive and disastrous in the long run. Safety in coal mines is the price of eternal vigilance, and continuous and efficient inspection must be regarded as an indispensability, and in the end will prove the cheapest and most satisfactory policy.

In conclusion it is encouraging to note the efforts that

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are being made in England and in this country toward a satisfactory solution of the problem, and it is to be hoped that the researches of the committee about to be appointed by the British Home Office to consider the existing regulations regarding the use of electricity in mines, not to mention the contemporaneous labors of the Institution of Mining Electrical Engineers in England and of the American Mining Congress in the United States, will result in some definite and standard advices regarding the safe use of electricity in mines.

THE STORY OF AN ELECTRIC PLANT.

Progresstown was first supplied with electric light and power in 1890, by a plant consisting of two fifty-lamp arc dynamos, two alternators rated at 650 lamps of sixteen candlepower each, and a fifty-horsepower, 500-volt machine.

This electric generating equipment was driven by two simple non-condensing steam engines of 190-horsepower total rating, piped to a pair of 125-horsepower fire-tube boilers.

Today, nineteen years after it was started, the electric plant in Progresstown includes four alternators of 750 kilowatts total capacity, driven by compound engines of 960 and boilers of 600 horsepower.

During this period the effort to keep pace with the electrical art has resulted in many changes in the equipment of this generating plant, and the record of these changes is a striking illustration of the depreciation incident to electrical supply.

In 1890, the lamps were of the open type, and the alternators that did the incandescent lighting were single-phase, 1,000-volt, 125-cycle machines. As the commercial load grew, it was necessary to have more capacity for this service, and so a seventy-kilowatt alternator of the same type as the first was added, two years after the plant started. This increase of load was more than the steam plant could carry, and so a sixty-horsepower simple engine was installed to even matters up.

Meanwhile, the coal bill demanded more consideration than had been given to it at first, and then, too, the entire engine plant was not large enough for all the dynamos when fully loaded. The problem was solved in the following year by erecting a pair of compound steam engines rated at 250 horsepower each, so as to do away with the simple engines.

In 1894, the street-lighting and commercial service demanded more arc lamps, and the only thing to do at that date was to add another arc dynamo, so a new fifty-light machine was installed. All went well for the next two years, but then it appeared that the commercial load of incandescent lamps had again caught up with the generator capacity, so that a new alternator was needed.

Sixty-cycle apparatus of two or three phase type, at 2,200 volts, might have been had at that time (1896), but the three alternators already in the plant were 1,000-volt, 125-cycle machines, and there did not appear to be much opening in the local field for induction motors. As the adoption of a higher voltage and lower frequency would mean expensive changes of transformers as well as station apparatus, it was decided to continue the existing system, and a 100-kilowatt high-frequency alternator was added to the plant.

In another two years the load of open arc lamps in street and commercial service had again outgrown the station capacity of three fifty-light dynamos, and so a 125-light machine was secured, and loaded with more lamps of the open type.

Up to 1899, no change had been made in the original pair of 125-horsepower boilers at the plant, but these boilers had then been in use nine years, their capacity was too small for the engines, and compounding had made some increase of steam pressure desirable so that three new boilers of 150 horsepower each were then installed, and the two old units discarded.

Arc lamps continued to increase in number, so that another fifty-light dynamo was added, in 1901, and in the following year it was decided to put the alternating-current service onto a sixty-cycle, three-phase, 2,200-volt basis as fast as was practicable. To start this change, an alternator of 200-kilowatts capacity was installed, and another of equal capacity and the same type was added to the plant, in 1904, so that the four old alternators of high frequency were displaced.

In the following year the boiler plant was increased with another 150-horsepower unit, and a simple steam engine of 100 horsepower was installed to operate a new arc dynamo of 120-light capacity. This new arc machine was devoted to the operation of enclosed direct-current arc lamps, used partly on the street and partly for commercial service, while the remainder of the street arcs were of the open type, as before.

For the purpose of operating all generators in parallel, and reducing expenses in several ways, all direct-current apparatus was discarded, in 1906, both at the station and on the line, and constant-current transformers were adopted for the street-lighting circuits. A compound engine of 210 horsepower and a 175-kilowatt, three-phase, sixty-cycle, 2,200-volt alternator were installed, in the same year.

The latest addition to the plant is another alternator of the type and capacity last named, and a 250-horsepower compound engine, which make up the total of 960 horsepower in engines and 750 kilowatts in electric generators, as first noted.

During its nineteen years of operation this electric station has had six steam boilers, of which four are now in use.

Eight steam engines have been installed in the plant, and four of these have been taken out.

Six arc dynamos have gone to make up the generating equipment, but all are now discarded.

One 500-volt direct-current generator that supplied current for motors has been replaced by alternators.

Eight alternators have formed parts of the plant at different periods of its history, and only four of these remain.

With these changes of generators has come a new equipment of switchboards and station instruments.

On the lines, all of the arc lamps and all of the transformers have been once replaced.

So much for the past nineteen years. What of the next?

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Chicago Electric Club.

The meeting of the Chicago Electric Club on Wednesday noon, October 20, was decidedly successful from every point of view. The attendance surpassed that of any previous meeting of the club, and the speaker of the day, Samuel Insull, president of the Commonwealth Edison Company, delivered a very interesting address on the subject of "The Sale and Distribution of Electrical Energy in Chicago."

Mr. Insull, who was introduced to the club by President Frederick P. Vose, in an appropriate manner, opened his address by asserting that the wonderful things accomplished in Chicago during the past fifty or seventy-five years were due mainly to the fact that the territory in which Chicago is located is the richest producing valley in the world. Continuing, he said substantially as follows:

It matters not whether you be in the service of an electricity supply company, whether you be in the service of a manufacturing corporation, whether you are engineers advising your clients as to what is to their best interests in buying energy, you are all equally interested in the development, in the distribution, of and the sale of cheap electricity in this community.

There is about $60,000,000 invested at the present time in the generation and distribution of electric energy from the central stations within the corporate limits in Chicago. To pay six per cent interest on this money, takes somewhere between $300 and $400 per hour, twenty-four hours a day, 365 days of the year. To enjoy the right to earn that interest we have to pay, and pay with pleasure, to the city of Chicago and to the state, an amount in taxes and compensation that exceeds $100 per hour, the total amount for this year in taxes and compensation being about $900,000 payable to the community.

It takes more than a hundred tons of coal an hour, 8,760 hours a year, to produce the energy which we sell. That coal must be burned at certain times in the winter at the rate of from 200 to 250 tons an hour. Consider the amount of engineering brains that must have been centered in that proposition—how to get through the grates 250 tons of coal in one hour. To take care of the business, to stand ready to deal with large and small consumers as they may come along, we have at the present time a capacity of over 240,000 horsepower, and during this coming winter the maximum load on our central stations will be upward of 200,000 horsepower.

I don't know how much power is being generated by waterpower plants at Niagara Falls, but I think the amount of power we get from steam plants will favorably compare with that produced at the plants at the end of Lake Erie.

It takes fifty-four substations to fit the various classes of business we deal with, from an ordinary lamp to the operation of a railway system. These fifty-four substations must have a converting capacity of 275,000 horsepower, and the current that passes through those stations is conveyed by a total mileage of 1,255 miles of cable, 4,000 miles of overhead wires, and a conduit mileage of 2,200 miles. When you bear in mind that all this development has taken place in less than thirty years, and that in order to take care of the current growth of the business we must spend on the investment of $60,000,000 nearly $2,000 per working day of the year, you can get some idea of the size of this business from the investment side of it.

The kilowatt-hours sold in 1896, as compared with 1909, have multiplied forty times. We are in the business of manufacturing kilowatts. Our unit of manufacture is a kilowatt-hour, and we figure our cost on that basis. If we save one-thousandth of one cent in cost of manufacture, that means $4,000 or $5,000 a year.

Our income for the fiscal year ended last September is only twenty-five per cent per unit sold of the income that we received thirteen years ago. That will give you an idea of what has been accomplished by improved apparatus, concentration of production, some success in selling, the greater volume of output, all of which points to the fact that if we can run a more profitable business today on an income of only twenty-five per cent of what we got thirteen years ago, you can see it is only a question of time when the isolated plant, I don't care whether in the manufacture of current for a small building, or for the manufacture of current, say, for electrification of terminals of one of the trunk lines in Chicago, I say the day of the isolated plant is doomed, and there can be no more reason for isolated installations in the manufacture of electrical energy than there is for isolated installations in the manufacture of gas or the pumping of water for use in large communities.

I wish to dwell upon that point for the benefit of those of you who are not engaged in the manufacture of current. If you will bend your energies to the sale of current-consuming devices, you can build up a business which has a permanency; if you bend your energies, over a long period of years, to competition with the power-generating company, I do not care whose company it is, you are doomed to failure, for it is not among the possibilities that electric current in this age can be produced in small units in competition with the large production, on a wholesale basis, of a generating company.

What is the field before us? We naturally look over the territory and see where all this expenditure of large sums of money to take care of our business is going to end. As near as we can figure now, we are only doing about one-third of the business of supplying the possible sales of energy of this community at this time. I do not talk of what may come as the state grows. The kilowatt-hours being sold at this time by the Commonwealth Edison Company, are about one-third of the possible amount of energy that can be sold in this community in times of ordinary industrial prosperity.

Most of you are familiar with the method under which our system of distribution of energy is conducted. As I mentioned to you, we have altogether fifty-four substations; that is, thirty of those belong to the Commonwealtth Edison Company and twenty-four belong to the street-railroad and elevated-railroad companies. The generating points are at Harrison Street and the river, at Quarry and Fisk streets, and one or two others. The extent of our distribution is from the city limits on the north to the Indiana line on the south, and this is further carried out by a road running to Kankakee, electric-light plants and a road north as far as Milwaukee and electric-light plants on the west, all of which are more or less supplied by the Commonwealth Edison Company.

I would like to emphasize, as far as I can, to our friends in the Electric Club, that our interests are practically one. We, on the side of the producing company, are engaged in an effort to produce the largest possible amount of electric energy at the lowest possible selling price. I think we can claim for Chicago the lowest selling price of any large electric supply company in the world. Some of our rates are nominally a little higher than in other cities, but if you realize the results the customers get, whether retail rates from house to house, whether wholesale rates to the large manufacturing and distributing concerns of the city, whether they be rates to large railway companies like the surface roads or elevated roads, if you compare them with the rates in other large cities, whether on this side of the Atlantic or on the other, you will find that we sell current here cheaper than it is sold anywhere else. Now, that should mean a great deal to those of you who represent manufacturing companies. All of those who are not in the producing side of the business, are either in the manufacturing or engineering side. The large wholesale consumers of current are buying their current in Chicago at a lower price than the railroad companies in the neighborhood of Niagara Falls buy current from the waterpower plants at that point, and that element must have a great bearing upon the agitation which is going on in this community on the subject of electrifying the terminals of the steam railroads. There are, of course, vast problems to be settled of which we know little, but so far as the current-producing side is concerned, if a steam-railroad man offers the information that electrification is impossible because of the cost of electric en-

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ergy, and bases his statement on a knowledge of the cost of electrical energy for the electrification of steam-railroad terminals around New York, he is basing his judgment on false information. Electrical energy can be bought here for that purpose much cheaper than for what it is now being produced by the two great traffic lines engaged in electrifying their terminals in New York at this time.

Following the address of Mr. Insull, and upon the invitation of the president of the club, a brief discussion was entered into. A question which was brought up for Mr. Insull to answer was, In case the railway companies decide to electrify the terminals here, and assuming that they are willing to make a contract with the Commonwealth Edison Company, will it be necessary for that company to build new stations, or can the current be supplied from the present equipment?

Mr. Insull replied that the present equipment can take care of any two railroads, assuming that they wish to electrify their terminals, based on the present consumption of current by the roads entering the New York Central depot; and with the equipment which has been ordered for the coming winter, the Commonwealth Edison Company could take care of two additional roads.

Another question asked was how much of a factor the placing on the lines of electric heating devices is believed to be. In replying, Mr. Insull said that during the past year they had loaned out over 10,000 flatirons to encourage their use, and the records show that only a few have been returned. He said the question was a difficult one to answer, but that judging from the sales recorded in the purchasing department the reduction in the rates of current have evidently had a great effect in encouraging the use of heating devices.

Live-Wire Hazard in Indiana.

The Railroad Commission of Indiana has instituted an inquiry into the "live-wire hazard" and has taken up with the railroad companies the question of greater care in preventing contact of crossings between telegraph and telephone wires with the high-tension wires of electric lines. The commission is asking all the steam and electric roads to furnish a list of all such dangerous wires where they cross trolley lines, the station nearest to which the sagging wires are located, and the name of the company owning the dangerous wires. After this information is furnished the commission will order that the dangerous wires be properly secured. S.

Annual Meeting of the Sons of Jove.

The seventh annual meeting of the Order of Rejuvenated Sons of Jove was held on October 14 and 15, at Cleveland, Ohio. Headquarters were at the Hollenden Hotel. About 175 Jovians attended. The work on the first day was confined to the meeting of committees. In the evening the Cleveland Jovians gave a theatre party at Keith's Hippodrome.

Friday, the 15th, was Jupiter's day. In the morning a business session was held at the Hollenden. In the afternoon special cars carried the Jovians to the Euclid Garden Theatre. There a class of nearly 100 candidates was initiated, one of the largest classes in the history of the order. The work of the rejuvenation was exemplified in full form by the Buffalo Degree Team in seven tableaux, with appropriate scenic setting and accessories. The floor work was in charge of Harry C. Rice, of Cleveland, assisted by an Imp team of six Cleveland Jovians.

In the evening the Joviation dinner was held at the Hollenden Hotel. The toastmaster called upon the following Jovians, who responded briefly: Seventh Jupiter, J. Robert Crouse, of Cleveland; Past Jupiter, Wm. E. Robertson, of Buffalo; P. Yensen, general manager of the Cleveland Telephone Company; E. H. Haughton, of Chicago; H. E. Hackenberg, treasurer of the National Carbon Company, Cleveland; E. E. Noble, of the Cleveland Electric Illuminating Company; C. A. Parker, secretary of the Curtis Advertising Company, of Detroit; and J. W. Worbs, secretary-treasurer of the Adams-Bagnall Electric Company.

Following the dinner, the entertainment committee, H. H. Cudmore, chairman, put on a very clever line of vaudeville. Before the Joviation ended a silent toast was drunk to Past-Jupiters C. W. Hobson and C. A. Newning, according to the Jovian custom.

The nominating committee offered two tickets for election, resulting in the choice of Oscar C. Turner, of Warren, Ohio, as the reigning Eighth Jupiter.

An interesting feature of the convention was the election of Charles F. Brush, the well-known pioneer in the electric-lighting field, as an honorary member of the order. The greatest enthusiasm was evoked by the announcement that Charles A. Coffin, president of the General Electric Company, had become a life member. Eight life members were elected, making a total membership of more than 2,500.

Joint Meeting of Sections of the American Institute of Electrical Engineers and Western Society of Engineers.

A joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers was held in the rooms of the latter in the Monadnock Block, Chicago, on the evening of October 22. J. G. Wray, secretary of the former body, presided over the meeting, which had assembled to listen to the presentation of a paper on "Central-Station Economies," by W. L. Abbott.

Mr. Abbott discussed at length the economies and economics of central-station management, considering particularly the operation of a large steam-driven generating plant. The distribution of the revenue is approximately as follows: Fixed charges, fifty per cent; general expenses, twenty per cent; operating expenses, thirty per cent. He analyzed the latter in the following manner:

OPERATING EXPENSES.

Generating Costs—		
Operating payroll	61	
Fuel	208	
Supplies and repairs	48	
		317
Distribution Costs—		
Substation and battery operating and maintenance	121	
Street system	123	
Reading and maintenance of meters	68	
Free lamp renewals	166	
Free maintenance of other current-consuming apparatus	129	
Free wiring and free repairs on customers' premises	76	
		683
Total		1000

Speaking of the unavoidably low heat efficiency of any fuel-burning plant, he gave the following analysis of where all the energy goes:

Losses in Converting Fuel Energy Into Electrical Energy—Starting with One Pound of Coal Equal to 10,000 B. T. U.		
Ashpit	300	
Stack	1,960	
Banking fires and firing up	560	
Radiation and unaccounted for	800	
Total boiler-room loss		3,620
Rejected condenser	4,810	
Pipe radiation, etc.	370	
Total turbine-room loss		5,180
Delivered to busbars		1,200
Total		10,000

The use of steam turbines has resulted in a revolution in central-station practice. They have not only improved the efficiency of the plants, but reduced the first cost and increased the capacity. He predicted turbine units of 25,000 kilowatts capacity as not beyond the range of early possible realization. A more extended abstract of Mr. Abbott's excellent paper is given in other columns of this issue.

The paper was discussed by J. G. Wray, R. F. Schuchardt, A. Bement, E. N. Lake, R. H. Kuss, O. E. Olsen, W. E. Kiely, G. H. Jones, B. E. Strohm, J. H. Warder, D. W. Roper, E. F. Smith, F. H. Bernhard and Mr. Abbott.

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Illinois Central Railroad Again Balks at Electrification.

At the annual meeting of the stockholders of the Illinois Central Railroad held in Chicago on October 20, the action taken a year ago, urging the board of directors to proceed with all reasonable dispatch to electrify the service within the corporate limits of the city of Chicago, was rescinded. This later action was upon the advice of the board of directors which in turn had received a special report from President James T. Harahan covering the entire subject of the electrification of the Chicago terminals. In the resolutions just passed after reciting the arguments presented by President Harahan, it is resolved to defer the determination as to the electrification, "until such time as a continued study of the subject can intelligibly determine a proper line of procedure." This is commonly accepted as meaning the "shelving" of the project for an indefinite period as far as the railroad is concerned.

In the report by the railroad's president he asserts that there are no precedents at the present time where electrical operation has been applied on a scale commensurate with the problem as existing in Chicago. He also claims that the practicability of applying electricity to the operation of large terminals has not as yet been demonstrated nor satisfactorily worked out. The need of handling mixed traffic consisting of freight, passenger, and suburban trains, he says, is complicated by the heavy interchange of freight traffic between the various railroads causing frequent and complicated switching movements on the main lines and in the yards. He regards the suburban traffic at Chicago as the only service which would be in any degree adapted to electric operation, but even as to this feature he cites figures purporting to show that the cost of electrification of this service would be $8,000,000; after allowing for interest and depreciation, the saving by electrification would be more than offset. No estimate in these figures is made of any increased revenue due to greatly increased traffic. The old argument that electrical operation of railroads has not yet been standardized is again brought forth. The claim is made that the prime object of the electrification, viz., the elimination of the smoke nuisance, has been already attained in a large measure on the Illinois Central system by careful firing, the use of superior quality of coal, and experiments with coke to replace soft coal. It is also contemplated to secure a type of self-contained motor car for use on the suburban lines. The city officials of Chicago made a proposition to the railroad that it start the work of electrification of its terminals by installing electric service on its local suburban trains between Randolph and Sixty-third streets, a distance of eight miles. This was urged so as to make a trial of the project before it was extended over the entire system. The city offered that, if such an initial installation was made, it would not urge complete electrification beyond a reasonable extent. In conclusion, President Harahan sums up the principal arguments against electrification as follows:

First—The art of electric traction applicable to the operation of large terminals has not progressed beyond the experimental stage sufficiently to justify the large expenditure necessary for its application on your Chicago terminals, and that it would be impracticable to operate the large freight terminals of Chicago railroads, with their interchange of freight traffic and switching movements, with electric traction, as developed at the present time.

Second—The large expenditure necessary to install electric traction on your Chicago terminals would involve fixed charges in interest and depreciation that would greatly exceed any economy that might result from electric operation.

Third—The elimination of smoke, to meet all reasonable public demands, can be accomplished without the use of electric traction.

Fourth—It would be inadvisable at this time for any one railway in Chicago to undertake the electrification of its line independently before a comprehensive plan has been developed through the joint cooperation of all the lines, in order that no precedents might be established which might retard, rather than promote a possible future development.

The attitude of the railroad officials in throwing a wet blanket over the electrification movement has not diminished the ardor of the municipal officials and the Chicago public for seeing the project carried out. On the contrary, the direct opposite may be said to have been the result. The public press, notably the Chicago *Tribune*, has given much space to extracts from the sayings of prominent electrical engineers who have had experience in the electrification of steam railroads. Bion J. Arnold, John F. Aspinwall and Wm. J. Wilgus have been quoted at length on this matter. Various societies, particularly a large number of women's clubs, throughout the city, have also held special meetings for the agitation of this subject, and have decided that the smoke nuisance must be abated; and further, as electrification is the only positive method of eliminating all of the objectionable features of the steam locomotive, electrification has been endorsed unmistakably.

The city officials, partly anticipating the action of the railroad, have bent their efforts to the consideration of the ordinance introduced into the City Council by Alderman Bernard W. Snow. The original draft of this ordinance which aims to make railroad terminal electrification mandatory was given in these columns in the issue of October 2. It has been decided to modify this draft with the utmost care so as to make it absolutely proof against attack by the ablest legal talent at the command of the railroad companies. Some doubt is expressed as to the power of the city to compel electrification specifically. It is felt in some quarters that it would be better in this ordinance for the city to compel the substitution of some motive power or fuel other than coal. Others feel that it is imperative to bar the use of steam locomotives entirely, without specifying the substitution of electric equipments. On all sides, however, it is felt that, however the ordinance may be drawn, it must ultimately bring about the electrification of all the Chicago railroad terminals.

Meanwhile, since the elimination of the smoke nuisance is the strongest objective that the city has, and since the railroads claim they are making serious efforts to eliminate it, a movement has sprung up to notify the proper authorities of every instance of a smoking locomotive. It is believed that in this way the railroads will be impressed with the earnestness of the city and the public in having the matter brought to an issue.

Mr. Insull at the Chicago Press Club.

At noon on October 22 the Press Club of Chicago tendered a luncheon to Samuel Insull, president of the Commonwealth Edison Company, at the conclusion of which Mr. Insull made a brief but excellent address on the central-station business of Chicago. This was somewhat along the same lines as his address before the Chicago Electric Club, two days preceding, and which is reported at some length in another part of this issue. Mr. Insull invited the members of the club and their friends to visit the principal power house of his company. Special transportation was provided for a party of nearly 200, who proceeded to the Fisk Street station.

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Electrical Exports for August.

A summary of the electrical exports from the United States for the month of August has just been completed by the Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C. From the figures below it will be noted that the August total shows an appreciable improvement over that of the preceding month but is not equal to that of the corresponding month last year, which was rather strong on account of large electrical machinery exports. The totals for the first eight months of this year show a very good recovery from the recent depression to the excellent returns in the first eight months of 1907 as regards electrical appliances, but, on the other hand, a further reduction even from the low figures of 1908 as regards electrical machinery.

The comparative monthly figures are as follows:

	August, 1909.	August, 1908.	July, 1909.
Electrical appliances.	$ 590,864	$ 437,690	$567,795
Machinery	448,976	663,468	391,195
Total	$1,039,840	$1,101,158	$958,990

A list of the principal countries to which American electrical products were shipped in August, 1909, and the values of these exports is as follows:

Exported to—	—Electrical— Appliances.	Machinery.
United Kingdom	$37,628	$44,001
Belgium	11,799	.....
France	3,522	3,834
Germany	9,377	2,753
Other Europe	4,813	29,158
British North America	181,733	57,213
Central American States and British Honduras	19,489	8,279
Mexico	59,614	38,116
Cuba	35,106	41,298
Other West Indies and Bermuda	3,021	332
Argentina	52,939	33,159
Brazil	74,464	8,788
Other South America	26,236	5,051
British East Indies	.....	7,005
Japan	34,102	83,389
British Australasia	5,334	49,461
Philippine Islands	7,343	11,640
British Africa	16,320	21,315

New York Electrical Show Entertainments.

One of the pleasant events in connection with the New York Electrical Show, which closed on October 21, was the entertainment and smoker tendered by the New York Edison Company to the electrical contractors of New York city. This took place on the evening of October 19. It began at 9 o'clock with an excellent vaudeville performance in the Concert Hall of Madison Square Garden. At its conclusion the guests were treated to a sumptuous buffet supper, which was served on the arena platform of the auditorium. The Garden was closed to the public as usual at 11 o'clock by the extinguishing of the lights. About fifteen minutes later the lamps were relighted for the special benefit of the guests of the evening. Most of the exhibits were also reopened so as to reproduce the complete effect.

On the last night of the New York Electrical Show (Thursday, October 21) a rejuvenation of the Sons of Jove was held at Madison Square Garden. About fifty new members were initiated, and addresses were made by Oscar C. Turner, the new Jupiter, and by J. Robert Crouse.

Navy Department Supplies.

The Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., will open bids on the dates given below for the following electrical equipment and supplies. Bidders should without delay make application to the Bureau for copies of the schedules they are interested in, being careful to give the number of each schedule. Copies can be obtained on application to the Navy Pay Office nearest each navy yard.

NAVAL SUPPLIES.

Date of opening.	Material.	Quantity.	Delivery at Navy Yard.	Schedule No.
November 2, 1909...	Cable, interior communication	32,500 feet	Brooklyn, N. Y., and Norfolk, Va.	1811
	Conductor, double, plain	10,000 feet	Norfolk, Va.	1811
	Conductor, night-signal cable	10,000 feet	Do.	1811
	Wire, galvanized-steel, No. 8, B. & S.	1,000 pounds	Boston, Mass.	1813
	Wire, lighting, twin conductor	43,000 feet	Brooklyn, N. Y., and Norfolk, Va.	1811
	Wire, lighting, single-conductor	7,500 feet	Do.	1811
	Do.	20,000 feet	Do.	1811
November 9, 1909...	Conduit, steel, enameled	3,200 feet	Brooklyn, N. Y.	1848
	Conduit and fittings	Miscellaneous	Various	1847
	Fire-alarm system	1	Philadelphia, Pa.	1844
	General-alarm gong system	1	Brooklyn, N. Y.	1846
	Lamps, arc, enclosed	32	Do.	1849
	Wire, rubber-covered	22,800 feet	Do.	1848
November 16, 1909..	Distribution boards	Miscellaneous	Brooklyn, N. Y.	1840
	Motors, fifteen-horsepower	8	Washington, D. C.	1836
	Switchboards	Miscellaneous	Brooklyn, N. Y.	1840
	Fans, ventilating, and spare parts	Miscellaneous	Mare Island, Cal.	1821
	Wire, brass and copper	750 pounds	Do.	1822

Economy Light and Power Company Decision.

Tuesday of this week the Supreme Court of the state of Illinois handed down a sweeping decision in the ouster case brought by the state of Illinois against the Economy Light and Power Company, of Joliet, Ill., whereby the state sought to get rid of the dam at Dresden Heights, and to enter into the possession of the company's property again.

The decision of the court leaves the company firmly intrenched in its position at Dresden Heights. It is now stated by Charles A. Munroe, manager of the company, that it will ask damages from the state to the extent of $250,000. As the state cannot be sued, the company plans to take the case before a commission. The grounds of the compensation are damages caused in stopping the work by means of an injunction obtained by the state when the litigation was first started, the consequent disorganization of the working force, and the loss of income from the power which might have been sold.

The original suit was started on the contention that the Desplaines River was navigable, and that any obstruction in it represented trespass. It was contended also that the State Canal Board, which originally granted the privileges to the Economy company, had exceeded its authority and that the grants were void as ultra vires. The Supreme Court decision rules against the state on every point set up. The company has always been perfectly satisfied as to the final outcome, and it may be noted that all its plans for the dam and pool at Dresden Heights were approved by the United States government engineers with a view to a future deep waterway. The Economy company makes announcement that it is not in any way opposed to such a waterway—always has been in favor of it, and will give the state every facility should that project ever be seriously undertaken.

Edison Electric Illuminating Company.

The Edison Electric Illuminating Company, of Boston, has petitioned the Massachusetts Gas Commission for authority to issue 19,452 shares additional capital stock, proceeds to take up notes issued for new properties acquired last month at a cost of about $2,870,000; also notes issued from time to time to take care of the normal growth of the business, amounting to about $1,000,000.

Electric Subway for Buenos Aires.

A report from Buenos Aires states that the Chamber has authorized the construction of an electric subway in that city, to run east and west.

Wireless Apparatus in India.

The importation of wireless telegraph apparatus into British India is prohibited, except by persons to whom a license has been granted by the government.

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Newly Elected Associates and Members of the American Institute of Electrical Engineers.

At the directors' meeting, held at New York on October 8, ninety-four applicants were elected to membership in the American Institute of Electrical Engineers in the grade of Associates. The list of Associates so elected is as follows:

Adams, Isaac Benjamin, acting superintendent, Colgate power division, Pacific Gas and Electric Company, Colgate, Cal.

Allen, William Daniel, 698 Ellicott Square, Buffalo, N. Y.

Alsaker, Alfred, chief electrical designer, North Shore Electric Company; residence, 939 West Division Street, Chicago, Ill.

Armstrong, Frank Hall, mechanical engineer, Pennsylvania Iron Mining Com pany, Vulcan, Mich.

Barker, John Henry, salesman, Diehl Manufacturing Company, 90 Prince Street, New York city; residence, 466 East Seventh Street, Brooklyn, N. Y.

Biesecker, Arthur S., traveling electrical inspector, D. L. & W. R. R.; residence, 737 Prescott Avenue, Scranton, Pa.

Brewer, J. Irving, assistant engineer, Interborough Rapid Transit Company, 32 Park Place, New York city.

Carlton, Rufus Houdlette, commercial department, General Electric Company; residence, 822 Union Street, Schenectady, N. Y.

Carr, Maurice L., assistant engineer, Underwriters Laboratories, Inc., 217 Ohio Street, Chicago, Ill.

Case, Samuel Lee, electrical engineer, Stone & Webster Engineering Corporation, Hauserlake, Helena, Mont.

Chappell, William Campbell, British Columbia Electric Railway Company, Ltd.; residence, 1631 Robson Street, Vancouver, B. C.

Clark, Ernest Lee, assistant engineer, electrical department, N. Y., N. H. & H. R. R. Company, Guilford, Conn.

Cochran, Albert William, electrical engineer, Oregonian Publishing Company; residence, 627 Fifth Street, Portland, Ore.

Cooper, Robert Groff, general solicitor, General Electric Company, 1003 Majestic Building, Detroit, Mich.

Dalemont, Julien Edouard, McGill University; residence, 128 Stanley Street, Montreal, Canada.

Denton, Charles Frederic, Porto Rico Power and Light Company, San Juan, P. R.

Dorsey, John Worthington, testing department, General Electric Company; residence, 248 Union Street, Schenectady, N. Y.

Eckworth, Fred Candler, draftsman, the Canadian General Electric Company; residence, 312 Boswell Avenue, Peterboro, Ont.

Faucett, Frank Fielding, superintendent, the Gardiner Light and Water Company, Gardiner, Mont.

Febrey, Harold H., electrical draftsman, P. T. & T. R. R. Company, 10 Bridge Street, New York city; residence, 1153 Mary Street, Elizabeth, N. J.

Feigel, John Richardson, superintendent of construction, Boone County Telephone Company, Boone, Iowa.

Fenno, George Francis, advertising engineer, George H. Gibson Company, 1119 Tribune Building, New York city.

Fetherstonnaugh, Edward Phillips, professor of electrical engineering, University of Manitoba, Winnipeg, Man.

Fligg, Horace Clyde, draftsman, Denver City Tramway Company, 816 Majestic Building, Denver, Colo.

Foltz, Thomas Franklin, P. T. & T. R. R. Company, East River division, New York city.

Geiger, Clayton Farney, chief electrician, the Wilmington City Electric Company; residence, 1125 West Seventh Street, Wilmington, Del.

Godfrey, John W., inspector, substation department, N. Y. C. & H. R. R. R. Company, New York city; residence, Sherwood Park, Yonkers, N. Y.

Gude, Richard Emile, Davis, Cal.

Halliday, Clifford, chief operator, Great Northern Power Company, Fond du Lac, Minn.

Harmer, Leonard Stanley, in charge of electric power, Grandfather Falls Company, Merrill, Wis.

Hawley, Kent Allen, draftsman, Viele, Blackwell & Buck; residence, 2545 Bervenue Avenue, Berkeley, Cal.

Hawley, Luther Willis, electrician, Estey Organ Company, Brattleboro, Vt.

Heller, George Arthur, Westinghouse Electric and Manufacturing Company, Pittsburg; residence, Wilkinsburg, Pa.

Herrold, Herschel McKinley, apprentice Westinghouse Electric and Manufacturing Company, Pittsburg; residence, 911 South Avenue, Wilkinsburg, Pa.

Hoag, Chance Montel, chief operator, Division Creek power plants, Los Angeles Aqueduct, Independence, Cal.

Hodgson, George Oscar, student engineer, General Electric Company; residence, 618 Chapel Street, Schenectady, N. Y.

Hoke, Charles Constantine, mechanical engineer, Compania Minera de Penoles, Maupin, Durango, Mexico.

Holland, Ray Kingsbury, draftsman with G. S. Williams, 205 New Engineering Building, Ann Arbor, Mich.

Hoppin, Glenn H., electrician on construction work, Washington Water Power Company, Reardon, Wash.

Hoy, Walter H., switchboard operator, Toronto Electric Light Company; residence, 128 Lennox Street, Toronto, Can.

Hutchinson, Miller Reese, electrical engineer, 1 Madison Avenue, New York city; residence, Deal Beach, N. J.

Iyengar, Srirangam D. S., superintendent, Bangalore Power and Lighting, Cauvery Power Scheme, Bangalore City, India.

Jensen, Trygve, assistant in electrical engineering, University of Illinois; residence, 701 West Green Street, Urbana, Ill.

Johnson, Samuel Andrew, superintendent, W. T. Weaver Power Company, Asheville, N. C.

Kamerer, Paul Tranger, instrument and construction work, West Penn Railways Company, Connellsville, Pa.

Kawado, Shuso, electrical engineer, Shibaura Engineering Works and Company, Shibaku, Japan.

Kilmore, John Bruce, engineer, commercial department, Scranton Electric Company, Scranton, Pa.

Kohlhausen, Benjamin Franklin, assistant to superintendent, Winchester & Washington City Railway Company, Winchester, Va.

Kribs, Gordon, electrical draftsman, Smith, Kerry & Chace; residence, 313 Spadina Avenue, Toronto, Ont.

Kun, Emil, draftsman, Metropolitan Street Railway Company; residence, 51 West Ninety-seventh Street, New York city.

Laidlaw, Hugh Alexander, operating and maintenance department, Pacific Gas and Electric Company, San Francisco, Cal.

Landes, Ray Calder, J. G. White & Company, 43 Exchange Place, New York city.

Leilich, Frank Thurman, special apprentice, Westinghouse Electric and Manufacturing Company; residence, 816 Ross Avenue, Pittsburg, Pa.

Lord, Mount Claud, electrical machinist, electric department, United States Navy Yard, Vallejo, Cal.

McCraig, Stuart James, lecturer in department of electrical engineering, McGill University, Montreal, Canada.

Merrill, Wilbur Lorin, engineer, Power and Mining Engineering Department, General Electric Company, Schenectady, N. Y.

Mitchell, Nathan Johns, president, N. J. Mitchell Company, 7 Pine Street, New York city.

Moody, Alexander Skene, electrical engineer, General Electric Company, 609 Colman Building, Seattle, Wash.

Morrell, Harry House, manager, Tate Accumulator Company of Canada, Duncan and Pearl streets, Toronto, Can.

Mulock, Redford Henry, testing department, Canadian General Electric Company; residence, 336 Rubidge Street, Peterboro, Ont.

Mumma, Fred Tyson, superintendent, Big Bend power house, Great Western Power Company, 5120 Grove Street, Oakland, Cal.

Noble, George O., sales engineer, Westinghouse Electric and Manufacturing Company; residence, 527 South Main Street, Los Angeles, Cal.

Noggle, Roy Louis, foreman, electrical construction, United States Reclamation Service, Minidoka, Idaho.

Parker, J. Alexander, 1171 Tenth Street, San Diego, Cal.

Parrish, William Cardell, superintendent, Laramie Light and Power Company, Laramie, Wyo.

Porter, George William, tester, Pacific Telephone and Telegraph Company, Seattle, Wash.

Pratt, Charles N., assistant superintendent, electrical department, Rochester Railway and Light Company, Rochester, N. Y.

Rasmussen, Hans Fredrich William, solicitor, Lowell Electric Light Corporation; residence, 24 Loring Street, Lowell, Mass.

Reed, Joel Earl, assistant manager, Chicago Telephone Company, 3334 Michigan Avenue, Indiana Harbor, Ind.

Rice, Chauncey Brewster, professor of electrical engineering, Yale University, New Haven, Conn.

Robbins, Arthur Hastings, the Electric Light and Power Company of Abington, North Abington, Mass.

Robinson, William, electrical and mechanical engineer, 276 Stuyvesant Avenue, Brooklyn, N. Y.

Root, Howard Clayton, Fort Wayne Electric Works; residence, 2817 Barr Street, Fort Wayne, Ind.

Saurman, Atlee B., Pacific Coast manager, Standard Underground Cable Company, First National Bank Building, San Francisco, Cal.

Schlingman, Paul H., construction man, General Electric Company, 816 Wainwright Building, St. Louis, Mo.

Schwerin, Banard G., electrical contractor, 424 Walnut Street; residence, 2113 North Seventeenth Street, Philadelphia, Pa.

Shepard, Edgar Raymond, instructor in physics and electrical engineering, Oregon Agricultural College, Corvallis, Ore.

Slocum, Winthrop Wallace, electrical draftsman, Carnegie Steel Company, Clairton; residence, 5500 Irwin Avenue, Pittsburg, Pa.

Stone, Dean, electrical construction department, Metropolitan Street Railway Company, New York city.

Stone, Harry Albert, inspector, electrical department, N. Y. C. & H. R. R. R., Pelham, N. Y.

Sylwan, Einar, district engineer, Kungl. Trollhatte Kanal & Vattenverk, Trollhattan; residence, Skara, Sweden.

Templin, Walter Wayne, power apparatus salesman, Western Electric Company;

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residence, 326 East Fifty-seventh Street, Chicago, Ill.

Talboys, Frank Powell, manager and chief engineer, the Wanganui Electric Tramways, Wanganui, New Zealand.

Tangeman, Charles Louis, assistant engineer, Triumph Electric Company; residence, 2706 Eden Avenue, Cincinnati, Ohio.

Thompson, Frank Forrester, professor of electrical engineering, Rutgers College; residence, 91 Bayard Street, New Brunswick, N. J.

Tucker, Charles Bailey, illuminating engineer, General Electric Company, Harrison, N. J.; residence, Marblehead, Mass.

Van Bylevelt, Joannes Samuel, 4 Weimarstrasse, The Hague, Holland.

Vick, William Robert, general superintendent, the Merchants' Mutual Electric Light and Power Company, Santa Barbara, Cal.

Von Krogh, Karl Konon, superintendent of motor, transformer and winding department, British Westinghouse Electric and Manufacturing Company, Trafford Park, Manchester, England.

Wagley, Oswal Olson, general superintendent, Wells Power Company; residence, 302 Fifteenth Street, Milwaukee, Wis.

Wilkinson, Thomas W., wire chief and superintendent, Auburn Telephone Company, Auburn, Neb.

Wilson, Alexander Massey, professor of electrical engineering, State University of Kentucky, Lexington, Ky.

Woodcock, Lancelot Richard, switchboard operator, construction camp, Washington Water Power Company, Reardon, Wash.

Wuest, Anthony Roeder, electrical engineer, Patent und Litterar Bureau, Felten & Guilleaume-Lahmeyerwerke Aktiengesellschaft, Frankfort-on-Main, Germany.

At the same meeting the following former Associates were transferred to the grade of Member:

Crawford, David Francis, general superintendent motive power, Pennsylvania Lines West of Pittsburg, Pittsburg, Pa.

Jones, George Harvey, power engineer, Commonwealth Edison Company, Chicago, Ill.

Knight, Charles D., electrical engineer, General Electric Company, Schenectady, N. Y.

McCarter, Robert Dale, consulting engineer, London, England.

Sothman, P. W., chief engineer, Hydro-electric Power Commission of Ontario, Toronto, Ont.

Specht, Hans Christian, electrical engineer, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

Van Norden, Rudolph Warner, consulting engineer, San Francisco, Cal.

Electro-Technic Club of Fort Wayne.

The Electro-Technic Club, of Fort Wayne, Ind., is composed largely of the employes of the Fort Wayne Electric Works and other electrical establishments of the city, and has prepared a series of lectures to be delivered at its monthly meetings. The topics comprise matters of general scientific interest, such as "The Theory of Light," "Mars and Other Worlds Than Ours" and a number of similar subjects, besides several of general cultural value.

The idea of such a club is commendable and one good effect will be a better acquaintance among electrical men.

Meeting of the Technical Publicity Association.

The first of the Technical Publicity Association's monthly meetings for 1909-10 was held on the evening of October 14 in its headquarters, 14 Gramercy Park, New York. There was a good attendance. All enjoyed the informal dinner, after which came an interesting programme.

The president of the association, Charles S. Redfield, advertising manager of the Yale & Towne Manufacturing Company, was toastmaster. Preceding the address of the evening the attention of the members was occupied with reports of committees.

Howard M. Post, advertising manager of the Western Electric Company, told of plans for a systematic, analytical study of effectually tracing results from trade-paper advertising. The keyed method, he said, has proved inadequate. There should be some way of determining the effect of such advertising, declared Mr. Post. At the close there was a discussion of this subject in which many points of view were presented.

"It is about time for advertisers to cease to shy at that word 'psychology,'" said George French, who gave an interesting presentation of the psychological and artistic aspect of advertising. His hearers were taken into the field of optics, and shown the effect advertisements have upon the eye of the reader. Mr. French took as his text the postulate of Hugh Chalmers in a recent address at Louisville. Mr. Chalmers he referred to as "the greatest salesman, perhaps the greatest advertiser, in the country." This postulate is that every sale by anyone anywhere is made in a man's mind—the mind of the one to become the purchaser.

"Advertising is profitable," said he, "only when we consider this one thing. The individual advertisers are the men who create, who place, who look at this. If I am to do anything, if I am to be effective, I have got to get the mind of the man I am to sell goods to. We all realize this, and all work toward it. If we want to arrive at any point, even if that point be the North Pole, we want to locate that place first—to fix it on the map. I will assume that in order to sell goods there must be a salesmanship message in the mind of the customer. The question is how to place that message; what kind of place is the mind; how does it comport itself; what is that message to be, and how is it to be sent?"

"It is well to assume," continued Mr. French, "without any discussion, that every human mind is favorably inclined to receive a suggestion. This is a physiological fact, established and indisputable. There are many fallacious ideas in circulation about suggestion. There is nothing occult about it. It is not even mental, but purely a physical quality of the mind. It is guided by definite, well-known, or rather well-ascertained laws. Memories and forgotten knowledge are in the mind, and help it to make its decision.

"You must think of your advertisement as a picture. The eye has to have something to attract it, or a person can't be impressed. The impression is dulled unless there is a distinctive something to attract the eye, like a picture. Certain elements or qualities go to make an advertisement attractive. These are the same that lie behind every piece of art, that is, true art. Some of these are form, proportion, balance, harmony, tone, symmetry, perspective, color. They are easy to get if in planning you have in mind their usefulness. A harmonious tone is almost impossible with the use of half-tone illustrations. Personally, I am very glad to see the renaissance of the line engraving, or the pen and ink sketch, in the work of advertising. It doesn't 'hog' all the attention given to the advertisement. The normal reading line is not over three-and-one-half inches wide. This the eye can take in with five, six or seven fixations. It should be divided up so that the eye can read it easily. Catch-lines should be of such a nature that the eye can pick them up without conscious impulse—without any effort of the will. There should be no obstacles. This is of the utmost importance to the advertiser."

In reply to a query, Mr. French said:

"Type below nine-point is apt to be less agreeable than nine, ten or eleven. We must also consider the design. Only two or three designs of type face endure. All publishers have noticed how many series of type have dropped out of use. Almost all that have lasted are of the pure Roman style, because it is more agreeable to the eye. Caslon type, in use back when our fathers were born, is just as popular today."

Mr. French's talk was highly appreciated by the advertising men present. A number of publishers were in attendance. Questions were asked during the course of his remarks and a lively discussion ensued at the close.

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Standardization of Electrical Equipment in Mines.

The preliminary report of the Committee on the Standardization of the Electrical Equipment of Mines (Dr. E. B. Rosa, of Washington, D. C., chairman) was presented at the recent meeting of the American Mining Congress at Goldfield, Nev. (September 27 to October 1 last). The report is as follows:

The Committee on the Standardization of the Electrical Equipment of Mines, appointed in accordance with a resolution of the last session of the American Mining Congress, has had one meeting and has done a considerable amount of work on the problem assigned to it, but is not as yet prepared to offer a final report.

After examining the mining laws relative to the use of electricity of those states that have legislated on the subject, and of a number of foreign countries where a considerable application of electricity has been made in mining, the committee has prepared a draft of a code of rules suitable for enactment into law by any state legislature. This first draft is to be submitted to representatives of other mining organizations for criticism and suggestion, and then carefully revised in the light of the suggestions received, and of the further experience of the committee. One of the members of the committee, Mr. Rushmore, is spending several months this summer in Europe studying the applications of electricity to mining, and he will doubtless obtain information of value to the committee in the final revision of its code of rules.

In addition to this formal code of rules, which may be given the force of law, governing the use of electricity in mines, the committee proposes to prepare a set of recommendations setting forth what it considers the best practice, and which, if followed, would tend to reduce the danger of personal injuries due to the use of electricity in mines, reduce the liability of explosions in gaseous mines, improve the efficiency and reliability of the service and tend to make the use of electricity more satisfactory both to the operators and the mine workers. These recommendations will go farther than is possible in a set of mandatory rules.

In order that this work may be performed most effectively, the committee is gathering data concerning many of the best installations of electrical apparatus in the mines of this country and Europe, and personally examining many of them. Important experiments are being conducted by the Technologic Branch of the United States Geological Survey to determine the condition under which explosions could be caused in gaseous mines by the breaking of incandescent electric lamps, blowing of "safety" fuses, sparking at the brushes of motors or flashes on electric signaling wires. The effect of acid mine water on various kinds of insulated wire and cables is being investigated, with the hope of finding an insulation that will be permanently satisfactory under the severest mine conditions. The committee is glad to take advantage of the results of these experiments, in the carrying out of which one of our members (Mr. Wood) has been retained by the Geological Survey as consulting engineer. The committee invites suggestions from manufacturers, mine operators and mine workers relative to any of the various phases of the problem which has been assigned to it, and especially any results of experience which may be of value in revising its code of rules or in making up its series of recommendations.

Wisconsin Supreme Court Decides Exceptional Telephone Case.

It is stated that the case of the Douglas County Telephone Company, concerning which a decision was made Tuesday by the Wisconsin State Supreme Court, is an exceptional one and is controlled by special circumstances. Certain city hall offices in Superior enjoyed free service at the hands of the Douglas County Telephone Company. The railroad commission held that this was general discrimination, but the court found that the contract was made before the enaction of the public-utilities law, and is therefore valid. Justice Marshall, who made the ruling, says in part:

"The contract in this case having been made before the legislation occurred prohibiting discriminatory rates, such legislation does not cut any figure in this case. If the contract were valid when made, it is within the constitutional protection precluding the Legislature from impairing the obligation of contract. Moreover, it is by no means certain but that the special circumstances in this case would, in any event, take the same out of the common-law rule mentioned.

"It should be noted that the Legislature, in enacting the law of 1907, appreciating that there might be contracts existing between public-service corporations and customers, valid in the absence of prohibition by written law, and that it was not within its competency to nullify or impair them, expressly provided, that

"The furnishing by any public-utility, of any product or service at the rates and upon the terms and conditions provided for in any existing contract executed prior to April 1, 1902, shall not constitute a discrimination within the meaning specified."

The case was appealed from the Circuit Court. As regards the temporary injunction and the general demurrer, the order was reversed by the state Supreme Court, and that as regards the improper rejoinder of causes of action was affirmed by the same tribunal. M.

Tarrytown, White Plains & Mamaroneck.

The sale of the Tarrytown, White Plains & Mamaroneck Railroad Company under the $500,000 foreclosure suit brought by the Knickerbocker Trust Company, of New York, which Referee Henry Barrett, of White Plains, intended to hold in front of the White Plains Court House on October 8, has been adjourned until November 5.

Fulton Light and Power Company Is Awarded $299,000.

The decision in the Fulton Light, Heat and Power Company against the state has been handed down by the Court of Claims, in which the claimant is awarded $299,000 for property including water rights. The property consists of three parcels of land situated on the Oswego River at the dam at Fulton, N. Y.

The company has an electric-light plant and is furnishing electricity to Fulton and surrounding territory. The state took for the coming barge canal all of the company's water rights, besides some land, and for this appropriation the award of $299,000 was made.

The company takes its water from the Oswego River at the state dam through certain openings, but claimed the right to all the surplus water of the Oswego River at this point not necessary for the old Oswego canal and its witnesses place the damage for the company at about $3,500,000, and the state claimed that the company had no right to any of the water of the Oswego River, and that in the construction of the barge canal the state could take all the water it needed from the Oswego River without compensating the claimants.

The Court of Claims in a previous decision held that the company had title to the center of the river, and in the present decision passes upon the other legal questions involved and awards the company the compensation to which the court finds the company is entitled.

Judge Rodenbeck, who wrote the opinion on the question of title, has also written the opinion upon the final decision of the case, and his opinion is concurred in by Judge Swift and Judge Murray.

Manufacture of Nitrate Fertilizers.

Among recent publications issued by the Bureau of Manufactures is one containing an article on the manufacture of nitrate fertilizers from the air by electricity, describing the method in use in Norway, by Consul-General Henry Bordewich, and a description of the new factory at Niagara Falls, Canada, by Consul Webster. This publication is issued in view of the fact that there are immense waterpowers in the United States, which can be made available for the production of air nitrates. Copies may be obtained by interested firms and business men on application to the Bureau at Washington, D. C.

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PEAT AND THE FUEL QUESTION.

A RÉSUMÉ OF SOME RECENT DEVELOPMENTS.

Peat has long had its uses. From times immemorial it has furnished a satisfactory, if smoky, fuel to the peasantry of Ireland and other countries. It is a sine qua non in the manufacture of Scotch whisky, for how otherwise would that peculiar "smoky flavor" be attained? In Michigan paper is being made from peat. It has even been utilized as a basis for a productive soil, as witnessed by the many flourishing farms on the reclaimed areas of the "mosses" in Lancashire, Eng., as the treacherous peat bogs in that district are designated. But the commercial utilization of peat as a fuel on a large scale is a problem which as yet has not been practically solved.

Peat is what one might call coal in embryo. It occurs in most countries in enormous beds at or near the surface of the earth, and so is readily accessible without mining. The aggregate amount of it at our immediate disposal is well-nigh incredible. It only remains, therefore, for someone to discover a process of converting it into fuel for commercial use at a price which will enable it to compete successfully and at large with coal and others fuels now in common use.

Peat as it comes from the bog usually contains from eighty-five to ninety-five per cent of moisture. To be utilizable as fuel a great part of this moisture must be removed, and the principal problem is to do this with as little cost and as quickly as possible in order to put matters on a commercial basis. In countries where the peasantry use peat as household fuel drying is usually accomplished by exposure to the atmosphere and sometimes by burning a quantity of the dry material to hasten the drying of the wet peat freshly dug from the bog. Air-dried peat as a fuel is considered superior to wood but inferior to bituminous coal of good quality, as even under favorable circumstances it contains from fifteen to thirty per cent of water.

Special processes for the commercial exploitation of peat are many and varied, and although most, if not all, of these can hardly be said to have passed the experimental stage, the prospects are decidedly encouraging. One of the recent processes for the conversion of raw peat into fuel, that by Dr. Martin Ekenburg, has been described at length in recent issues of *The Engineering Magazine*, of London. Doctor Ekenburg's process depends upon the fact that after heating peat in the presence of water to a temperature of at least 150 degrees centigrade, about ninety per cent of the contained water can be removed by very moderate pressure, and practically all of the remaining moisture may then be driven off by the application of a small amount of heat. This is the so-called "wet carbonization" process, as distinguished from the process of ordinary dry charring in retorts. Briquettes made from the resulting product have been obtained which have a calorific value of 11,000 British thermal units per pound. The price of the briquetted fuel has been estimated in England at $1.60 per ton, and the total fuel consumption in making briquettes from the "wet-carbonized" peat has been put down as thirty-seven per cent of the fuel available in the raw peat. The by-products resulting from the consumption of part of the peat as fuel, notably the ammonium sulphate, reduce the actual cost of the finished briquettes to $1 per ton, so it is estimated by the promoters of the Ekenburg process. The briquettes are hard, and black and glossy in appearance, and with ordinary chimney draft burn without soot and smoke. They ignite readily, burn with a long luminous flame, and appear to be suitable for use in place of ordinary coal for most purposes.

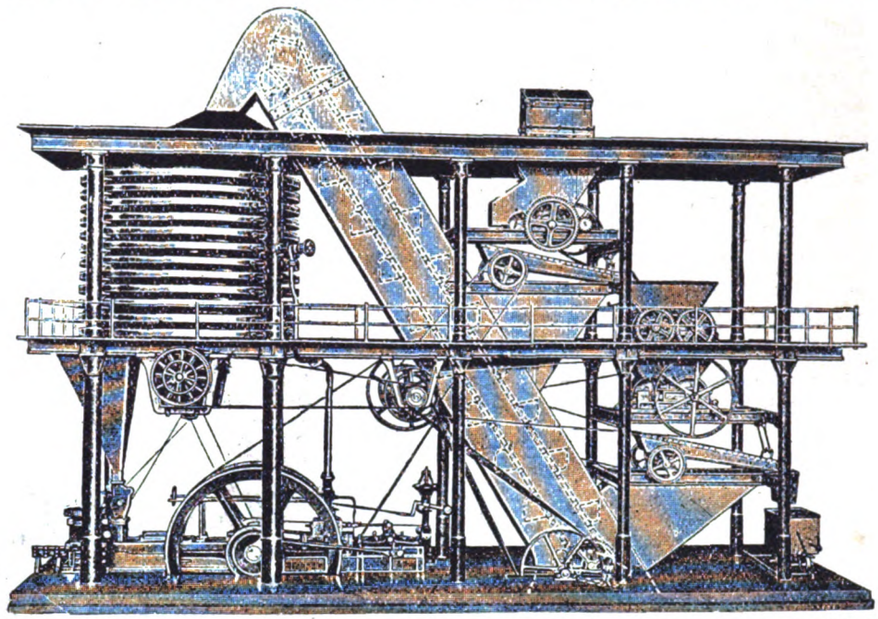

FIG. 1.—PEAT-BRIQUETTING PLANT BY ZEITER EISENGIESSEREI UND MASCHINENBAU ACTIEN GESELLSCHAFT, ZEITZ, GERMANY.

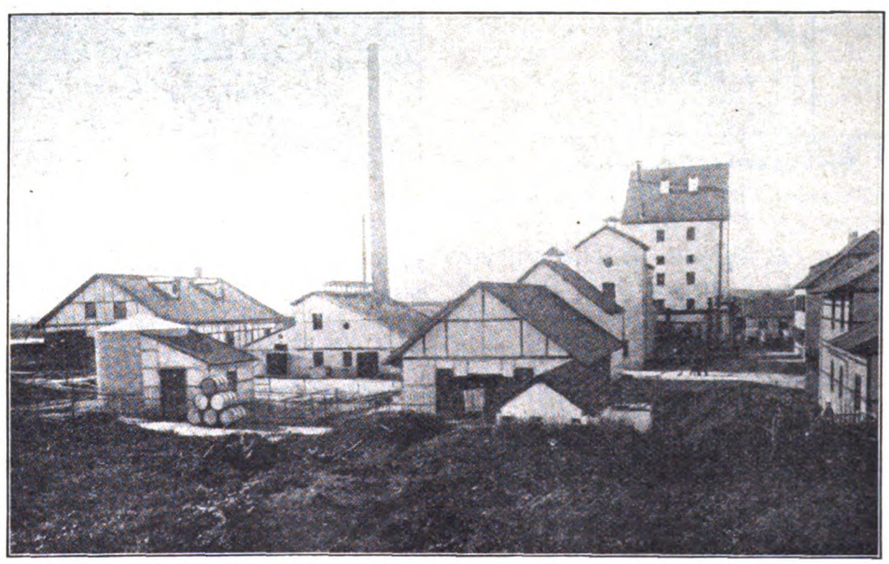

FIG. 2.—PEAT COKING PLANT AT BEUERBERG, GERMANY.

The gasification of peat has long occupied the attention of both scientific and commercial men. This subject was taken up very thoroughly in an interesting paper

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recently presented before the American Peat Society by Charles A. Davis, peat expert of the technologic branch of the Geological Survey, and which was fully reported in a recent issue of *Cassier's Magazine*. Mr. Davis endeavored to show that a gas may be obtained from peat suitable for power and lighting purposes, or a high-grade coke and sufficient by-products to pay for the entire cost of the operation. Peat may be gasified with any of three principal purposes in view, to wit: (1) To drive off the volatile matters to get coke or charcoal; (2) to drive off the volatile matters to get illuminating gas; (3) to convert all of the fuel into low-grade fuel gases. In the first case tar products may be largely recovered as by-products, while in the other two cases the principal residue is in the form of ash of little value left in the producer.

Dr. Martin Ziegler, of Germany, has invented a process using the first of these three methods, which has attained some

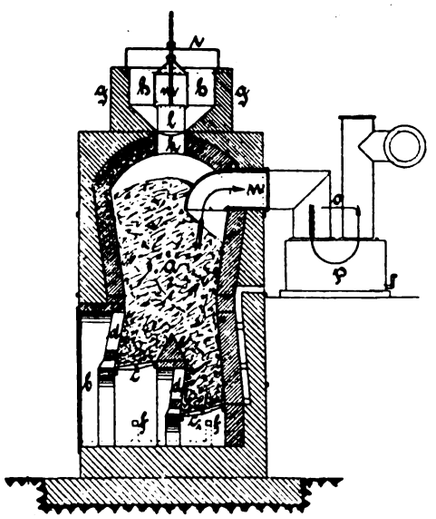

FIG. 3.—SECTION OF THE ZIEGLER PEAT GAS-PRODUCER.

success. In this the peat is coked in vertical retorts connected with condensers for cooling and saving the liquid distillates. The heat of the waste gases from the furnaces is utilized to heat the retorts and concentrate the solutions of the by-products, while the non-condensed gases from the retorts, after passing through the condensers, are turned back to the furnaces to carry on the coking process. The process is thus self-maintaining after once being started. The primary product is a high grade of peat coke, especially suitable for metal melting and refining, and the by-products include light and heavy petroleum oils, lubricating oil, paraffin wax, asphalt, creosote, acetic acid, methyl alcohol, ammonium sulphate, etc. It has been estimated that peat costing $1.19 per long ton delivered at the kiln yields 777.6 pounds of peat coke per ton, valued at $3.75, and by-products to the amount of $1.90, a total of $5.65. The initial cost of the plant, however, is large, and although reports from the three plants so far erected have shown a working profit, the financial results have not up to the present been nearly so flattering as the above figures would seem to indicate.

The Mond producer has been requisitioned in more or less adapted forms for the production of gas from peat, with especial regard also to the recovery of ammonium sulphate as a by-product. In Caro and Frank's experiment in England with Italian peat, an average of 107 pounds of ammonium sulphate per ton were reported to have been recovered in a trial run on 715 tons of peat gasified in a Mond producer. As a principal product, 48,087 cubic feet of gas were obtained, of a calorific value of 152 British thermal units per cubic foot. This sufficed for generating the steam used in the producer and in evaporating the ammonium-sulphate solution, besides leaving gas enough to generate in gas engines 480 horsepower-hours of energy for each ton of dry peat gasified. The cost of production per 100 tons of dry peat used was estimated at $125, while the value of the ammonium sulphate produced was given as $325, and the gas was free and reached the engines perfectly pure. Among other similar producers may be mentioned one by Crossley Brothers, Ltd., in England, which has been placed on the market in that country with some success. Another successful process, but one which has as practically its sole motive the recovery of ammonium sulphate from the peat, is the Woltereck process, and may not be considered here.

Mr. Davis concludes that for small gas-producer plants for generating electricity or other power, the amount of ammonium sulphate to be obtained from peat rich in nitrogen would probably not prove commercially successful, since the skilled-labor cost of maintaining a small recovery plant is high when compared with the margin of profit.

In America a peat gas-producer, known

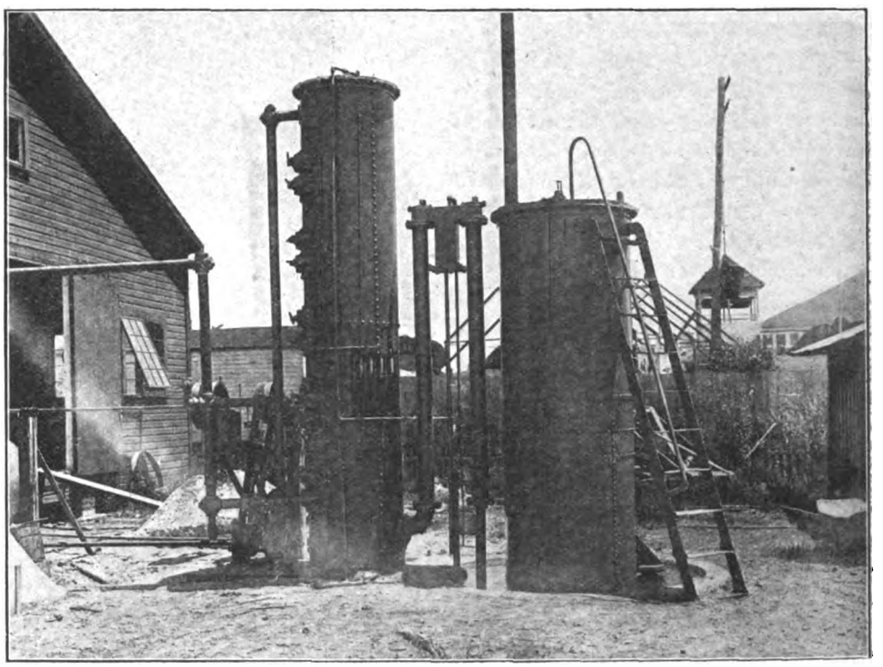

FIG. 4.—GIBBS TWENTY-FIVE-HORSEPOWER PEAT PRODUCER PLANT AT SOUTH JAXVILLE, FLA.

as a vibratory disintegrator, has recently been invented by Colonel Aster, of New York. This machine is at present being tried out in connection with an engine of 150 horsepower, to run a stone crusher. No further records of this invention are to hand at the present time.

There is no doubt that the peat question has progressed much more rapidly in Europe than it has hitherto in this country, this being especially the case in Germany, Sweden and England, where many producer plants for gasifying peat are in successful operation. One of the largest of recent developments is the works now being erected near Aurich, in Germany, where electrical energy, generated from peat, will be utilized to a large ex-

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tent by the German government on the new harbor works at Emden. Thus it appears that in certain localities, even at the present time, peat can be advantageously used as a fuel to a restricted but none the less important extent, and on a commercially paying basis; but whether the methods outlined above will ultimately tend to commercial utilization of peat on a universally large scale still remains to be determined.

The Swedish State Railways are at the present time making tests of peat as fuel for their locomotives. The experiments are carried on between the stations of Elmhult and Alfoesta, with a train of fifty wagons loaded with coal. This train covers the distance between the two stations daily; on some of the trips English coal alone is being used, on some a mixture of coal and peat, and on some peat alone, the mixtures also being of different proportions. Accurate records are kept as to fuel consumption, water consumption, speed, etc.

In this country some commendable work on the utilization of peat as a fuel has been done by the Gibbs Gas Engine Company, of Atlanta, Ga. This company manufactures a producer using peat as the fuel, and has undertaken an elaborate research on the subject of peat gas-producers which it is hoped will be given in full in a later issue of this publication. The Gibbs producer is illustrated in Fig. 4. The other illustrations are reproduced, by permission, from a bulletin entitled "Peat and Lignite," by E. Nystrom, issued by the Canada Department of Mines.

Thanks are due to Charles A. Davis, of the Geological Survey, Washington, D. C., for help in preparing this article.

The Spark Test for Steel.

In a paper presented before the International Association for Testing Materials, at Copenhagen, last September, Max Bermann, of Budapest, stated that in testing steel with the emery wheel, the spark test is so sensitive that a difference of 0.01 per cent of carbon in the composition of the steel could be clearly noted by the character of the sparks, and that the spark ray gives a precise indication of the quality of the metal. Pointed branching lines denote carbon steel (Siemens-Martin); leafy ends of the branching lines indicate Siemens-Martin steel containing a high percentage of carbon; spark pictures, with a blossom-branch-like appearance, are obtained from ordinary tool steel, and so forth.

Use of Rowland Printing Telegraph Machines Temporarily Discontinued.

The Postal Telegraph-Cable Company has recently decided to discontinue the use of the Rowland printing telegraph. Quite a number of newspaper comments adverse to this decision have recently appeared. Since many of these indicate considerable misconception of the facts the company has issued the following brief statement, which shows the great carrying capacity of the Rowland printer and the reasons why this capacity is not conclusively advantageous, however, under the present traffic handling methods:

The Rowland printers have been in operation for about two years upon six of our important circuits, three being operated in octoplex, two in quadruplex and one in duplex.

The octoplex circuits show an ordinary carrying capacity of from 2,000 to 2,500 telegrams of thirty words each per day. The other circuits have the same relative carrying capacity. When there is more active traffic, we have found the system generally to be capable of carrying approximately fifty per cent more than the above-mentioned traffic, when the operators were called upon to make the effort.

One of the quadruplex Rowland installations has been in operation on the line from New York to Chicago (about 1,057 miles) for nearly two years, and includes a Rowland repeater at Meadville, Pa., midway upon the circuit. This circuit has never hitherto been operated on quadruplex so satisfactorily as with the Rowland system.

One of the quadruplex circuits is operated between New York and Pittsburg, Pa., and presents unusual conditions, because of the fact that the wires pass through the coal regions, and are unavoidably coated with carbon to a considerable extent. The method of operating this circuit with the Rowland system has largely obviated any difficulties in that section resulting from these conditions, and our quadruplex operation of this circuit with the Rowland is more satisfactory than it has been with the Morse quadruplex.

Our operators are young women, inexperienced in Morse telegraphy, and, in general, they have proved able to sustain a rate of 300 messages per day, and some of them are able to increase this to 400 messages per day and sometimes 500 messages per day.

We have found the method of "half working" when difficulties of balancing occur, an important and useful improvement in the Rowland system.

We have occasionally found it possible to operate the Rowland circuit in full octoplex when it was difficult, on account of weather conditions, to operate with Morse in any larger capacity than that of duplex.

The standard-model Rowland apparatus is well constructed and extremely durable.

By the employment of low-priced operators, we have been able to effect economies in labor cost, and it is obvious that the use of the Rowland at times results in considerable wire saving.

On the other hand, we have not succeeded in maintaining Rowland operation at all times so steadily as not to conflict with a prompt service. Although the Rowland carries a large amount of traffic, it is subject to more or less frequent interruption. We cannot keep all the parts of the machine constantly operative, and we do not keep reserve installations.

To secure successful operation, the Rowland must be used upon wires with which the Rowland attendants are familiar. The Rowland cannot be promptly placed in operation upon a wire which has not previously been used in Rowland service, or one whose characteristics have not been approximately noted, so as to avoid delay in getting started.

The recent determination to prevent every avoidable delay to telegrams has brought into prominence the somewhat numerous interruptions that take place in the operation of an intricate page printer. It has become necessary to greatly increase the amount of printer apparatus held in reserve, or to provide a reserve of Morse operators and equipment always ready to supplement the work of the printer. To prevent delay to traffic, either of these reserves would be too expensive to permit economical operation of the printer, and for this reason we have decided to stop using the printer for the present.

Although the use of the Rowland system has extended over a period of several years, this use has always been experimental. Modifications of the Rowland apparatus have been suggested, and it is quite possible that further experiments will be made.

All-British Cables.

At a meeting of the Congress of the Chambers of Commerce of the British Empire, held at Sydney, New South Wales, last month, a resolution was moved recommending the completion of the Imperial route between England, Canada, Australia and New Zealand by State-owned electric communication across Canada to Great Britain, and that the postal departments of the various governments of the empire be requested to frame a combined scheme for substantial reductions of telegraphic rates, especially for press cablegrams.

The citizens of Freemantle, West Australia, have voted in favor of raising a loan of approximately $100,000 for the construction of a municipal tramway system.

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CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

CENTRAL-STATION ECONOMIES.[1]

BY W. L. ABBOTT.

The selling price of electricity in large quantities is now about one-tenth of what it was twenty years ago, and as the business of selling electrical energy twenty years ago was a precarious one, whereas stock quotations indicate that this same business at the present time is on a safe commercial basis, despite the greatly reduced prices, which are tending steadily lower, it is apparent that radical changes have been and are still being made in central-station economies.

With the improvement in the general scheme of generation and distribution has come a much more wonderful and unprecedented increase in the volume of business, permitting and necessitating more elaborate organization and a minutely detailed analysis of all of the elements contributing to the cost of the energy sold, so that it is possible for the wholesale manufacturers of electrical energy to tell with as great exactness the cost of each element entering into the grand total of the expenses of conducting the business as it is for a manufacturer of any other staple article to tell the cost of each piece which his shop turns out.

The items which go to make up the total cost of central-station operating may be generally classified as fixed charges, general expenses, and operating costs, of which fixed charges equal the other two combined. Fixed charges comprise interest or dividends on investment, sinking fund or depreciation, taxes and insurance, and are the severest burden on the business. An extravagance or error of judgment in design and construction becomes a tax on the business until that investment is wiped out through the operation of the sinking fund.

Most of the earlier plants were of such irrational design and cheap construction that the depreciation ate up the margin between revenue and operating costs. Under early designs of central-station distribution, the fixed charges, instead of being fifty per cent of the total costs of the business, must have been as high as seventy or eighty per cent, or in cases where the system broke down under excessive fixed charges, they may have been as high as ninety per cent.

Fortunately, now that the day of high prices formerly obtained for electrical energy is past, the business has gotten upon a conservative basis, the different components of the costs are better understood, and the engineering is done by experienced engineers. With the increasing investment in these properties, the capitalization of former errors and of old-time apparatus, now obsolete and discarded, is becoming a smaller component of the entire capitalization, so that the effect in time will be to lessen materially the relative importance of the item of fixed charges. It is by the reduction of fixed charges, rather than by reductions in the amount of general expense or operating costs, that the decrease in the cost of electrical energy in the immediate future will be obtained.

On the other hand, because it is not feasible to construct a pole line for a single wire nor a conduit line for a single duct, and because all installations of whatever nature must have some provision for future growth, as well as for reserve capacity to guarantee the service in case of accident, it is evident that the investment must always be far in advance of the minimum requirements, and to that extent be unprofitable.

The number of power houses which will most economically serve a given market depends on several factors—extent of territory, amount and density of business, overhead or underground transmission, and the amount of permissible voltage.

At the beginning of the era of consolidation of smaller lighting companies and power houses, great economy was realized in operating costs by shutting down the smaller scattered plants and supplying the entire territory from one large central station. This saving was due partly to the higher efficiency of the larger apparatus and partly to the smaller operating force required for the larger units. Such savings, however, occur relatively less and less with the size of the plants, and in plants having a capacity of 50,000 kilowatts are practically negligible, providing the power houses are ideally located.

Unfortunately, however, it is seldom feasible to scatter power houses about through the territory served in the way which will result in a minimum of investment and of operating costs. To provide for the inevitable future extension, for coal storage piles, and for necessary track space requires a tract of land equal in extent to several city blocks. It must, of course, be located where it can obtain an abundance of free water for condensing purposes. It must also have direct connection to at least one, and preferably two, coal railroads, meaning roads along whose lines coal is mined, so that the freight charges will not be increased by switching charges, as would be the case if the coal originated on some other road and had to reach the power house over the rails of the road upon which the power house is situated.

Next to the fixed charges, the largest single item of expense is that of fuel, and as central-station systems increase in size and as the business on their ramified circuits builds up, the fixed charges will relatively decrease and the fixed costs will become correspondingly greater. One of the keys to cheap electrical energy in future years, therefore, will be an abundant supply of cheap fuel.

Having acquired a power-house site of ample dimensions, conveniently located to the center of gravity of the load, adjacent to free water and accessible to the rails of two or more coal-producing railroads, the subject of power-house design is next in order. It should be borne in mind that a power house is primarily an establishment where coal is to be received and burned in enormous quantities, and the refuse to be quickly and conveniently

[1] Abstract of a paper read on October 22 before a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers. Mr. Abbott is chief operating engineer of the Commonwealth Edison Company, of Chicago.

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removed, and, moreover, that of all of the money sent to the power station in pay envelopes, one-half is placed in the grimy hands of those honest sons of toil who handle and burn the coal. The controlling feature, therefore, in power-house design should be to handle cheaply and to burn efficiently the great tonnage of coal which must go through the boiler room every day. A car of fine coal, when standing over the receiving hopper, may be unloaded by hand for five cents a ton, and it may appear to some that this is cheap enough, but if this cost can be reduced to two cents or less by the use of unloading machinery, the resulting saving on a consumption of 1,000 tons a day is not negligible, even in a large power house.

A vigorous fireman, with nothing else to do, may be able to fire ten tons of coal a day on a plain grate, and this, on a consumption of 1,000 tons daily, with some allowance for the load being irregular and with some further allowance for a few additional men to take the place of those who might not show up when their shifts begin, would require, say, 125 firemen—a small army of a class of help which it would be difficult to subject to that degree of discipline which would be necessary for the efficiency required and for the security of the service.

The advent of the chain-grate stoker, with its perfect adaptability to Illinois screenings, makes it possible for one man to burn ten times as much coal as is possible with hand-shovel stoking, and, not only that, but the fires are run much more evenly and at a higher efficiency. Smokelessness now is considered feasible and necessary in all new boiler installations. Such combustion can be readily obtained by the use of chain-grate stokers, but is absolutely out of the question with hand firing.

Formerly boilers were rated on the basis of twelve square feet per boiler horsepower, and it was supposed that the engineer who ran his boilers at a higher rate to some extent took his life in his hands in doing so. Later, with the general introduction of the water-tube boiler, the boiler rating was changed to one horsepower for ten square feet of heating surface. Recent tests and recent practice have shown that not only is a boiler not injured by working it harder, but the efficiency of the boiler and furnace is almost always improved thereby. Therefore, we now find our boilers equipped with tall stacks or with forced-draft apparatus, or with both, to increase the consumption of coal to make a fire over the entire furnace grate of the intensity of that in a blacksmith's forge. To work a boiler fifty per cent above rating is a normal condition, and to work it 100 per cent above rating is not unusual.

With all the refinements and improvements known to steam engineering and adopted in power-house work, we must admit that in our best practice eighty-six per cent of the heat of the coal is wasted and only fourteen per cent converted into useful work under best test conditions; in fact, only twelve per cent is saved under best operating conditions. The greater part of this loss is unavoidable, and it is, therefore, all the more necessary that all possible minor leaks be stopped.

The loss at the bunghole is unavoidable, but some of the spigot losses may be avoided in whole or in part, and as the net amount saved is small, any additional savings effected will add a respectable increment thereto. To this end the fires are run at the highest temperature that the furnace brickwork will stand. All possible precautions are taken to prevent the infiltration of air through leaks in the setting. The steam is superheated to prevent its condensing during its discharge through the turbine blades. The steam pipes are protected with the best of non-conducting covering, to prevent radiation from the high temperature, the latent heat in the exhaust from the auxiliaries is all returned to the boilers through the feed water by being condensed in the feed-water heater, and the vacuum is kept at the highest possible point by the use of large condensers and unlimited volumes of cooling water.

The most striking, as well as the most important, improvement in power-house apparatus in recent years, and the improvement which, to a great extent, has made possible the reduction in the selling price of electrical energy since its introduction, is the substitution of the steam turbine for the reciprocating engine. The old and time-honored piston engine, which has been the handmaid of industrial development through the past century, has probably reached its highest possible development and largest practicable size in the four-cylinder combined horizontal and vertical engine, and any further increases in the size of the unit would result in a prohibitive increase in its cost. This was in part because the weight and external dimensions of the apparatus must increase in a greater ratio than the power of the engine.

The ponderous mechanism, enormously expensive and requiring a huge building to house it, is uneconomical at loads above or below its rating, and, therefore, was a great charge upon the expense of the business, both because of the fixed charges and of the operating costs. The piston speed of these engines permitted only of a comparatively slow revolution of the shaft, not to exceed seventy-five per minute, necessitating a generator of great weight and dimensions. The advent of the steam turbine, with a rotor having a speed ten or fifteen times that of the shaft of the reciprocating engine, permitted a corresponding decrease in dimensions and weight and a material increase in the cost of the prime mover and of the electrical generator. This of itself would be sufficient to warrant its adoption in the place of the piston engine, but most fortunately the efficiency of the new prime mover was greater than that of its predecessor, and its economy was practically constant over a wide range of load.

As a steam turbine exerts its power through the effect of unconfined steam blowing against curved deflecting blades, it is not at once apparent why its efficiency should be greater than that of steam acting expansively in a cylinder against a tight piston, where no leaks exist. As a matter of fact, the piston engine is more efficient than a steam turbine, as far as it goes, but unfortunately it is not practical to expand the steam in a piston engine to more than, say, twenty-five times its original volume, and at that point it is exhausted into the condenser with the loss of that power which would result from all possible expansions below, say, five pounds of absolute pressure.

With the turbine, however, its best efficiency only begins at the point where the piston engine stops. The turbine can and does get the full benefit of the expansion of the steam down to the lowest point obtainable by the largest condenser, and if this highest vacuum obtainable is one-half inch barometric pressure, or, say, one-fourth of a pound absolute, it means that the steam has expanded to nearly 700 times its volume. The object, therefore, of getting a vacuum of the lowest pressure obtainable is that as the absolute zero of pressure is approached any slight decrease in pressure will make a great difference in the number of expansions which the steam undergoes. Thus with a vacuum of twenty-eight inches, the vol-

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ume of steam would be doubled, if the pressure were reduced to twenty-nine inches, and would be doubled again if the pressure were reduced to twenty-nine-and-one-half inches, which is an attainable vacuum in winter, when the cooling water has a temperature in the neighborhood of freezing.

One of the important economies which must not be overlooked in such a discussion as this is the economy of labor. I do not consider it highly important to get cheap labor, but it is essential in a modern central-station system, where equipment costing enormous sums is entrusted to employes, many of whom are miles from their supervising officers, that they be loyal to the employing company, have a fair degree of intelligence and in most cases of education, and, above all, that they be trustworthy.

The greatest of all extravagances in connection with the central-station business are the results of accidents which shut the system down in whole or in part for a longer or shorter period of time. The capital invested is necessary to build up and run the business, but without the confidence of the public invested capital cannot earn dividends. It is, therefore, imperative that the greatest diligence and foresight be exercised in guarding against all possible contingencies which may affect the continuity of the service.

To keep the equipment in prime condition and the operating force at the highest point of efficiency is, therefore, of the greatest importance. This means, therefore, the generous recognition of loyal and efficient service from the employes, or prompt discipline or removal for the opposite reason. It means the prompt and remorseless abandonment of equipment to the scrap pile, regardless of its first cost, the moment it can profitably be supplanted with newer and better designs; protective devices and methods to guard against probable and improbable contingencies. Eternal vigilance and activity and unstinted, yet carefully considered, expenditures are the price of success in the manufacture and distribution of electrical energy, and are the prime factors in central-station economy.

Authorize Merger.

Authorization has been given by the New York Public Service Commission, Second District, to the merging by the Nassau Light and Power Company and the Oyster Bay Electric Light and Power Company.

ARCHITECTS' WIRING SPECIFICATIONS.

BY S. DEUTSCH.[1]

The majority of architects who prepare their own wiring plans and specifications, overlook, or perhaps do not appreciate, the amount of work and engineering skill incidental to the electrical installation.

A few symbols selected from "Kidder's" chapter on "Wiring," located indiscriminately on the floor plans, with a line or two of specifications advising that the installation is to pass inspection, is supposed to cover the situation adequately, with the result that many possible advantages of the installation are denied to the owner.

Specifications prepared in this manner omit a great many important details, such as grade of materials, method of control, construction, etc. The contractor views them with caution, as experience warns him to expect clashes with the architect while the work is in progress, as to their real intent and meaning.

It is natural to expect, then, that the bidder will submit figures which provide against all possible contingenices, such as changes in locations and number of outlets, in the method of switching, providing of proper chases, etc.

The writer recalls a set of specifications which were prepared by an architect with an enviable reputation as a designer of artistic public buildings, but whose ideas on electrical matters differed extensively with the prescribed rules and regulations of the National Board of Fire Underwriters. The sizes of wire which were specified were not consistent with the lengths of the circuits shown on the plans and the allowable drop. No provision seemed to have been made for the vertical risers. It was not evident whether the lights were to be controlled by local switches, or from the cut-out cabinets.

It is perhaps unnecessary to add that in spite of all this, bids were received. The bidders guessed at what was desired and handed in their figures. And, further, it is very likely that no estimate had ever been made by the parties concerned as to the probable saving which could have been effected had all work, materials, etc., been clearly and correctly defined.

In the interest of the prospective owner of a building and the electrical contractor, to those architects who believe it better economy to outline their own electrical specifications, the writer wishes to advance a few suggestions.

A separate set of plans should be prepared on which should be clearly shown all outlets, conduit runs, switches, risers, feeders, mains, cut-out cabinets, etc. A large saving can be effected by combining circuits wherever possible; *i. e.*, using one run of three-fourths-inch conduit from the distributing center to care for two branch circuits, or one-inch conduits to care for five circuits, instead of individual runs of one-half-inch conduit. Symbols should clearly show if the outlet is a ceiling, wall, floor or baseboard outlet. Channels for risers should be located so as to be as near the center of distribution as possible, and every effort should be made to keep the load divided as evenly as possible among the branches. In selecting the distributing centers, thought should be given to the accessibility to points at which the cut-outs and controlling devices are grouped. In the larger and more modern buildings a recess is generally made in the wall for the special purpose of caring for steam, water, gas and electric pipes.

The location of switches in a room should be selected so as to be readily accessible at all times. It should not be necessary to walk through a dark room and grope along the wall for a switch. In public buildings, the layout should be such that janitors and cleaners at night time can readily find the switches and be enabled to turn on only sufficient lights to clean by properly. A big saving in the current consumption is often effected by attention to such details.

While the rules governing interior wiring vary in different localities, yet in the majority of places the rules and requirements of the National Board of Fire Underwriters, as published in the National Electrical Code, are followed, while in other places it is necessary to comply with certain ordinances of the municipality, or requirements of the local electric-light company, before energy will be supplied.

However, inasmuch as the National Electrical Code exemplifies the best methods of installation and construction, it should be followed explicitly, if, after a thorough investigation of local ordinances, no interfering or modifying rules are found to be in force.

The supplement to the National Electrical Code contains a list of approved electrical fittings. These fittings are approved only after they pass the rigorous laboratory tests to which they are sub-

[1] Electrical engineer of the Electro-Mechanical Engineering Company, Manhattan Building, Chicago.

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jected, and are in shape and form such as to minimize fire hazards. Only approved fittings should therefore be specified.

The specifications should also include sufficient detail to insure satisfactory mechanical execution of the work.

Although several methods of wiring are approved, such as open work, molding work, concealed "knob and tube" work, armored cables, and interior conduits, for new construction, plain iron-enameled conduit is used almost exclusively.

The wiring systems are generally either two or three-wire systems; three wires being used as feeders and mains, and two wires for branch circuits.

The following headings and notes are suggested as an aid in describing the plan of installation and equipment in an office building, for example:

A—General Conditions.
Number of plans and what each covers.

B—Explanations.
Give meaning and force of specifications and plans.

C—Scope of Contract.
Generally includes all materials and labor to install and put in good working condition.

D—Inspection.
Compliance with National Board of Fire Underwriters' rules and regulations. Inspection and approval of local board. Contractor pays for inspection and furnishes certificate of inspection.

SECTION I.—ELECTRIC-LIGHT WIRING.

1.—Where electric current is to be supplied from. Class of service. Where service wires enter.

2.—Lamps and Fixtures.—If included in this contract, describe. Generally separately specified.

3.—Locations.—To be as shown on plans. Regarding authority for change of location, and allowances to contractor.

4.—Feeders and Mains.—Separate feeders for lighting and motor service. If alternating current, all wires of one set of feeders or mains must be drawn into one conduit. Regarding proper support for risers.

5.—Branch Circuits.—Size of wire to use. Length of circuits. Kind of wire.

6.—Conduits.—Kind of conduit. Sizes for feeders and mains. Sizes for branch circuits.

7.—Arrangement of Conduits.—To be installed as a system before wires are inserted, ends to be plugged. Care to be used in fitting, etc. To be run concealed. Exposed conduit to be painted.

8.—Conduit Bending.—How to make bends. Allowable in place of elbows.

9.—Outlets.—Kind of outlet box. Must be of approved design.

10.—Fixture Supports.—Must be of approved pattern. To be installed at each lighting-fixture outlet.

11.—Cut-Out Cabinets.—Who to be provided by. Kind. Dimensions, trim, etc.

12.—Cut-Outs.—Generally of the "panel" type, mounted on black polished slate. How supported. Thickness of slate, etc. Knife or snap-switch control of branch circuits.

13.—Fuses.—Kind, and where to be provided.

14.—Switches.—Types of switches, definite locations, etc.

15.—Joints.—All wire joints to be continuous between points they connect.

16.—Cutting, Chasing, etc.—Generally done under other contracts.

17.—Baseboard, Wall and Floor Receptacles.—Kind and locations.

18.—General.—Regarding arrangement of circuits so as to have load evenly distributed. Loop for meter connections. Special features of control, etc.

SECTION II.—TELEPHONES.

1.—Conduit Run for Telephone Service.—Location of telephones. Number of systems to be installed.

2.—Terminal Boxes.—Generally located on each floor in cut-out box for lighting service.

SECTION III.—ELECTRIC WIRING FOR ELEVATOR SERVICE.

1.—Kind of service. Separate feeders. Separate meter. Outlets in elevator hatchway.

2.—Where feeders are to be brought, etc.

The above notes following each of the general headings are descriptive of what these headings should cover. All parts of, and the method used, in the installation should be described in detail, and where necessary, should be accompanied by sketches outlining any special features or arrangements.

In view of the many new electrical devices and specialties being daily placed upon the market, and the stage to which the art of illumination is now being developed, it is to be strongly advocated that for buildings of any appreciable size the average architect will do well to cooperate with experts in the making up of these specifications.

McCall Ferry Power Company.

Judge Lacombe, in an order filed in the New York United States Circuit Court, affirmed the decree of foreclosure granted October 12 by Judge Holland in the Circuit Court of the Eastern District of Pennsylvania, in the suit of the Knickerbocker Trust Company against the McCall Ferry Power Company, which has its main offices in New York city and owns large tracts of land in York and Lancaster counties, Pennsylvania; also a number of islands in the Susquehanna River; valuable flowage rights in that part of the state, and shares of stock in the Susquehanna Canal and Power Company, aggregating $826,900; 1,500 shares of the Susquehanna Properties Company, and all the rights and privileges of the Sowego Water and Power Company.

To secure an issue of bonds aggregating $10,000,000, the McCall Ferry Power Company on June 15, 1905, executed a general mortgage covering all its properties to the Knickerbocker Trust Company, of New York.

The action was brought in the Federal Court of the Eastern District of Pennsylvania because there was a default in the payment of interest on December 15, 1908, and since then the principal on the bond issue, which amounted to $9,027,000, has become due and payable.

Judge Lacombe's order directs that unless the principal and interest due on the bonds, which amounts to $9,226,534, is paid to the Knickerbocker Trust Company within ten days in accordance with the decree of foreclosure, all the mortgaged property is to be sold.

Buying Coal on a Heat-Unit Basis.

At the recent meeting of the American Mining Congress at Goldfield, Nev., Samuel A. Taylor presented a paper entitled "The Purchase of Coal by the British-thermal-unit Method," in which he arrived at the following conclusions, with which many will disagree:

First—That while the British-thermal-unit method of purchasing coal, so far as the purchaser is concerned, may temporarily prove a good thing, it will, in the end, result in his paying much more for his coal.

Second—That, so far as it affects the conservation of fuel, it will prove a failure.

Third—That it is quite possible so to study the method and conditions under which fuel may be used as to effect a very great deal more economy to the purchaser, at the same time not destroying the stability of the business of the producer of coal, which is a condition very much to be desired, as a matter of fact, a necessity, and something which will not obtain should the British-thermal-unit method of purchasing fuel come into general practice.

Fourth—That where the British-thermal-unit method is used, the agreement should state specifically the following:

(a) The method of sampling the coal for testing, which is the most important item in connection with this method.

(b) The method of determining the British thermal units, preferably with the bomb calorimeter.

(c) The person who would make the tests, and, in case of dispute, to have an arbitrator, agreeable to all parties in any way interested, named in the contract.

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ELECTRICAL Advertising *and* Selling

ADVERTISING, DIRECT AND INDIRECT.[1]

BY DUNCAN T. CAMPBELL.

In formulating a campaign for publicity for a central station a number of conditions which exist only in public-service business must be met squarely and overcome before the central station can be said to be well advertised.

First and foremost, the public at large is inclined to think the very worst of the central station for the reasons that it is a public-service company and, second, because it is generating and supplying an energy with which that public is a stranger. Therefore to the central station will fall the blame for absolutely all faults of service, both past and present, and to it will be attributed methods which are not entirely square and above board.

You will be accused of neglecting small consumers for large ones, of discriminating and of discourtesy. This is your own fault. You have not properly reached the public through your advertising.

If you want the truth about your business and its methods known to the public, it lies entirely with you to teach them. You cannot trust to what a layman with good intentions may say, neither can you depend on the outside advertiser to do what you want. You have to meet your local conditions with talk which deals with those conditions. Half-way measures in central-station publicity are dangerous. To secure the best results you should train a man in your employ, a commercial man, if possible, to do your advertising.

Pick out a man with a disposition to observe. Train him in the writing of your copy, in the forms of display. Have him understand what is going on in your plants. Teach him to write what he knows. Put him in touch with the forward movement of advertising over the country and supply him with the magazines relative to the subject. No man, no matter how good an advertiser he may seem, can advertise a central station unless he understands thoroughly these three points, selling, advertising and electrical practice. You cannot advertise a clothing store without a knowledge of dry goods, nor can you advertise electricity, which is a thousand times more involved, unless you understand electricity.

The public understands very little of electricity, more than that the public is afraid of electricity. It is afraid of the central station. There lies your first point. See to it that every piece of copy which leaves your office has a tendency to explain electricity in some one of its forms. See to it that every "ad" which you sign is the bearer of a message of confidence from you to the public. Say that electricity is not the raging devil that people imagine. Explain that it is perfectly controlled and that accidents from it are as rare as they are with ordinary everyday knives and forks. Make the people understand that electricity is there to serve them and that to serve them is your business and that you are doing your level best to make your service so good, so uniform and so impersonal that you are asking them for their confidence.

SEASONABLE ADS.

Each separate season brings a new demand on the central station for timely uses of electricity. Fans, refrigerators, cooking appliances in summer, radiators in fall and winter, heating coils in the spring and fall, all are revenue producers and each should be pushed hard in its own time. A good appliance "ad," backed up by a hard talk by a representative of your commercial department, will do a lot more toward selling the appliance in question and the current it consumes than will an ad dealing simply with the efficacy of electricity.

INDIVIDUALITY.

Make your copy so interesting that no matter what its length it will be read. Therefore, look at home for your advertising man. Writing copy is a matter of individuality, and a man without individuality is like the boy who handles your lamp room, all right in his way, but doesn't produce much additional business for you.

Personality is the hook upon which you catch your customers. Develop personality in your advertisements.

So much for direct advertising.

Be progressive. You cannot tell all you have to say in the columns of a newspaper. Therefore reach out and tell it over the signature of your manager. Put out a booklet. Tell about meters, about lamps, about appliances, about motors. Address each booklet to one subject and see to it that it reaches the class of people who will be interested in that subject.

A MAILING LIST.

Make up a mailing-list from your directory and sort that list into classes. People who are interested in motor drive will not bother about an electric curling-iron, and people who are interested in wiring will not want to take electric radiators at first. Address to each class of customers and prospects the particular literature in which that class is logically interested. What is good stuff for the homes of your merchant class will not go in the homes of your mechanics, so don't try to make it. Tell me what you think I want to know at the moment you are telling it, and when you have convinced me, tell me something new, but keep me interested in you and your doings.

DEMONSTRATION.

Demonstrate. It you haven't a display room, make one. In it keep appliances such as irons, coffee percolators, washing machines, lamps, etc., and everything which can increase the load on your generators. Use them. Make a dark room for your lamps, and keep there every form of lamp you carry and care to have used on your lines. Explain those lamps. Work them separately. Tell what each is best suited for and why. Tell what each consumes and connect them to a meter with a glass front so that the "inside workings" will be seen.

Explain the working of the meter.

Put your appliances to work. If you need hot water, make it electrically. Remember the story of the fountain-pen salesman, who, when he had brought his prospect to the closing point, fished out a pencil to write the order and thereby lost a sale. Give coffee and tea, made

[1] Abstract of a paper read before the second annual convention of the Pennsylvania Electric Association, Eagles Mere, Pa., September 9.

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electrically, in the cold spell, and keep on giving it. Five percolators sold will cover all the coffee and tea you can buy and use in a winter, and the current they consume will be clear gain.

You cannot sell an appliance which has not been explained, and as yet no better method of explanation has been devised than showing that appliance at work.

In summer, use that same salesroom as a rest spot for the citizens of your town. Offer them iced water, keep the place clean and cool with your fans. Offer them the use of your telephones, and make no charge for such service. You are the servant of the people and the oftener you can serve them in small ways the oftener they will think of you.

SHOW WINDOWS.

Use your show windows. Keep them immaculate. In them make displays of the proper method of window lighting. The little trouble and cost of changing the lighting system is part of the regular expense of advertising and will bring in big returns. One week, run a clothing-store window in which you can use your tungsten lamps, again, an appliance window in which your appliance is at work. A window in which an electric-motor drives a real machine will draw a crowd and you have a chance to show the tremendous power of the little motor. A florist's window lighted with a Cooper-Hewitt lamp is a good idea, both from the beauty of the display and because the rays of the green light will cause no end of amusement to passersby in their effect on colors exposed to their glare. Try to have something novel in your windows all the time, and tell the people to come and see it. A little insert in your "ad" space in the newspaper will bring them if you make the display interesting enough the first time.

CARE OF DETAILS.

If you conduct a general advertising campaign, outside and above what you run in your papers, booklets and on the backs of your bills and statements, apply the same care to it as you would to your direct advertising. Don't make use of any advertising that you would consign to your own waste-basket if sent to you.

If you use postal cards, make them attractive. The views of your city help to spread its fame over the country, and your name need appear in only very small type to do all you require of it. The margins of letterheads may be used to advertise various electrical appliances which may be in season, such as irons in the spring and summer, heating pads in the fall, etc., and in addition there may be enclosed in your regular business letters as many advertising fliers as a two-cent stamp will carry.

BILL BOARDS.

It often pays to advertise on several bill boards located on the most traversed thoroughfares, devoting these signs to advertising electric irons, fans, sewing-machine motors, washing-machine motors and other apparatus which can be used in connection with the service you supply.

FOLLOW UP.

Follow up your advertising. If you are talking irons, have your commercial men talk irons. If motors, let them talk motors. Don't rely entirely upon your copy to bring the immense returns you look to it for. Help it out a little with your selling force. There again comes the personal equation. You can help your "ad" man make good with a good solicitor and your "ad" man will be of decided assistance to the salesman, if they work together. Co-operate with every department of your company, it's good advertising to have them boost the commercial end, and it's better advertising to have them keep right along boosting it.

CO-OPERATE.

Co-operate with the city movements. Help such movements as the city beautiful, the playgrounds, parks and bridges, for the good-will of the public created thereby is an asset that cannot be measured in dollars and cents.

If there is an exhibition or a civic carnival given in your town you be in on it, too. You have every opportunity to do some pretty and clever advertising, besides convincing the spectators that you are leading the progress parade.

TALK SENSE.

Turn your advertising, then, into such channels as will increase the confidence of the people in you. Turn it to good use. Make it talk sense. People are interested in saving money. Tell them how to do it. Play the advertising game squarely and above board and never make an assertion in print that you do not mean to carry out. Tell the people you are square with them and prove it. Then you will make your advertising the means of bringing in a lot of revenue and you will have made a padlock for its keeping of the confidence you have created in the people's minds.

A Large Telephone Merger Rumored.

A newspaper account, emanating from Toledo, Ohio, states from what is claimed to be reliable authority that a combination of the independent telephone interests of the Middle West with the Bell company's system has almost been completed. The statement was that the Bell company had secured options on the various Independent companies, which James S. Brailey, of Toledo, and his associates control. These properties are:

The United States Telephone Company (the Independent long-distance line); the Cuyahoga Telephone Company, of Cleveland; the Home Telephone Company, of Toledo; the Indianapolis Telephone Company (local), and the New Long-Distance Telephone Company, of Indianapolis.

Neither confirmation nor absolute denial could be obtained at Toledo directly after the publication of this statement. However, Charles S. Norton, secretary-treasurer of the New Long-Distance Telephone Company, of Indiana, stated at Indianapolis that this story was without foundation of any kind, and is merely a reiteration of the rumors that have cropped up periodically. He stated emphatically that no deal of this kind was in contemplation, and said the recent deals that had been transacted in Ohio were merely steps in the progress of unifying the Ohio Independent system, and to associate it more closely with the Indiana system. Mr. Brailey has also denied the whole story.

The New Telephone Newspaper.

The Telephone Company of America has been organized in New York with Manley M. Gillam president and William H. Alexander secretary and treasurer, and pretty soon we'll be able to flop over in bed mornings, turn on a telephone-like arrangement and listen to a summary of news from all over the world without getting up out of bed.

To anyone who has been to Budapest the "telephone newspaper" is no novelty. President Gillam says. Over there a complete plant is working. It furnishes "canned" news to 160,000 subscribers daily. It has other features, too. The new company hasn't decided on rates. In Budapest subscribers pay sixty cents a month and a quarter a month for every additional extension. Cornelius Balassa, of New York, is said to own all American rights to the machinery, appliances and patent that will be utilized.

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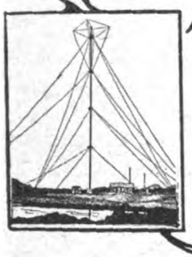

TELEGRAPHY—TELEPHONY, and WIRELESS.

THE BELLINI AND TOSI DIRECTIONAL WIRELESS SYSTEM; THE NEW EXPERIMENTS.

BY A. DE COURCY.

Our readers will remember the interesting results which were obtained by Messrs. Bellini and Tosi, two Italian scientists, as regards the directing of wireless messages to a given point. In fact, they have gone far toward solving this problem, which is an important and indeed almost an essential point in order to secure the benefits which we should expect to have from wireless telegraphy. As long as waves from a station are sent out in all directions and can be perceived by any station within range, the system must be acknowledged to be yet in a primitive stage of development. In a conversation which the author had not long since with M. Tosi, that gentleman spoke of the experiments he and his colleague had been making at the stations upon the channel coast of France, at Dieppe, Havre and Barfleur, and at present, after a long series of preliminary researches, the system has reached a practical working point, as was clearly demonstrated in the messages which were exchanged between the different stations and also between stations on the English side of the channel.

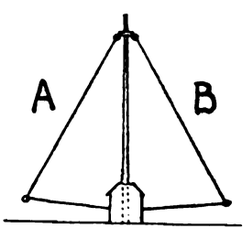

FIG. 1.

The work which was carried out for directing the waves consisted of two parts: First, the experimenters were able to direct the waves in a certain line, but in this case the waves proceeded in both directions from the front and the back of the apparatus. Quitie recently, however, they were able to suppress the waves coming from the back part, so that the messages could be sent in one direction. It is this latter feature which we wish to bring out at present, but in order to have the matter clear we will speak briefly of the general method which is used.

For the aerial circuit there are used two systems, each of which consists of a triangular nearly closed circuit formed by two wires *A B* brought down from the top of the mast and connected by a cross-wire at the station (Fig. 1). The second vertical triangle is mounted crosswise to the first, so that we have four descending wires at the four points of the horizon. When the two circuits are excited at the same time, they give a resultant effect, and the direction of the effect in space depends upon the amount of excitation in each. Where one of the circuits only is excited, the waves will follow one direction, owing to the neutralization effects which take place between the two wires of the same triangular oscillatory circuit. In all these cases, however, the term "direction" applies to the front and rear at the same time. To make this clear we show the character of the radiation from a single circuit, as taken by a Duddell thermo-galvanometer (Fig. 2). Thus directly in front, or at an angle of no degrees, the energy of the waves is represented by the value 308. At the fifteen-degree point it falls to 264; at thirty degrees it is 198, and so on, and thus the working angle is limited to a comparatively small area. When we mount a like system perpendicular to this we have an effect which is the same as if the present curve were to be rotated about its center, and the waves are thus directed to any point of the horizon. Were we to discard all the values below 264 as useless, we would thus secure a directing effect limited to fifteen degrees on each side of the center, and so on.

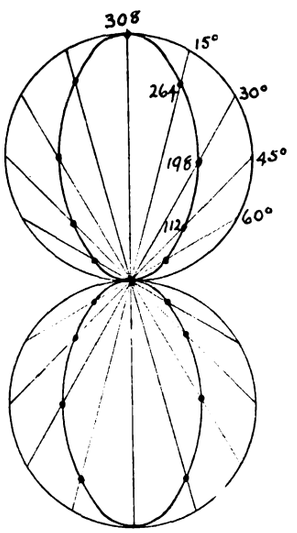

FIG. 2.—ENERGY DIAGRAM.

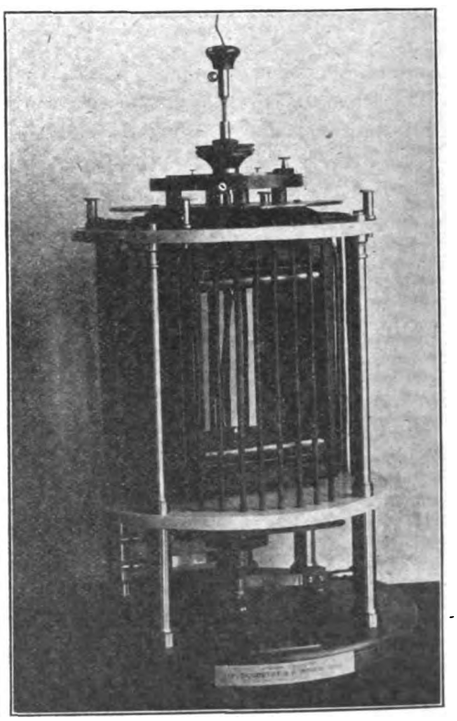

FIG. 3.—RADIO-GONIOMETER, TRANSMITTING END.

The triangular form is chosen instead of a four-sided circuit, as it is easier to support from a mast. However, all the previous attempts to direct the waves failed because it was impossible in practice to turn such a system about so as to face the different points of the horizon, and the problem is only solved by the above use of the double system, combined with an apparatus which allows of vary-

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ing the excitation in the two systems at will, so as to change the direction of the resulting waves. Such an apparatus has been devised by Messrs. Bellini and Tosi, and it is constructed at Paris by the well-known Ducretet firm, which makes a specialty of wireless apparatus. The writer is indebted to the kindness of M. Roger, the chief engineer of the firm, for the illustrations given of the radio-goniometer (Figs. 3 and 4) for the transmission and the similar instrument for the reception.

The radio-goniometer (Fig. 3) of the transmission end is composed of two fixed coils mounted vertically, the system being represented in horizontal projection at m_1 and n_1, Fig. 5. The coils are connected, respectively, to the fixed antennæ $A\,B$ and $A_1\,B_1$, respectively. A third coil

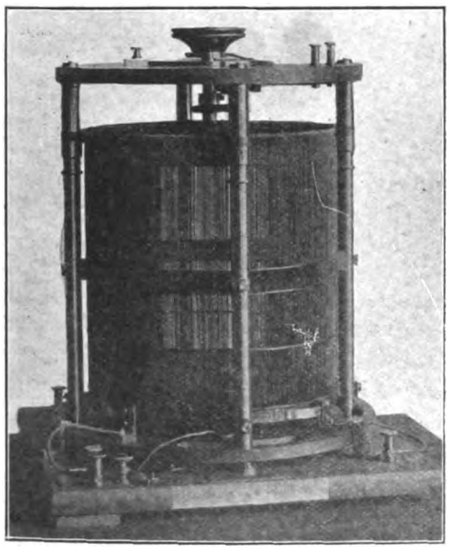

FIG. 4.—RADIO-GONIOMETER, RECEIVING STATION.

S_1 is mounted so as to rotate in the interior of the two fixed coils, and this coil is connected to the exciting circuit. If we dispose the movable coil S_1 according to the plane of the fixed coil m_1, we will in this position only excite the mast circuit $A\,B$, and in consequence the waves will be transmitted in the direction $A\,B$. If the same coil S_1 is placed in the plane of the fixed coil n_1 we will have the transmission on the other hand in the direction $A_1\,B_1$, or at right angles to the former direction. When the movable coil is disposed as represented here, that is, at forty-five degrees, or midway between the above positions, the two mast circuits $A\,B$ and $A_1\,B_1$ will be excited equally and simultaneously, and the electromagnetic field resultant from the action of the two coils will have the direction of the coil S_1. If the movable coil were turned completely about, so as to be still at an angle of forty-five degrees, but in the contrary direction from the present, we will invert the sense of exciting the aerial circuit and the direction of transmitting will be perpendicular to what it was previously.

In an analogous manner, when the coil S_1 is in any position with reference to the fixed coils, the two aerial circuits are excited differently, one of them more so than the other, and in consequence the resultant effect of the two aerial circuits lies at a certain angle which corresponds to the angle at which the coil S_1 is set. As the construction of the apparatus allows us to turn the movable coil through any angle, it follows that we are able to produce an emission of waves in any given direction corresponding to this. In order to operate the system so that the direction of the resultant field will coincide with that of the movable coil S_1, it is necessary that the excitations of the mast circuits shall vary according to the sinusoidal relation in function of the angular position of the coil S_1. To carry this out in practice, the coil S_1, instead of being wound in a flat shape, as is indicated in the diagram, is in actual construction wound upon an upright cylinder which can be rotated about a vertical axis, as will be noticed in the illustration. The apparatus carries a needle which is fixed to the movable coil perpendicular to the axis of rotation and in the mean plane of the winding, and the needle moves over a fixed graduated circle. In consequence, when we know the angle of direction of any given post of reception it is only necessary for us to place the needle upon the corresponding point of the graduated scale in order to be able to transmit in the direction of the post.

In Fig. 4 is shown the appearance of the radio-goniometer for the reception of the waves from a distant station, and it is analogous in its principle to the above-described transmitting instrument, being formed of two fixed coils m and n (Fig. 6), and a third and movable coil S. The fixed coils are connected to the aerial circuits $A\,B$, $A_1\,B_1$, and the coil S is connected to the coherer or other wave-detecting device. If the transmitting post is placed in the direction of the aerial circuit $A\,B$, this latter is traversed by a current, and this latter acts to form a magnetic field in the interior of the coil m whose direction is perpendicular to $A\,B$. When the movable coil S is placed in the direction of the coil m connected to $A\,B$, it receives the maximum action of the magnetic field, and we thus have the maximum action upon the coherer, or the best effect in the reception of the waves. When we turn the coil away from this position we gradually lessen the effect of the reception, coming down to zero. When the transmitting post is in the direction of the other aerial circuit $A_1\,B_1$, on the other hand, we have an analogous result when shifting the movable coil with relation to the second coil n.

If the direction of the distant transmitting station forms an angle of forty-five degrees with the plane of one of the aerial circuits, the resultant magnetic field is perpendicular to the line of direction, and its effect upon the coil S is a maximum when the latter is perpendicular to the direction of the field, that is, when it is directed toward the transmitting post.

When the transmission post is situated at any angle on the horizon, the direction of the magnetic field depends upon the angle which the direction of this post forms with the planes of the aerial circuits, and in consequence the maximum

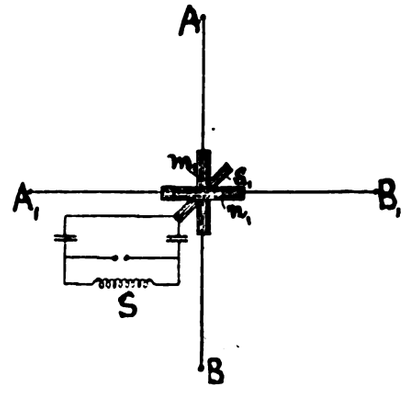

FIG. 5.

point for the reception occurs where the movable coil is turned in the direction perpendicular to the field's direction. To carry out this principle under the proper conditions, the winding of the movable coil is analogous to that of the transmitter coil mentioned above, and like it there is provided a pointer for showing the direction.

Owing to the form of the apparatus, it has a selective effect, and will now receive only the waves coming from stations lying within a certain angle, thus giving the reception of messages only from a given post (at least as concerns posts which are not very close together) and excluding other stations. At the same time we perceive the actual direction of the distant post after we make the adjustment of the movable coil for the maximum effect, seeing that to obtain such

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effect the coil must be adjusted in that particular direction, so that when signals are received from an unknown post we are able to find its direction at the same time as we receive the message. The best method of determining the direction of the post is to make the reading at a certain angle on either side of the supposed

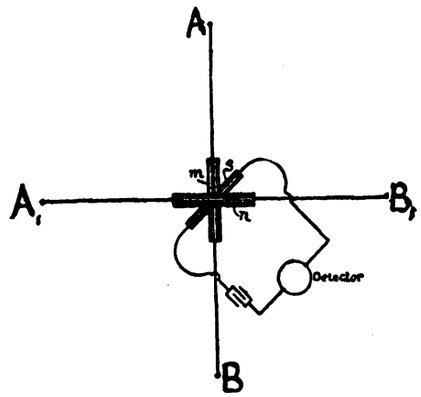

FIG. 6.

direction, at which the effect is zero, and then to take the middle point between the two zero readings, which gives the maximum point, and therefore the desired direction. In the case where several readings can be taken in one experiment, we can find the angular position of the distant post to within one degree without any trouble.

We now come to the more recent experiments which were carried on by Messrs. Bellini and Tosi, in which the method has been carried to a still further degree of perfection. In the foregoing experiments it was possible to direct the waves at a given angle, but in this case the waves were sent out in the front and the back direction at the same time, so

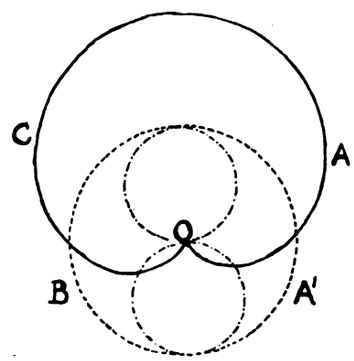

FIG. 7.

that there was still an important point to be reached in suppressing the backward waves, so that all the radiation would be sent out from the front and in consequence directed toward a single station. In the former case either of two stations placed at the front or back on the same straight line, could affect the receiving station, so that it would be impossible to say from what side the signals were being sent. As to the new method of transmitting the messages, which was carried out very successfully from the channel coast stations, it can be shown how it is possible to suppress the radiation which passes to the backward side of the station. In this case we use a third antenna, which is composed of a single vertical mast wire, mounted in the middle between the wires of the other circuit. In this way we have at the same time the ordinary antenna, which radiates out in all directions, and the above-mentioned combination, which radiates only in the front and back direction. When we operate both of these methods at the same time we produce a resultant effect which is shown in Fig. 7.

As we saw above, the effect of the double-directed method could be represented by a diagram formed of two circles lying tangent to each other $A\,A^1$, with the transmitter placed at O. On the other hand, it is evident that the diagram of the simple or all-direction antenna will be represented by a circle having the mast as the center. The radii of the circle show the values of the electromagnetic field taken at the various points, these values being necessarily equal. It remains to be seen what will be the result when we combine the effects of the two systems. The present circular diagrams represent the values of each system where the amplitude of the circular-emission

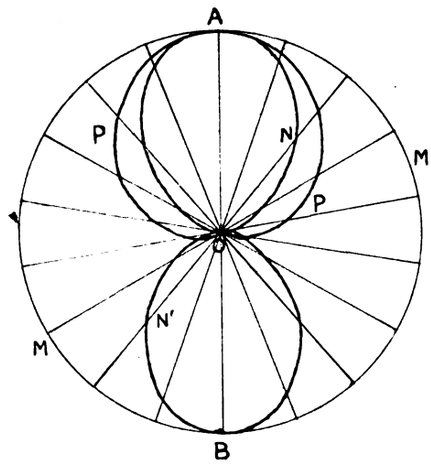

FIG. 8.

system is equal to the maximum amplitude of the double-direction system. (Here the difference of phase of the waves between B and A is zero and that between B and A^1 is 180 degrees.) By drawing the radial lines from the central point representing the values we can combine such factors so as to find the resultant energy radiated from O along any given radius. This gives us the closed curve C, which is, in fact, a cardioid. It will be seen that we now practically suppress the radiation from the rear side of the transmitter, leaving only that on the front side, with a maximum effect directly in front of the apparatus. It is

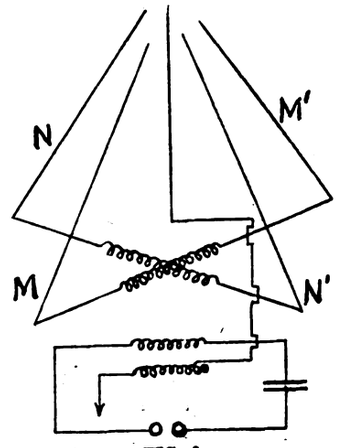

FIG. 9.

of more importance, however, to see what will be the curve for the energy values, as these are what go to influence the receiving station. By using the proper formulas for the cardioid curve we can plot these values, and they give us the closed curve shown in Fig. 8 in heavy lines. We can now compare this with the values shown by the circle for the ordinary antenna, or by the double curve of the two-direction system. It will be seen that the area covered by the single-direction system is smaller than for the other cases, and hence we secure a decided advantage.

Different methods can be used in practice for exciting the closed oscillatory cir-

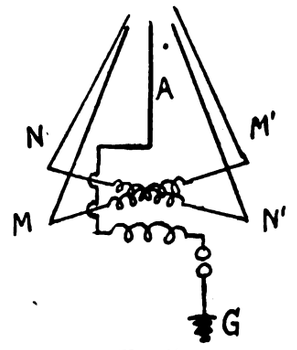

FIG. 10.

cuit and the single-mast wire at the same time. There is a phase difference of about ninety degrees between the emissions of the two antennæ, for an equality of phase in the excitations. In Fig. 10 is shown the vertical antenna A mounted between the four wires $M\,M_1$, $N\,N_1$ of the above-mentioned system, together with

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the exciting system. Another method is used in Fig. 9, and various other combinations can be employed. In the one case the excitations of the two systems coincide as to phase, while in the other case there is a difference of ninety degrees between phases. Actual readings of the energy transmitted were made with

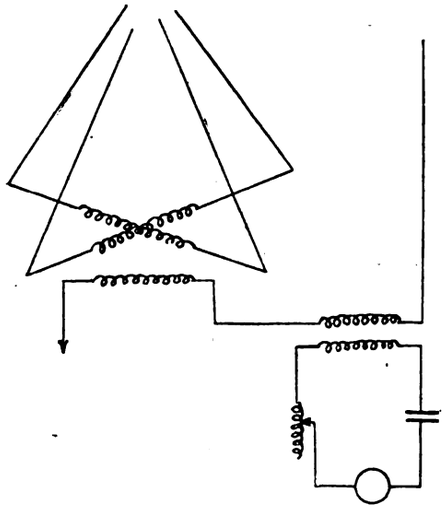

FIG. 11.

the thermo-galvanometer in the different connection methods.

To excite the two systems at the same time there is added an internal coil to the radio-goniometer, which is connected to the vertical antenna, and it is arranged so that the latter is constantly excited while we make the needed variations in the double circuit. In this way the pointer is placed as before in the desired direction to which we wish to transmit, but this time there are no backward waves.

The reception of waves upon this prin-

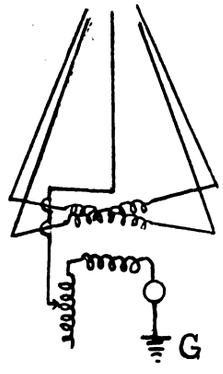

FIG. 12.

ciple is carried out by a method which is analogous to the transmission. Without going into the details of the latter, we give two diagrams which show the methods of connecting. For adjusting the phase difference for quadrature, an excess of self-induction can be inserted in one of the circuits (Fig. 11), or the connections shown in Fig. 12 can be employed. In this way we are able to find the point whence the transmission comes and also to receive no effect when the radio-goniometer is reversed, as is desired. The advantages of the above system are many, as will be supposed, and under the present conditions of radio-telegraphy we can only achieve independence of stations in this way. In fact, according to the convention of Berlin, wireless posts are to use a fixed and determined wave-length. Vessels, for instance, are to employ a wave-length of 300 metres. When, therefore, there are two vessels transmitting at the same time to a post it will be impossible, or at least very difficult, to read the signals. A directed system is in fact necessary for the extension of wireless operations.

For naval or military work, among others, its advantages are striking, and we have results which are obtained for the first time. Thus we can determine the direction and the position of a vessel which is in distress. To determine the actual position of a distant station we use two shore stations. Knowing the angle of direction of each from the distant station and the length between the land posts, we calculate the exact position from these data. We can also learn the position, speed and route of a fleet, friend or enemy, and take the needed decisions. Friends can receive our signals, which are concealed from the enemy, and again the position of an enemy's army is found. Intentional disturbing waves cannot be sent by the enemy so as to affect the signals from or to these instruments.

Proposed Wireless Across the Russian Empire.

Advices from St. Petersburg state that the Russian War Department has begun the installation of a chain of wireless stations connecting Russia in Europe with the far eastern parts of the empire. It is proposed for this purpose to erect a number of intermediate stations between the Baltic and the Pacific Ocean, and it is calculated that from three to four stations would be sufficient to permit of messages being transmitted from the Far East to St. Petersburg. In the most recent trials which have been made in military telegraphy in Russia, it was found possible to exchange telegrams between wireless stations on the Baltic and the Black Sea, a distance of 1,240 miles. In these experiments the most favorable results were obtained in damp weather.

Restricted Telephone Development in Great Britain.

The Government monopoly in telegraphy and telephony in Great Britain and the manner in which the control given by that monopoly has been exercised have largely restricted the development of the telephone in this country, says a writer in the London *Times*. If the telephone were as free from political interference here as it is in the United States there might easily be six times as many telephones in use in Great Britain as there actually are, and the service would be proportionately more valuable to the public. But the cost of the service to the public is not nearly such a great deterrent in its larger use as the lack of facilities for extensive development. When the annual use of a telephone line and station can be had for $25 or $30 it cannot justly be urged that the service is not supplied at a cheap rate. When a public station call can be made for four cents in London or for two cents in any other city in the country it cannot justly be urged that the general public is debarred from the use of the service by the cost. Indeed, considering what it accomplishes, the telephone service is the cheapest of all means of communication.

What can be justly urged, and is unquestionably true, is that the development of the telephone system has been artificially restricted through the exercise of the postmaster-general's legal monopoly. This control has been ostensibly exercised in order to protect the state revenue from the telegraphs, although the state was losing money on its telegraphs before the telephone came into use. The history of the political control of telegraphy and telephony in this country is that of a continued effort, with all the power of the state machine behind it, to prevent the growth of the fittest.

The real grievance of the public against the political authorities who have controlled the fate of the telephone is not that they have made the telephone service dear—for it is not dear—but that they have restricted its development, and so reduced the usefulness and efficiency of the most valuable means of communication yet invented.

A party of officers of the Postal Telegraph-Cable Company, including President Clarence Mackay and Vice-President C. C. Adams, have been in Chicago the past week on a tour of inspection of the company's properties.

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ELECTRIC TRACTION

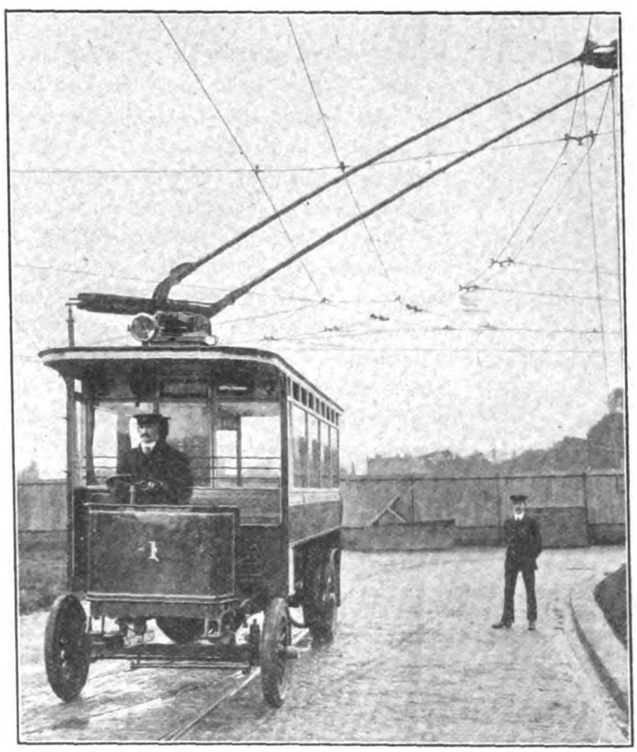
First Trackless-Trolley Car Around London.

During the past twelve months great efforts have been made to introduce into England what has come to be known as the trackless-trolley system of electric traction, although by many this designation is regarded as a misnomer. Deputations from many leading British cities have made trips to the Continent to view what has been done there in the matter, and invariably they have returned enamored of the principle of the system and reported in favor of its adoption, especially for the outer portions of existing tramway systems.

Several corporations expressed their intention of promoting bills in the last session of Parliament in order to secure the necessary powers to spend money in this direction, but in no case was success achieved, for the ratepayers were not taken into the confidence of the tramways committees in most cases and indignation was usually expressed at what was generally regarded as a leap in the dark, particularly as no important Continental city has yet taken seriously to the system. Perhaps another reason for the antipathy of the British public was the repeated exhibition in England of photographs of German and Austrian built cars, the design of which is in such opposition to English general ideas of tramcar and omnibus construction, that a feeling of repulsion may have been engendered.

But, however all this may be, it is certain that tramway managers throughout the country are favorably disposed toward the system, and the knowledge of this may have had an influence in the incorporation in July of last year of the Railless Electric Traction Company, which set to work to evolve a system of trolley traction without the use of rails which would embody the best features of the Continental systems and at the same time retain many characteristic British features. After twelve months of experimental work the company has now completed a vehicle of all-British make which from the exterior appearance alone is bound to create a far better impression on the public than the less rakish and more cramped designs of the Continental cars of a similar character.

The main interest in the car really lies in the current-collecting device, for it is fitted with two twenty-five-horsepower railway motors of the British Thomson-Houston Company's standard construction with the usual series-parallel controller and grid resistances. As will be



THE FIRST TRACKLESS-TROLLEY CAR AROUND LONDON.

seen from the illustration, the car body is of the single-deck type, and has a seating capacity for twenty-two passengers, with two additional seats on the rear platform. It will also be noticed that the method of transmission to the rear wheels is by means of chains, thus following the earlier, and many present, designs of petrol-driven motor omnibuses, so common on the streets of London.

Coming now to the general principles which have guided the company in drawing up their designs, it was realized that railless traction in England would be extensively employed as feeders to existing tramway lines, and that these extensions might themselves afterward be converted to tramway lines when the traffic had sufficiently developed to justify the use of rails. It was therefore deemed requisite that the overhead equipment should be of such a character as would be equally serviceable to either system of traction with the least possible alteration. This, of course, rendered it necessary that the trolley head should be of the usual under-running type, but early experiments soon proved that the ordinary swiveling trolley base was useless to keep the head in contact with the overhead conductors under the special conditions of service, even when the pressure of the springs was such as to almost cause the destruction of the overhead conductors. A special trolley base has therefore been designed on which, besides the usual running springs, there are additional springs working in a horizontal plane and controlling the pivot of the trolley base in such a manner as to relieve the trolley wheel of excessive side pressure against the trolley wire, even when the car is running at some distance from the wires. With this attachment, experiments have shown that the head travels freely under the wires, and without appreciable side pressure, at whatever angle the pole may be trailing, from ninety degrees on one side to ninety degrees on the other.

The earthing of the steel frame of the car is a point to which much consideration has been given, although hitherto, in Continental systems, this has been ignored, and full reliance placed upon the insulation of the motor circuit. The company claims to have solved this difficulty by a combination of the triple trolley head and triple line hanger. (This

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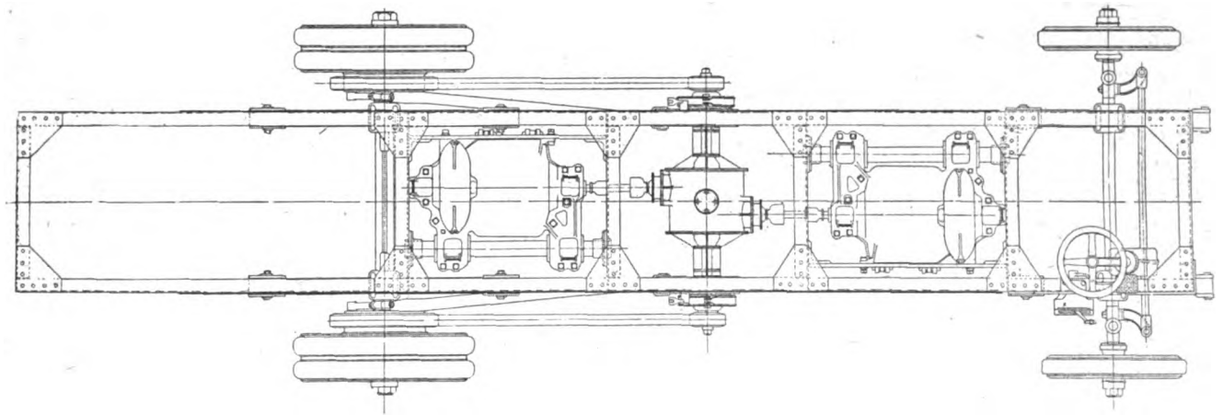
is plainly seen in the illustration.) These designs require that the overhead line should comprise three trolley wires, of which the outer two wires are positive and the center wire negative. (An alternative two-wire design has also been prepared which will be described later.) Three trolley wheels are mounted on a single rotatable head, the two outer wheels, which are connected together, making contact with the outer or positive wires and the inner wheel with the center or negative wire. To insure that the inner wheel may not, under any circumstances, come in contact with either of the positive wires, the negative wire is supported at a level of several inches below the positive wires, and the negative trolley wheel is mounted in a corresponding position relative to the outer wheels. In order to insure accurate spacing of the trolley wires, the three conductors are supported by a triple hanger, which may be made in three separate parts bolted together. Then, if at a later date it is decided to equip the route as a tramway, it is only necessary to remove the center portion of the hanger with the center wire and slide the two outer portions with their trolley wires to any desired position on the span wire.

A distinctive feature is that the trolley head has a rigid base. The trolley pole is made up of two separate poles which form two sides of a parallelogram of which the two ends are the trolley base and the head, respectively. The head, therefore, always remains parallel to the base, and in consequence, approximately parallel also to the surface of the roadway. By a socket-and-plug attachment the head may be converted into the usual single-pole trolley head, which can be used for running the trackless car along the route of an existing tramway line. The return circuit is, in this instance, provided by the rails, to which connection is made by a pair of slippers, which are suspended from the rear platform of the car, and travel in the groove of the rails. These slippers, however, allow the car to deviate several feet on either side of the center line of the track. In combination with the spring-controlled trolley base, the triple head has demonstrated its ability to maintain contact with the trolley wires with a pressure of only ten pounds on each wheel.

While maintaining that the triple trolley head is the only means by which the electrification of the metal framework of the car can be permanently avoided, an alternative design has been prepared—and indeed is actually being used on the experimental line—in which two trolley wires only are used. In this, while the possibility of the dangerous condition is not removed, audible notification is given of its existence. The positive and negative trolley wheels are mounted as before on a common rotatable head. The framework of the car, instead of being directly attached to one of the trolley wheels, is brought to the middle of a single-pole double-throw switch, by which it can be connected to either one or the other trolley wheel. A polarized relay is mounted on the car, one coil of which is energized by the trolley circuit and the other by a small storage battery. When the single-pole switch is in the correct position to connect the framework of the car to the particular trolley wheel which is at that moment in contact with the negative or grounded conductor, the relay is inoperative. But should the polarity of the trolley wires be for any cause reversed, the relay instantly brings into action an electric hooter mounted in the front canopy of the car. The hooter continues in action until the driver reverses the switch and thereby transfers the connection of the framework to the other trolley wire. In conjunction with this apparatus is a second hooter which notifies the driver of a breakdown in the insulation of the motor circuit.

Next to the methods adopted for making contact with the trolley wires, the greatest divergence from Continental practice is exhibited in the means devised for transmitting the power of the motors to the driving wheels. The motors are attached to the frame of the chassis and the weight is in consequence entirely spring-suspended from the chassis. In its general features, the chassis follows the lines of motor-omnibus design, but the side channels are strengthened by vertical plates, and the framework is stiffened by cross-channels. Two designs have been standardized, in both of which the rear wheels are independently chain driven from a countershaft. The first design requires only one motor, which is placed with its axis parallel to the center line of the car, and drives both ends of the countershaft through differential gearing. In the second design—that being experimented with—there are two motors, one in front of and the other behind the countershaft, each motor driving one-half of the countershaft through a bevel gear; the two motors are thus mechanically independent. In both cases the controller is fixed under the driver's seat and operated by a lever working over a notched quadrant. Foot and hand brakes are provided for the driving wheels and countershaft. The second design has the advantage of series-parallel control, which, however, is not of such importance for a road vehicle as for a tramcar. The road resistance of a trackless-trolley car bears a much higher proportion to its weight than does rail resistance to the weight of a tramcar. Consequently, the energy consumed by a railless car in over-



PLAN OF CHASSIS OF TRACKLESS-TROLLEY CAR IN LONDON.

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coming its inertia during acceleration, bears a much smaller proportion to the total energy consumed in completing a given cycle of operations than is the case with a tramcar. Thus series-parallel control, which reduces the energy expended during acceleration, effects no appreciable economy in the over-all consumption of electric power. Series-parallel control for railless vehicles has, however, practical advantages, for it provides a second efficient running speed which is often of service in crowded thoroughfares. It also enables a railless car to return to the car sheds without external assistance should one motor be burned out or damaged.

It is quite conceivable, however, that as the result of the experience with the experimental car, modifications will be made in the design, and the present structure must not be regarded as the limit of the ingenuity of the engineers. G.

New York City Interborough.

A final hearing on the failure of the New York City Interborough Railway Company to construct a railroad through the Bronx was held Monday last week before the Public Service Commission.

John C. Tomlinson, counsel for R. C. Wood, plaintiff, called the commissioners' attention to the fact that the nine principal stockholders of the New York City Interborough Company, controlling a total of 2,115 shares, were directors of the Interborough Rapid Transit Company. These names are Edwin Hawley, E. J. Berwind, T. P. Shonts, William A. Read, Joseph Jourdan, Gerald A. Hoyt, each of whom hold ten shares, and Andrew Freedman, with 635 shares, leaving 710 shares for Cornelius Vanderbilt and Alfred Skitt, president of the New York City Interborough Company. Mr. Tomlinson said that the Interborough Rapid Transit Company had put ten shares of stock in the names of six of these men, to qualify them to serve as directors, as they had no direct interest in the New York Interborough Railway Company.

In summing up the case Mr. Tomlinson said: "Of the $3,000,000 of bonds, $1,500,000 has been paid to the Subway Construction Company, which is the Interborough Rapid Transit Company, in advance for work that has never been finished. The other $1,500,000 is in nubilus, which points to the assumption that these gentlemen paid themselves in advance. The secretary, in a report, sets aside a sinking fund of $30,000, indicating that these bonds have been issued."

ELECTRICAL FACILITIES FOR GETTING PERISHABLE FREIGHT TO MARKET.

BY ORRIN E. DUNLAP.

Nowadays we learn, from various sources of information, particularly the press dispatches, that the farmers of the United States are the most prosperous class in existence, made so by the bounteous crops they are harvesting and selling at profitable prices. This is all highly gratifying, especially as we have learned that when the farming communities grow rich, business improves in nearly all lines. However, when the present-day prosperity of the farmers is taken into consideration, it is well to determine the various factors that assist to their strength and wealth.

It might be well to take Niagara County, New York state, as a section typical of the assistance the farmers are receiving from the electrical forces as represented by telephones and electric railways. Of late, Niagara County, considered the garden county of the Empire State, has been harvesting its varied fruits, particularly peaches, and it is told that within a fortnight the cars of the International Railway Company carried over 300,000 baskets of this fine fruit to the Buffalo market. This service was rendered by twelve box cars, one flat car and eight open cars. Each box car had a capacity of 1,200 baskets, the flat car carried 900 baskets, and each of the open passenger cars that were pressed into service carried ninety baskets. The box cars and the flat car made up two trains, one of which reached Buffalo at 10:00 p. m., the other at 1:00 a. m., while the open cars were run regularly every half hour. Loading places were established at Olcott, Burt, Newfane, Corwin's and Wright's stations, and to these places the farmers drew the peaches.

The scene of loading at each place was inspiring, as day after day the fruit was placed aboard the cars, the farmers receiving a receipt from the railroad for their daily shipments. These receipts were practically cash in hand. The farmer receives them without the old-time long drives over rough and dusty roads, breakdowns, etc., and without the time expenditure which driving to market formerly necessitated. He has more time to look after his harvest, the men he employs, his family and stock, and the telephone, with which nearly every farmhouse is equipped, affords quick access to the markets for price informations and orders for the morrow. Throughout the harvest period he is right at home, sending his fruit to the best markets, and is no longer subjected to the low prices offered by the commission men who used to visit his place. His telephone enables him to be fully informed on every feature of the market and shipment, indicating a wonderful revolution in revenue-producing powers. Apples, peaches, plums and melons, as well as other fruits and vegetables, are similarly handled, in each case the farmer being the one who profits.

It is estimated that no less than $1,500,000 will flow into Niagara County as a result of the fruit sales, and those who know feel that it is astonishing how efficient the electric-road service has been for the farmers.

Connecticut Electric Roads.

Reports of the street-railway companies of the state of Connecticut have been filed with the Connecticut Railroad Commissioners for the year ended September 30, 1909. That of the Connecticut Company shows that 129,824,599 fare passengers were carried; net earnings per mile operated, $3,867.47; gross income from all sources, $3,683,227.79; net earnings, $2,873,166.52; taxes paid to the state, $2,500; killed, thirty-four; injured, 1,355. There was paid over to the New York, New Haven & Hartford Railroad Company in accordance with operating contract the sum of $3,644,314.86.

The net earnings of the Hartford & Springfield Street Railway were $62,912.80. During the year the net earnings of the Norwich & Westerly Street Railway Company amounted to $12,816.36. The company paid the state $5,376.17 in taxes and it carried 1,230,508 passengers. There were three persons killed and two injured.

More Electrification.

Further evidence that Rock Island is to have an electric interurban doing business shortly is to be had in the beginning of the work of electricians of the Rock Island road's Mercer County branch, which will be used as far as Preemption, Ill., by the Rock Island Southern. Crews are now working out of Milan setting the poles that were distributed last spring, stringing the wires and connecting the rails with electric wires for the return circuit.

The work, it is said, will proceed until the weather intervenes.

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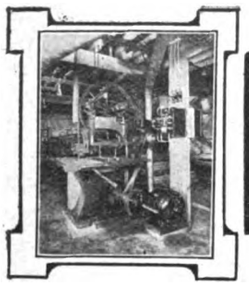

Industrial Power

INSTALLATION, OPERATION, CARE AND REPAIR OF ELECTRIC MOTORS IN INDUSTRIAL OPERATIONS.—II.

BY C. E. DANIELS.

REPAIRS.

Relining Bearings.—Badly worn motor bearings or those accidentally injured in service should be relined, using only the

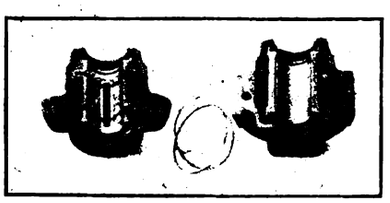

FIG. 9.—SPLIT MOTOR-BEARING.

best grade of bearing metal. Unless a considerable number of machines are operated in one plant, necessitating the provision of facilities for renewing bearing linings, such work should be done in a properly equipped repair shop.

The following instructions in connection with the accompanying illustration are suggestive of methods of renewing all split bearings of the self-lubricating oil-ring type. An iron mandrel *A*, is prepared, having the same diameter *f* as the shaft and dimensions *c*, *d*, and *e* taken from the bearing to be renewed. Iron pieces *BB* and *C* are attached by screws to the mandrel to form the oil-ring slots and the horizontal inspection opening in the top half of the bearing. The pieces *BB* are tapered so that they will withdraw easily from the cast metal. A shoulder *D*, placed so as to fit against the end of the bearing shell, serves as a guide.

Melt the old bearing metal out of the shell and warm the mandrel. While both are still warm so as not to cool the metal too rapidly when pouring, place the mandrel in the lower half shell with the shoulder *D* tight against the end of the shell and the straight bottom portions of the pieces *BB* resting on the split plane of the bearing. Close the joints *x* with putty and fill the openings between the shell and the housing leading into the oil well with wet waste. Pour the molten metal, heated just enough to flow readily, into the space between the shell and the mandrel until the metal is flush with the split surface of the housing. The metal will harden very quickly and the mandrel can then be removed.

Fill the openings *E* in the upper half shell with putty and lay the mandrel in the shell (split side up), block the openings leading to the oil well with waste, and pour, as before described for the lower half. Remove the mandrel, smooth all rough edges in the bearing by chipping or filing, and chip the oil grooves in the lining of the upper half. The bearing surface of both halves should be eased off by scraping, and the edges along the split surface should be filled flush with the shell.

Solid bearing bushings, usually of bronze, when badly worn or damaged, should be replaced by new bushings obtained, if possible, from the manufacturers of the motor in order to insure a good fit.

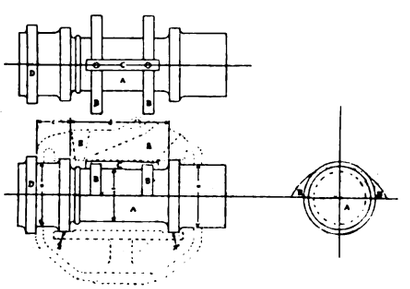

FIG. 10.—MANDREL FOR REBABBITTING SPLIT BEARING.

Removing Shaft.—The laminating rotors or rotating armatures of all modern industrial motors, except the small sizes, are assembled on spiders, which are pressed on to the shafts and keyed. With this spider construction, the shaft can be removed by applying pressure to the spider hub and the end of the shaft, taking great care that the blocking behind the hub does not slip and injure the windings. A suitable press can be improvised by placing cross-bars behind the hub and across the end of the shaft, connecting them by iron rods through the

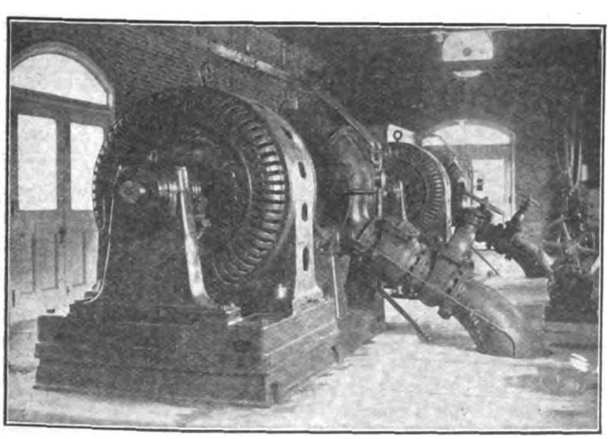

FIG. 11.—500-HORSEPOWER ALTERNATING-CURRENT MOTORS OPERATING CENTRIFUGAL PUMPS.

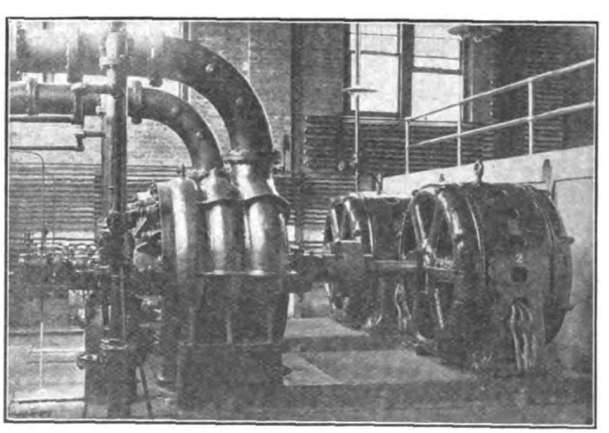

FIG. 12.—250-HORSEPOWER ALTERNATING-CURRENT MOTORS OPERATING CENTRIFUGAL PUMPS.

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spider parallel to the shaft, and drawing the bars together by nuts on the ends of the rods.

Insulation.—To locate poor insulation or "grounds" in motor windings connect one terminal of a circuit containing one or more incandescent lamps to a good ground and the other to different parts of the motor circuits to be tested while they are subjected to full voltage. If the lamps light a ground exists, and the point at which least light or no light is obtained is nearest the ground. The combined voltages of the lamps in the testing circuit should be equivalent to the voltage of the motor, *i. e.*, for a 220-volt motor use two 110-volt lamps in series, etc.

If the defective insulation is accessible it can be repaired with mica, adhesive

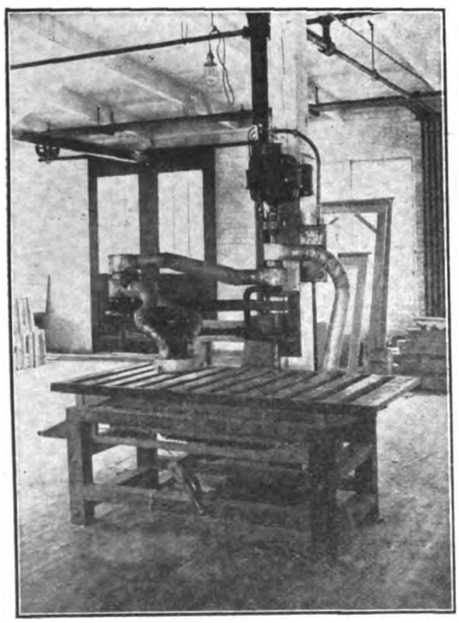


FIG. 13.—ALTERNATING-CURRENT MOTOR ON VERTICAL SUPPORT, DIRECT-CONNECTED TO POST SANDER.

tape, or treated cloth, according to the nature of the defect, and a thorough coating of shellac or insulating varnish should then be applied. If of a serious nature, the renewal of a portion of the windings may be necessary.

Dismantling and Reassembling.—In dismantling a motor, the most careful attention should be paid to all attachments and adjustments, and notes should be made if necessary. In reassembling, each part should be replaced and adjusted exactly as before. The omission or misplacing of any part or the change of an adjustment may cause serious trouble. The windings, commutators and bearings must be well guarded from injury. Armatures or rotors must be handled with slings and spreaders to keep all pressure away from the commutator, collector rings or windings; they must be supported on trusses under the ends of the shaft or laid on a perfectly clean floor or a pad to keep all sharp particles from penetrating the windings. Clean burlap wrapped around the journals and well oiled is a safety precaution against injury and rust if the shaft is to remain long out of the bearings. In replacing the shaft, the oil rings must be lifted to avoid bruising them.

[To be continued.]

Electrical News from Panama.

The installation of the electric light and telephone equipment at Porto Bello is practically completed, says the *Canal Record* (Ancon, C. Z.), and the service is about equal to that maintained in the settlements of the Canal Zone. The power plant occupies a part of the engine house containing the main driving machinery for the rock crushers, and consists of two seventy-five-kilowatt, 125-volt, direct-current General Electric generators, direct-connected to two Ames tandem-compound engines, with the necessary switchboards, etc. Each generator will carry a load equivalent to 1,200 incandescent lights of thirty-two candlepower, but only one machine is operated steadily, the other, which was recently installed, being held in reserve. Day and night service is furnished, and current is also supplied to operate two fifteen-horsepower dynamos which drive the machinery in the machine shop.

There were 435 incandescent and twenty five-ampere arc lights in use on September 15. Thirty thirty-two-candlepower incandescent lights are used in outside lighting, and of the arcs, nine are used outside, and eleven distributed among the buildings of the rock-crushing plant. The incandescents are attached by gooseneck fixtures to poles and buildings along the sidewalks, while the arc lamps are used in the more open spaces.

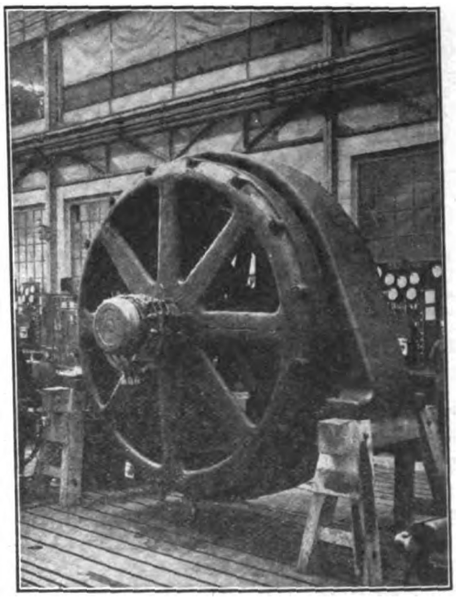
A transmission line to the wireless station was completed in August, and an electric line, with five stations, for firing blasts has been installed in the quarry.

Telephone service is supplied from a central exchange located in the superintendent's office. The apparatus consists of a Sumter, S. C., magneto switchboard, equipped for fifty drops. Instruments of the Sumter, and National Electric Supply Company makes are used, and twenty stations so far have been installed.

DIRECT ELECTRICAL OPERATION OF LARGE WOOD-PULP GRINDERS.

BY OUR BERLIN CORRESPONDENT.

The wood-pulp manufacture of Austria, with her many forests, is of high economical importance to the country, the more so as the numerous waterfalls afford a cheap natural source of energy for working the raw material. With a view to reducing to a minimum the transporting expense of the raw material, a number of minor wood mills were erected immediately on the site of the waterpower, the finished wood pulp being conveyed, after a complicated drying process, to the main factory, where it had to be reconverted to its original condi-



750-HORSEPOWER SLIP-RING THREE-PHASE MOTOR FOR PULP GRINDER.

tion. Being carried out without any concentration or centralization of operation, this scheme thus entailed a number of useless processes, requiring expensive installations and consuming considerable amounts of power.

More rational results could obviously be expected from the adoption of electrical operation, and this has been recently introduced on a large scale, involving the installation of grinding mills adjacent to the paper mill, and connecting the former to a central station. Thus the labor cost and the cost of production were reduced considerably.

The electrical operation of high-powered wood-pulp grinders has been carried out in a number of cases without any hitch, especially as the load is almost

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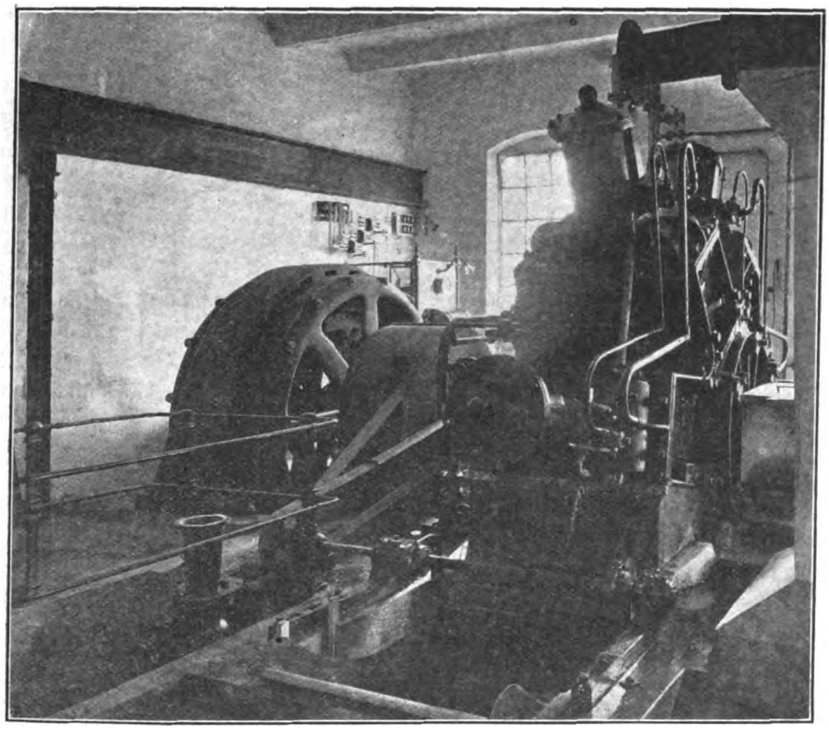
uniform and the load factor nearly perfect.

Direct motor drive for the stone was eventually adopted, the speed of the motor being adapted to that of the grinder, while all the live parts, such as coils, slip rings, brushes, etc., were designed to be unaffected by the moisture which is always prevalent in wood-pulp mills. Owing to the uniform character of the load, polyphase-current motors can be most advantageously used.

At one of the largest Austrian paper mills, that of Ignaz Spiro and Sons, at Krumau, a high-powered, direct-connected, motor-driven grinder was recently installed by the Austrian Siemens-Schuckert Works.



DIRECT ELECTRICAL OPERATION OF LARGE WOOD-PULP GRINDER.

In this interesting plant, the grinder produces wood pulp for the manufacture of printing paper. From 10,000 to 12,000 kilogrammes of wood pulp (supposed air-dry) are produced every twenty-four hours. The stone is 1.37 metres in diameter and makes 246 revolutions a minute. The press cylinders are connected to a conduit, fed with water under pressure by a pump, and of a size allowing beams one metre in length to be inserted into the press casings. These beams are pressed automatically against the stone. The feed of the beams is effected automatically by an electrical regulator, insuring a uniform load on the various presses. The stone can be dressed during operation by means of a special machine.

The operation of the grinder is effected through a Zodel-Voith clutch from a 750-horsepower, three-phase motor designed for 300 volts and forty-two cycles per second, and connected through transformers to a 15,000-volt transmission line.

In designing this motor, special account had to be taken of the fact that operation had frequently to be continued for days and weeks at full load, so that no intervals for cooling could be relied on. Without resorting to any artificial cooling by special ventilating fans or blowers, the dimensions of this motor were so chosen as to avoid any excessive heating in any one of its parts, by causing the air current produced by the rotating armature to ventilate all the live parts.

The stationary part of the 750-horsepower motor has a cast-iron casing, forming a case girder with a number of ventilating openings, and two substantial feet, by which the stator rests on the foundation beams. The active iron body proper is made up of annealed special sheets with coils distributed round its circumference, and is freely suspended in this cast-iron casing by a number of fixed points, so that all parts are air-surrounded.

The coils are made of well-insulated shaped wires in closed slots lined with micanite tubes, and, being provided with bandages outside the iron body, are likewise exposed to the cooling air current. In order to avoid any deformation of the stator, the bearing shields on both sides are fitted in with double teeth, so that an air-gap of one millimetre can be safely admitted. Each shield contains a ring-lubricated bearing, of ample dimensions, with a labyrinth packing of special construction which is absolutely air-proof.

The motor comprises a double-arm system and is fitted to the steel shaft by means of two shrink rings and a wedge. The sheet bundle of the rotor, two metres in diameter, with coils in closed slots, is likewise so designed as to be as well ventilated as possible, so that no accumulation of heat may occur.

The flying arrangement of the slip rings is especially favorable, warranting an excellent means of access to the brushes and rings, while allowing of a symmetrical design of the casing with short distances between the bearings.

Before being delivered, this motor was submitted to thorough tests at the premises of the Siemens-Schuckert Works, when an efficiency of over ninety-two per cent was ascertained with full load, its overload capacity being up to 1,300 horsepower.

This plant is the largest of its kind in Austria and has been for some months in continuous operation.

"Hydroelectrics" in Switzerland.

There is about 250,000 electrical horsepower already developed and used in Switzerland, and it is calculated that a further 750,000 horsepower at least is available in connection with the various waterfalls, says *The Electrical Review,* of London, Eng. In many of the cantons the local government is retaining the ownership of all the public rivers and lakes. The price of electrical energy generated varies according to the method of consumption. Where meters are used the price is usually below nine centimes per hectowatt-hour; where sold for power, an annual sum of 105 lire to 335 lire is paid for the use of each horsepower for 3,000 hours per annum. There is a tax per horsepower of one lire per annum for any fall up to 100 horsepower, of two lire from 100 to 500, and of three lire for everything above 500 horsepower.

Monorail systems have been very successful and are being rapidly introduced throughout India for many purposes.

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BOOK REVIEWS.

"Electricity Explained." By J. Calvin S. Tompkins. The Cochrane Publishing Company, New York, N. Y. Cloth, 64 pages (4¾ by 7¼ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.

This book is designed to present electricity and electrical phenomena so that they may be readily understood by all. The author opens the subject by explaining the methods of detecting electricity with a telephone receiver, goes into the theory briefly, and describes at length the various kinds of currents produced. The last two chapters are devoted to wireless telephony and wireless telegraphy. The author describes the methods in use at present and outlines the manner in which wireless systems may be constructed. The text is written in popular language, and where possible it is augmented by diagrams, making this little book one which should tend to enlighten beginners on some of the phases of electrical phenomena.

"Railway Signaling in Theory and Practice." By James Brandt Larimer. The MacKenzie-Klink Publishing Company, Chicago, Ill. Cloth, 420 pages (5 by 7¾ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $2.50.

This book is an elementary treatise on the subject of railway signaling as practiced in America. As applied to railroad operating practice, railway signaling may be divided into two general divisions: Fixed signals, in which is included any form of signal permanently placed in one spot, and other signals, in which is included any form of signal not of a permanent nature. The author in this work deals only with the former division, which he again divides into two classes, namely —visible and audible signals. Under the first division, the author discusses the theory and practice of mechanical, power, electro-pneumatic, and other types of power interlocking and the various other visible signals. As the designing of interlocking is the most important and also the most difficult feature to acquire of any part of the signal engineer's duty, much space is devoted to this branch of signaling. In American practice little, if any, general use is made of the audible fixed signal as a means of conveying information to those employed in running engines, so that the second division is necessarily brief. Throughout the book the author has used drawings and diagrams liberally to show in detail the construction and installation of the various signals.

"The A B C of Railroad Signaling." By W. H. Elliott, MacKenzie-Klink Publishing Company, Chicago, Ill. Cloth, 75 pages (4¾ by 7¼ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.

This little book is intended to conduct the student engineer or railroad officer who desires a working knowledge of signaling merely to the entrance to its inner workings and apparently mysterious applications. It is written in popular language and is put forth to serve as a first step of railroad signaling. Methods of signaling in use on various railroads throughout the country are described and illustrated.

"Dynamo Laboratory Manual." Volume I. By William Suddards Franklin and William Esty. The Macmillan Company, New York, N. Y. Cloth, 152 pages (5½ by 8½ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.75.

This book is a revised and enlarged edition and covers direct-current studies and tests in three sets of experiments. The object of arranging the experiments in sets is to facilitate the use of the manual by technical students of different grades according to the amount of time they can devote to laboratory work. The tests are arranged in order, in reference primarily to their educational and practical value. Complete practical directions are given for the performance of each experiment, together with a list of suggestions for the student in writing a report of the result of each experiment as he worked it out, thus leaving a wide field for the exercise of the student's originality. This book is particularly suited as a text-book for colleges and technical schools.

"Dynamos and Motors." By William Suddards Franklin and William Esty. The Macmillan Company, New York, N. Y. Cloth, 489 pages (5¼ by 8½ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $4.

This book is intended as a text book for colleges and technical schools, and is divided into five parts. In the first part the author deals with electric current in general and the theory of the dynamo, motor and transformer. Under part two he discusses the operation of the direct-current dynamo as a generator, the operation of the direct-current dynamo as a motor, power losses and efficiencies, and the ratings and guarantees of the various machines. Part three is a general introduction to the theory of alternating current and harmonic electromotive-forces and currents, and fundamental problems as well as polyphase systems are fully discussed. Under alternating-current generators and motors the author treats of the alternator as a generator and then as a synchronous motor; he then considers the converter, the induction motor, the single-phase series motor and the theories of the alternating-current transformer. The last part of the book is devoted to switchboards, switchboard appliances and practical operation of the dynamo. Under this heading the various operating troubles are taken up and their remedies fully discussed. Also the methods of practice are outlined and proper installations shown. In addition this book contains an appendix devoted to several problems most frequently encountered. Numerous diagrams and illustrations are used, which tend to simplify and elucidate the text.

"Welding and Cutting Metals by Aid of Gas or Electricity." By L. A. Groth. D. Van Nostrand Company, New York, N. Y. Cloth, 281 pages (5½ by 8¾ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $3.

An examination of the various methods existing for the production and liquification of combustible gases, of their easy application and economical advantages, and of the phenomenal advance during recent years in their adaptation to the immense variety of metallurgical and engineering operations which have hitherto been carried out under less favorable conditions, proves that compressed gases have become an indispensable factor in almost every branch of industry. This text is limited to the description of welding and cutting metals by means of combustible gases as well as the application of electric welding. A general description of the various and distinct methods, their suitability and selection for different operations is given, together with a collection of results and tests obtained. In addition to an extended study of the various gases, their sources and generation, and the methods in which these gases are applied to welding, this book contains a chapter devoted to a table of useful information which should prove valuable to students interested in this science.

"Direct and Alternating-Current Testing." By Frederick Bedell. D. Van Nostrand Company, New York, N. Y. Cloth, 265 pages (5½ by 8½ inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $2.

This manual consists of a series of tests on direct and alternating-current apparatus selected with reference to their practical usefulness and instructive value. While the book has been prepared primarily for students, it may also prove beneficial to others engaged in this branch

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of work. The presentation is in the form of a laboratory manual; the author, however, has not restricted himself to a mere statement of instructions for conducting tests, but has directed the reader's attention to the principles that underlie the various experiments and to the significance of the results. The material has been systematically arranged, and it is believed that the book may be found useful for reference or as a text, aside from its use in testing. From the text proper are excluded specialized tests and those that are of a limited application or require unusual testing facilities, such tests being described in the appendices to the several experiments. This permits a fuller discussion of more of the details of the tests and various modifications than could be included to advantage in the text proper. The tests in general are those that can be performed in any college laboratory. The book covers in all fifteen experiments which are classified under the following heads: Direct-current generators, direct-current motors, synchronous alternators, single-phase transformers, polyphase currents, phase changers and potential regulators.

"Erecting Work." By Hubert E. Collins. Hill Publishing Company, New York, N. Y. Cloth, 140 pages (4¾ by 7 inches), 110 illustrations. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.

This and the three books reviewed below belong to the series known as "The Power Handbooks." They are thoroughly practical books containing much useful information for the stationary engineer operating a small or moderate-sized plant. In each book the material has been compiled by Hubert E. Collins chiefly from special articles that have appeared in *Power* from time to time. In this particular book are given practical hints for the general handling of heavy machinery during its erection and particularly in erecting a steam engine. The subject is handled in a logical manner, beginning with the building of the foundation, whether it be of concrete or brick. The hitching and knotting of ropes to the various parts of the machinery is next considered, and then its haulage through the streets and up inclined runways. Various methods of hoist rigging are described, especially as applied to the handling of the receiver, cylinder and shaft of the engine. The book is concluded with special hints for the building up of flywheels, the erection of high-speed, center-crank engines, and particular details of some of the lighter work in erecting. While many of these hints seem self-evident on account of their simplicity, they are highly valuable in erecting work, for on the failure to observe some apparently slight precaution on the part of even experienced erecting engineers, has frequently resulted a series of vexatious troubles and delays, not to say even occasional serious accidents. Throughout the book these matters are dealt with in simple and clear language, which makes its contents doubly valuable.

"Pipes and Piping." By Hubert E. Collins. Hill Publishing Company, New York, N. Y. Cloth, 140 pages, 75 illustrations. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.

One of the most important duties of the steam engineer, that relating to the proper design, installation and care of power house piping, forms the subject of this book. At first general rules relating to the design of both high and low-pressure steam piping are given. Methods for properly taking care of expansion and contraction, for estimating stock for curved pipes, and for overcoming vibrations in the piping are described. The increasingly important subject of high-pressure steam-pipe flange joints is treated at some length and the German standard dimensions given. Other subjects discussed are: The connection of boilers to steam mains, the bursting strength of standard screwed cast-iron elbows and tees and of malleable-iron pipe fittings, the piping for a small steam plant, accidents due to faulty piping, steam-pipe conduits, color schemes for pipe lines and the effect of superheated steam on cast-iron valves and fittings. A great many practical suggestions and useful hints are given relative to supporting pipes, arrangement and operation of the pipe system, pipe fitting, sizes of pipe, how to distinguish steel from iron pipe, and other topics of like nature.

"Knocks and Kinks." By Hubert E. Collins. Hill Publishing Company, New York, N. Y. Cloth, 137 pages, 82 illustrations. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.

All kinds of knocks that may become associated with the operation of an engine, from the slight click to the heavy pound, form the subject-matter of this book. Since most of these periodic noises are the indication of some defect, the object of the book is to suggest means for locating the defect and for remedying it. The causes of knocks form the subject of a thorough discussion in three chapters. While some of these knocks are of the simplest origin, to locate them is often a baffling proposition. A great many valuable kinks for removing the trouble are given as well as a number of examples where relief in time prevented disastrous results. There are also described several emergency and temporary repairs and a number of rush jobs that were successfully carried out. Besides kinks of service in remedying knocks there are given several that are of value in the normal operation and maintenance of the engine.

"Steam Turbines." By Hubert E. Collins. Hill Publishing Company, New York, N. Y. Cloth, 186 pages, 76 illustrations. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $1.

This little manual is devoted to the practical construction and operation of a number of typical steam turbines. The details of construction are discussed in each case at some length, after which is given a series of valuable hints in operating the unit. The machines considered in this manner are the Curtis, Allis-Chalmers and Westinghouse-Parsons turbines. After considering these typical machines the method of testing the steam turbine is taken up. The book is concluded with a discussion of the auxiliaries for steam turbines and the troubles that are liable to be encountered in operating the auxiliaries.

To Care for Chicago Subway.

At the conferences between the Harriman-Armour interests in the Chicago Subway and representatives of the original promoters of the enterprise which have been going on for the last two weeks, an arrangement has been made, it is said, by which the fixed charges of the company will be met until it is able to get its present system in full operation. The December 1 interest on the $17,000,000 five per cent bonds outstanding amounts to $425,000, and the company's operations at present are said to not quite meet fixed charges.

Hitherto the interest payments have been made possible by the funds advanced by the Harriman-Armour interests, who have taken notes of the company totaling some $11,000,000, secured by $13,000,000 of the company's bonds. Mr. Harriman's death coming at a time when the company's operations were still limited by the unsettled state of the relations between railroads, shippers, and the company, and before the completion of its dock terminal, it became necessary to settle the question of where the funds were to come from to meet the interest payments until such a time as the returns began to come from full operation.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

BOSTON EDISON ELECTRIC.

The Edison Electric Illuminating Company, of Boston, has issued its annual report for the year ended June 30, 1909. It compares as follows:

	1909.	1908.	1907.
Gross	$ 4,111,342	$ 4,229,239	$ 4,020,821
Exp. and taxes.	2,737,496	2,658,929	2,569,658
Net	$ 1,373,846	$ 1,570,310	$ 1,450,963
Misc. income....	45,360	38,442	41,340
Total income..	$ 1,419,205	$ 1,608,751	$ 1,492,303
Interest, etc.....	86,845	54,989	102,417
Balance	$ 1,332.360	$ 1,553,762	$ 1,389,886
Dividends	1,424,389	1,390,796	1,304,283
Deficit	$ 92,029*	$ 162,967*	$ 85,602

*Surplus.

Lamps and motors connected as of June 30 compare as follows:

	1909.	1908.	1907.
Incandes. lamps..	1,040,613	938,670	863,313
Arc lamps	9,282	9,867	10,339
Motors, h. p....	44,065	39,422	35,095

The balance sheet as of June 30 compares:

ASSETS.

	1909.	1908.	1907.
Installation	$22,158,254	$20,875,414	$19,440,047
Cash on hand...	320,509	72,853	1,590,897
Stock on hand..	370,993	529,846	458,766
Notes and accounts receivable	2,011,079	1,875,697	1,847,689
Open accounts...	87,990	107,380	78,859
Sinking fund....	23,641	29,428	26,128
Totals	$24,972,468	$23,442,388	$20,511,833

LIABILITIES.

Capital stock	$13,603,400	$12,643,600	$12,643,600
Mtge. bonds....	1,472,000	1,485,000	1,485,000
Notes and accts. payable	1,043,329	1,708,419	1,753,100
Div. payable....	476,119	442,526	442,526
Reserve for main.	543,983	335,036	238,438
Prepaid on new stock	7,604,940	6,501,170	6,501,170
Accrued interest and taxes	72,024	66,827	64,132
Replac. acct. ...	8,811	15,324	24,311
Coupon notes....	42,000	45,500	49,000
Profit and loss..	105,860	247,218	241,108
Totals	$24,972,468	$23,490,621	$23,442,388

WESTERN UNION TELEGRAPH.

The Western Union Telegraph Company has issued its full pamphlet report for the year ended June 30, 1909. The income account compares as follows:

	1909.	1908.
Gross revenue	$30,541,072	$28,582,212
Operating expenses	23,193,966	25,179,215
Net revenue	$ 7,347,106	$ 3,402,997
Interest on hand	1,732,250	1,732,250
Net profits	$ 5,614,856	$ 1,670,747
Dividends	2,739,435	1,714,571
Surplus	$ 2,875,421	*$ 43,824
Previous surplus	14,393,856	16,884,781
Total surplus	$17,269,277	$16,840,957
Less approp. stock div		2,447,000
Profit and loss surplus	$17,269,277	$14,393,857

*Deficit.

Western Union Telegraph Company's expenses in detail for the past four years compare as follows:

	1909.	1908.
Operating and general expenses and taxes	$18,112,476	$19,069,813
Rental of lines	1,542,520	1,546,182
Maintenance and reconstruction of lines	3,124,093	4,139,358
Equip. offices and wires..	315,876	423,862
Total	$23,193,966	$25,179,215

The following table gives some interesting statistics covering a period of four years:

	1909.	1908.
Miles, poles and cables....	211,513	208,477
Miles wire	1,382,500	1,359,430
Offices	24,321	23,853
Messages	68,053,439	62,371,287
Receipts	$30,541,072	$28,582,212
Expenses	23,193,966	25,179,215
Net revenue	$ 7,347,107	$ 3,402,996
Average toll per message..	34.1c	33.7c
Average cost to company per message	28.5c	34.3c

The general balance sheet of the Western Union Telegraph Company as of June 30, 1909, compares as follows:

ASSETS.

	1909.	1908.
*Tel. lines	$124,086,920	$123,139,624
Stock and bonds other companies	8,645,000	8,645,000
Other securities	17,798,672	16,497,865
Real estate	5,088,359	5,088,359
Supplies and materials..	1,243,472	1,137,475
Sundry accounts receivable, etc	2,295,537	2,368,746
Cash in transit	3,158,903	3,278,733
Total	$162,316,864	$160,155,804

*Telegraph lines, stocks owned, franchises, patents, etc.

LIABILITIES.

Capital stock	$99,817,100	$99,817,100
Funded debt	38,645,000	38,645,000
Gold and Stock Tel. Co..	1,946,592	1,946,592
Sundry accts. payable..	3,040,710	3,755,072
Surplus prior to October 1, 1881	1,598,184	1,598,184
Surplus since October 1, 1881	17,269,278	14,339,856
Total	$162,316,864	$160,155,804

At the annual meeting of the Western Union Alvin W. Krech, Edward T. Jeffery and Kingdon Gould were elected to the board in place of General Eckert, James Hazen Hyde and E. H. Harriman.

AMERICAN TELEPHONE COMPANIES.

The Mackay Companies, which control the Postal Telegraph and numerous other telegraph and cable companies, owned 82,400 shares of American Telephone and Telegraph Company stock on June 1 and were the largest owners of stock in that corporation. American Telephone, with nearly $200,000,000 stock outstanding as of June 1 last, had but thirty-two shareholders out of 35,000 who held 5,000 shares of stock or more, and fourteen of these were brokerage firms. The list of stockholders with 1,000 shares or more totaled 254 names. Subjoined is the list of the shareholders who own 5,000 shares or more: Asiel & Company, New York, 10,001; Frederick Ayer, Lowell, 14,297; J. S. Bache & Company, New York, 5,231; George F. Baker, New York, 15,000; E. D. Barbour, Sharon, 5,189; Baring Brothers, London, 5,456; A. N. Cooley, Pittsfield, 8,750; W. Murray Crane, Dalton, 14,200; Zenas Crane, Dalton, 14,442; Curtis & Sanger, Boston, 16,471; Joseph S. Fay, Falmouth, 7,000; Halsted & Hodges, New York, 5,800; C. W. Harkness, New York, 5,250; Hayden, Stone & Company, Boston, 9,126; Hayden, Stone & Company, New York, 8,446; Moffatt & White, New York, 5,398; F. S. Moseley & Company, Boston, 6,021; Eugene Higgins, New York, 6,850; Jackson & Curtis, Boston, 7,845; Kidder, Peabody, Boston, 18,383; Mackay Companies, New York, 82,408; William Morgan, New York, 13,331; Parkinson & Burr, New York, 12,310; Parkinson & Burr, Boston, 7,173; F. F. Stanley, Tr., Boston, 5,205; Moorfield Story, Tr., Boston, 5,219; Sutro Brothers, New York, 5,071; T. N. Vail, Boston, 8,425; H. C. Wainwright, Boston, 5,285; F. C. Welch, Tr., Boston, 5,521; Weld, Grew & Company, Boston, 5,782; Mrs. C. A. Williams, Boston, 9,640; C. F. Wright, Boston, 8,700; Old Colony Trust, Boston, 5,196.

AURORA, ELGIN & CHICAGO.

The Aurora, Elgin & Chicago Railway Company reports for the year ended June 30, 1909, showing earnings, compared as follows:

	1909.	1908.
Gross	$1,467,214	$1,401,107
Expenses	796,270	766,977
Net	$ 670,944	$ 634,130
Charges	341,327	334,408
Surplus	$ 329,617	$ 299,722
Dividends, common and preferred	255,750	248,000
Net surplus	$ 73,867	$ 51,722
Previous surplus	211,395	.....
Profit and loss adj., deb....	13,584	.....
Surplus, June 30	$ 271,678	.....

The report of the Aurora, Elgin & Chicago Railroad Company for the month of September and three months ended September 30 compares as follows:

	1909.	1908.
September gross	$149,140	$137,387
Expenses	74,467	70,804
September net	$ 74,673	$ 66,582
Charges	29,413	27,624
September surplus	$ 45,259	$ 38,958
Three months gross	480,453	440,029
Expenses	228,810	214,187
Three months net	$251,642	$225,842
Charges	87,663	83,026
Three months surplus	$163,979	$142,815

At the annual meeting of the Aurora, Elgin & Chicago, directors were re-elected.

FAIRMONT & CLARKSBURG TRACTION.

The report of the Fairmont & Clarksburg Traction Company for the month of July and seven months ended July 31, 1909, compares as follows:

	1909.	1908.
July gross	$ 39,899	$ 35,462
Expenses	13,356	12,315
July net	$ 26,543	$ 23,146
Other income	3,689	2,316
Total income	$ 30,232	$ 25,462
Taxes and insurance	1,892	1,069
July surplus	$ 28,340	$ 24,393
Seven months gross	231,048	210,081
Expenses	90,242	83,136
Seven months net	$140,806	$126,945
Other income	24,833	16,890
Total income	$165,639	$143,835
Taxes and insurance	13,266	7,513
Seven months surplus	$152,372	$136,322

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HUDSON & MANHATTAN RAILROAD.

The Hudson & Manhattan Railroad reports to the New York Public Service Commission for the quarter ended June 30, 1909, as follows:

Gross operating revenues	$196,049
Operating expenses	107,997
Net operating revenue	$ 88,052
Other income	181,900
Gross income	$269,952

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways of St. Louis for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$ 929,329	$ 887,344
Expenses and taxes	589,357	554,164
September net	$ 339,972	$ 333,180
Charges	232,132	234,380
September surplus	$ 107,840	$ 98,800
Nine months gross	8,226,385	7,860,624
Expenses and taxes	5,217,704	5,073,080
Nine months net	$3,008,681	$2,787,544
Charges	2,101,632	2,097,319
Nine months surplus	$ 907,049	$ 690,225

NORFOLK & PORTSMOUTH TRACTION.

The report of the Norfolk & Portsmouth Traction Company, for the month of July and seven months ended July 31, 1909, compares as follows:

	1909.	1908.
July gross	$ 180,227	$ 181,804
Expenses	101,163	98,326
July net	$ 79,064	$ 83,478
Seven months gross	1,103,754	1,057,423
Expenses	648,653	645,861
Seven months net	$ 455,101	$ 411,562

LEXINGTON & INTERURBAN.

The report of the Lexington & Interurban Railways Company for the month of July and seven months ended July 31 compares as follows:

	1909.	1908.
July gross	$ 54,238	$ 58,706
Expenses	34,720	37,495
July net	$ 19,517	$ 21,211
Seven months gross	321,653	328,565
Expenses	236,878	229,156
Seven months net	$ 84,775	$ 99,409

NORTHERN INDIANA GAS AND ELECTRIC.

An issue of Northern Indiana Gas and Electric Company first refunding mortgage five per cent twenty-year bonds is offered by White & Company, of New York. The present issue of $1,809,000 is part of an authorized issue of $10,000,000, of which $1,756,500 is reserved to retire underlying bonds, and $6,434,500 is reserved for acquisitions, betterments, etc., at eighty-five per cent of cost.

In the year ended August 31 last net earnings of combined companies were $227,369 and interest on underlying bonds was $87,825, leaving a net surplus of $139,544. Annual interest on present issue will amount to $90,450, so that, on a basis of last year, earnings would show a surplus of $49,094 over interest. It is estimated that earnings for the current year will show an advance over last year.

The company was formed April 1, 1909, consolidating the South Shore and Electric Company, Indiana Harbor & East Chicago Electric Company and the Michigan City Gas and Electric Company.

AMERICAN TELEPHONE.

The report of the American Telephone and Telegraph Company for September compares as follows:

	1909.	1908.
Dividends	$ 210,168	.....
Interest and other revenue	924,917	$ 790,170
Telephone traffic (net)	387,969	380,252
Real estate	8,101	33,123
Other sources	73,969	70,358
Total	$1,605,124	$1,273,904
Expenses	203,033	172,659
Net earnings	1,402,091	1,101,245
Interest	498,658	614,215
Surplus	$ 903,433	$ 487,030

The Associated Bell Operating Companies of the American Telephone and Telegraph Company, not including the long-distance lines of the American Telephone and Telegraph Company, report for the month of August compared as follows:

	1909.	1908.
Gross	$11,307,730	$10,403,288
Operating maintenance and taxes	8,220,247	7,442,492
Net earnings	$ 3,087,483	$ 2,960,796
Interest	533,559	614,480
Surplus	$ 2,553,924	$ 2,346,316

In 1909 all maintenance and depreciation is charged against expenses monthly, instead of being partly provided for by an extraordinary charge in December, as heretofore. The 1908 figures include in expenses for each month one-twelfth of the extraordinary provision which was made in December, 1908.

KEYSTONE TELEPHONE.

The report of the Keystone Telephone Company, of Philadelphia, for the month of September and three months ended September 30 compares as follows:

	1909.	1908.
September gross	$ 91,908	$ 87,656
Expenses and taxes	45,070	42,873
September net	$ 46,838	$ 44,783
Charges	33,015	34,445
September surplus	$ 13,823	$ 10,338
Three months gross	272,851	262,187
Expenses and taxes	135,523	131,334
Three months net	$137,130	$130,853
Charges	101,827	103,684
Three months surplus	$ 35,501	$ 27,169

CHICAGO & MILWAUKEE ELECTRIC.

Judge Grosscup is allowing the receivers of the Chicago & Milwaukee Electric Company to spend $135,000 for new cars. Total receipts for April, May, June and July were $299,024, against $183,298 for the same period last year. Expenses were $180,343, against $133,610 last year.

ALLIS-CHALMERS.

During the first quarter of its current fiscal period Allis-Chalmers booked a considerably larger volume of business than in any similar previous period in its history, and interests of the company state that there is every indication that the present rate of improvement is to continue throughout the year. During the current calendar year the improvement has been continuous from month to month. From January 1 to June 30, the last six months of the fiscal year 1909, orders booked were approximately double those in the same period in 1908 and but twenty per cent below the company's best year. July was about on a level with 1907, while August and September showed a considerable gain over the record for that year. The improvement has extended to every branch of the company's business, but the demand has been strongest for its gas engines and steam turbines. Of recent orders the most important was one from the Pullman Company for the power equipment of its new passenger-car shops at Pullman, including two steam-turbine generators aggregating 5,000 horsepower.

Operations are now on a basis of only about eighty per cent of normal, but forces at the different plants are being continually added to, and it is probable that by January 1 the company will again be running at full capacity.

Chicago Consolidated Traction.

Charles G. Dawes has been elected chairman and B. Blye secretary of the general reorganization committee of the Consolidated Traction Company. The new company will seek a franchise the same as the Chicago Railways Company. The bondholders of the company will receive participation certificates against the new company's stock, the amount of which issue will be small.

Big Car Equipment Merger.

Arrangements are being perfected in Montreal whereby all the leading Canadian car construction companies will be consolidated. Under the proposed plan the new concern is to have a capital of $10,000,000, and will include the Rhodes Curry Company, of Amherst, N. S.; the Dominion Car Foundry Company, of Montreal, and the Canadian Car Company.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Tungsten Shock Absorber.

The popularity of the tungsten incandescent lamp for shop lighting has led to the demand for a device which would successfully counteract the shocks unavoidable in a shop and thus prolong the life of the lamp.

This demand has led to the marketing of numerous so-called shock absorbers, among which may be named the Benjamin tungsten shock absorber, illustrated herewith, manufactured by the Benjamin Manufacturing Company, Chicago, Ill.

This shock absorber consists primarily of a strap wire stirrup with a circular

BENJAMIN SHOCK ABSORBER.

opening in which is located a bushing tapped to receive the fixture stem. This bushing is set into a square metal washer at the top which bears on a coiled spring. This compression spring forms a resilient connection between the stationary element and the fixture. The stirrup has two feet provided with screw holes for attaching to the supporting surface, and when so attached takes the place of an ordinary crowfoot. An additional strap centrally threaded to fit a three-eighths-inch insulating joint is attached to the stirrup by the means of two screws. This strap may be omitted for attaching to a wooden ceiling or block. In one case the device becomes a shock absorbing hickey; in the other, a shock absorbing crowfoot.

Where it is desired to use a brass casing and canopy, a canopy support consisting of seven-eighths-inch brass tubing with the upper end flanged outwardly passes through the opening in the bottom of the stirrup and surrounds the bushing. This permits the canopy to be attached by means of a seven-eighths-inch slip ring to the supporting element, thus leaving the fixture with its stem free to move in a vertical plane. There is also enough play between the movable parts to allow the fixture to hang plumb even though the support might be uneven.

On either side of the stirrup are located machine screws, the purpose of which is to keep the bushing from being displaced. These screws, however, can be removed and the device taken apart for the purpose of changing the springs, or for removing or inserting the canopy support which should be finished to correspond with the fixture.

The device is furnished with one of three springs varying in stiffness to correspond to the weight of the fixture with which the absorber is to be used. The light spring will hold a fixture from one to four pounds, the medium, from four to ten pounds, and the heavier from ten to sixteen pounds.

The shock absorber meets one of the fundamental requirements of the successful devices of this character in that provision is made for locating it at the ceiling or point of the fixture support rather than above the individual lamp sockets. The greater weight and consequent greater inertia of the former lessens the liability of the lamps to shock from sudden jars, from which more filaments are broken by vibrations from above than from accidental shocks from below. By use of this shock absorber short, quick vibrations at the ceiling or support are not transmitted to any part of the fixture except the top directly attached.

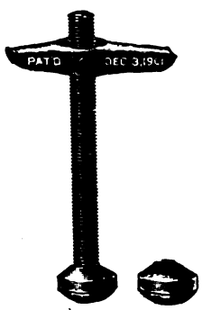
Speer Carbon Exhibit at Denver.

The Speer Carbon Company had on exhibition at the Denver convention its new line of street-railway motor brushes made by a new process to conform with the recent specifications of the American Street and Interurban Railway Engineering Association. This brush was shown for the first time at the convention and was spoken of very highly by the engineers. It was the general opinion that the better grade brush would be adopted by more than three-fourths of the electric railways before the next convention, as they are now giving the matter of proper commutation considerable thought.

The Wrigley Toggle Bolt.

In the accompanying illustration is shown a Wrigley patented trunnion nut steel toggle bolt with double-flange sides and rigid back for securing brackets and fixtures to hollow tiling, marble slabs, steel ceilings, or plastered walls, that screws and nails fail to hold. The bolt illustrated, three-sixteenths of an inch in size, can be pushed through a half-inch hole and instantly anchors itself.

The trunnion nut steel toggle bolt differs from the plain toggle bolt in that it screws clear through a toggle key or plate the full length or has a hexagonal or round screw-driver nut, flat or cone-



WRIGLEY TOGGLE BOLT.

shaped, which can be taken off after the bolt has been inserted. This style of bolt is particularly adapted for marble slabs, telephone boxes, and all finished work.

The Thomas Wrigley Company, Chicago, Ill., manufacturer of this bolt, is making a number of improvements on its standard line and will put them on the market in the near future.

Westinghouse Electric.

The actual shipments of the Westinghouse Electric and Manufacturing Company, in the month of September, approximated $2,250,000. Orders aggregated $2,500,000. Shipments and orders continue to improve, and it is anticipated that October will reveal an increase over the preceding month.

More men are being put to work, and the large business the company is now doing means larger earnings. It is understood that the Westinghouse Electric and Manufacturing Company, in the first six months of this year, earned approximately five per cent on its entire capitalization.

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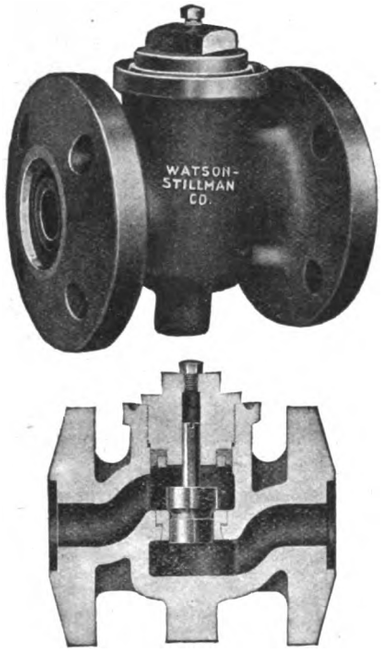
Special Hydraulic Valves.

The special types of hydraulic stop valve and check valve which we illustrate have recently been installed in one of the plants of the New York Edison Company, and are illustrative of the Edison Company's efforts to provide every possible protection against breakdowns.

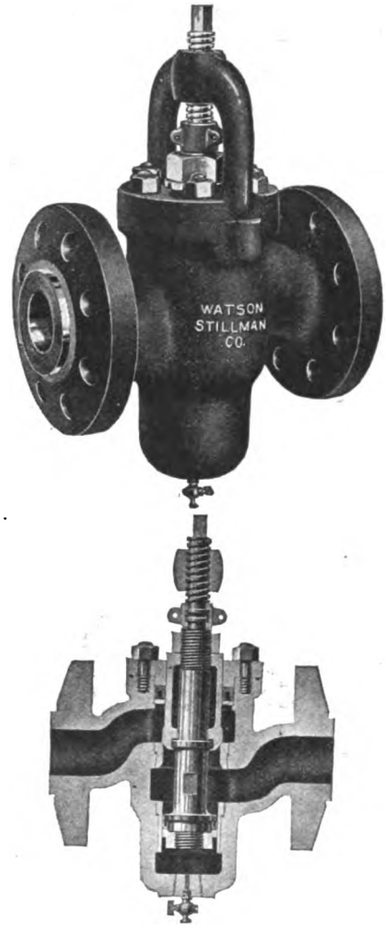
Over a hundred of these valves, in two-inch, two-and-one-half-inch and four-inch sizes, are installed on the forced-feed lubricating system which serves the step bearings of the Curtis turbines. The lubricating system is under 1,500 pounds per square inch pressure, is provided with accumulators to deliver pressure in case of temporary failure or stopping of the



WATSON-STILLMAN CHECK VALVE AND SECTION.

pumps, and all joints in the lines are welded to prevent failure. All parts are three or four times as heavy as ordinarily, and the bodies of the valves shown above are made of steel and extra heavy. Strength, however, was not the main question in discarding other valves on this service. It was found that ordinary rubber, hemp or leather packing would not stand up with oil and the unusually heavy pressure, but was subject to annoying blowouts. These troubles were overcome in the Watson-Stillman stop valve in two ways; first, by using a special packing which would not soften, but would retain its elasticity; and second, by a construction which would permit the system to be used even though a packing weakened. The improvement in the latter instance consists in the addition of the small pressure-tight chamber under the end of the valve stem. When running under ordinary conditions the small pet cock at the bottom is left open to act as a telltale if a packing starts to leak. Should the packing leak, the pet cock is closed and the valve used until such time as a repair may be conveniently made.

Both stop and check valves have seats of a special metal which is spun into place. The check valve stem is slotted so that by removing the screw on top of



WATSON-STILLMAN STOP VALVE AND SECTION.

the valve a screwdriver may be used to regrind the valve seat.

These valves are made by the Watson-Stillman Company, of New York, which makes a complete line of hydraulic pumps, piping fittings and valves for forced-feed lubricating systems.

An Improved Line of Pocket Meters.

Those engaged in electrical pursuits have become so accustomed to the large power installations of the present time, that they are apt to lose sight of the fact that immense units of energy in the aggregate are being used in the shape of dry cells and small storage batteries, yet it is undoubtedly true that the daily production of batteries in this country, measured by their kilowatt-hour capacity, would prove a revelation to most of us.

So widespread has the use of batteries become that the demand for small pocket meters with which to test them has grown to considerable proportions.

The Hoyt Electrical Instrument Works early recognized the importance of this field, and have devoted a great deal of attention to it, their latest being a line of ammeters and voltmeters approximately the size of a gentleman's watch, the novel feature of which is a silver-plated metal scale which combines accuracy, durability and tastiness in design.

Realizing that the first requisite was a careful standardization of every part, they have for some time been working along these lines, and they claim to have designed every part so carefully that exhaustive tests have failed to show any material error in any part of the scale.

HOYT POCKET AMMETER.

These meters are of the permanent magnet type, and in designing them the purpose of their use has been constantly kept in mind. The relation of the moving system to the poles of the permanent magnet is such as to insure a practically dead beat movement, with extreme sensitiveness to current changes. Every detail has been carefully looked after, even to the construction of the case which is substantially made in one piece to insure rigidity and mechanical accuracy.

Telephone Competition Ended.

Competition in the telephone business is ended in Connecticut, as the Southern New England Telephone Company has made a traffic agreement with the Farmington Valley Telephone Company which has a line from Plainville through Litchfield County to Winsted, and thence to Otis, Mass. There has been a long standing fight between the two companies, especially in the Legislature where bills were introduced to drive independent telephone companies out of the field.

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Mill Motors.

The characteristic features of steel mill service are exceedingly heavy momentary overloads, severe shocks and vibration, abnormally rapid acceleration, application of power at several points remote from one another, high-room temperatures and dust-laden atmosphere. Certain operations necessitate a reversal when running at full speed. Reliability of service is absolutely essential, as the various processes form a practically continuous train of operations and a breakdown stops the whole train. This condition makes it imperative that replacement of damaged parts be made in the shortest possible time.

The electric drive has several features which especially adapt it to mill work.

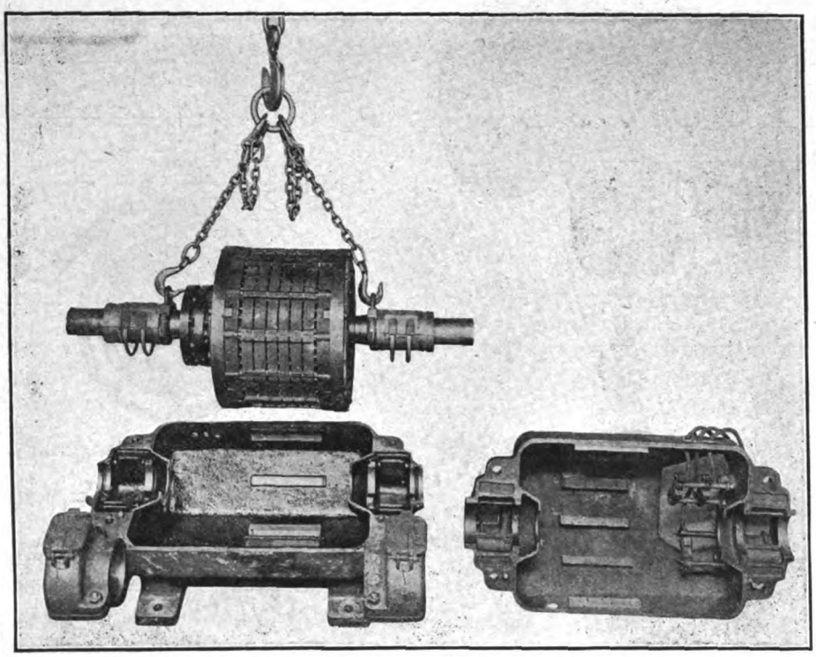

Fig. 1.—Stator and Rotor and Method of Handling Latter.
GENERAL ELECTRIC INDUCTION MILL MOTOR.

Its advantages are, simplicity of power distribution, easy and rapid replacement of parts, low cost of inspection and maintenance, flexibility of controlling mechanism and adaptability to automatic control.

The General Electric Company manufactures a complete line of both alternating-current and direct-current motors of especially rugged design for this type of service, and these have met with great favor, notably so in steel mills, which service is the most exacting in existence. The corresponding sizes of direct-current and alternating-current machines have the same outline dimensions and are interchangeable on the same foundations.

The alternating-current motors, known as HI motors, are standard at 220 and 440 volts, three-phase, twenty-five cycles, and are furnished in sizes from three to 150 horsepower, inclusive.

These motors are built totally enclosed in horizontally split steel magnet frames of octagonal shape, the two halves being held together by a large bolt at each of the four corners. They are supported by four large substantial feet, each foot being drilled for one foundation bolt. Two bails are cast into the upper half of the frame for handling the motor.

The most noteworthy feature of this line of motors is the construction by which the stator winding is entirely separate from the frame, resembling in this respect the field coils of a direct-current motor. This construction, together with a horizontally split frame, permits of replacing the rotor or stator very quickly and renders it necessary to keep only spares of the parts most liable to damage in stock. Fig. 1 illustrates the manner in which the upper half of the frame is removed and the rotor, stator and bearings lifted out for inspection or repairs. In making replacements it is not necessary to make any disconnections inside of the motor frame.

The stator is built up in the form of a hollow cylinder forming a unit entirely separate from the frame.

The punchings are assembled on steel studs which pass through end flanges by means of which the punchings are clamped tightly together. Each half of the frame has several ribs extending lengthwise which are bored to the diameter of the stator and are equal in length to the distance between its end flanges. When the stator is lowered into the frame and the upper half of the frame bolted on, these ribs automatically center it and prevent end motion. Rotation of stator is prevented by ears projecting from the core.

End flanges are provided which insure complete protection to the end windings and permit handling the apparatus freely without damaging the windings. The stator coils are form wound, molded to exact size and thoroughly insulated before assembling on the core. The conductors are asbestos insulated and the completed coils are insulated with mica and woven asbestos. They are assembled in open slots and are held in place by non-combustible wedges. This construction makes it possible to replace a coil very easily and quickly.

The rotor is built up on a heavy spider, the punchings being assembled between end flanges keyed into place under heavy hydraulic pressure. The rotors are bar-wound, in all sizes except the three and seven horsepower, in partially enclosed slots.

In order that reversal may be accomplished in the shortest possible time and with a minimum loss of energy in acceleration, the diameter of the rotor has been reduced to a minimum.

The collector spider is carried on an extension of the rotor spider to which it is keyed, making it unnecessary to disturb any connection if it is necessary to replace the shaft. The collector rings are bolted to this spider, making their removal a very simple operation. The rings are of exceptional size and the collector throughout is ruggedly built.

The brush-holder studs are of steel, are exceptionally large, and are screwed into the frame. Heavily coiled phosphor-bronze springs maintain practically uniform tension over their entire working range and permit a large amount of wear of the brushes.

The bearings are exceptionally large, affording ample bearing surface. The armature-bearing housings are a part of the frame castings. The bearings are furnished for either oil-ring lubrication, or waste lubrication. To change from one form of lubrication to the other it is necessary to change only the upper half of the lining. The two halves of the lining are bolted together and a wrought-iron bail is cast in the upper half providing an easy means of handling the armature, as shown in Fig. 1.

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Armature end thrust is transmitted directly to the frame by a shoulder in the bearing lining.

The countershaft brackets are cast with the lower half of the frame and are heavily ribbed. The caps are bolted to the brackets. Linings for minimum standard countershaft diameter are cast-iron babbitted and for maximum standard diameter are malleable iron babbitted. Countershaft bearings are supplied for waste lubrication.

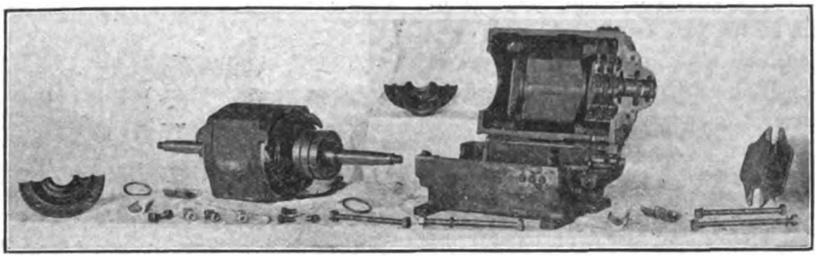


FIG. 2.—GENERAL ELECTRIC TYPE "M.I." INDUCTION MILL MOTOR.

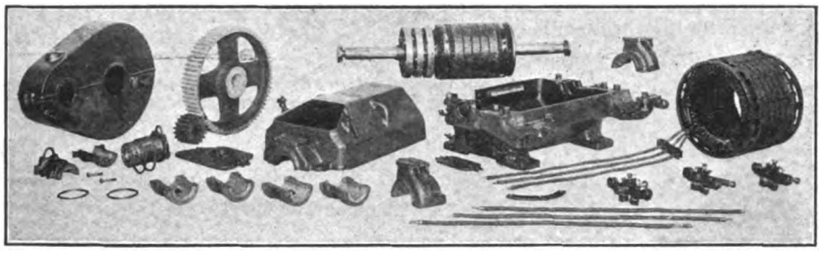


FIG. 3.—PARTS OF GENERAL ELECTRIC GEARED INDUCTION MILL MOTOR.

Where motors are geared it is an advantage to use, where possible, a countershaft passing through brackets on the motor frame to prevent the gear and pinion from springing apart under heavy loads.

The rotor shafts are exceptionally heavy and have pinion extensions at both ends. They can be replaced without disturbing connections.

Pinions are made of the highest grade of hammered steel and gears of cast steel. The gear cases can be used at either end of the motor and are bolted to webs on the lower housing of the armature bearing and countershaft bracket.

In order to adopt this type of motor to crane service, the three, seven, twelve and twenty-horsepower motors have been designed with a view to facilitating the replacement of the armature in either of two ways. These machines have circular frame heads at both ends, the frame and the frame heads both being split. This construction admits of the removal of the rotor by removing the upper half of the frame and lifting it out or removing the head at either end and pulling the rotor out endwise. The heads may be shifted through an angle sufficient to permit of the motor being installed on the wall or ceiling. In these sizes the upper half of the frame is hinged to the lower half, the hinge block being bolted to the frame to permit of their removal if not desired.

Fig. 3 shows the individual parts of these motors and brings out very clearly the many advantages in this design.

This type of motor is designed for control by a rheostat in the secondary or rotor circuit. By this means partial speed control can be obtained and the motor can be started and accelerated at practically the same torque per ampere as at full speed.

HI motors have a maximum torque of approximately 250 per cent of rated full-load torque, and are designed to carry loads varying instantaneously from maximum in one direction to maximum in the other with stresses far within the safe limit. They can be stalled momentarily without injury.

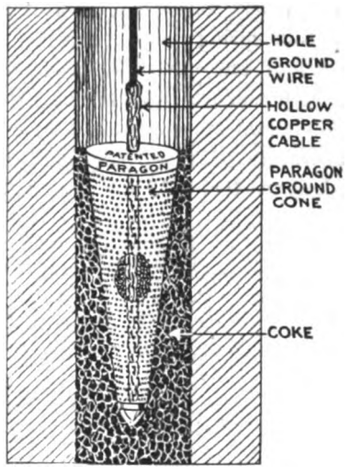
Although these motors were designed primarily to meet steel mill conditions, they are especially adapted to any service in which the cycle of operation is short and the rate of acceleration and breaking high, and where the equipment is subjected to rough handling and forced to its maximum output.

The Paragon Ground Cone.

A device recently brought out which has attracted the interest of engineers and gained much enthusiastic approval generally, is the Paragon ground cone, shown herewith and manufactured by Frank W. Pardee, 48 Fifth Avenue, Chicago. New uses for the cone are constantly developing, and it has been widely adopted.

Its value and efficiency have for some time been recognized by telephone engineers for use in securing good and permanent currents for protector and distributing frames, cable terminals and lightning arresters. Central-station engineers find the cone satisfactory for grounding transformer secondaries, and the neutral of three-wire systems and lightning arresters, and both railroads and trolley lines have given their approval of this little device.

The Paragon ground cone is, as its name implies, a cone-shaped arrangement



THE PARAGON GROUND CONE.

made of heavy gauge pure sheet copper, thoroughly perforated. The cone is filled with charcoal, which attracts and holds moisture, thus keeping the earth around the cone damp all the time, and insuring a perfect ground. A braided, hollow copper cable runs through the cone, and is securely soldered at the bottom. Into this hollow cable the ground wire may be run to the bottom of the cone, and then soldered at the top of the cable.

The Paragon ground cone is easy to install, as it is necessary only to bore a post hole and drop the cone in it. Moreover, the cone can usually be buried to a much greater depth than make-shift grounds, and at practically no extra expense.

It is made in one-foot and two-foot lengths, the one-foot length being recommended for distributing frames or switchboards up to 100-pair capacity, and for cable terminals of any size for grounding the sheath or messenger. The two-foot cone is adapted for use on frames or switchboards up to 1,000 lines, and for larger frames the cones are generally used in batteries, that is, several leads are run off from the ground wire and each attached to a cone, or else several ground wires are run, each one ending in a cone.

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The Adaptable Lamp Changer.

A new device which is destined to become popular on account of its usefulness and simplicity of construction is the Adaptable lamp changer, illustrated herewith. This changer embodies in its construction many new and valuable features which makes it a most useful and convenient device.

As may be seen from the illustration, it consists of a clamping arrangement securely fastened in a tubular rod. This rod is fitted with a sleeve which, by moving up and down, adjusts the clamping end to fit any size lamp. The clamps are of thin spring metal, protected with rubber, and are unusually long, which makes it possible to grip the largest size of incandescent lamps. At the same time the curvature of these gripping fingers is so designed that with the closing sleeve

ADAPTABLE LAMP CHANGER.

projected far toward the end they will come together so closely that the base of a broken lamp can be removed by gripping the sealed tube of the leading-in wires.

This changer is constructed also with a spiral spring neck which permits the gripping end to be bent down at any angle, even as far as a complete reverse of direction. This is accomplished by a cord which runs from the clamping sleeve down to the handle. A metal sleeve is also provided to be moved over this spring when the whole of the lamp changer is desired for use as a straight rigid pole. Extension poles are furnished with the cleaner in either nickel, steel, aluminum or wood in any desired length.

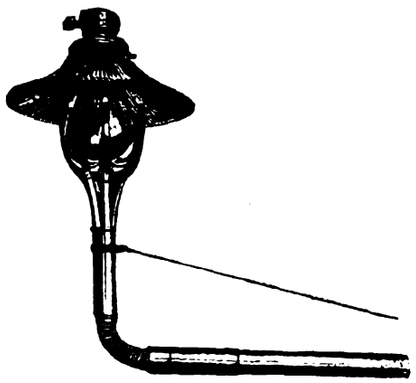
The Illinois Appliance Company, of Chicago, is the manufacturer of this device.

Sewing-Machine Motors.

A very interesting application of the General Electric small motors is to the driving of sewing machines. In the accompanying illustration is shown a motor of this type driving a sewing machine by means of the new General Electric sewing-machine attachment. The design of this device is extremely simple, and it can be attached to any machine of the usual construction in a few minutes.

Either alternating-current or direct-current motors can be furnished for the operation of sewing machines.

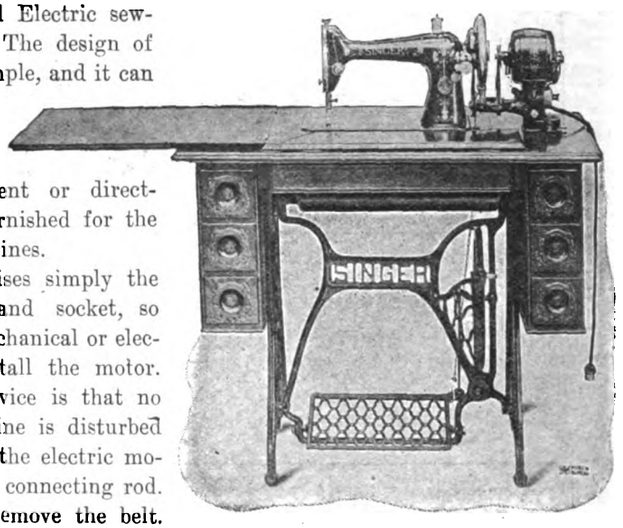
The attachment comprises simply the operating switch, cable and socket, so anyone without special mechanical or electrical knowledge can install the motor. An advantage of this device is that no part of the sewing machine is disturbed in order to equip it with the electric motor, not even the flywheel connecting rod. It is only necessary to remove the belt. The motor is placed so that its shaft and



ADAPTABLE LAMP CHANGER USED AT AN ANGLE.

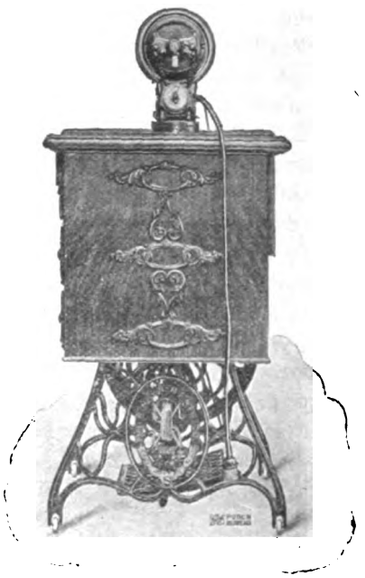
the shaft of the hand wheel are in the same straight line. Sewing is accomplished by turning the switch and depressing the pedal in the usual manner. This latter action removes the friction brake and increases the tension of the driving belt, the whole attachment rocking about the pivot, which can be seen directly below the motor. When the pressure of the foot on the pedal is removed a coiled spring in the base of the attachment causes the tension on the driving belt to be relieved and the brake to be applied to the hand wheel, causing the machine to stop. This method of control is so positive and simple that it is not necessary for the operator to remove her hands from her work. In case the sewing machine is so constructed that the pulley is on the outside of the hand wheel, provision has been made for changing the location of the small driving pulley of the apparatus.

When it is desired to lower the head or to place the cover on a stationary-head machine, the driving apparatus can be turned to one side by withdrawing the



GENERAL ELECTRIC MOTOR ATTACHED TO SEWING MACHINE.

indexing pin shown close to the table. If the machine is not to be used for a considerable period of time, the complete driving mechanism can be removed, leaving only the small plate, which is not objectionable in appearance.



END VIEW OF SEWING MACHINE AND MOTOR.

No special house wiring is necessary for this motor, but connection is made from any lamp socket by means of a flexible cord and attaching plug.

The motor eliminates the hard work of operating the sewing machine and enables one to sew for a long period without being in the least fatigued.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, OCTOBER 15.—Apparently a vigorous attempt is to be made by the Home Office in forcing mine managers and owners to give stricter attention to the special rules relating to the use of electricity in mines than has been the case hitherto. In connection with two recent explosions in Scottish mines, the managers of the Companies owning the pits have been prosecuted for negligence for allowing defective electrical apparatus to exist in the workings. Unfortunately for the dignity of the Home Office, however, the charge in the case of one of the managers broke down somewhat badly, for whereas he was charged with contravening one of the special rules which lays it down that there shall be installed an apparatus to show immediately any defect in the insulation, when the case came on for hearing it was admitted that such a piece of apparatus actually existed, but had been overlooked by the Home Office Inspector. In the other case the manager was completely exonerated from all blame. A similar case is down for hearing next week in another part of Scotland, but in view of what has taken place as mentioned above, it would not be surprising if the charge were withdrawn. Even so, the purpose of the Home Office will have been achieved, for the prosecutions have brought home to mine managers the importance of putting down any suspicion of carelessness in dealing with their electrical plants. There is a general outcry just now in favor of abolishing the use of electricity in dry and dusty mines, owing to the risk of explosion, and this is a matter which is to be specially investigated by the special Home Office Committee when this is appointed. From the decisions given in the Scottish Courts it would appear that it will be difficult for the Home Office to successfully prosecute mine managers under the regulations referred to above, and probably some alteration of the rules to more clearly define the responsible person will have to be made.

Since the fire upon the City & South London tube railway last year, the Board of Trade has made certain suggestions to this and other tube railway companies, with the object of removing all wood from the station premises. Acting upon these recommendations, the City & South London Company and the Central London Tube Railway Company are reconstructing their platforms with concrete and abolishing the use of wood. These two lines, of course, were the first of their kind to be built in London and consequently suffer by comparison in this respect with the more recent tubes. Arrangements have also been made whereby the London County Council fire officials will be allowed to periodically inspect the tube railway station fire appliances with a view to making any necessary suggestions in order to keep the apparatus in a thoroughly efficient state.

A net sum of $3,700 remained as profits of the electrical exhibition held at Manchester last autumn after meeting all expenditure and refunding a certain percentage to stall holders and donors. In accordance with the original arrangement, this sum has been distributed among a number of charitable institutions in the neighborhood of Manchester, in addition to handing over $1,750 to the Electrical Trades Benevolent Institution.

The Australian Government representative in Great Britain has been waited upon by a deputation from the London Chamber of Commerce in respect of the new Australian patents act. This act provides for the working of all patents in Australia, but the deputation pointed out that in the present state of Australian progressiveness such a condition will be extremely harmful, as the cost of manufacturing on the spot will tend to materially increase the cost of the goods to the purchaser.

The Indian Government is erecting a wireless telegraph station at Bombay for the use of ships. It is also announced that wireless stations will be erected by the Australian Government at Sydney and Fremantle. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, OCTOBER 16.—The Metropolitan Subway Company, of Paris, announces that the new section of line which runs from the Seine to the Orleans Gate will be opened for traffic about the end of the year. In this way passengers will be able to make the complete passage across town from north to south, seeing that the other half of this line extending from the Seine to the northern city limits was started for regular service some time ago. Owing to the extensive caisson work under the Seine, the southern half of the line could not be opened at the same time.

In Holland there is being promoted an extensive project, which includes an electric plant and network of power lines, this being intended to furnish electric lighting for a part of the Limburg province and the northern part of Brabant.

An electric plant of some size is to be installed at the mines of Segne, in Servia, which are owned by the government. Bids for electrical material for the plant have been advertised for. At Linz, in lower Austria, the firm of Ernst Beck & Sons has installed a turbine plant on the Mühlbach stream in order to secure a supply of power for their cotton-spinning works.

The municipality of Dunaföldvar, Austro-Hungary, is considering a project for an electric plant for public and private lighting and power.

The French Thomson-Houston firm is organizing a large syndicate, which is to be concerned in various electrical enterprises in Europe. Banking houses in Paris and elsewhere on the Continent are interested in the enterprise. The new syndicate is to be known as the Société Centrale pour l'industrie électrique, and its object is to form different companies in Europe which will develop electrical affairs.

In Switzerland there is being constructed a turbine station which will use the power of the Istar and the Saricé streams at Niederuntigen. The barrage is located at Niederried, and a canal 2,080 metres long leads from this point to Kallnach. Here is erected a 1,500-horsepower station, using a twenty-metre head of water.

The Lucerne-Weidegg railroad section is being electrified, the length of the line being thirty-five miles. As this is a standard-gauge line, it will figure among the longest electric roads in Switzerland. Single-phase current is employed here. A. DE C.

LIGHTING AND POWER.

(Special Correspondence.)

DAVENPORT, IOWA—The Davenport Water Power Company has asked the Council for a franchise for an electric-light plant. C.

SAN DIEGO, CAL.—Sealed bids will be received up to November 15 for lighting the streets, avenues and parks of this city after June 1, 1910.

SEATTLE, WASH.—Sealed bids are being asked for by the Board of Public Works for the construction of a municipal electric transmission line.

BEAR CREEK, MONT.—A franchise has been granted to the Bear Creek Water and Electric Light Company, and work on plant is to begin at once.

BOSTON, MASS.—The Westborough Gas and Electric Company has petitioned the Gas Commission for approval of an issue of $29,500 additional stock.

MADISON, S. D.—The machinery is being installed in the electric-light plant, and it is expected to have it in working order by the middle of next month. C.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas and Electric Company is installing a 2,000-kilowatt, General Electric, 2,300-volt, engine-driven generator and new switchboard.

FRESNO, CAL.—The San Joaquin Light and Power Company will next year furnish power for irrigation to all the foothills along the eastern portion of this county. An order has been placed for a 17,000-horsepower plant to be installed in Crane Valley by next May.

MADISON, WIS.—The executive committee of the state capitol commission has awarded the contract for additional electric fixtures in the east wing of the new state capitol being erected here to Mitchell, Vance & Co., of New York. The contract price is $9,000. M.

NEW BEDFORD, MASS.—The Soule cotton mill is building a new addition where 300 new thirty-six-inch Crompton & Knowles looms are to be placed, making 2,300 looms on one floor. This mill is to be electrically driven. It is to be 155x111 feet, brick construction.

COLUMBUS, GA.—The filing of a petition for a charter for the Chattahoochee Power Company, with a minimum capital of $100,000 and a maximum capital of $2,000,000, brought to light a plan to make another big waterpower development on the Chattahoochee River. The incorporators are B. H. Hardaway, George A. Pearce, E. J. Rankin and other prominent Columbus citizens, all stockholders being home people. The company has acquired

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seven miles of water front in Harris County, and will build a dam thirty feet high, developing 4,000 minimum horsepower and bringing it to Columbus, seventeen miles away, as electricity.

NORWICH, CONN.—Construction of an electric power plant has been begun by the Falls Company, manufacturer of cotton fabrics, at the dam near the Chelsea File Works. It is proposed to generate 200 horsepower and to transmit it over high-tension wires to the company's plant.

RICHMOND, IND.—Articles of incorporation have been filed by the Liberty Light and Power Company. The capital stock is $25,000. The company proposes to generate, transmit, distribute and sell electricity and electric current to towns, cities and the public in general for lighting, heating and power purposes. Robert S. Ashe, John A. Perkins, Winfield Jessup and Gordon E. Varney, directors. S.

LENOIR, N. C.—The Citizens' Light and Power Company, Eugene Ivey, manager, will make extensive enlargements in order to meet the growing demands for power for light in that town. A 100-kilowatt, three-phase Allis-Chalmers dynamo is included among the machinery to be added. The six-hour service of lighting will probably be changed to an all-night service throughout the town. L.

MONTPELIER, VT.—The Corry-Deavitt-Frost Company has let the contract for the new dam in East Montpelier. The dam will be 150 feet long and twelve-and-one-half feet high and will have a fall of thirty feet. The power house will be located 1,500 feet below. The capacity of the new addition will be about 1,000 horsepower, doubling the present output. The cost of the extension is set at about $35,000.

BRAZIL, IND.—Clay County Commissioners have granted the Vigo County Electric Company, which recently got control of the Brazil Electric Light Company's plant in Brazil, a franchise to set poles for high-tension wires through the county. Work of putting up the poles will be begun at once. The company will construct a line to Greencastle, Ind., for the purpose of furnishing light and power for that city.

ALBANY, N. Y.—The Public Service Commission has authorized the Plattsburg Gas and Electric Company to mortgage its property to secure the payment of $500,000 in five per cent thirty-year gold bonds and to issue presently $340,000 of the bonds to discharge outstanding indebtedness and for improvemnts. The Poughkeepsie Light, Heat and Power Company has been authorized to issue $100,000 in bonds for similar purposes.

FERGUS FALLS, MINN.—The concrete electric dam, belonging to the city and worth $60,000, together with the electric transforming machinery; the Red River mill dam, worth $10,000; the Rice dam, worth $52,000, and the woolen mill dam, worth $6,000, were washed out, owing to the foundation of the city dam having been built on a quicksand. The private dams will be rebuilt and the city has taken bids on the supply of electricity. C.

HATFIELD, WIS.—It is stated that another dam is to be erected at Hatfield, above the present one, to cost about $100,000. The proposed dam will have a head of thirty-two feet and create a lake seven miles long. Not much power was generated at the Hatfield dam this season. Expecting the usual June rise, the water in the lake was allowed to get very low in the early summer. But the season was dry, and the reservoir was not filled. M.

FRESNO, CAL.—Wm. S. Douglas and C. M. Russell have filed a notice of appropriation of 15,000 cubic feet of water from Fish Creek, in Fresno County, for electric power purposes. The same parties have also filed on property necessary for the construction of a dam for diverting the water and the construction of a ditch and tunnel two-and-one-third miles from the proposed dam to the power house, and for a power-plant site and reservoir site.

CHARLOTTE, N. C.—A rather high voltage is to be maintained over the transmission-line wires of the Southern Power Company when it starts up its service to Greensboro, Winston and Lexington, N. C., when 10,000 volts will be carried over a maximum distance of 140 miles from upper South Carolina entirely across the state of North Carolina. It is said that no difficulty is experienced in maintaining these long-distance services of current. L.

EAGLE PASS, TEX.—The Chamber of Commerce of Ciudad Porfirio Diaz, Mexico, and the Industrial League, of Eagle Pass, are working together in an effort to secure the construction of an electric railway to run from the former city to San Carlos, a town on the Mexican side of the Rio Grande. The proposed line will be about fifty miles long and will traverse the irrigated lands of General Lorenzo Trevino, which embrace about two hundred thousand acres. D.

MARINETTE, WIS.—The Northern Hydro-Electric Company has decided to erect transmission lines to the towns of Green Bay, De Pere and Manitowoc from its power plant at High Falls on the Peshtigo River. If these places do not use all the power, a line will be built to Oshkosh. The Northern Hydro-Electric Company operates a 7,000-horsepower plant at High Falls and generates 4,000 horsepower at Johnson Falls. It is stated that work will be begun very soon on these lines. M.

SAN BERNARDINO, CAL.—The Board of Supervisors of this county has advertised for sale an electric transmission franchise along certain streets and roads of the county, bids to be received till November 2. The action was taken at the request of the representatives of the Southern California Edison Company, of Los Angeles. The franchise as offered for sale provides that the successful bidder shall, after the first five years, pay over to the county 20 per cent of the gross receipts.

ATLANTA, GA.—Plans to have a "Great White Way" or an "Arc Avenue" on Peachtree Street and adjacent territory, by the installation of electric lights sufficient to turn night into day and to make an impressive electrical display by night along the thoroughfares selected, are being pushed, and several thousand dollars have already been donated by property owners for the purpose. A committee has been appointed to solicit subscriptions and to push the undertaking to a successful outcome.

TOLEDO, OHIO—The Columbus & Cincinnati Air Line Traction Company was incorporated at Columbus, Ohio, this week, with an initial capital of $10,000. Its purpose is to build an electric line direct from Columbus to Cincinnati, through territory heretofore untouched. The Riggs & Sherman Company, of Toledo, has been engaged to make preliminary surveys. Randolph Walton, former executive clerk in the office of Governor Harris, is said to be at the head of the new company. H.

LOS ANGELES, CAL.—Plans for utilizing the waters of the Colorado River for the generation of electric power at The Needles, launched two years ago by Count Apponyi, an engineer of international reputation, are now complete. Behind the project, it is stated, is Count Lascio Szechenyi, who married Gladys Vanderbilt, and through him the Rothschilds have been interested. The electric power developed is expected to be utilized in the mines of eastern California and Arizona.

MANCHESTER, N. H.—An electric-power plant is to be erected by the Amoskeag Manufacturing Company to run the new Coolidge Mill which it is building on the Merrimack River. The new plant will be located on the east side of the river just north of the Jefferson Mill. Besides furnishing the Coolidge Mill power and lighting will be provided for the Amory, Jefferson and Langdon mills of the Amoskeag company. It is believed that the power house will be completed in February or March of next year.

SALT LAKE CITY, UTAH—The Thor Power Company, of Salt Lake, has filed its articles of incorporation with the county clerk. The capital stock amounts to $500,000, divided into shares of $1 each. Of this amount 200,000 shares have been set aside as treasury stock. The company owns water rights in Six Mile Creek in Sanpete County, and will engage in furnishing electric light and power. The officers are: A. G. Burritt, president; T. J. Yates, vice-president, and Mark Anderson, secretary and treasurer.

SAGINAW, MICH.—The general mortgage, drawn by the Saginaw Power Company in favor of the Michigan Trust Company, trustee, Grand Rapids, and filed at the register of deeds office, shows that it covers all the property of that company of every form and shape. The terms of the mortgage specify that the Saginaw Power Company conveys to the Michigan Trust Company, as trustee, all of the estates and properties, real, personal and mixed, rights, privileges, franchises now owned by the Saginaw Power Company.

PITTSBURG, PA.—The Easton Consolidated Service Corporation, which supplies electric lighting and power and furnishes steam heating, has been merged with the Eastern Pennsylvania Power Company, incorporated last July in Pennsylvania, with $2,000,000 capital. The latter company is building a big water-power plant at the mouth of the Paulins Kiln Creek, at Columbia, N. J., twenty miles above this city, and has secured water rights on the Big Bushkill, in Monroe County, where another big power plant is to be erected.

HICKORY, N. C.—Flaming-arc lamps will be substituted for the old pattern of lights heretofore in use, when the city begins to use Southern Power Company current about November 1, securing the same through the Thornton Light and Power Company, which will distribute the current. This company has a plant valued at about $60,000, while $5,000 will be required to make the change from steam and the dynamo to hydroelectric power delivered from the Catawba River plants of the power company, several score miles away. L.

MAMMOTH SPRING, ARK.—Work has been started on concrete dam No. 3, on Spring River, three miles below Mammoth Spring. This enterprise is financed by Napoleon Hill, of Memphis, who owns some ten miles of this river, including some twenty valuable waterpowers. The dam is to be used to further develop the electric-light plant which Mr. Hill owns. Negotiations are on now to light West Plains, Mo., by means of the power from this latter dam. Besides the concrete dam, a steel

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bridge over Spring River is to be erected two miles below town by Mr. Hill, at his own expense, and donated to Fulton County, Arkansas. The outlay will be something like $65,000. Already Mr. Hill is having some half-mile of concrete sidewalks put down in Mammoth Spring.

MODENA, UTAH—The Gold Springs Mining and Power Company has had a corps of surveyors at Modena the last two weeks, staking off the site for its new power plant, running a line for a spur of the Salt Lake Route to the power site, locating the line for the transmission wires which are to carry electric energy across the country to the mines and mills of Gold Springs camp, and laying out the route for the water-pipe line from Deseret Wells, one mile north of the power plant site. Construction on the plant is to be started October 25. U.

ALBION, N. Y.—The sale of all the property owned by the Albion Power Company took place recently at the office of Receiver Sanford T. Church. The property sold includes the Electric Light and Power Plant and gas lighting plants in Albion, N. Y., the Electric Light and Power Plants in Brockport, Middleport, Waterport and Clark's Mills, all originally bonded for $275,000 and sold to Lucian H. Tyng of Philadelphia, Pa., for $38,250, and he assumed the incumbrances amounting to $120,000 with the interest on the various mortgages.

INDIANAPOLIS, IND.—W. S. Blatchley, state geologist, has located three good waterpower sites on the Mississinowa River—one in Wabash County and two in Grant County. Mr. Blatchley has made several trips for waterpower investigation recently on the streams of Indiana and reports a number of power-producing sites. Mr. Blatchley anticipates some legislation by the next Legislature relative to waterpower for generating, electricity and will include in his forthcoming report an interesting chapter on the waterpower sites of Indiana. S.

DUBLAN, STATE OF HIDALGO, MEXICO—A hydroelectric plant will be constructed on the Moctezuma River about three miles from Dublan by the Hidalgo Cement Company, which operates a large cement works at Dublan. The dam which the company will build across the Moctezuma River will cost about $500,000. The hydroelectric plant will cost an additional $200,000 and will have a capacity of 1,200 horsepower. The electric power will be used by the company to operate its machinery and to furnish lights for the town and plant. D.

JANESVILLE, WIS.—The historic Indian Ford dam and power plant has been purchased by the Janesville Electric Company from Captain Pliny Norcross, who has owned it for some time. This power plant is over sixty years old and originally furnished power for a saw-mill plant. The Janesville Electric Company will remodel and install modern machinery in the plant. It is stated that the company is considering the proposition of transmitting power and light to Edgerton. The acquirement of this plant gives the company a total of 4,000 horsepower. M.

GUADALAJARA, MEXICO—The Chapala Hydroelectric and Irrigation Company, which has its headquarters in Guadalajara, expects to have its hydroelectric plant and transmission lines finished and in operation by January 1. The several larger mining companies in the Etzatlan district, state of Jalisco, have contracted for power from this concern and are equipping their respective plants with electric motors and other necessary machinery. The Amparo Mining Company, of Etzatlan, recently placed an order for $25,000 worth of electrical equipment. D.

TOLEDO, OHIO—The Maumee Valley Electric Company, controlling the big waterpower plant just below Toledo, at Miami, and which for a long time has been in disuse, has been reorganized and it is said will be known in the future as the Maumee Rapids Power Company. The old plant will be reequipped to furnish power for Toledo factories. J. M. Ashley is temporary president of the new organization; R. R. Livingston, vice-president; I. L. M. McCord, secretary and treasurer; Harvey Scribner, attorney. H. L. Crawford, of New York, is on the directorate. H.

SALISBURY, N. C.—An announcement has been made that the Bankers' Trust Company, of New York, has taken an appeal from the decision of Judge J. C. Pritchard, in federal court, in the case of the Whitney Power Company, in which is involved the question of the control of the $4,000,000 plant of the company on the Yadkin River. This appeal, it is said, will have the effect of stopping all work on the plant now under course of construction, and which is nearing completion under the direction of the receiver, Col. W. S. Henderson. The receiver was able to give no opinion as to the cause of the step taken by the trust company, it was added. L.

WATERTOWN, S. D.—The Watertown Light and Power Company, controlled by the Ferris Bros. System, has purchased the property of the Kirlin-Gray Electric Company, of Watertown, S. D. The officers of the Watertown Light and Power Company are: Robert Ferris, president, Yankton, S. D.; W. J. Ferris, vice-president, La Crosse, Wis.; Thomas Ferris, treasurer, Osage, Iowa, and James W. Ferris, secretary, Watertown, S. D. The Ferris Brothers now control and operate the following properties: Eldora (Iowa) Electric Light Company, Osage (Iowa) Electric Light, Heat and Power Company, Yankton (S. D.) Light, Heat and Power Company, Union City (Ind.) Lighting Company, Franklin (Ind.) Water, Light and Power Company, Watertown (S. D.) Light and Power Company.

ATHENS, GA.—Rufus Moss, John D. Moss and Wm. Moss, of this city, have sold their extensive interests in the Tallulag, Ga., Falls, to the Atlanta Power Company, the amount involved being about $100,000. This includes water rights, but not the property. The Atlanta Power Company will develop 18,000 horsepower at this point, to be transmitted to Atlanta, Gainesville and other towns in Georgia. The company will complete a modernly equipped plant at the site of the newly acquired water falls. L.

GREENVILLE, S. C.—The Southern Power Company, Charlotte, N. C., is just completing new transmission lines to this city, the first terminus to be run to the Monoghan cotton mills, where electricity will be used as motive power. It is predicted, with plenty of evidence to substantiate the same, that practically every cotton mill in and about Greenville will have the electric drive installed within twelve months. The advantages of electricity, as compared with steam motive power, are being more forcibly recognized every day, and the industrial plants of the Piedmont section of the South are rapidly coming to use the cheap power offered by the hydroelectric companies. L.

MONTREAL, CANADA—In a letter to clients on Ottawa Light and Power, McCuaig Bros. & Co. say: "The stock of the company occupies a rather unique position for a public utilities one, as it was not issued at a bonus, or sold at a low figure, but represents an actual cash investment of one hundred cents on the dollar. At the present time it pays a dividend of five per cent, but it is generally expected that the rate will be increased to six per cent, beginning with the first quarter of 1910. At present the company is showing net earnings equal to about eleven per cent on the common stock."

DEMING, N. M.—B. P. Shull has closed a contract with the Western Construction Company, of Wichita, Kan., for the installation of a large electric-power plant at this place. The power will be used chiefly for the operation of irrigation pumps. It is stated that forty wells will be put down within a radius of ten miles of the proposed central-power station and that electric transmission lines will be built to cover the territory embraced in these wells. Water will be furnished to farmers at a cost of less than $3 for three acre feet, which is said to be much less than that of ordinary irrigation concerns. D.

SACRAMENTO, CAL.—The long-standing dispute between the Sacramento Electric, Gas & Railway Company and the State of California concerning the rights to the use of the waters of the American River at Folsom, Cal., for electric-power purposes has been settled by a compromise. The state had the better of the question in the court decisions to date, but thought it best to recognize the claims of the power company to a certain extent. It is now agreed that the Sacramento Electric, Gas and Railway Company shall have the right to control the waters as formerly, but shall regulate the flow to suit the needs of the state.

ROCK HILL, S. C.—The published report that this town was about to assume a hostile attitude toward the Southern Power Company is strenuously denied by the city through its leading business men. It is reported on the other hand that the Southern Power Company, which failed to procure certain privileges sought at the hands of the Columbia, S. C., Council, is considering the advisability of putting up a five-story office structure in Rock Hill, and making that town headquarters for the state, if not for the entire territory of the concern, though so many rumors have been afloat regarding the company's future plans that, without a definite statement from the Southern Power Company, the report must be taken with a grain of salt. L.

OGDEN CITY, UTAH—The Utah Light & Railway Company has commenced the erection of a new hydroelectric power plant in the mouth of Weber Canyon (on the line of the Union Pacific Railroad). The power house will be constructed of brick and steel upon a cement base and the dimensions are 53 (fifty-three) feet by 73 (seventy-three) feet and will cost $400,000 when completed. One 2,500-kilowatt, 2,300-volt generator will be installed, connected direct to a 5,000 horsepower turbine, and space for an additional machine of the same size will be provided for and installed when needed. A transmission line built of steel towers will connect with the old Pioneer Transmission line five miles west of the plant and the power will be used in Ogden and Salt Lake City. N.

IOWA FALLS, IOWA—Statements made by representatives of the Interstate Power Company indicate that the water-electric project proposed here will be one of the biggest waterpower propositions ever outlined in the state of Iowa. According to the company's agents, it is capitalized at $15,000,000 and proposes to expend $612,500 in the proposed plant. This expenditure is based on the estimates of Engineer Chappell and includes the construction of the plant proper and the acquirement of rights, franchises and lines here, as well as the high-tension lines to surrounding

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cities and towns. It is stated that the Interstate Power Company, which proposes to make this big investment in this section, is backed by the Westinghouse Company and three private Chicago banks.

SANTA BARBARA, CAL.—One of the first acts of the directors of the newly incorporated Santa Barbara Gas and Electric Company has been to pave the way for the merging of the Edison Electric Company and the Merchants' Mutual Light and Power Company in Santa Barbara. A resolution providing for the creation of a bonded indebtedness of $1,000,000 has been adopted. This money and certain capital stock will be used in the purchase of the two gas and electric plants, which are to be united.

MARION, S. C.—The plant of the Marion Water, Light and Power Company has been sold under the decree of United States Circuit Judge Pritchard by P. A. Willcox, receiver. The property was bid in by Martin Maloney, of Philadelphia, who was the largest holder of the bonds of the company, $55,000 being the bid. This plant was a part of the system comprising the water and light plants at Rock Hill, Florence and Darlington. Similar sales have already been made at Rock Hill and Darlington. It is thought that a reorganization of the property will take place, which will mean better equipment and as a consequence more efficient service. The operation of the plant by the receiver has been quite satisfactory under the circumstances.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SALEM, ORE.—The Portland General Electric Company is planning to build car barns in this city, at a cost of $20,000.

MERRILL, WIS.—The Chicago & Wisconsin Valley Railroad Company has been organized to construct an electric line to Janesville. C.

VINTON, IOWA—The Iowa Traction Company is planning the construction of a dam and race on the Cedar River, between here and Cedar Rapids. C.

SAN FRANCISCO, CAL.—The Peninsular Electric Railway Company has begun service on its new line from Palo Alto to Stanford University, on the peninsula south of San Francisco.

FT. WAYNE, IND.—Two carloads of motors for the new interurban and city cars purchased by the Ft. Wayne & Wabash Traction Company have been delivered and are now being installed. S.

LA CROSSE, WIS.—The La Crosse Water Power Company will ask for a franchise for an interurban road, to Winona, Minn., and Sparta, Wis., to cost $3,000,000, to be completed in the fall of 1910. C.

ALBUQUERQUE, N. M.—The City Council has granted to D. K. B. Sellers and M. B. Stamm, representing the Highland Electric Railway Company, a franchise for an electric railway in this place.

CENTERVILLE, S. D.—L. F. Phelps, of Wagner, S. D., is promoting a company to construct an interurban line, thirty miles long, to Spring Valley, via Viborg, at an estimated cost of $25,000 per mile. C.

DES MOINES, IOWA—Thos. F. Flynn, general manager of the Des Moines, Council Bluffs & Western Railway Company, is authority for the statement that money has been secured for the construction of the line to Council Bluffs. C.

GRAND RAPIDS, WIS.—It is stated that interurban service between Grand Rapids and Nekoosa will begin November 1. The finishing touches are now being put upon the line and everything is favorable for opening the road on time. M.

ATLANTIC, IOWA—Rattenborg, Ross & Judd, of the Atlantic Northern & Southern Railway Company, of this city, are in the market for fifty-eight miles of steam-railroad construction material. For particulars address them at Atlantic, Iowa.

FRESNO, CAL.—The Board of Supervisors has advertised for sale on November 11 the electric-railway franchise applied for by the Fresno Traction Company. If the franchise is secured by this company a number of extensions to its present system will be made.

LA CROSSE, WIS.—The sale of the La Crosse City Railway Company and the La Crosse Gas and Electric Company to a syndicate of eastern capitalists, consisting of Wm. Edmunds and Arthur H. Gilbert, of Boston, and some others, is under consideration. C.

LA CROSSE, WIS.—President W. J. Ferris, of the La Crosse Water Power Company, says a special meeting of the City Council will be called shortly, at which the company will apply for a franchise to enter La Crosse with an electric railroad from Winona, Minn., to Sparta, Wis.

TRENTON, N. J.—United States Judge Rellstab has made an order appointing Judge Louis Starr, of Woodbury, N. J., as master to sell as one property the Camden & Trenton Railway Company, at a time to be fixed by the master. The sale is the result of the foreclosure of a mortgage held by the Provident Life and Trust Company, of Philadelphia, as trustee for $750,000 of the bonds of the corporation and a second mortgage for $3,428.12 held by J. Karney Rice, of New Brunswick. Adjutant-General Wilbur F. Sadler is receiver for the road.

MACON, GA.—Application has been made to the City Council for franchises to operate a trolley line over certain streets by Frederick Kauffman and J. B. Hart, who have planned to construct their Recreation interurban line through Macon to Montpelier Springs. The extension will be several miles long. L.

INDIANAPOLIS, IND.—The Beech Grove and Indianapolis Traction Company has applied to the County Commissioners for a franchise permitting the construction and operation of an interurban road along the public highway from Beech Grove to Indianapolis—a distance of ten miles. Louis McManis is general manager. S.

NEW ALBANY, IND.—The Louisville, Blue River & French Lick Traction Company filed articles of incorporation here to build a line from this city to French Lick, connecting Louisville and French Lick and West Baden Springs. J. H. Fawcett, Charles O. Kelso and Walter A. Gadient, of this city, are the incorporators.

COLUMBUS, OHIO—The Columbus & Cincinnati Air Line Traction Company, headquarters at Columbus, $10,000 capital stock, has been incorporated by Frank E. Ruth, Emmett B. Tompkins, Randolph W. Walton, W. L. McVey and M. M. Recob. The company is to operate in Franklin, Fayette, Clinton, Clermont and Hamilton counties and to pass through Washington C. H. and Wilmington.

IOWA FALLS, IOWA—The City Council has concluded its consideration of the street-railway franchise submitted by the Interstate Power Company, of Chicago, changing it in the following particulars: The time is reduced from twenty-five to fifteen years and construction is required to be commenced within one year and completed within two. On acceptance by the company the question will be submitted to a vote of the people. C.

WABASH, IND.—As a result of the voting of subsidies in two townships in Wabash County and one township in Kosciusko County, aggregating $60,000, in aid of the construction of a traction road from this city to Warsaw, by way of North Manchester, General Manager J. A. Barry announces that work will begin at once. Mr. Barry announces that the Bethlehem Steel Works will furnish the rails and the J. G. Brills Company the rolling stock equipment. S.

FAYETTEVILLE, N. C.—The sum of $75,000 has been procured on bonds of the Fayetteville Consolidated Power and Street Railway Company, and the financial difficulties of the company will be quickly adjusted, following a temporary receivership, and work on extensions formerly planned will be carried out, application being made to the court for the dissolving of the receivership, since sufficient money has been raised to liquidate all indebtedness. W. D. Neill, receiver, will be reinstated as president of the company. L.

TOLEDO, OHIO—Papers have been forwarded to the secretary of state, increasing the capital stock of the Fostoria & Fremont Railway Company from $10,000, its initial capital, to $300,000. The new line will be bonded for $250,000, the bonds having been already sold. There will be $150,000 of common stock and $150,000 of preferred. The officers of the new company are: President, F. D. Carpenter; vice-president, J. H. Goeke; secretary and treasurer, J. D. McDonel, while both the Lake Shore Electric and the Western Ohio Electric will be represented in the directorate. H.

TACOMA, WASH.—With the mayor threatening to swear out a warrant for its manager unless the crowded condition of the cars is relieved, and nearly a dozen towns holding indignation meetings and threatening to vote annexation to the city of Tacoma because of an advance of suburban rates, the Tacoma Railway and Power Company is in line for one of the hardest street-railway battles since the inauguration of street cars in Tacoma. Recently it bought out the Pacific Traction Company, its only competitor. Mayor Linck declares he will compel better service if he has to resort to the courts. But all of his threats have been ignored by the traction company. Under a provision of the franchise, according to the city attorney, the company is liable to a fine of $100 per day.

ANDERSON, S. C.—The sale of the entire properties of the Anderson Traction Company in bankruptcy proceedings took place on October 11, the property being bid in by Edwin W. Robertson, of Columbia, S. C. The price paid was $154,750. There is included in the sale eighteen miles of track, rolling stock, power plant, equipment and franchise. The bankruptcy proceeding grew out of a claim held by the International Trust Company, of Maryland, who instituted the proceedings some months ago to recover moneys due them. Mr. Robertson has been acting as receiver for the Anderson Traction Company, and held second mortgages on the property. There was a prior sale ordered under a ruling by Federal Judge J. C. Pritchard, at an

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upset price of $175,000, but no bids were forthcoming. The second decree named no upset price, and also made provision for a large suit pending against the traction company. Mr. Robertson has announced that the company will be reorganized and the system operated in good shape. L.

MEMPHIS, TENN.—Officials of the Lakeview Traction Company, which is incorporated under the laws of Maine, with a capital stock of $1,500,000, and which was organized for the purpose of building interurban lines connecting Memphis with Collierville and Covington, Tenn., on the north, and with Lakeview, Clarksdale and other points in Mississippi on the south, announce that work is to begin at once on the construction of the traction lines. They have just succeeded in selling $350,000 first-mortgage bonds and $87,500 of preferred stock, and the proceeds thereof will be used for pushing construction work.

TOLEDO, OHIO—The first of the equipment of the Lake Shore Electric shops will be taken to Sandusky early next week. Everything is now in readiness at Sandusky, and the Fremont shops will be entirely dismantled and abandoned. Franchises are being secured by the Toledo & Fort Wayne Electric Railway Company to complete its lines between Bryan, Ohio, and Fort Wayne. The company agrees to have its road completed by December 1, 1910, and has given a $5,000 bond to that effect. While this is a separate enterprise it will be in fact an extension of the Toledo & Indiana, and will provide continuous electric transportation between Toledo and Fort Wayne, Ind.

COLUMBUS, OHIO—Columbus men have incorporated a traction company to build a line direct from this city to Cincinnati, rnnning through a district that now has no traction lines, and opening up a territory they think will be profitable. The company is known as the Columbus & Cincinnati Air Line Traction Company. Its line will pass through Washington, C. H. and Wilmington, besides numerous small towns. The incorporators have been at work on the project for several months. Randolph Walton, former executive clerk in the office of Governor Harris, is at the head of the company, which includes former Congressman Emmett Tompkins, Frank E. Ruth, W. L. McVey and M. M. Recob.

DUNDEE, N. Y.—Announcement is made of the immediate building of an electric line from Dundee, a station on the New York Central Railway, to Starkey Station, on the Northern Central Railway of Pennsylvania, connecting also with the steamers for Geneva and Watkins Glen. The construction will be overhead trolley, narrow gauge, fifty-pound rails and small cars, alternating-current motors, sixty-cycle. The owners of the road will be the same as the lighting plant, and the current will be supplied from these alternators. A. J. Pierce, C. E., has been engaged in the engineering work of roadbed and grades. The rapid growth of Dundee and its enthusiastic spirit has made the venture possible.

ATLANTA, GA.—The expenditure of about $150,000 is now under way by the Georgia Railway and Electric Company, the sum being utilized for new buildings and electric apparatus in the city, officials declaring that the growth of the city and of their business renders the increase imperative. Car barns are being added costing one-third of the amount named above, and $25,000 for a new substation in the company building on Walton and Fairlie Streets, this station to have a capacity of 1,500 horsepower, supplying power and current for 25,000 lights. Also, $25,000 is being used for a new motor generator set in the Davis Street power plant, and $50,000 for new tracks from the Hapville line to the autodrome. L.

FORT WAYNE, IND.—An inspection party, headed by General Manager C. D. Emmons, has just completed the first annual inspection of the Fort Wayne & Wabash Valley lines, covering the Fort Wayne city lines, the Bluffton interurban division and the main line. The officials report a great improvement in roadbeds and trackage since the preliminary inspection of last spring. Since that inspection $5,000 has been spent on tracks exclusive of ballasting, which has been general on the Lafayette division. Prizes will be divided among the nineteen section foremen of the system as follows: For best line and surface—first prize, $50; second, $40; third, $25. For the greatest improvement in the trackage during the first six months—first prize, $50; second, $25. S.

MONTREAL, CANADA—It is stated by one who is in a position to know the facts, that the Quebec Railway stock will be taken up at $75 a share, if the present plans of those who are negotiating with a view of bringing about a merger of the light and railway companies of that city are successfully carried out. It is understood that the light companies at Quebec are cutting rates to a price at which there is a minimum of profit, and if a combination can be formed between the companies, better prices will be assured. This will account for the strength of the stock, as it generally is admitted that on the railway's own showing the price around today's level is unduly high. The price to be paid for Quebec Railway stock, as above stated, will, of course, only be paid in case the merger plans are successfully carried out, so that purchasers of the stock will bear in mind the contingency of the scheme falling through.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

OLIVIA, MINN.—The Renville County Telephone Company will install a telephone system. C.

MARMADUKE, ARK.—The Independent Rural Telephone Company has been incorporated.

LEMMON, S. D.—The Dakota-Montana Telephone Company will extend its line to Mobridge. C.

OLIVIA, MINN.—The Renville County Telephone Company is about to install a telephone system.

TROY, MONT.—A co-operative telephone company has been organized to construct a line to Bull Lake. C.

HAVRE, MONT.—The Montana Independent Telephone Company has applied to the city for a franchise. C.

MARSHALL, MINN.—The Northwestern Telephone Exchange Company will rebuild and improve its system. C.

DICKSON, TENN.—The Citizens' Telephone Company has increased its capital stock from $3,000 to $6,000.

LANGDON, N. D.—The Langdon-Waterloo Telephone Company will construct a line to Waterloo township. C.

NORTH PLATTE, NEB.—Tricounty Telephone Company has been incorporated, with a capital stock of $10,000.

CROSBYTON, TEX.—The Crosbyton Telephone Company has been incorporated, with a capital stock of $10,000.

SACO, MONT.—The Moore Telephone Company is constructing a local and long-distance metallic telephone line. C.

LOUISVILLE, NEB.—The Plattsmouth Independent Telephone Company will shortly erect an exchange building. C.

ST. LOUIS, MO.—The Keisel Telephone and Electric Supply Company has been incorporated, with a capital of $9,000.

LEAGUE CITY, TEX.—The League City Telephone Company has been incorporated, with a capital stock of $2,500.

SMITHVILLE, ARK.—The Smithville Rural Telephone Company has been incorporated, with a capital stock of $6,000.

DICKINSON, N. D.—The People's Telephone Company has been granted a franchise for the extension of its lines in the county. C.

STEVENSON, WASH.—The Skamania Co-operative Telephone Association has been incorporated, with a capital stock of $10,000.

VERGAS, MINN.—The Vergas Telephone Company, James Nesbitt, secretary, has been incorporated, with a capital of $10,000. C.

RUGBY, N. D.—The County Board granted the Barton Farmers' Telephone Company permission to construct telephone lines in the county. C.

DES MOINES, IA.—The Hawkeye Telephone Company has been incorporated, with a capital of $5,000. Jas. B. Mason, secretary and treasurer. C.

VALDEZ, ALASKA—The Valdez-Fairbanks Long-Distance Telephone Company will build a line along the government road between the two points.

PLAZA, N. D.—The Queen City Telephone Company, of Ryder, N. D., is considering the construction of a line to Stanley, with an exchange at Ross. C.

WHITE SULPHUR SPRINGS, MONT.—It is probable that the Rocky Mountain Bell Telephone Company will build across the Flathead reservation to Kalispell.

DILLON, MONT.—The Montana Independent Telephone Company, of Butte, is considering the construction of lines to Whitehall and from Twin Bridges to Virginia City. C.

BRUCE, WIS.—The Chippewa Valley Telephone Company has moved its headquarters from Bruce to Ladyship. The latter place is more convenient for the company and its patrons. M.

OTTAWA, ILL.—The properties of the Central Union Telephone Company and those of the Home Telephone Company have been merged into a company to be known as the United Telephone Company. V.

SPOKANE, WASH.—The Home Telephone Company has been acquired by a syndicate composed of Thaddeus S. Lane, of Butte, Mont., and others, and will expend $400,000 in the completion of the plant at Howard Street and Second Avenue. C.

LANSING, MICH.—The annual report filed with City Clerk Gray in compliance with the franchise of the Citizen's Telephone Company, shows that the company has an investment of $348,581.81 in this city and that a profit of $7,121.18 was realized on the investment during the last year. According to the report the total earnings were $35,097.74, $3,118.67 being commission on toll

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lines. The expense of operating was $27,976.56, divided as follows: Reconstruction, $607.61; maintenance, $4,841.41; labor, $18,126.63; fuel, $163.04; taxes, $959.37; general expense, $848.50; depreciation, $5,430.

SPOKANE, WASH.—T. S. Lane, of Butte, Mont., announces that the Home Telephone Company, of Spokane, will be in operation within six months, and that $400,000 will be expended in equipment.

YREKA, CAL.—The Board of Supervisors has granted a franchise to the Edson and Foulke Company, of Gazelle, to construct a private telephone line along the county road between Gazelle and the Granada Ranch.

LUMBERTON, N. C.—The town has granted a franchise to the Bell Telephone Company to operate locally, and the Bell Company has purchased the old system from its former owners and will rebuild and improve the same. L.

RENO, NEV.—Articles of incorporation have been filed at the county clerk's office for the Bannock Telephone and Telegraph Company, capitalized at $20,000. The incorporators are J. F. Haley, J. L. Considine and A. E. Littler.

OTTAWA, ILL.—Ottawa is now without telephone competition. The properties of the Central Union Telephone Company and the Home Telephone Company have been merged into a company known as the United Telephone Company.

BILLINGS, MONT.—Capitalized for $60,000, the Montana Eastern Telephone Company has filed articles of incorporation. The principal place of business is Glendive, and the directors are H. J. Haskell, F. C. Hughes, E. P. Baldwin, L. R. Barnett and William Lindsay, all of Glendive.

TOLEDO, OHIO—Last week suits were brought at Bowling Green, Ohio, by Jacob Huffman, against James Wade and Henry Huebner, to compel the delivery of 150 shares of stock of the Tontogany Telephone Company. Plaintiff also asks $500 damages for alleged refusal to deliver the stock. H.

WHITEHALL, WIS.—The meeting of the representatives of the different farmers' telephone companies in Jackson and Trempealeau counties at Whitehall last week resulted in nothing definite being decided upon, because the attendance was too small. The meeting was called to consider the proposition of consolidating the companies into one organization. It is stated that another meeting will be called soon. M.

CLEVELAND, OHIO—The incorporation of the Ohio Home Telephone Company at Columbus, Ohio, for the purpose of leasing the property of the United States Telephone Company brings to a close negotiations which have been in progress for over a year for a merger of all independent telephone interests in the state of Ohio. An amalgamation of all of the independent interests in the country is expected as an outgrowth of the Ohio organization. Stockholders of the local companies are the stockholders of the Ohio Home Telephone Company, which will, it is said, render it impossible for outside interests to obtain control of the independent long-distance service and thus cut off the local companies from outside telephone connections. The new company was incorporated for $500,000.

INDIANAPOLIS, IND.—The first-mortgage five per cent gold-mortgage bonds of the New Long Distance Telephone Company of Indiana have been listed on the stock exchanges. This property is in excellent financial condition. Indiana is admittedly the stronghold of the independent telephone business in the United States. The New Long Distance Company has increased its facilities to eighty circuits out of Indianapolis and operates over 10,000 miles of wire and connects with nearly 2,000 stations in Indiana. The recent organization of the Toll Clearing Company has proved immensely advantageous in the handling of the business. The new merger company recently organized in Ohio will greatly strengthen the Indiana company in its interstate affiliations. Over $35,000,000 is invested in telephone business in Indiana, and plans are now being made to enter upon a general campaign of expansion of systems next year, and it is predicted that there will not be a single undeveloped field in the state at the close of 1910. S.

PITTSBURG, PA.—The Norfolk & Western has put into service two telephone circuits for handling its trains, following the lead taken by some of the roads in the Pittsburg district. The first circuit is between Roanoke, Va., and Bluefield, W. Va., 102 miles; and the other between Bluefield and Williamson, W. Va., 107 miles. There are sixteen stations on the former and twenty-two on the latter circuit, the Western Electric Company's telephone equipment being used. This equipment extends through mountainous country and affords a good test of telephone train dispatching under severe conditions. The new service was installed September 25 and W. C. Walstrum, superintendent of telegraph, reports that both circuits have given excellent service since that time. A feature of interest in connection with one of these circuits is that the telephone was pressed into service before being completed owing to the telegraph circuits having gone out of commission, due to the recent widespread electrical disturbances.

ELECTRICAL SECURITIES.

The electrical security market is resting with this one exception, that returns are now coming in from other industrial companies, which proves what has been stated in these columns over and over again, that the business revival of the country has long ago commenced, that speculation discounted it, that again speculation will discount the returns, but conditions are sound. If need be, pertinent examples may be given of the returns of the Elevated Railway Companies of Chicago, the public service corporations, one of the largest of which did the greatest business last September in the history of the concern; and again the Pullman Company, which publishes an excellent report showing the amount of business done by the railway companies derived from that business revival.

Some of those electrical companies, two in particular, well known all over the country, which have passed through grievously hard times, are gradually pulling out. Their returns are not as splendid as some boosters in the daily press would indicate, but the fact remains that they are coming into their own.

The Wilkes-Barre (Pa.) Gas and Electric Company has called for payment all of the underlying bonds of both the Gas Company of Luzerne County and the Wyoming Valley Electric Light, Heat and Power Company. By virtue of this call the Wilkes-Barre Gas and Electric Company consolidated five per cent bonds, January and July, 1955, become a first and only mortgage on the entire property.

It is understood that early next summer the stock of the North Shore Electric Company, Chicago, Ill., will be placed upon a four per cent dividend basis. The present rate is three per cent. The growing earnings warrant a larger rate. There also will be an increase in the company's capital stock next year of $400,000, bringing the total to around $4,500,000. While the increase will be sold to stockholders at par, they will have issued to them treasury stock in such an amount as to make the subscription price equal to 70. The shares are now selling around 80.

The directors of the Western Union Telegraph Company met October 20 and organized by electing the retiring officers.

DIVIDENDS.

American Gas and Electric Company; regular quarterly dividend of one-and-one-half per cent on the preferred stock, payable November 1.

Cuyahoga Telephone Company; quarterly dividend of one-and-one-half per cent on its preferred stock, payable October 30 to stockholders of record October 15.

Edison Electric Illuminating Company, of Brockton; semi-annual dividend of $3.50 per share, payable November 1.

Helena (Mont.) Light and Railway Company; one-quarter of one per cent on preferred stock, payable November 15, and one per cent on common stock, payable November 1.

Mexican Tramway Company; quarterly dividend of one-and-one-half per cent, payable November 1.

United Electric Securities Company; semi-annual dividend of $3.50 per share on the preferred stock, payable November 1, to stockholders of record October 23.

NEW YORK.

	Oct. 25.	Oct. 18.
Allis-Chalmers common	14	14¾
Allis-Chalmers preferred	50	52
Amalgamated Copper	79½	83⅛
American Tel. & Cable	*80	*80
American Tel. & Tel.	139⅜	142
Brooklyn Rapid Transit	76½	78
General Electric	159	163½
Interborough-Metropolitan common	17⅛	16½
Interborough-Metropolitan preferred	48⅜	48⅜
Kings County Electric	128	128
Mackay Companies (Postal Telegraph and Cables) common	90⅛	92⅜
Mackay Companies (Postal Telegraph and Cables) preferred	74	74
Manhattan Elevated	141	141
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	123½	123½
U. S. Steel common	86⅝	91⅞
U. S. Steel preferred	126	128⅝
Western Union	76	78
Westinghouse common	84½	86½
Westinghouse preferred	132	140

*Last price quoted.

BOSTON.

	Oct. 25.	Oct. 18.
American Tel. & Tel.	139¾	142
Edison Elec. Illuminating	252	248
General Electric	159	163½
Massachusetts Electric common	16½	17½
Massachusetts Electric preferred		81
New England Telephone	134½	136
Western Tel. & Tel. common	10	10½
Western Tel. & Tel. preferred	88	88

PHILADELPHIA.

	Oct. 25.	Oct. 18.
American Railways	45½	45¼
Electric Company of America	12⅜	12¼
Electric Storage Battery common	59½	59½
Electric Storage Battery preferred	59½	59½
Philadelphia Electric	12⅝	13¼
Philadelphia Rapid Transit	25¼	28
Philadelphia Traction	89¼	88¾
Union Traction	52	53¼

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CHICAGO.

	Oct. 25	Oct. 18.
Chicago Railways, Series 1	107	106
Chicago Railways, Series 2	35	35½
Chicago Subway	7¼	7¾
Chicago Telephone	136½	136
Commonwealth Edison	119½	120
Metropolitan Elevated common	17	16
Metropolitan Elevated preferred	50	52½
National Carbon common	95¾	99
National Carbon preferred	118	118

PERSONAL MENTION.

GUY H. GIBBS, who has been with the Westinghouse Electric and Manufacturing Company for the past eight years, four of which have been with that company's Cincinnati office, is now with the Western Electric Company at Cincinnati.

R. M. HOWARD has tendered his resignation as general manager of the Green Bay Traction Company and the Green Bay Gas and Electric Company, of Green Bay, Wis., to take effect November 1. He will be succeeded by John T. Huntington, of Topeka, Kan. C.

JOHN H. DALE, president of the Dale Manufacturing Company, of New York, made a flying visit to Chicago the first of this week. Mr. Dale recently returned from Europe, where he had been on a prolonged rest, and from which he returned with health fully restored.

DANA H. HOWARD, advertising manager for the Commonwealth Edison Company, of Chicago, has been visiting the New York Electrical Show, also Boston and Philadelphia, looking over the field with a view to the Chicago Electric Show next January. Mr. Howard supervises the Commonwealth company's exhibits each year at the Chicago show.

HOWARD EHRLICH, associate editor of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, was married to Miss Jennie Conklin, of Oak Park, Ill., on October 28. After returning from their wedding journey Mr. and Mrs. Ehrlich will make their home in Chicago near Washington Park. Mr. Ehrlich is a graduate of George Washington University and spent several years in the engineering departments of the Westinghouse Electric and Manufacturing Company at Pittsburg and the Western Electric Company at Chicago. His friends in general, and particularly his associates on the editorial staff of this journal, extend to him hearty congratulations and best wishes.

ARBA B. MARVIN has opened an office at 950 Commercial National Bank Building, Chicago, Ill., for general practice as a solicitor of patents. Mr. Marvin graduated from the Electrical Engineering Department of the University of Wisconsin, and served in the testing department of the General Electric Company at Schenectady, N. Y. He was for a time instructor in electrochemistry at the University of Wisconsin, and has made a special study of chemistry, electrochemistry and electrometallurgy. Mr. Marvin studied law at Columbia University, and for two years was an examiner in the United States Patent Office. For the past five years he has been employed by the General Electric Company as assistant attorney in the patent department at Schenectady.

OBITUARY.

ALFRED RUTGERS WHITNEY died on October 22 at his home in Morristown, N. J. He was in his seventy-fifth year. In 1865, Mr. Whitney started in the iron business and obtained the contract for the structural iron work in the Grand Central Station. In the seventies he constructed the old Greenwich Street elevated roads, the Second and the Third Avenue elevated roads and a large part of the Sixth Avenue road, all in New York city. At one time he was connected with the Carnegie Steel Company.

NEW INDUSTRIAL COMPANIES.

LOS ANGELES, CAL.—The Los Angeles Trolley Catcher Company has been incorporated here, with a capital stock of $20,000, by J. R. Ricketts, W. D. Craigmile and J. S. Weber.

NEWARK, N. J.—The United Electric Smelters has been incorporated, with a capital of $150,000, and the following are the incorporators: J. H. Reid, Newark; E. A. Filkins and F. E. Gollier, New York city.

NEW YORK, N. Y.—The Odin Dry Battery Company has been incorporated to manufacture electrical supplies, with a capital of $25,000. The incorporators are: B. Colby, Bronx Borough; H. C. Adams, H. R. Berlinecke, New York city.

SAN FRANCISCO, CAL.—The Pacific Motor Publishing Company has been incorporated. Capital stock, $15,000; shares, $1 each; subscribed, $7,515. Directors—William Richards, A. G. Briggs and Lynn C. Simpson, 2,505 shares each. Place of business, San Francisco.

PORTLAND, ME.—The International Electric Manufacturing Company has been organized for the purpose of manufacturing and dealing in electrical machinery, et cetera, with $1,000,000 capital stock. President, Clarence E. Eaton, of Portland; treasurer, T. L. Croteau, of Portland.

INDUSTRIAL ITEMS.

H. M. BYLLESBY & COMPANY, Chicago, Ill., consulting engineers, announce that they have moved to temporary quarters at 218 La Salle Street, Chicago.

MACGOVERN, ARCHER & COMPANY, 114-118 Liberty Street, New York city, have issued their October list of second-hand electrical and steam machinery, etc.

THE H. H. PAISTE COMPANY, Philadelphia, Pa., has distributed the October issue of "Paistery," a monthly bulletin devoted to descriptions of approved and improved electrical wiring supplies.

M. L. NEWMAN & COMPANY, consulting and industrial engineers, announce that they have removed their office from 25 Broad Street to the United States Express Building at 2 Rector Street, New York city.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio, is distributing an attractive folder calling attention to its industrial lighting department and discussing the merits of Buckeye lamps and reflectors for shop lighting.

THE ELECTRIC CONTROLLER AND MANUFACTURING COMPANY, Cleveland, Ohio, has recently issued the October number of its publication, entitled "Common Sense." The issue contains some very interesting articles.

THE NERNST LAMP COMPANY, Pittsburg, Pa., has published the September-October number of "The Glower," which contains descriptions of typical Westinghouse-Nernst lamp installations, an article on factory lighting, etc.

PETTINGELL-ANDREWS COMPANY, Boston, Mass., has distributed the October issue of "Juice," a monthly publication giving interesting information about electrical material. This issue contains a valuable article on tungsten sign lamps.

THE GAGE PUBLISHING COMPANY, New York, N. Y., announces that hereafter it will devote its entire energies to the publication of the "Electrical Record," the Ferguson Publishing Company having purchased its other publications.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., is mailing to the trade a postal card, illustrated with a picture of the H. W. Johns-Manville Company's factory, Milwaukee, Wis., in which building "Sherarduct" is exclusively installed.

H. W. JOHNS-MANVILLE COMPANY, 100 William Street, New York, N. Y., announces that it has taken the exclusive sales agency for the New Lexington High Voltage Porcelain Company, New Lexington, Ohio, manufacturers of porcelain insulators for all voltages.

THE HOLOPHANE COMPANY, Newark, Ohio, has issued the October number of "Holophane Illumination," which contains, among other things, an illustrated article describing the illumination of the Brooklyn Masonic Temple. This building, it is said, contains over 1,400 pieces of Holophane glass.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a new folder descriptive of Opalux glassware. This folder is of particular interest in that it announces the new method of packing and gives considerable information on the cost of maintenance, etc. Efficiency curves are given, showing the light distribution with 100-watt tungsten lamps.

THE NATIONAL X-RAY REFLECTOR COMPANY, 247 East Jackson Boulevard, Chicago, Ill., has issued its Bulletin No. 2, containing directions for planning installations using the "Eye-Comfort" system of indirect illumination. Various tables of illumination data are given, as well as rules and practical examples illustrating their use.

THE ARNOLD COMPANY, consulting engineers and constructors, of Chicago, Ill., is distributing a souvenir post-card showing the erecting bay of the locomotive and car-repair shops that were designed and constructed under the supervision of the company for the Frisco Car and Engine Company at Springfield, Mo. These shops were recently completed and placed in service.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has published in its October issue of the Emerson Monthly several articles devoted to electric exhaust fans, sewing-machine motors and winter uses for the desk fan. A new type of one-half horsepower enclosed motor is also described. The motor stock list is given and also a list of motor bargains.

THE REYNOLDS DULL FLASHER COMPANY, 152 Fifth Avenue, Chicago, has prepared several sets of folders illustrating and describing a very large number of the flashing electric signs that have been equipped with Dull's flashers. In this series is included a large number of signs showing some very unique effects, a number of signs illustrative of "High Life," also a number of illustrations showing the flasher itself and the method of laying out a sign on the dummy board to suit the

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desires of the various patrons. This series of folders shows very strikingly the great variety of effects that can be produced by means of flashing signs, but, of course, can give but a comparatively vague idea of the beauty and striking effect produced by many of them.

THE J. P. DEVINE COMPANY, 428 Brisbane Building, Buffalo, N. Y., has published an interesting pamphlet devoted to Passburg vacuum drying and impregnating apparatus for electric coils, cables, transformers, armatures, etc. The apparatus is illustrated and described and its operation explained. It is built for heating by steam, gas or oil, the latter being the latest type. A special vacuum pump is also described in this connection. The advantages of the Passburg impregnating process are stated briefly, since they are generally well known. The pamphlet is concluded with a long list of the principal users of the Passburg apparatus.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, Pa., has recently issued an attractive publication on the "Exide Sparking Battery." It contains a very complete description of this well-known ignition cell and a rather unusual double-page illustration showing its entire construction at a glance. Every feature which makes this battery so durable and efficient is clearly shown. In addition to this description of the battery three excellent articles have been specially written for this publication by the editors of "Motor," "Cycle and Auto Trade Journal" and "Automobile." They are well worth preserving, as they touch upon such subjects as spark plugs, care of the automobile, etc.

THE UNITED STATES LIGHT AND HEATING COMPANY, 30 Church Street, New York city, through J. Allan Smith, its general manager, writes to the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN as follows, under date of October 25: "My attention having been called to a misleading item in your issue of September 11, relative to an alleged infringement of a patent claimed to be owned by the Electric Storage Battery Company, of Philadelphia, I would state that the patent in suit only involves a machine used in the manufacture of a specific type of plate. The item which you have printed creates a false impression, since The United States Light and Heating Company is engaged in the manufacture of a number of different types of plates. Nearly all are covered by patents owned by this company, and the few other types of plates that are manufactured by us do not infringe, we are advised by our attorney, any patent owned by any competitor. Further, the patent in suit does not claim a battery plate, but simply covers certain features of a machine for making a secondary-battery plate. In view of the possible false impression which your readers may have formed, I trust that you will give this letter as much publicity as possible."

THE ALBERT SECHRIST MANUFACTURING COMPANY, of Denver, Colo., has one of the most extensive and best equipped factories for the manufacturing of plain and ornamental, combination and straight electric-lighting fixtures in the country. This company maintains a large art and designing department, spins all of its forms from heavy sheet brass, cuts all of its patterns and carries in stock a remarkable line of material entering into construction of everything in the way of a fixture from a plain lantern to the most elaborate chandelier. The company's design book is very complete, and its method of publicity and preparation of designs for prospective buyers is unique. The company controls a very extensive business throughout the Western and Central States, and so attractive is its proposition that it is shipping regularly many orders to both the Atlantic and Pacific coasts, and to foreign countries. The company's data and design books are of such magnitude and so costly to prepare that great care is taken to avoid a promiscuous distribution, but general requests will be promptly complied with.

DATES AHEAD.

National District Heating Association. First annual meeting, Columbus, Ohio, November 10 and 11.

Alabama Light and Traction Association. Annual convention, Birmingham, Ala., November 15 and 16.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 to 18.

Boston Electrical Show. Mechanics' Building, Boston, November 15-25.

Empire State Gas and Electric Association. Annual convention, New York city, November 17 and 18.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual meeting, Lima, Ohio, November 19 and 20.

International Independent Telephone Association. Annual convention, Chicago, December 7, 8 and 9.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) October 19, 1909.

937,050. TELEPHONE SYSTEM. Henry P. Clausen, Chicago, Ill., assignor to American Electric Telephone Company. Filed June 4, 1908. A "busy test" circuit can be established through a supervisory relay (in the cord circuit) and a tertiary winding provided on an induction coil in the operative talking circuit.

937,052. TERMINAL-CONNECTOR CONSTRUCTION. Charles Cuno, Meriden, Conn., assignor to Connecticut Auto Engineering Corporation. Filed February 10, 1909. Describes a form of terminal connector for wire ends.

937,062. THERMAL PROTECTOR. Samuel B. Fowler, La Fayette, Ind., assignor to Sterling Electric Company. Filed May 23, 1907. A metallic cylinder with a flange at one end has a pair of insulating disks associated with the flange, and means co-operating with the disks secure a terminal head to the cylinder.

937,074. ELECTRICAL-HEATING METHOD. Woolsey M. Johnson, Iola, Kan., assignor to the Continuous Zinc Furnace Company, Hartford, Conn., a corporation of Connecticut. Filed January 11, 1904. Leakage currents through the walls or lining of an electric furnace are prevented by feeding between the charge and the walls of the furnace a granular material of high electrical resistance relative to that of the charge.

937,075. COUPLING FOR TROLLEY-WIRES. John W. Kline, Terre Haute, Ind. Filed December 26, 1908. The trolley wires are secured by setscrews in the holes of inclined bosses on a long narrow plate of peculiar construction.

937,098. MERCURY-CONTACT RELAY. Charles F. A. Schuldt and Frank H. Nicholson, St. Paul, Minn. Filed October 12, 1908. Movable contact co-operates with mercury wells in an airtight glass envelope.

937,099. MEASURING INSTRUMENT HAVING AN ELECTRO-MAGNETIC BRAKE. Otto Schulze, Strassburg, Germany. Filed July 29, 1908. Changes of temperature are compensated for by changing the size of an air space in which rotates a metal disk through a magnetic field in the air space.

937,107. OVERHEAD ELECTRIC CONTACT. Thomas W. Small, Cleveland, Ohio, assignor to the Acme Automatic Street Indicating Company. Filed June 26, 1908. Contact members consist of sets of narrow flat strips arranged in pairs (with air space between), projecting laterally from opposite sides of a frame which depends on opposite sides of the trolley wire.

937,119. PROCESS OF PRODUCING SILICON CARBIDE. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Company. Filed April 1, 1908. A mixture of silicious and carbonaceous material is subjected to the heat of an electric arc.

937,120. METHOD OF REDUCING METALLIC COMPOUNDS. Frank J. Tone, Niagara Falls, N. Y. Filed June 24, 1908. Describes a form of electrode furnace.

937,128. METHOD OF OXIDIZING METALS DISSOLVED IN MERCURY. Jasper Whiting, Boston, Mass., and Charles F. Burgess, Madison, Wis., assignors to the Whiting Company. Filed December 16, 1908. Carbon surfaces are exposed to an oxidizing electrolyte and a moving body of amalgam and electrical contact is established between the carbon and the amalgam through pure mercury underlying the latter.

937,140. NON-DETACHABLE INSULATOR. Harry Bartlett and Alexander P. MacCallum, Albuquerque, N. M. Filed May 12, 1908. A tapering insulator locks on one end of an axial pin or shank.

937,189. TELEPHONE REPEATING SYSTEM. Herbert E. Shreeve, Wyoming, N. J., assignor to American Telephone and Telegraph Company. Filed August 21, 1908. The various line sections are associated with a circuit for transmission from one to the other; a repeating apparatus is pro-

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vided; and an induction coil having windings included in the circuit is provided with means to prevent direct transmission of voice currents between the line sections.

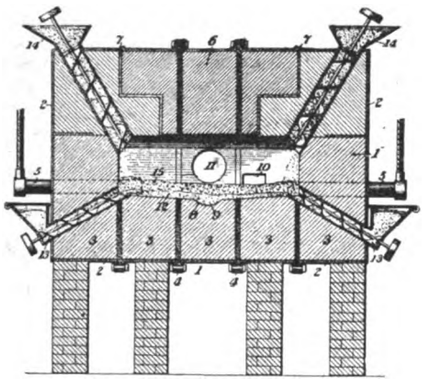
937,201. CURRENT-CONTROLLER. Frank Andrew, Cincinnati, Ohio. Filed April 27, 1908. A slight retrograde movement of the handle from a spring-actuated catch block permits contact engagement with the next succeeding stop.

937,207. STATION-INLICATOR. Claud O. Frick, Fostoria, Ohio. Filed April 20, 1908. The master roll and the two ribbon rolls are electromagnetically controlled.

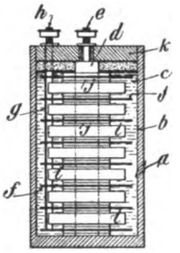
937,229. PUFF-IRON. Jacob W. Cook, Omaha, Neb. Filed February 16, 1909. An egg-shaped casing, supported by a standard, is electrically heated.

937,242. AUTOMATIC CIRCUIT-BREAKER. Newman H. Holland, Brookline, Mass., assignor to Western Electric Company. Filed October 22, 1904. Renewed March 18, 1909. Abnormal current raises the temperature of a heat coil, the expansion of the core of which causes the release of a spring-retracted contact pin.

937,253. STREET AND STATION ANNUNCIATOR AND ADVERTISER. Gerald R. Livergood and Bertram C. Donnelly, St. Joseph, Mo., assignors of one-half to E. P. Snowden, St. Joseph, Mo. Filed May 26, 1908. Cards are detachably attached to a holder which is electrically rotated in a series of jerky movements to display successive cards.



937,074.—ELECTRICAL HEATING METHOD.



937,324.—ELECTRIC BATTERY.

937,281. SPACE TELEGRAPHY. Sewall Cabot, Brookline, Mass. Filed December 31, 1906. A sonorous circuit is associated with a multiple spark gap having a rotating member.

937,282. SPACE TELEGRAPHY. Sewall Cabot, Brookline, Mass. Original application filed November 18, 1905. Divided and this application filed December 31, 1906. Similar to the preceding.

937,318. COIN-CONTROLLED ADVERTISING DEVICE. James H. Montgomery, Denver, Colo. Filed November 23, 1908. Insertion of a coin temporarily establishes an electrical circuit to operate the mechanism.

937,324. ELECTRIC BATTERY. Maurice Nicholas, Paris, France. Filed February 21, 1907. A central vertical carbon has disposed around it a number of superposed zinc washers separated by disks of agglomerated depolarizing material.

937,326. FUSE-MOUNTING FOR ELECTRIC CUT-OUTS. William J. Patnode, Providence, R. I. Filed November 20, 1908. Describes a form of enclosed fuse.

937,332. THERMIC CONTROLLER. Earl H. Richardson, Ontario, Cal., assignor to Pacific Electric Heating Company. Filed May 14, 1908. The fusible material is contained by a casing which retains it whether in a solid or liquid condition, and the controlling element is permitted to move bodily through the material only when the latter is fused.

937,342. ELECTRIC CEILING-FIXTURE. Aral G. Walin, Seattle, Wash., assignor of one-half to Cascade Gas & Electric Fixture Company, Inc., Seattle, Wash., a corporation of Washington. Filed March 8, 1909. A hollow wall-plate is formed with its outer part into an electric-lamp shade.

937,369. INSULATED RAIL-JOINT. George L. Hall, New York, N. Y. Filed March 26, 1909. Insulating material is disposed between the fishes and the adjacent parts of the rail and base-plate, also around the clamping bolts, in such a way as to be protected from moisture, etc.

937,377. APPARATUS FOR PREVENTING COLLISIONS ON RAILWAYS. Thomas C. Mason, Los Angeles, Cal., assignor to Mechanical and Electrical Appliance Company. Filed February 24, 1908. Describes an electrically-actuated, throttle-closing trip device.

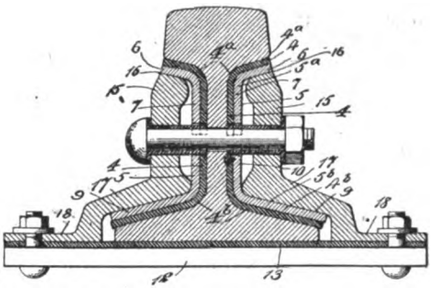
937,386. ARC-LAMP. Robert H. Pyle Indianapolis, Ind. Filed October 9, 1907. The clutch ring for the (upper) movable carbon is actuated by a lever controlled directly by the solenoid core.

937,387. PROCESS OF RECOVERING PRECIOUS METALS. James H. Reid, Newark, N. J. Filed February 3, 1909. Volatile products are expelled by passing the comminuted ore and flux through an electric arc.

937,393. ELECTRIC FLUID-PRESSURE BRAKE. Walter V. Turner, Wilkinsburg, and Robert H. Blackall, Edgewood Park, Pa., assignors to the Westinghouse Air Brake Company, Pittsburg, Pa., a corporation of Pennsylvania. Filed February 24, 1904. An electrically operated valve controls the air supply to the brake cylinder.

937,399. FOUR-PARTY TELEPHONE-LINE. Klas Weman, Buffalo, N. Y. Filed January 23, 1906. A signaling device, and a condenser and a retardation coil of equal resistance and induction, at each subscriber's station, are connected to respective line branches, the device and coil being grounded through the condenser.

937,429. MEANS FOR COOLING DYNAMO-ELECTRIC MACHINES. William L. R. Emmet, Schenectady, N. Y., assignor to General Electric Company. Filed August 19, 1905. The machine is ventilated by means of inlets through which air is circulated by a fan.



937,369.—INSULATED RAIL-JOINT.

937,435. FLEXIBLE CABLE FOR LAMPS. Emile J. Guay, Lynn, Mass., assignor to General Electric Company. Filed September 12, 1908. Large and small insulating beads are loosely strung alternately on a flexible conductor.

937,439. BLOCK-SIGNAL SYSTEM. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. Filed March 18, 1909. Describes a form of electric block-signal system.

937,440. BLOCK-SIGNAL SYSTEM. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. Filed April 23, 1909. Similar to the preceding.

937,442. CIRCUIT-CONTROLLING DEVICE. Edwin Johnson, Schenectady, N. Y., assignor to General Electric Company. Filed April 13, 1906. An operating handle has a rigid connection with a switch-actuating toggle and a lost-motion connection with a circuit-breaker actuating toggle.

937,447. INSULATOR. Martin T. A. Kubierschky and Paul E. Herkner, Berlin, Germany. Filed October 19, 1904. A number of insulators independent of each other are provided with a metallic shell, the insulators providing a multiple insulation between the shell and an insulated bolt.

937,448. PROTECTOR FOR TELEGRAPH AND OTHER POLES. Restore B. Lamb, Mount Holly, N. J. Filed February 8, 1909. Spacing stakes are provided within a casing (adapted to enclose an object to be protected) around and in contact with the casing and object, and a filling material is placed within the casing and between the stakes.

937,451. MOTOR-CONTROL APPARATUS. Walter O. Lum, Schenectady, N. Y., assignor to General Electric Company. Filed July 28, 1906. Renewed April 14, 1908. Actuating circuits are successively connected to the actuating coils of successive electrically-controlled switches, and means are provided for temporarily energizing the circuits successively.

937,462. DYNAMO-ELECTRIC MACHINE. Jakob E. Noeggerath, Schenectady, N. Y., assignor to General Electric Company. Filed June 1, 1908. A casting in electrical contact with the armature is slotted to form a number of collector rings separated by air spaces.

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937,469. SYSTEM OF VOLTAGE REGULATION. Paul Rose, Berlin, Germany, assignor to General Electric Company. Filed May 27, 1909. Describes means for producing uniform load distribution among a series of generators connected in parallel.

937,495. TROLLEY-GUARD. Samuel G. Wilcox, North Adams, Mass. Filed November 18, 1908. A bracket is attached to the trolley pole near the trolley wheel, and a spring-pressed plate, mounted to slide transversely in a guideway on the bracket, normally extends across the top of the wheel to prevent disengagement of the trolley wire with the groove of the wheel.

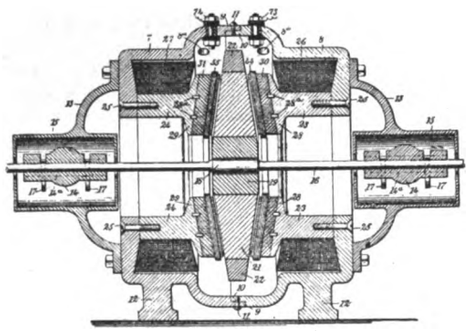
937,499. INSULATED RAIL-JOINT. Benjamin Wolhaupter and Lawrence F. Braine, New York, N. Y., assignors to the Rail Joint Company. Filed November 6, 1908. A brace connection prevents relative vertical displacement of the bolted, insulated parts.

937,515. INSULATOR-PIN. Conrad J. Dorff, Chicago, Ill., assignor to Fredric Greer, Chicago, Ill. Filed February 3, 1909. A supporting carries a hollow frusto-conical screw-threaded member, the larger end of which is reduced in diameter to contact the sides of the arm to prevent relative lateral movement.

937,522. IGNITION APPARATUS. George Haniquet, Longbeach, Cal. Filed June 11, 1908. The circularly-arranged, enclosed contacts are successively engaged by a revolving brush.

937,555. INDICATOR. August Sundh, Yonkers, N. Y. Filed April 17, 1905. A carrier is wound upon a drum and unwound from another drum, step by step, by an electromagnetically operated ratchet-and-pawl device.

937,559. ELECTRIC TIME-SWITCH. Alexander Weinberg, Pittsburg, Pa. Filed March 25, 1908. The normally locked handles of knife switches are electromagnetically unlocked and thereby caused to open automatically by a trip device controlled by a clock mechanism.



937,675.—INDUCTOR-DYNAMO.

937,581. TELPHERAGE SYSTEM. Orrin J. Davy and Carl W. Dauber, Washington, D. C., assignors to Industrial Motor Company, a corporation. Filed December 21, 1906. Renewed May 22, 1909. A trolley spool axially mounted on a vertical shaft is held in lateral contact with a current wire by the action of the depending motor-driven carrier.

937,586. STORAGE BATTERY. Louis H. Flanders, Wilkinsburg, Pa., assignor to the Westinghouse Machine Company. Filed August 6, 1904. A plate is autogenously connected to electrodes of like polarity and integrally formed with this plate is a terminal lug symmetrically located with reference to the sides of the cell so that it may be bent in any direction to be connected to a similar terminal lug on the next adjacent cell.

937,590. ELECTROMAGNETIC MEANS FOR OPERATING AIR AND OTHER WHISTLES. Herbert H. Freeman, St. Paul, Minn. Filed August 24, 1908. A valve is lifted electromagnetically.

937,594. ELECTRIC BELL. Edward A. Graham, Brockley, England. Filed February 2, 1909. Several features are made watertight.

937,617. ALTERNATING-CURRENT-CONTROLLING MEANS. David L. Lindquist, Yonkers, N. Y., assignor to Otis Elevator Company. Filed June 21, 1905. The primary winding of a transformer is parallel with a portion of a parallelogram bridge of inductances and resistances, and circuits and connections are provided for varying the voltage supplied to a portion of the windings of a motor connected to the line circuit for varying the voltage supplied to a portion of the windings of the motor to any desired value or phase difference.

937,634. ALTERNATING-CURRENT ELECTROMAGNETIC VALVE APPARATUS. Frederick W. Newell, Philadelphia, Pa. Filed April 2, 1907. The valve apparatus is operated by a multiphase electromagnet and resilient means are provided for restoring all parts to normal position upon de-energization of the magnet.

937,675. INDUCTOR-DYNAMO. George A. Colman, Seattle, Wash. Filed December 31, 1908. The rotor casting has integrally formed sectors with non-magnetic sectors disposed between them, the whole being embraced by a circular metallic band to combine the whole into a solid wheel.

937,694. STATIC INDUCTION GENERATOR. Burton E. Baker, Hartford, Conn., assignor to the Baker Electric Company. Filed November 6, 1905. A disk for use in static induction generators is composed of layers of mica interlaid with a binding material and the whole cemented together.

937,709. SWITCH. Homer N. Motsinger, Pendleton, Ind., assignor to Motsinger Device Manufacturing Company. Filed March 28, 1908. A switch block comprises a main body, three spring terminals, a switch-pin guide, etc.

937,730. BATTERY-ELECTRODE. Gustav A. Wedekind and Heinrich P. R. L. Poerscke, Hamburg, Germany; said Poerscke assignor to said Wedekind. Filed June 19, 1905. The electrode comprises a ribbed rigid support with a layer of electrolytically deposited spongy copper thereon overlaid by an electrolytically formed layer of copper oxide.

937,736. INSULATOR. Perry S. Dumbolton and Frank Franz, Burke, Idaho. Filed November 21, 1908. A kind of petticoat insulator has a central conical socket provided with a spring groove in which is a spiral spring embracing (but separated from below the top) the supporting screw-threaded pin for the insulator.

937,737. BLOCK-SIGNAL SYSTEM. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. Filed March 11, 1909. Describes a form of electric block-signal system.

937,738. BLOCK-SIGNAL SYSTEM. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. Filed June 10, 1907. Renewed April 28, 1909. Similar to the preceding.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired October 25, 1909:

484,778. TELEPHONIC TRANSMITTER. Arthur T. Collier, St. Albans, England.

484,785. MAGNETO-ELECTRIC GENERATOR. Sydney Evershed, London, England.

484,822. THERMAL CIRCUIT-CHANGER AND PROTECTIVE APPLIANCE. Harry A. Rhodes, Denver, Colo.

484,825. INCANDESCENT LAMP. Frank S. Smith, Pittsburg, Pa.

484,865. AUTOMATIC CUT-OUT. Charles E. Sanford, Brooklyn, N. Y.

484,867. TEST-CIRCUIT FOR MULTIPLE-SWITCHBOARD SYSTEMS. Charles E. Scribner, Chicago, Ill.

484,919. ELECTRIC-RAILWAY SYSTEM. John H. Pendleton, Brooklyn, N. Y.

484,924. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. Benjamin F. Sutton, Brooklyn, N. Y.

484,959. ELECTRIC CONVERTER. Ludwig Gutmann, Fort Wayne, Ind.

484,964. ELECTRIC SEARCHLIGHT. Louis Hill, New York, N. Y.

484,990. ELECTROLYTIC PROCESS AND APPARATUS. Henry Blackman, New York, N. Y.

485,013. SECONDARY BATTERY. William Main, Brooklyn, N. Y.

485,017. ELECTRIC SOLDERING. Elias E. Ries, Baltimore, Md.

485,028. ELECTRICAL SWITCH. Gustav Binswanger, London, England.

485,054. REGULATION OF ALTERNATING-CURRENT GENERATORS. Gustav Pfannkuch, Cleveland, Ohio.

485,089. STANDARD CELL FOR ELECTRIC BATTERIES. Henry S. Carhart, Ann Arbor, Mich.

485,105. INSULATOR FOR ELECTRIC-RAILWAY CONDUCTORS. Charles T. Lee, Boston, Mass.

485,106. INSULATOR. Charles T. Lee, Boston, Mass.

485,128. FINISHING GRIDS FOR SECONDARY BATTERIES. Albert F. Madden, Newark, N. J.

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CONTENTS.

EDITORIAL:
Natural Gas 867
Electric Power from Enfield Rapids 868
School-House Lighting and Power Rates 869
Annual Meeting of the Electrical Trades Association of Chicago 870
The Next Chicago Electrical Show 870
Cleveland Electric Club Entertains 870
The Chicago Electric Club 871
Convention of the Railway Signal Association 871
The New York Electrical Society 872
Steam and Electric Roads 872
New $50,000,000 Telephone Company Chartered 872
Ohio Telephone Deal Completed 872
Mackay Companies 872
An Old Patent Suit Ended 872
Meeting of the Central Electric Railway Association 873
Plan New Subway to Carry Packages 873
New York Edison Company Offers Power 873
Smoking Cars Abandoned 873
Annual Banquet of Commonwealth Edison Branch, N. E. L. A. 873
Metropolitan Lease of Forty-Second Street Railway 873
Illinois State Electric Association, Convention at Alton 874
Illinois Electrical Exhibitors' Association 874
Receivers for Electric Road 877
The American Electrochemical Society, New York Meeting 878
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
Illumination of the Minnesota State Fair 884
A Fluid-Electrode Arc Lamp 885
The Old and New Strikingly Contrasted at Denver 886
Locomotive Headlight Tests 886
Gross Earnings of Boston Edison Company Show Increase 886
CENTRAL-STATION PRACTICE:
The Advantages to Electric Companies of Central-Station Steam Heating 887
Vibratory Alternating-Current Rectifier 891
Safety Suspension for High-Tension Electric Conductors 891
A New Radium Factory 891
INDUSTRIAL POWER:
Installation, Operation, Care and Repair of Electric Motors in Industrial Operations 892
Curing Ham by Electricity 894
A Motor-Driven Current Unloader 894
QUESTIONS AND ANSWERS 895
Statement of the N. Y., N. H. & H. Railroad Company 896
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 897
AMONG THE CONTRACTORS AND SUPPLY MEN 899
INDUSTRIAL SECTION:
High-Efficiency Transmission Current for Telephone Train Dispatching 900
Electric Welding for Bonding Electric Railways 901
A New Printing Press Controller 901
Allis-Chalmers Lighting Transformers 902
Drawback on Imported Lamp Bases 903
Emery Adjustable Tripod 903
Graphite in Lubrication 903
Lighting and Power Plant of the Metropolitan Building 904
A Novel Turbine Installation 904
CURRENT ELECTRICAL NEWS 905
RECORD OF ELECTRICAL PATENTS 912

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NATURAL GAS.

Natural gas is being supplied over wider areas, and it comes as both an ally and a competitor of electric lighting This dual position relates to both the central station and to the isolated plant, for natural gas may displace the lamps or operate the engines of either a public or private electric system, under same conditions.

As a lighting agent at the open-flame natural gas has no value, but in incandescent mantle burners it has even greater illuminating power than good manufactured gas. It is thus only in so far as mantle burners are adapted that natural gas competes with the electric light, and the most important point of such competition for central stations is probably in street lighting.

It has previously been pointed out that mantle burners with all their supposed advantages have been able to displace the open flame of manufactured gas to only a slight extent among ordinary consumers, and it may well be doubted whether natural gas can do much more in this direction. An illustration of the preference of the public for a gas that carries its own illuminating power may be noted at Buffalo, where some 600,000,000 feet of eighteen-candle artificial gas is annually sold at one dollar per thousand, though natural gas retails at thirty-two cents.

In factories and stores and on the streets, however, there is some competition between natural gas and electric light, but this can often be offset by the use of gas as a source of power for electrical supply. The owner of a factory that will either operate an isolated electric plant or use natural gas for lighting finds the cost less and the service better if natural gas is burned in an engine instead of in mantles.

With mantle burners that consume only three-and-one-half cubic feet of natural gas each per hour, the volume required by eight burners will give a kilowatt-hour if used to drive a small gas engine and dynamo, and with this kilowatt-hour twenty tungsten lamps of forty candlepower each may be operated.

A central station that must compete with natural gas for lighting and power will often find itself armed for the conflict by using this gas under boilers or in engines. Though subject to some variation, the heating power of natural gas may be taken at 900 British thermal units per cubic foot, or 900,000 units per thousand cubic feet, which is approximately one-and-one-half times the heating power of ordinary manu-

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factured gas. If a ton of 2,000 pounds of steam coal be taken to have 24,000,000 British thermal units, 26,600 feet of natural gas should make more steam than this coal, for the gas can be burned under boilers with a higher efficiency.

Even better results may be had if gas engines are used to drive the electric generators, for it would not be unreasonable to expect an efficiency of thirteen per cent, including friction losses, under reasonable conditions of load. This should give twelve per cent of the heat energy of the natural gas in the form of electric current at the dynamo terminals, or, say, thirty-one kilowatt-hours per thousand feet of the natural gas used in engines. In other words, a combined gas engine and dynamo should deliver $900{,}000 \times 0.12 = 108{,}000$ heat units per thousand feet of natural gas consumed, and 108,000 divided by 3,412, the number of equivalent heat units per kilowatt-hour, gives thirty-one kilowatt-hours per thousand feet of gas.

In the wide area between Pennsylvania and Oklahoma where natural gas is sold the rates to small consumers range from about fifteen to fifty cents per thousand feet, while the rates to factories and other large users are often as low as three, five, eight or ten cents per thousand feet. With thirty-one kilowatt-hours per thousand feet of natural gas at the rate of three cents, the fuel cost amounts to less than one-tenth cent per kilowatt-hour, and even at the rate of ten cents per thousand feet the cost of gas is no more than one-third cent per kilowatt-hour, where gas engines are used. On the basis of the above conclusion that 26,600 cubic feet of natural gas will more than equal 2,000 pounds of steam coal under boilers, the cost of this gas to replace the short ton of coal is $0.798 at the rate of three cents, and $2.66 at ten cents per thousand feet.

Where a central station is operating with a steam plant and coal for fuel, it may or may not be advisable to install gas engines for use with natural gas, according to the price of the gas and the prospect of a permanent supply. Even if the cost of natural gas used under boilers nearly equals that of coal, the saving of labor in the fire room and the ability to instantly increase or decrease the gas heat may warrant its introduction.

Of course, an electric station has a legal right to as low a rate for natural gas as any other consumer of a like amount, even though there is competition in lighting.

ELECTRIC POWER FROM ENFIELD RAPIDS.

From the foot of the Holyoke Rapids to Long Island Sound, a distance of some eighty-three miles, the Connecticut River falls thirty-eight feet, and most of the power there available has gone undeveloped from the beginning of time. Now, however, it is reported that a hydroelectric plant is to be located at the Enfield Rapids to absorb a large part of this power.

As one travels from Springfield to Hartford along the banks of the Connecticut River, the low Enfield dam may be seen across this river at a point a little downstream from the railroad station at Thompsonville, Conn., marking the head of six miles of rapids that end at Windsor Locks.

On the west bank of the Connecticut, in the town of Suffield, a canal opens at that end of the dam and parallels the river to Windsor Locks, where it discharges at the foot of the Enfield Rapids. This canal is available for navigation by light craft, but its principal present use is for the supply of power to a number of factories that are located between the canal and the river, at Windsor Locks.

At best, however, the present canal appears to deliver only a fraction of the normal flow of the river to waterwheels, and its capacity for storage is small. Furthermore, while water can now be delivered only to plants on the bank of the canal, the service of a hydroelectric plant would extend over its radius of transmission.

In 1880, when the canal had been in use for half a century, the capacity of all the waterwheels set at Windsor Locks was only 1,800 to 1,900 horsepower, but it appears that the discharge of the Connecticut River with the head there available might develop ten times this power during a great part of each year.

The dam, canal and locks at Enfield and Windsor Locks were first constructed about the year 1830, but have since been in part rebuilt. As improved some years ago, the canal had a center depth of six feet and a width of 180 feet at the water line. When first constructed the main purpose of the canal was that of an aid to navigation by carrying boats past the Enfield Rapids, but the railroads made it unprofitable to run the small boats that the canal would carry, and thus limited its main use to the development of power.

If the purposes of navigation are now to be served in an effective way, it seems that either the size of the present canal must be much increased, or an entirely new canal constructed, or else that a dam at or below the foot of the rapids must be employed to set back the water to the top of the present Enfield dam. One or more locks at such a dam would, of course, transfer boats between the higher and the lower level.

Without assuming to pass on the relative desirability of the several means by which the facilities for navigation may be increased and a great addition be made to the power developed at the Enfield Rapids, it may be noted that the river lies between high banks from Thompsonville to Windsor Locks, so that the amount of flowage created by a dam that flooded the rapids would be small. An obvious advantage of such a dam in a plan for the development of power on a large scale is the storage area that it would create along the six miles of rapids.

While a large storage area is desirable in connection with almost any hydroelectric development, such storage is particularly desirable on the Connecticut River, because of the great and rapid fluctuations in its rate of discharge. Unfortunately, no records of the rate of discharge of the Connecticut River at Hartford have been found for recent years, but public records were kept between 1871 and 1878, inclusive, and show a mini-

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mum of 5,208 cubic feet per second and a maximum of 139,410 cubic feet.

In May, 1854, when the highest freshet ever known on the river occurred, the height of the water at Hartford was twenty-nine feet, eleven-and-one-half inches above its lowest recorded elevation, and the rate of discharge was estimated at 205,464 cubic feet per second. At Hartford, ten miles below the foot of Enfield Rapids at Windsor Locks, the drainage area of the Connecticut River is 10,235 square miles, but it receives two tributaries, the Scantic River and the Farmington River, between these two points.

From the top of the Enfield dam to the foot of the rapids at Windsor Locks the fall of the Connecticut River is thirty-two feet at times of fairly low water, but this head is decreased when the river is in flood. As the mills are ranged along the bank of the river, opposite the lower end of the rapids, most of them are able to obtain an effective head of less than thirty feet on their wheels, and all draw water from the canal at the same level. At the end of the canal, below the mills, there are three locks for the transfer of boats to and from the river.

During the eight years from 1871 to 1878, according to the Report of the Chief of Engineers, United States Army, for 1878, the lowest rate of discharge was 5,208 cubic feet per second, and the average of the lowest rate in each of the eight years was 5,538 cubic feet per second. For the eight years just named the average of the entire discharge of the river was 20,208 cubic feet per second.

If it be assumed that the development of the Enfield Rapids for a hydroelectric plant would make thirty feet of the possible thirty-two feet of fall available at the wheels, then each 1,000 cubic feet of water used per second would develop a total of 3,404 horsepower, from which all wheel, generator and transmission losses must be deducted to determine the net delivered power.

With 5,000 cubic feet of water per second passing through the wheels, the gross horsepower would be 17,020, and if it proved to be advisable to utilize 10,000 cubic feet per second the gross power of the water would amount to 34,040 horsepower.

As sixty per cent of the gross power of the water used in wheels may be transmitted and delivered to consumers under fair conditions of economy, it may be assumed that with a hydroelectric plant using 10,000 cubic feet of water per second at Windsor Locks, some 20,400 horsepower may be supplied to consumers in the form of electric energy.

Even if it be found desirable to give the above plant a capacity to handle 10,000 cubic feet of water per second, there appears to be a ready market within a moderate radius of transmission for more power than this flow of water will develop. Hartford is only ten miles and Springfield less than twenty from the foot of Enfield Rapids, and in each of these cities the electrical supply systems are operated in large part by steam power, besides which many factories are driven entirely by steam. Strike a radius of twenty-five miles about Windsor Locks and not only Springfield and Hartford, but also Manchester, Rockville, New Britain, Berlin and a number of other manufacturing centers are included.

From the above figures it may be noted that the prospective power available at the Enfield Rapids surpasses that of any existing hydroelectric plant in Connecticut, the nearest approach to it in point of volume being that at Bull's Bridge, on the Housatonic. At the Bull's Bridge plant the head of water is about 110 feet, the highest at any large hydroelectric plant in New England, but the discharge of the Housatonic there during 1906, which was rated as a good year, was only 296 as a minimum and 1,670 as the mean number of cubic feet per second.

With only thirty feet of head at Enfield Rapids, a minimum of about 5,000 and an average of nearly 20,000 cubic feet per second carry the possible power much above that at Bull's Bridge.

SCHOOL-HOUSE LIGHTING AND POWER RATES.

By a recent ruling that the Edison Electric Illuminating Company of Boston need not supply current to the school houses of that city at rates lower than its established charges, the Massachusetts Gas and Electric Light Commission has set a precedent which is liable to be turned to excellent account by central stations wrestling with the question of municipal power and lighting prices. In a most carefully drawn statement the commissioners state that if they should order the company to supply current to the Boston School Committee at reduced rates, the result would be nothing short of discrimination. The board recognizes the tendency of many municipalities to take the position that having granted the public-utility corporation locations in the public ways, or under them, a reduction in charges is deemed to be a logical return for the privilege. This point of view receives a severe setback in the commission's opinion, which states that the officers of any municipality in granting a location in or under the public ways are really acting as agents of the state for the general public welfare, since only on the grounds that a location is for the public interest as a whole can such a location be properly granted. This is sound doctrine and worth bearing in mind.

A specious plea of the Boston School Committee was that the size of its load justified a reduction from the company, but the commission punctured this bubble with the technical ability which its long experience has conferred. The combined load of all the school houses was indeed considerable, but practically this load represents a scattered installation of transformers and distributing mains feeding points so far apart that little if any physical relations exist between them except at the power station busbars. The company would not be expected to supply power at wholesale rates to a private consumer owning factories from five to ten miles apart, on the basis of their combined load, and so the commissioners ruled in regard to the schools. A decided stand of this kind is gratifying to central stations and should be generally helpful.

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Annual Meeting of the Electrical Trades Association of Chicago.

The fiscal year of the Electrical Trades Association of Chicago ended October 31 and has been one of extraordinary accomplishments. The membership of the Chicago association embraces representative electrical manufacturers and jobbers in the territory from Cleveland to Denver and from Detroit to New Orleans and numbers 210 strong. These members are co-operating with the manufacturing and jobbing members of the associations located in Boston, New York, Philadelphia and San Francisco, about 425 in all, in the confidential exchange of ledger facts upon which the credit of customers is predicated. One of the incidental features of the association has been the large number of accounts adjusted by use of the association forms, amounting to a million dollars annually. But the adjustment and collection features are regarded as purely incidental, the main objects of the association being to protect the mutual interests of the members, secure uniformity and certainty in the customs and usages of electrical trade and commerce, to settle differences among its members and to collect and distribute confidential trade information to save the members from making unsatisfactory credits.

The fourteenth annual meeting and dinner will be held this year on Friday evening, November 12, at the University Club, Chicago, and will be without doubt the biggest function ever promoted by the organization.

Charles E. Brown, of the Central Electric Company, will act as toastmaster and will introduce the following speakers: Samuel Insull, president of the Commonwealth Edison Company; H. E. Hackenberg, treasurer of the National Carbon Company; James Wolff, president of the National Electrical Trades Association; Hon. William F. McSurely, judge of the Superior Court of Cook County; and Charles E. Kremer, wit of the Chicago Bar. Benson's Orchestra will be the accompaniment for the maennerchor musical features.

During the past thirteen years the association's influence for the general good of the trade has been felt throughout the country. It has, at all times, had as its executives the leading men in the electrical trade, who have at heart the interests and welfare of this particular line of industry, and whose able administration has done much to promote cordial feeling among the members and by the safe and sane operation of the association has commended it to the electrical buying public, irrespective of membership. Trade frauds have been detected and exposed, and the territory has been made a safer one in which to trade freely. The credit of customers generally has been more accurately determined, with the result that losses have been minimized and profits have correspondingly increased.

Since the organization of the association in the fall of 1896, Frederic P. Vose, Marquette Building, Chicago, has been the secretary, and his office has been long recognized among the electrical manufacturers and jobbers as the credit center of the trade.

While the association has great power, it has never been used tyrannically. Everyone receives a square deal, as it has never been the intent to do an injustice to anyone, and this intent has always characterized the actions of the association and has done much in widely establishing its reputation for the welfare of the trade throughout the country.

The Next Chicago Electrical Show.

There is every reason to believe that the next Chicago Electrical Show, to be held in the Coliseum from January 15 to 29, 1910, will be the most successful and interesting of the several shows the Electrical Trades Exposition Company has given in Chicago. The demand for space is far ahead of any previous year at this time, and many leading concerns have taken more space than heretofore with the idea of making larger exhibits. Contracts have already been signed with the following concerns: American Steel and Wire Company, Crane Company, Swedish-American Telephone Company, Duntley Manufacturing Company, Pelouze Electric Heater Company, General Vehicle Company, Driver-Harris Wire Company, Hurley Machine Company, Neville Illuminating Sign Company, Electric Cleaner Company, National Acme Manufacturing Company, Keller Manufacturing Company, Hinde & Dauch Paper Company, Simplex Electric Heating Company, Grand Ledge Clay Product Company, Hoskins Manufacturing Company, Mathias Klein & Sons, Appleton Electric Company, Vulcan Electric Heating Company, General Electric Company, National Electric Lamp Association, Westinghouse Electric and Manufacturing Company, North Shore Electric Company, Commonwealth Edison Company, Chicago Telephone Company and The Electric Shop.

It is believed that before the end of December every available foot of space will have been taken. D. H. Burnham & Company, the architects, are working on a new scheme of decoration which it is thought will surpass anything disclosed in former shows in the way of attractiveness and brilliancy. Horace Wild, Chicago's young aviator and electrician, wants to put a cigar-shaped balloon under the roof of the building, the movement of which he will direct by Hertzian waves from a station in the balcony. The balloon is to be gas-filled and motor-driven. Mr. Wild claims that his demonstration will show the value of dirigible balloons, controlled by wireless, in modern warfare.

Cleveland Electric Club Entertains.

The Cleveland Electrical League, composed of the leading electrical interests of Cleveland, Ohio, tendered a very successful luncheon to its members on Saturday noon, October 30. H. H. Cudmore, president of the Brilliant Electric Company, and secretary of the League, presided in the absence of President G. E. Miller.

The speaker was W. A. Warner, of the Warner & Swasey Company. Mr. Warner took for his subject the use of technical instruments in polar observations. In view of the keen interest now attaching to this subject, Mr. Warner was greeted enthusiastically and listened to attentively. With a few simple drawings on a blackboard, Mr. Warner showed how it would be possible for anyone of ordinary intelligence, with simple instruments, to tell when he had arrived at the North Pole.

"The question of the discovery of the pole comes down to a matter of the reliability of the explorer, as I understand it," said Mr. Warner. He told of his visit to the North Cape and the observations of the midnight sun.

"There is no ground for a question on the part of the explorer, and it is simply a question of his word," continued Mr. Warner. "As I understand it, neither Dr. Cook nor Commodore Peary had competent witnesses with them, and no number of scientists can settle the question, because the records of the explorers will have the same reliability as the word of the men, no more, no less."

The League will hold regular luncheons throughout the season, and an active committee is formulating plans to keep alive the great interest which is now being demonstrated.

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The Chicago Electric Club.

The Chicago Electric Club was entertained at its regular meeting on Wednesday, October 27, by George B. Caldwell, manager of the bond department of the American Trust and Savings Bank, who addressed the club on the subject of "Electrical Securities as Investments."

In the building of great electrical plants, a question more fundamental than that of technical means and methods, is, in Mr. Caldwell's opinion, "How shall the enterprise be financed?" It is in considering this question that the electrical men representing progressive ideas and the banker handling bonds meet on common ground and ask another question, "What is the attitude of investors toward electrical securities?"

In dealing with the subject of the elements which are essential to a marketable bond on an electrical plant, Mr. Caldwell named the following points: It must not be overbonded, if the bonds are to be sold to the public; it must have good management; it must have a depreciation reserve or sinking fund and honest accounting.

Continuing, he said that the attitude of the investor is one seeking security first, income next, and finally convertibility. In this respect electrical securities are not different from those of other corporations, the only difference being that electricity is still regarded as an element that is less understood than most any other public utility. However, it is growing very fast in public favor for power and lighting. Yet with this in its favor, the feeling exists that it has not yet been fully developed and that the methods employed for its production and distribution are rapidly changing. The refusal of most investors is based not alone on the plea that the apparatus required to produce electricity wears out rapidly, but that it has not yet become standardized, thus making an additional risk and double depreciation.

Mr. Caldwell asked that the electrical men and the bankers engaged in financing should work hand in hand to the end that tests as to the durability and productive power of all modern electrical plants should be clearly and conservatively determined, and the facts freely distributed, if the securities are to be sold to the public.

Another thing regarding the marketability of electrical securities that the speaker emphasized was that the census report of 1892 showed that the average cost per electric plant was $140,000, while in 1907 it was $200,000. The eleven or twelve hundred millions of dollars invested in electric-lighting and power plants is divided among some 8,000 or 10,000 separate companies with a net earning power of fourteen per cent on the capital invested. Consequently there are a great number of small individual plants unrelated in management or corporate organization. It is obvious that one must have a very specialized information to be the judge of the character of these innumerable different issues of bonds and stocks, and that the stocks in but a few instances pay dividends, while bond issues, even though conservative, lack convertibility, which is but another word for marketability.

The speaker asserted that the business of manufacturing and selling of electrical energy has been almost uniformly profitable. Yet it has become so only after encountering many expensive obstacles both in engineering and financing. So much progress has been made, however, that the bond issue of a modern electric-light plant in any city of 50,000 and over is regarded as only an ordinary business hazard. Mr. Caldwell said also that in his opinion the utilization of the great waterpowers also tends toward a combined management covering large areas, and has already worked great results in the matter of long-distance transmission.

At the conclusion of the address the question of what routine was generally followed in lending money on bonds was asked the speaker. Mr. Caldwell replied by citing numerous instances, bringing out the point that the bonding department of any bank earnestly solicits the co-operation and assistance of the electrical men in determining the actual value from the operator's standpoint.

Another question asked was, why, in nearly every instance, is the denomination of a bond $1,000 or more, which in frequent cases limits the market of the bond in certain communities. Mr. Caldwell replied that the denomination of the bond rests entirely with the party or corporation seeking same, and in frequent cases where the bonds were to be sold in a certain community were made as low as $50 or $100. From the bank's standpoint, however, bonds of $1,000 denomination were preferable, because they occupy less space than numerous bonds of smaller denomination, and hence the system of keeping account of them is necessarily much simplified.

Convention of the Railway Signal Association.

The fifteenth annual convention of the Railway Signal Association was held in Louisville, Ky., October 12, 13 and 14. The meetings were well attended, a number of excellent papers were presented, followed by lively discussions, and the reports of the various committees were thoroughly digested and accepted.

The convention was opened Tuesday morning by the president, who delivered his annual address, called on the secretary for various unfinished business, and for the reports of the following committees: Report of the committee on mechanical interlocking, power interlocking, automatic stops and cab signals, subjects and definitions, and the report of the special committee on storage batteries.

Wednesday was devoted to the reading and discussion of the report of the committee on signaling practice and the report of the committee on automatic block signaling.

The meeting on Thursday was devoted to an extended discussion of the report of the special committee on wires and cables and the report of the special committee on lightning arresters.

At the Thursday afternoon session the selection of the place for the next meeting was discussed, and it was decided to leave it to a letter-ballot by the association, with the suggestions that Atlantic City, N. J., was first choice, Washington, D. C., second, and either Niagara Falls, N. Y., or Old Point Comfort, Va., third. The following elections of officers for the ensuing year were announced: H. S. Balliet, president; C. E. Denney, first vice-president; C. C. Anthony, second vice-president; C. C. Rosenberg, secretary.

Elaborate entertainment features were provided, particular attention being paid to the ladies whose time was occupied during the sessions of the association. The annual Louisville Horse Show was held during the week of the convention, and many of the delegates, guests and ladies took advantage of this form of entertainment. On Friday, those who remained, enjoyed a delightful trip to Mammoth Cave.

Extensive exhibits were made of railway signal equipment and supplies.

Copper Exports.

Exports of copper for the week ended October 28 were 4,368 tons. Since October 1 they were 21,615 tons compared with 19,977 tons the same period last year.

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New York Electrical Society.

At the 288th meeting of the New York Electrical Society, held at the Engineering Societies Building, October 27, G. Herbert Condict read an excellent paper on "The Handling of Freight at Terminals by Electricity." The possibilities of telpherage were exhaustively considered, and a large number of slides showed the progress which had been made either in existing installations, as well as situations in which telpherage could economically and effectively be introduced.

The discussion was extremely interesting, being contributed to by T. C. Martin, Edwin B. Katte, George R. Larwill and C. O. Mailloux, who gave a masterly review of the history of telpherage and of its developments up to the present. This was effectively supplemented by an admirable talk by H. McL. Harding, who showed graphically the industrial possibilities of handling freight by electricity.

The following members were elected: Dr. Frederic deKraft, F. H. Wappler, Dr. Byron S. Price, Henry Haywood, Jr., J. C. Hubbard, Charles H. Terry, Cloyd Marshall, Fred Bliss, Jr., Douglass S. Warren and Frederick M. Sammis.

Steam and Electric Roads.

Whether or not steam railways shall cooperate physically with electric lines is a question which has been presented to the Interstate Commerce Commission, and will shortly be argued at Cincinnati.

The case at issue is of unusual importance and significance, because up to the present time the steam railroads of the country have refused absolutely to enter into any arrangement with electric lines for through routes and joint rates, either for freight or for passengers. The law does not explicitly require physical connection between two railroads—either steam or electric—but it has been the policy of the commission in interstate business to require such connection to be made between two steam roads where the conditions appear to demand, or even to warrant it.

The making of through routes and joint rates, for both freight and passengers, naturally follows the physical connection of the two roads.

The extensive construction and operation of electric lines has increased the demand for their connection with steam railroads. Many of them have endeavored to effect a joint arrangement with steam roads, but in practically every instance the efforts have been of no avail.

New $50,000,000 Telephone Company Chartered.

The Continental Telephone and Telegraph Company has been incorporated at Trenton, N. J., with an authorized capital stock of $50,000,000. This is to be divided equally into common and preferred stock, the latter bearing six per cent noncumulative dividends. In the event of the earnings exceeding the amount necessary to pay the preferred stock dividends, the directors may declare dividends of not more than six per cent upon the common stock. Any excess of earnings declared is to be divided equally between the common and preferred stock.

Among the objects specified in the charter are to unite and consolidate telephone, telegraph and cable lines, and the right to do so is made part of the charter powers of the company. The directors are also given authority to issue bonds convertible into preferred stock at par. When such convertible bonds have been issued the directors are required by the charter to set aside an amount of preferred stock equal to that of the convertible bonds and to be used for no other purpose until the time limit has expired within which the bondholder is given the option of making the exchange for the preferred stock. The common stock is alone vested with a voting power.

Specific authority is given to consolidate or merge with any corporation engaged in a similar business, and the consolidated company may be any one of the merging companies or a new corporation to be formed by means of such consolidation. The directors are given power to remove any officer of the company elected or appointed by them by a majority vote.

The incorporators are: William M. Clark, of Plainfield, N. J.; Powell Crichton and William E. Conley, of New York. The charter was filed by Philbin, Beekman & Menken, of New York.

Ohio Telephone Deal Completed.

The incorporation of the Ohio Home Telephone Company at Columbus, Ohio, for the purpose of leasing the property of the United States Telephone Company brings to a close negotiations which have been in progress for over a year looking toward a merger of all the independent telephone interests in the state of Ohio. An amalgamation of all the independent telephone interests in the country is anticipated as an outgrowth of the Ohio organization.

Stockholders of the local companies are the stockholders of the Ohio Home Telephone Company, which, it is said, will render it impossible for outside interests to obtain control of the independent long-distance service and thus cut off local companies from outside telephone connections. The new company was incorporated for $500,000.

Mackay Companies.

Extensions of the Postal Telegraph Company in the western mining regions and the efforts of the Mackay Companies to improve the service on the Pacific Coast is a principal reason for the present inspection tour of President Clarence H. Mackay, it is asserted. With associates, Mr. Mackay is now in the western section of the country. The party is expected to return in about two weeks. Special construction work from Salt Lake City to Sacramento has been under way during the past year, with the result that an additional transcontinental line will soon be ready for business.

The Mackay Companies experienced prosperous business during 1908. Notwithstanding the fact that the earnings of the Commercial Cable Company showed a decrease because of the disruption of the submarine cables through powerful steam fishing vessels operating their deep-sea nets, the general revenues increased. Since the improvement in business, the telegraph companies included in the Mackay system have shown monthly increases in net earnings, and it is expected that the next annual report, to be issued in February, will prove that all the subsidiaries have contributed materially to the earnings of the holding company.

Last year's income from investments in subsidiary companies netted the Mackay Companies $3,685,761, of which $2,000,000 was paid in preferred dividends, and $1,655,216 in common. There are included in the holding company 102 subsidiaries. It is part of the plans of the company to give its interests wide distribution, so as to minimize the effect of any decrease in profits from one particular source.

An Old Patent Suit Ended.

Judge Hough, in the United States Circuit Court at New York, has denied the application made by former Justice Alton B. Parker, for a reargument of the motion to confirm the report of Arthur Masten, special master, made in the action brought by George Harrington and others against the Atlantic & Pacific Tele-

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graph Company and George J. Gould and other executors of the estate of the late Jay Gould.

The special master awarded damages to the complainants of $1,622,000. The action concerned a duplex and quadruplex telegraph patent which was transferred by Thomas A. Edison and Harrington to Gould and by him turned over to the Atlantic & Pacific Telegraph Company. This transfer was made in 1874, and the value of the patent at that time was said to be $4,000,000.

The complainants alleged that because of the Atlantic & Pacific Telegraph Company getting possession of the patent in that way the stock was increased in value from $18 a share to $60 a share.

Meeting of the Central Electric Railway Association.

The regular bi-monthly meeting of the Central Electric Railway Association will be held in the Palm Room of the Claypool Hotel, Indianapolis, Thursday, November 18. Members of the association residing in Michigan, Ohio and Kentucky will come to the meeting in special cars.

The programme for the meeting has been prepared with special care and embraces a number of papers on interesting and important subjects. The forenoon session will be devoted to routine business matters and reading of the reports of the committees.

The afternoon session will open with the reading and discussion of a paper prepared by J. G. Callen, of Boston, on "Centralized Testing Organization; Its Function in the Management of Electric Railways." The subject of the second paper is "Publicity," and will be read by A. D. B. Vanzandt, of Detroit, publicity agent for the Detroit United Railways.

E. C. Carpenter, of Anderson, will present the importance of a "Claim Adjusters' Association," and J. B. Crawford, of the Winona road, of Warsaw, will speak of the "Transportation and Traffic Association." S.

Plan New Subway to Carry Packages.

The Public Service Commission of New York, recently received from the law firm of Kraukoff, Harmon & Mathewson a letter relative to the contraction of a tube subway system in various parts of the city, to be operated for the carriage of parcels and packages either by compressed air or electricity.

No details were suggested in the letter of the lawyers, but the statement was made that L. B. Stillwell, president of the American Institute of Electrical Engineers, and Edward Carson, engineer-in-charge of the construction of the tunnel connected with the Boston subway, would confer with the commission as to the plans for construction and routes.

An experimental section of 1,200 feet of tube was built by the New York Subway Company, at Elizabeth, N. J., and special demonstrations of the workings of the system were made, to the satisfaction of the backers of the enterprise. Important banking interests are said to have recently become affiliated with the company and are proposing to go ahead with a comprehensive scheme of contraction.

New York Edison Company Offers Power.

One result of the debt-limit decision of the Court of Appeals which will permit New York city to build new subways at its own expense has been the receipt by the New York Public Service Commission of an offer by the New York Edison Company to submit bids for the power supply of future subways. The suggestion made by the company is that in specifications for the building a clause should be inserted providing for buying current instead of maintaining independent plants. The Interborough spent between $6,000,000 and $7,000,000 for its plants. It is estimated that the power plant for the Broadway-Lexington Avenue line will cost from $7,000,000 to $10,000,000. The company argues in its letter to the commission that, instead of sinking such a large sum in a plant, the city would be benefited by buying the power from the company. The commission has replied that it will consider the suggestion at once.

Smoking Cars Abandoned.

The Chicago & Oak Park Elevated Railroad, familiarly known as the Lake Street "L," on November 1 abandoned the setting apart of a car on each train for the use of smokers. The cars which formerly were so used were the motor cars at the front of each train. No change has been made in these cars, and they are still confined almost exclusively to male passengers. The road expects, however, to be enabled thereby to give its female passengers more seating room when the second car of its numerous two-car trains is completely filled. The rule of "no smoking" has been carried out quite generally since it was promulgated, but it is doubtful whether it will be followed by the other elevated railroads of Chicago who declare that the provision of a separate car for smokers is necessary.

Annual Banquet of Commonwealth Edison Branch of National Electric Light Association.

The annual banquet of the Commonwealth Edison Branch of the National Electric Light Association was held at the Lexington Hotel, Michigan Avenue and Twenty-second Street, Chicago, on Thursday evening, October 28.

The three hundred members and guests were entertained by Frank W. Frueauff, of New York, president of the association, and Samuel Insull, president of the Commonwealth Edison Company and former president, who were the speakers of the evening. George H. Jones, president of the local branch, presided at the dinner, and then turned the direction of affairs over to Louis Ferguson, another former president of the association, who acted as toastmaster. John W. Ferguson was chairman of the entertainment committee.

Metropolitan Lease of Forty-second Street Railway

Messrs. Joline and Robinson, receivers of the New York Metropolitan Street Railway Company, recently asked Judge Lacombe for instructions as to what action they should take on the petition of the Forty-second Street and Grand Street Ferry Railroad Company that they elect within a time to be fixed by the court whether or not they, the receivers, should adopt the lease of the road made April 6, 1893, by the Metropolitan Crosstown Railroad Company providing for a rental of $134,640 and taxes and assessments.

Replying to the request of the receiver, Judge Lacombe, in an opinion filed last week, said: "The rent reserved upon the lease, eighteen per cent upon the outstanding capital stock, may have been reasonable when the lease was executed, but under existing conditions it is grossly exorbitant. The court is not without hope that before many months the property may pass out of the receiver's hands Upon sale or otherwise it would seem very unwise to encumber it with any such burdens for the future. If petitioners think they can show that there are some special reasons why they continue the stipulated rental without adopting the lease, even at a preposterous price, they may take an order sending the matter to a special master to take testimony."

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ILLINOIS STATE ELECTRIC ASSOCIATION.

CONVENTION AT ALTON, ILL., OCTOBER 26, 27 AND 28.

The annual convention of the Illinois State Electric Association was held in Alton on October 26, 27 and 28, and in point of number of members attending was the best that has been held by the association. The weather was ideal throughout these three days, and this doubtless helped the attendance. The headquarters of the association were officially at the Illini Hotel. A well-balanced programme was arranged and carried out according to schedule. The papers presented were not numerous, but were well received. The discussions were spirited and covered many phases of the subjects involved. Some of the suggestions made were shown to be generally applicable, and in other cases applicable only to the towns in which the respective companies were using them.

The first session of the convention was assembled in the City Council chamber on Tuesday afternoon. Mayor Beall, of Alton, delivered a pleasant address of welcome, to which President F. M. Sinsabaugh appropriately responded on behalf of the association. The convention then adjourned and many of the delegates took advantage of the opportunity to visit the Illinois Glass Works, one of the principal industrial establishments in this portion of the state.

In the evening a smoker and musical was given at the Elks Club. Many good speeches were made and rejoinders that were quite humorous.

WEDNESDAY MORNING SESSION.

Wednesday morning the convention got down to the real business before it. The meeting was again assembled in the City Council chamber, with President Sinsabaugh in the chair. The committee on membership reported eleven new applications, which were favorably acted upon.

Two papers on the subject of rates were presented. The first was by W. J. Whetzel, of Eureka, on "Lighting Rates in Small Towns" and the second by M. G. Linn, of Bloomington, on "Lighting Rates in Towns of Over Fifteen Thousand Population." These papers are abstracted below.

Mr. Whetzel pointed out in his paper that there was considerable variation in the rates and methods of charging now in vogue. The industry would be much benefited by greater uniformity. In a small town it is particularly necessary to have a simple system of rates. Some of the principal elements affecting the determination of the cost of current were given under the heads of standing costs or fixed charges and running or operating costs. A well-equipped small station requires an investment of about $200 per kilowatt of equipment installed. The standing costs should be about fifteen per cent of this, or about eight cents per kilowatt hour, for a consumer who uses only this amount per day. To this must be added the operating cost, thus requiring a dual rate. A number of systems of this kind were described, especially the plan of having a minimum charge plus a straight rate per kilowatt-hour, and the plan providing for a maintenance charge plus a straight rate. The author regarded the latter as the better one. It is easily computed by multiplying the number of kilowatt-hours by ten and adding fifty, which gives the total bill in cents. The giving of ten per cent discount for prompt cash payment was also encouraged.

Mr. Linn's paper was a strong argument on the equity of the double-rate system for larger towns. It is fair both to the consumer and the company. It encourages the long-burning customer, whether large or small. The primary rate must first be determined from the amount of the investment. For ease in figuring, it is frequently assumed to apply to one hour's daily use of the connected load. In determining the secondary rate, the cost at the customer's meter should be taken instead of the switchboard cost. Special rates should be eliminated as far as practicable. It is much better to reduce the rates in accordance with the growth of the station's output and the accompanying reduction in generating cost than to wait for city councils to regulate the rates. Those plants which have low rates are the ones that are doing the largest electrical business and showing large net profits. The introduction of the tungsten lamp should not prevent reduction of rates, as there are some large companies that have found it expedient to reduce their rates, in spite of diminished current consumption, due to the use of the more efficient illuminant.

After the reading of the two papers a general discussion on the subject ensued. This was opened by Elmer Smith, of Kewanee, who said too little attention was given to the costs by station managers. Very few knew just what cost they were producing their current at. A switchboard meter was the only means of telling just what was going on. He would divide the cost into three parts, viz., station expense, distribution and general expense. The best thing is to increase the power load, and in order to do so to make a price that would be an inducement for power users, especially if they could be made to yield an off-peak load.

J. F. Gilchrist, of Chicago, said that the larger companies were coming to a uniform rate for current, but a uniform rate for all companies would not do, as in various towns the costs varied considerably, such as the costs of fuel and labor with various local conditions. A uniform basis of charging should be arrived at by all companies, however. Two factors are needed to get the actual cost to the company, viz., the amount of the investment and the cost of operating. A large number of the association's members should get together and see if some equitable basis of charging for current could not be arrived at. Two ways of determining the primary rate are by charging (1) for connected load and (2) for maximum load, or assumed maximum load. Charging for connected load was not fair for residence districts, as they seldom used over twenty to thirty per cent of their connected load, while commercial houses commonly run at sixty to seventy per cent load factor. The most reliable way to get the maximum load is with a maximum-demand meter, but the cost of these increases the investment charges. The Commonwealth Edison Company, with which Mr. Gilchrist is associated, had compiled data on the average results from 30,000 demand meters that it had in service and these are available for any member interested. This company is not now using demand meters on loads of one kilowatt or less. He held that the ratios of demand to connected load that were found in Chicago would hold good all over the state in the same class of buildings, or buildings used for the same purposes. A series of cuts in the rates by his company in the last four years have reduced them from twenty cents to twelve cents for the high part and from ten cents to six cents for the low rate. In the meantime, however, the business had increased rapidly and the reduced rates had doubtless much to do with it. Mr. Gilchrist thought the manufacturers should make a lower priced meter for the small user. With the advent of the tungsten lamp it was not impossible for a consumer to use only one kilowatt, and the present costs of meters increased the cost of investment per kilowatt to too high a figure.

J. R. Cravath, of Chicago and Lawrenceville, said that his company had based its charges on the number of occupied rooms multiplied by 1,200 watts, which was charged for at a rate of fifteen cents per kilowatt-hour, and the excess at six cents. This is the Detroit plan and works out excellently for residence lighting. It does not put a penalty on the use of convenient lights, which are so useful in bathrooms, closets, and other places where they are used only a few minutes at a time, that the plan of charging for the connected load would do. Commercial business is charged at the

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same rate, but runs at a higher percentage of connected load.

The discussion then turned on the scheme of giving discounts for prompt payment of bills. Mr. Davis said he had given up a collector and got better results by giving the customer the discount. Some members stated that it cost two-and-one-half to ten per cent to collect and that giving this to the consumer for prompt payment really made the rate much better to the consumer. In some towns, after ten days, a notice was sent to the consumer that he had lost his discount and unless he paid by the twentieth of the month his service would be discontinued. As a rule there was no more trouble from that customer. Ten per cent was said to be a good discount. If a company had decided to make a reduction in rates it might be a good idea to charge the old rate and give a discount to bring the bill down to the lower rate.

Regarding guarantees and deposits, much difference of opinion was expressed, some requiring a deposit from all consumers, while others required a guarantee from the owner of the property where the current was used. Those who required cash deposits paid interest on them. By this practice it was believed that the losses this year would not be one-half of one per cent for non-payment of bills. One company has all its customers make a deposit; if the customer is still on the books after eighteen months and has made prompt payments, his deposit is returned with a check for five per cent interest. The general opinion was that the companies should be liberal with the customers and try them a month anyway. The service of electric lighting is not like a grocery business, where, if the customer could not get what he wanted at one store, he had more that he could go to; electric lighting was in the nature of a monopoly, and therefore the companies should be liberal with their consumers.

It was moved and carried that a committee of five members be appointed to devise a basis of charging for electric service, and report at the next annual meeting.

WEDNESDAY AFTERNOON SESSION.

The afternoon session was held in the Elks Club auditorium, as the City Council room was found to be too noisy. H. W. Dickermann, of Rockford, read his paper on "The Relation of the Electric Vehicle to the Central Station."

This paper gave a history of Mr. Dickermann's attempts to introduce the electric vehicle into various cities and the results achieved. At first the lighting companies had not taken favorably to them and had discouraged the use of them. But later they had seen the possibilities in this service and now were more favorable to its extension. Kansas City was now a good city for electric vehicles and even with its hills one could there cover from fifty to eighty miles on one charge. There are about 20,000 electric vehicles in use in this country and 5,000 more would be manufactured this year.

F. H. Golding, of Rockford, said that his city was level and had about 140 cars that yielded an average income of $60 each per year. Fifty-seven private charging plants averaged $48 per car per year. There were six public garages. The bulk of the charging is done from 11 p. m. to 2 a. m. The charges were six cents per kilowatt-hour for private garages and four cents for public garages, with a resale of six cents to the public. This was made under contract to be an off-peak load. The average life of the battery was three years, and the cost of batteries runs from $125 to $175.

The question as to the lighting company taking care of cars was brought up and thoroughly discussed. Some thought it a good thing to do, while others thought it should be left to the public garage. The trouble heretofore has been that the public garages have not had the men who understood the care of the batteries and motors.

The Commonwealth Edison Company, of Chicago, has about eighteen 3,000-pound wagons or trucks that it uses itself and finds that for long hauls they are better than horses, while in the congested downtown districts they cannot make better time than the horse trucks. According to the state licenses issued, there are 2,300 electric pleasure vehicles in Chicago. There are over 80,000 horses in Chicago, and the average cost to feed them is $125 per year. This shows the immense possibilities of the business that might come to the lighting company. It has been said by F. M. Tait, of the Dayton Lighting Company, that the income from electric vehicles is better than that from furnishing current to a street railway.

The discussion showed that the business of charging the cars was very desirable, especially if it was an off-peak load. From the nature of it, it comes after the peak of the lighting load, and hence should be taken at an attractive figure. One company reported an income of $8,000 per year from that source, from 139 cars. If the regular rate was eleven cents, a charging rate of seven cents could be made if cars were not charged from 4 to 8 p. m.

One case was cited where the company had cared for electric vehicles and then gave over the work to the garages. This was not satisfactory, and finally the man it had doing the work took up the business again under his own name, but backed by the company. He was able to care for forty or fifty cars, and with a charge of fifty cents per week and other work he picked up, was getting an income of $120 to $175 per month.

The paper by David Davis, of Litchfield, on "Gasoline Lighting" was not read by him, as he was unable to get it ready in time on account of sickness. But he gave a talk on conditions as he had met them in his city. This caused more discussion than had been expected and showed how much the gasoline plants were doing to injure the income of central stations. The cost of the first installation of these plants did not seem to worry the consumers, who put them in on the promises of the salesman that they would not cost so much to run as his electric lights had. Few of the owners ever kept an accurate account of the cost of maintenance, and no account of the time required to care for them. At first they generally work well, but later they do not get the necessary care, then something happens. One started a fire that caused a loss of $50,000 in a double store.

Much discussion ensued on how best to overcome this competition, and several plans were suggested and ways explained how it was done by various companies. A good argument was put up by one landlord for not allowing his tenants to use gasoline for lighting, viz., that he had taken out all his stoves, installed steam heat, so to have only one fire in the building, and hence would not allow the gasoline lights to be placed in the stores. The use of the tungsten lamp with its high candlepower and low wattage was a help to the central-station men to fight the gasoline lamps. One case was cited where arcs had been displaced, the owner agreed to keep an accurate cost of his gasoline, chimneys, mantles and all renewals to his gasoline system, with the result that only twice was his total cost less than his former bill for the electric arcs, and then only $1.60 or $1.40 for the corresponding months. One company had bought several gasoline lighting plants and replaced them with electric lights. The former were then hung up in the storeroom, and whenever anyone said any-

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thing about gasoline lighting plants they were offered their choice at $15 for any kind they might wish to use. This discouraged the agents and they finally gave up and left the city.

At this point C. A. Howe, of the Chicago office of the Holophane Company, gave a short talk on illumination. He gave a simple rule for finding the necessary wattage for proper illumination of various rooms. He also quoted from a letter received from an engineer showing the saving effected by the proper lighting of a factory. The modern engineer, when it came to laying out an illumination for a certain installation, too often figures out just how much he could cut down the cost of lighting. The proper thing to do was not so much to cut down the cost as to have the installation properly designed to give proper illumination with a minimum cost.

On Wednesday evening the members were the guests of the salesmen at the Temple Theatre, where they heard Damrosch's Orchestra render an excellent concert.

THURSDAY SESSION.

The first business at the session on Thursday morning was the appointment of the nominating committee, President Sinsabaugh selecting Messrs. Learned, Bivins and Brown for this purpose. The president also announced the committee that was ordered on the previous day to devise a method of making base rates for figuring the selling price of electric current and to report at the next annual meeting, the following being named: Messrs. Burton, Wallace, Cushing, Brown and Frey.

The committee on resolutions reported resolutions on the loss of Mr. Schroeder, who had died during the year. Also a resolution expressing the thanks of the association for the courtesies extended by the mayor of Alton, the Alton, Granite & St. Louis Traction Company for the trip to East St. Louis, the Illinois Glass Works for allowing the visitors to inspect its plant, the Elks Club for the smoker and the use of the lodge rooms for holding the meetings, the salesmen for the entertainment provided for the members, and the Alton Gas and Electric Company for the banquet.

The paper on "Power," by F. H. Golding, of Rockford, was then read.

In this paper Mr. Golding showed that by careful selection of the power business a decidedly improved station load factor may be obtained. The most important features to consider are hours of usage, load factor and capacity demand of each prospective installation. A consumer whose business can be regulated to suit an "off-peak" schedule and a twenty-four-hour consumer with a fair load factor are much more desirable than the short-hour consumer, and should therefore be entitled to a lower rate. Maximum demand meters are very desirable in determining the capacity demanded by the installations. If these meters should prove too costly for the size of the installations, good results may be obtained by basing the capacity demand upon the transformer capacity or the size of the fuses or circuit-breakers. The power rates should embody a suitable readiness-to-serve charge per kilowatt of maximum demand plus the meter rate for the current consumed. In planning a systematic power campaign, it is necessary to obtain complete and accurate data on each plant that is considered as a prospect. The solicitor must base his proposal to the manufacturer upon an accurate report of the conditions to be met with. It is well to train the lighting solicitors to handle power business also, since the solicitor confined to power business alone is apt to become discouraged on account of the frequent rebuffs and difficulties to be met with in this line of work. It is surprising how much power business can be built up among the smaller consumers who frequently are lost sight of in the effort to get large users of central-station power.

This started a lively discussion that a number of the members took part in. The main thing that was desired seemed to be a basis of figuring power rates. A customer that was charged a rate based on the connected load did not secure a fair rate if he had a motor that was underloaded; a betteer way was to take the maximum demand. The discussion brought out that the Ontario Power Company sells power from its plant at Niagara Falls on the basis of the average of three five-minute maximums taken any time during the month. The graphic recording meter was mentioned as the best way of getting these maximum demands, but was objected to on account of its cost. It could be used, however, to find the average demand as well as the maximum demand. Mr. Baker told of a German instrument that was operated by clockwork and could be set to take a record of the current used at any certain time and for any period of time. There are none of the instruments in this country, but he had some ordered, and thought they would cost somewhere near $30, as compared to the printing instrument at $125.

As the manufacturer always wished to know what it would cost for power to operate his factory, several methods of determining this were described, one being to install motors, if the manufacturer would pay for the wiring and keep accurate records of the power used for, say, two months. This has a double advantage, as by this method the central station and the consumer are both enabled to know just what the latter was using and the company could then make an intelligent rate for the power. It was also stated that the average factory owner always overestimated the power he was using. Often the power used could be cut down by eliminating shafting, cases being cited where the shafting and transmission were taking from twenty to fifty per cent of the power furnished. One case was cited where the factory owner was using a thirty-five-horsepower steam engine that was displaced with a ten-horsepower motor, with satisfactory results.

The matter of pumping water was discussed, and it was said to be good business, especially on account of the moral effect, for the lighting plant doing this work. As to the size of the motor that could be put upon a generator without spoiling the regulation or causing the lights to flicker, there was shown to be diversity of opinion; one plant with a seventy-five-kilowatt generator was running a forty-horsepower single-phase motor, with a separate transmission line, but this was doing a twenty-four-hour service, with a steady load pumping water. Regarding the cost of pumping water, a case was told of where against a 100-foot head with a triplex pump 700 watt-hours per 1,000 gallons was taken.

The last paper on the programme, entitled "The Advantages of the Tungsten Lamp," was then read by its author, J. G. Learned, of Chicago.

In Mr. Learned's paper the well-known advantages of the tungsten lamp in affording more and better light are clearly shown. It was feared by many central stations that on account of the high efficiency of this lamp, and therefore the possibility of furnishing the same amount of light with much less current, it would hurt the revenues of the companies quite materially. This fear has proven to be unfounded. The advantages of the lamp have been shown to apply mutually to the customer and the central station. By means of this lamp the central station has been enabled to secure a very large volume of new lighting business. The slight reduction in the revenue secured from some lighting customers, who have installed tungsten lamps to secure reduced bills, is more than made up by the large number of new customers, who are attracted to central-station service on account of the great economy of this lamp. Tungsten lamps will continue to be improved, as they have been very materially since their introduction. Their cost will doubtless be decreased and their life or efficiency further increased.

The main thing brought forth in the discussion was not the reducing of the customer's bill so much as the giving of better service and more light for the same money; also the fact that the cus-

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tomer is better satisfied with the installation, and that the best is none too good. It was stated that if the lamp held up for three days it was an evidence that it would burn the full allotted life. One company reported that with the use of the tungsten lamp it had decreased its peak load, but had also broadened it out. Special attention was paid to the securing of window lighting with the tungsten lamp, as the greatest advantages came with the longer burning lights. A case was related where the lighting company designed the lighting equipment and selected the size of the lamps to be used; then, as it did no wiring nor furnished fixtures, it made the specifications so that each contractor could have a set and submit to the owner a bid on the installation. This made a good basis for comparing the bids and the customer reaped the benefit of the equipment installed at the best obtainable price, with the advantage of the illuminating engineering furnished by the company.

This closed the session, and after a recess of five minutes the convention went into executive session and elected the following-named gentlemen for officers for the ensuing year:

President, E. W. Smith, manager of the Kewanee Light and Power Company, of Kewanee, Ill.

First vice-president, W. G. Austin, of Effingham.

Second vice-president, H. A. Foster, of Fairbury.

Third vice-president, J. J. Frey, of Hillsboro.

Fourth vice-president, F. H. Golding, of Rockford.

Treasurer, E. MacDonald, of Lincoln.

Secretary, H. E. Chubbuck, of La Salle.

Assistant secretary, C. A. Willoughby.

Executive committee: W. B. McKinley, F. J. Baker, E. S. Schmidt, F. M. Sinsabaugh and David Davis.

In the afternoon of the last day a trip over the Alton, Granite City & St. Louis Railway to its power house at East St. Louis was taken advantage of by those in attendance, with the compliments of the railway company.

On Thursday evening a banquet was given at the Illini Hotel to the delegates and salesmen who remained, as the guests of the Alton Gas and Electric Company, which concluded the programme.

EXHIBITS.

A new departure was made in this convention, as the various manufacturers and supply houses had exhibits in the basement of the Illini Hotel, which was headquarters for the convention. The various companies made interesting displays of their goods and the local lighting company ran in a special heavy service. There was evidence everywhere that the tungsten lamps were much in use, as these were shown from the small sign lamp to the largest made.

The H. W. Johns-Manville Company showed its new tungsten Linolite and also carbon lamps, No-ark fuses, services boxes for all classes of work, high-tension fused disconnecting switches, mica insulators of all kinds, guy anchors, weatherproof mica sockets and heating pads. H. M. Frantz, of Chicago, was in charge, with W. E. Rapp, of St. Louis, to assist him.

The Electric Appliance Company, of Chicago, together with the Sangamo Electric Company, of Springfield, made an interesting working exhibit of Sangamo meters, regenerative flaming arc lamps, electric heating goods of the American Electrical Heater Company and small sign lamps on the transformer system for tungsten lamps. H. N. Remington, F. W. Greusel, R. C. Lamphere and J. H. Hodde were present

The Westinghouse Electric and Manufacturing Company had an exhibit that showed electric heating and cooking goods, electrically operated sewing machines and washing machines, the small five-watt sign lamp and electrical testing instruments. W. R. Pinckard, J. M. Schilling, Jos. W. Busch, R. W. Emerson, F. A. Servis and C. R. Wood, of the Chicago office, were there with the force from St. Louis, consisting of W. S. Wiswall, and Messrs. Bussman and Jackman.

The Electric Service Supplies Company had an exhibit, consisting of the specialties that it handles, with several representatives from Chicago in charge.

The Century Electric Company, of St. Louis, had a display of single-phase motors.

The Jandus Company had an exhibit of its fans and lamps, which was in charge of W, L. Cummiskey, of St. Louis.

The Holophane Company was represented by C. A. Howe, of the Chicago office, who had a display of the Holophane goods from the smallest Holophane glass to the largest made, and also the new D'Olier steel factory reflectors.

The Condit Company, with Wm. S. Taussig, of Chicago, showed a line of switches, circuit-breakers and other specialties.

The Wagner Electric Manufacturing Company, of St. Louis, exhibited its single-phase motors and lamp-testing volt and wattmeters. F. Johnson, of St. Louis, was in charge.

The Pacific Electric Heating Company had a number of its irons, together with other electric heating goods, on display. H. F. Holland, of the Chicago office, was in charge.

The Tungstolier Company had its booth filled with the fixtures it is making and especially called attention to the new cloister finish that is now proving so popular with the public where serviceable finish is desired. A. B. Wilson, Illinois representative, was in charge.

The Keller Manufacturing Company's Santo vacuum cleaner was shown and attracted much attention from the station men as another source of income for them.

The Fort Wayne Electric Works showed meters, small motors, transformers, and the special transformer for picture machines that makes a material saving in the cost of operation. L. A. Carr, A. L. Pond, and Mr. Weymeyer were on hand.

The Central Electric Company, of Chicago, made a complete display of its well-known specialties, such as Okonite wire and tapes, Columbia tungsten lamps, D & W specialties and Pittsburg transformers. One of the newer specialties which attracted much attention was the P-M meter testing system, which comprises a complete method of installation, test and inspection. The new type of Opalux shades and reflectors were effectively displayed by the decorative outline scheme of the booth. As usual, a complete display was made of the Pittsburg silico-vanadium steel, high-efficiency type transformers of various capacities. Other features were high-tension disconnecting switches for indoor and outdoor mounting, high-tension wall tubes for carrying transmission wires into stations and a new design of three-phase 12,000-volt cable pot head. A unique measuring instrument known as the "tungstometer" was connected in service and indicated the wattage consumption of Columbia lamps. The exhibit of Okonite insulated cables, wire, etc., for all classes of service and crude rubber in the form received from the natives by the rubber-producing companies was instructive. The enormous biscuit of Up River para rubber excited much comment. Particular attention was called to the long life of Okonite insulation, which is due principally to the use of thirty per cent of Up River para rubber in the insulating compound. The company was represented by H. W. Young, sales manager; Louis Privat, of the Southern Illinois district, and J. M. Lorenz.

The Wesco Electric Supply Company, of St. Louis, had an exhibit showing Holophane shades, electric chafing-dishes, coffee percolators and electric irons.

The General Electric Company did not make an exhibit of goods, but had a space where Mr. Croniger, J. F. Kidd, V. A. Hain, J. A. Van Splunter and J. S. Buchanan offered one a seat and explained how the company was able to take care of all one's electrical wants.

The Illinois Electrical Exhibitors' Association.

The Illinois Electrical Exhibitors' Association, having as its membership the representatives of various electrical manufacturing companies, formed a permanent organization during the recent convention of the Illinois State Electric Association.

This new association will co-operate with the state organization in the matter of conventions and exhibits for the same, and will undoubtedly tend to strengthen the latter organization.

The first president elected by the new association is W. R. Pinckard, of the Chicago office of the Westinghouse Electric and Manufacturing Company, and the first secretary is William S. Taussig, who is now also secretary of the Chicago Electric Club.

Receivers for Electric Road.

Judge Barnard, of the Supreme Court of the District of Columbia, has appointed George T. Bishop, of Cleveland, Ohio, and George Weems Williams, of Baltimore, auxiliary receivers for the Washington, Baltimore & Annapolis Electric Railway Company. The receivership proceedings were not resisted by the company.

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THE AMERICAN ELECTROCHEMICAL SOCIETY.

SIXTEENTH GENERAL MEETING, NEW YORK CITY, OCTOBER 28, 29 AND 30, 1909.

The sixteenth general meeting of the American Electrochemical Society was held in New York city on October 28, 29 and 30 last.

The Thursday afternoon (October 28) session was called to order by President L. H. Baekeland, of Yonkers, N. Y., at the Chemists' Club, 108 West Fifty-fifth Street, at two o'clock.

The first paper was read by William S. Weedon. A short abstract of the paper follows:

THE TITANIUM ARC.

The author began by stating that as a result of a series of experiments made some years ago to determine what material would give the maximum light efficiency when used as arc electrodes, none of the substances tried was equal to material containing the element titanium. Titanium carbides, being the most convenient preparations of titanium available, were tried in various forms, and it was found that a mixture of TiC and Ti gave the best results, especially when iron was present only in negligible quantities, as this latter metal tended to cause unsteadiness of the arc. The best arc was obtained by using a cathode electrode of titanium-carbide preparation, and an anode electrode of copper, the latter being inactive and not wasting appreciably. The deposition of a titanium oxide "button" on the copper anode can be obviated by the use of Halverson's anode "rocker" (designed originally for the magnetite lamp), which is connected to the lamp mechanism, so that the arc plays upon one portion of the anode while running, but strikes from another portion. It was explained that the titanium arc is a flame arc, and that the efficiency increases with the current density and the arc length. Volt-ampere curves and volt-arc-length curves were given, also the power-consumption curves, the last showing the titanium arc to be extremely efficient. The efficiency curves proved that titanium-carbide arcs are most satisfactorily operated on a constant-current circuit rather than on a low-voltage multiple circuit (with the necessarily short arc length). Photographs of plain carbon and various flame arcs were given, with accompanying observations, for purposes of comparison. A diagram of the light distribution of the titanium arc showed the superiority of this type of arc for street-lighting purposes. A short account of the method of preparation of titanium carbide electrodes, and a résumé of some experiments carried out in the research laboratory of the General Electric Company on the titanium suboxide direct-current arc, concluded the paper.

The president, in calling upon Doctor Whitney to open the discussion, characterized the paper as the result of several years of conscientious and very intelligent work. The society, he said, was to be congratulated on having the opportunity of listening to a paper of this sort.

Doctor Whitney, of the General Electric Company, said that most of this work by Doctor Weedon was the result of original experimentation in the use of titanium lamps, and he arose, not to discuss the subject-matter presented in the paper, but to apologize for the delay in the publication of the experiments. The General Electric Company would like to be able to publish rapidly and immediately the results of experiments in its laboratory, and similar researches, but the commercial conditions do not always permit this to be done. One interesting thing that always appealed to him in Doctor Weedon's data was the efficiency obtained in the socket. One way of determining luminous efficiency is to put a lamp in a vessel of water and determine the rate at which it heats the water. The rate at which the lamp heats the water gives the data for determining the lamp efficiency. That was determined by Tumlirz and his 100 per cent efficiency is 0.22 of a watt mean spherical candlepower, which Doctor Weedon has found almost met by this titanium arc, 0.37 of a watt. In other words, apparently, from this data, we are getting down to the percentage of efficiency for light. The probability is there is an error in the Tumlirz measurements and those made by Aengstrom; in other words, 0.11 of a watt per mean spherical candlepower, which is 100 per cent light efficiency. That is also probably wrong. The interesting question might come up as to how near we are to the theoretically perfect light. He opined in that connection that we still have about as far to go as we have gone.

Dr. S. A. Tucker, of Columbia University, said that he has tried a good many different compounds to make carbide, and has made them up into electrodes and tested them with a photometer. His experience was that the zirconium carbide was more efficient than the titanium carbide. He asked for information on this point.

Doctor Weedon said that he had tried the zirconium carbide obtainable at that time, and it was not as efficient as the titanium carbide.

Prof. J. W. Richards, of Lehigh University, asked Doctor Weedon whether they had tried the carbides of aluminum, magnesium, beryllium, cerium, lanthanium, didymium, zirconium and thorium, or mixtures of the same, as to whether they might explain the great luminosity of this arc. His friend, Porter W. Shimer, of Easton, had shown him some specimens of a residue, in perfect crystals, obtained by dissolving titanium in pig iron. Mr. Shimer had taken and analyzed them, and found them to be titanium carbide, having the proper formula, and came to the conclusion that titanium, as dissolved in pig iron, was there as titanium carbide, and not as simply fused or generally dissolved titanium. That may have some bearing on the properties of titanium salts.

Doctor Weedon said they had tried practically all of these rare metal carbides and were not able to obtain any which had greater efficiency than the titanium carbide, but he thought it should also be stated that a great deal depends on the direction of current used.

Doctor Whitney suggested that the use of these metals is out of the question in arc lamps until we have some way of preventing the consumption of the electrode. The electrode will burn from 100 hours to 200 hours, and most of the metals which have been mentioned are too expensive to be practically used in electrodes which will burn for comparatively so limited a time.

The next paper was by E. Weintraub, on "The Element Boron," which was read and discussed.

The paper entitled "The Preparation of Silundum," by Prof. S. A. Tucker, H. F. Kudlich and E. M. Heumann, was read by Professor Tucker. Samples of silundum were handed round for examination during the reading of the paper, an abstract of which follows:

THE PREPARATION OF SILUNDUM.

Silundum is defined as a preparation made by partially converting carbon into carborundum in the electric furnace. F. Bölling, the discoverer of silundum, first produced this substance by heating carbon in an atmosphere of silicon, the combination of the two producing carborundum, which is absorbed by the carbon to a depth varying with the temperature and the time of the reaction. The present paper is an account of an experimental study of the formation of silundum. The charge was first made up according to the reaction used by F. J. Tone ($SiO_2 + 2SiC = 3Si + 2CO$), and placed in a fire-brick furnace similar to that used in making carborundum, but using a core made by pressing together a number of small carbon plates between two horizontal graphite electrodes. Around the core was placed a charge of sand and carborundum, in which was embedded at various distances from the core the carbon articles to be converted into silundum. Air was excluded by concreting the side and end walls of the furnace. Several experimental runs, at different currents and voltages and under various conditions, were made, and the results noted. In run No. 8, in which the most satisfactory results were obtained, no cover was built over the furnace, the gases being allowed to escape and burn over the entire surface, as in a carborundum furnace. The penetration or conversion of carbon into silundum de-

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pends upon the time of the run and also on the temperature employed. The conversion of the carbon into silundum depends upon its position with respect to the core. No very careful study was made of the product; the following points were noted, however. In appearance it is compact, of a light gray to greenish color. It has a hardness apparently the same as carborundum and is heavy. Its most valuable property and probable use is its ability to stand a high temperature in the air without sensibly undergoing oxidation, and, as it is a conductor of electricity, its use as a resistor material. Several experiments were made with a view to testing it in this capacity, and they pointed to a satisfactory material for temperatures up to say 1500 degrees centigrade. The electrical resistance of the material varies greatly, depending upon the penetration, but there seems to be no reason why the material should not prove valuable as a resistor material and come into general use for a variety of purposes in which a high temperature is to be maintained electrically.

Professor Richards said that the reaction recalled to his mind what he had conceived as a method of the preparation of carborundum. He had studied the carborundum furnace a good deal, and seen it in operation, and always thought that the large crystals were produced by contact of the silicon vapor and the carbon vapor. He could not conceive of the production of these crystals in place, except from the interaction of two vapors, one of silicon and one of carbon. Here is a case, he said, where we have the proof, in the electric furnace, of the presence of a large amount of silicon vapor, and further suggested that at the proper temperature, in contact with carbon vapor, this vapor causes the formation of the crystals of carborundum.

Doctor Whitney wished to differ with the definition given by Doctor Tucker. He imagined that silundum is a compound or mixture of some metals. Is it a mixture of carborundum, he asked?

Professor Tucker said that as far as he could see, there is a penetration of the silicon vapors into the massive carbon. This penetration depends upon the temperature, and the length of time it is exposed to the effect. The converted material on the outside is what Bölling calls silundum. As to what the chemical composition of that is, he did not knew, because he had not analyzed it, nor did he think anyone else had. It has a good many properties of a very similar nature to carborundum.

C. A. Hansen, of the General Electric Company, said his company had a small grid, similar to one Bölling gives a picture of, one inch long by one-eighth inch in diameter. He had analyzed some of these, and they were eighty-two per cent silicon. They have a grayish green on the surface and the centers were dark, in appearance something like magnetite, brown metal, or metal oxide. He would like to agree with Doctor Tucker as to the lasting properties of this grid. He ran it for two days at 1,300 or 1,400 degrees, and it then broke mechanically.

Doctor Tucker, answering a question by M. H. Kohn, said the resistance of silundum is greater than that of the original carbon, but every piece of the material he obtained seemed to have its own resistance depending on the penetration of the silicon vapor, and as far as he could find out, those which were completely converted through and through, were practically non-conducting.

C. A. Hansen said he had twenty pieces, one inch long and one-eighth inch in diameter, and they seemed to be fused together with silicon at the points. That grid took something like 1.2 amperes at sixty volts, and when heated up to 1,400 degrees, it would stand the pressure. The little grid took something like four amperes at twenty-five volts.

F. J. Tone, of Niagara Falls, said he had analyzed many samples of silundum made in accordance with the processes described, and in every case found that silundum consists principally of carborundum. The percentage of carborundum will vary from 96.0 to 99.5 per cent. There is often present a small percentage of metallic silicon, but for all intents and purposes, the material is silicon carbide. He did not agree with Professor Tucker that pure silundum is a non-conductor. It has a high resistance when cold, but it has a large factor of conductivity, and this is increased very rapidly by rise in temperature. Professor Tucker also states that the penetration depends on the time of the run and the temperature employed. He thought another consideration which governs this is the character of the atmosphere.

The president then announced the presence of Prof. H. E. Armstrong, a distinguished chemist of London, Eng., who he hoped would subsequently address the meeting. He then called on Prof. Edgar F. Smith, of Philadelphia, whom he congratulated on his recovery from a recent severe illness, to address the meeting. Professor Smith, who was received with a burst of loud applause, then took the floor. An abstract of his address follows:

PROFESSOR SMITH'S ADDRESS.

Thirty-one years ago, while teaching quantitative analysis to boys, I became disgusted with the methods then in use for the determination of copper. You are familiar with them as they are laid down in our text-books, and you all know from experience the difficulties which surround them, and so I was led to try the suggestion of our dear Doctor Gibbs, no longer with us, namely, to let an electric current act upon the salt of copper that was up for analysis and obtain the metal. I arranged two bichromate cells, and connected with one pole a platinum spiral. That was my anode. It dipped into a solution of copper sulphate contained in a small platinum crucible, around which crucible was wrapped a bit of copper wire, which was my cathode, and I watched that brisk current—that is the thing, the energetic current—and I soon saw the copper make its appearance upon the inside of the crucible. Cadmium seemed to be a good deal of annoyance to us in those days, particularly when we undertook to separate copper from cadmium, and the question came to my mind, May not cadmium be determined in the same manner as copper? And so we substituted a solution of cadmium salt for the copper salt, and the same little process was tried, using, however, not the sulphate of cadmium, but the acetate, and there appeared on the sides of the cathode genuine, crystalline cadmium, the first time it was ever determined in an electrolytic way, and determined with extreme accuracy. Its separation, however, was still bothersome, and that was realized in a day or two afterward, when from a nitric acid solution containing the two metals copper was deposited free from cadmium. I continued practicing the electrolytic method for the determination of metals, and went on to uranium, and was made happy when that great analyst, Freder Ghent, professor of chemistry in our institute, said to me: "One of the difficult problems in analytical chemistry is the satisfactory separation of uranium from alkalines." I said nothing in reply to what the professor said, but concluded I would see what the electric current would do with a solution of some uranium salt, using the double acetate of potassium, and applying the same current from the two bichromate cells, capacity unknown, not measuring the strength of the current at all, but just proceeding in that simple way. Uranium was deposited as the hydrate-sesquioxide existing in hydrate form in the cathode, and it was not long until I was able to tell the doctor that I could determine uranium electrolytically, and that I could separate it from potassium. So he wanted to see this separation of uranium from the alkaline metal. He saw it, and then he turned over to me a solution, without telling me anything about the quantity of metal with which he started, giving me no idea as to the content of uranium, or sodium, or potassium, and he said: "Electrolyze that." It was done, and my happiness was increased when he told me, after I had repeated the separation three or four times, that my results agreed most accurately with his, both for the uranium and for the sodium, and there was a separation which was done in an hour's time, a separation which, by the old method which he pursued, required hours, really days. Tungsten has always been a favorite element with me, in conjunction with molybdenum, particularly having in mind the separation of the two metals. In the course of our early experimentation we learned that it was possible to deposit molybdenum from a hydrate upon the cathode, as a hydrate of sesquioxide. Taking a normal tungstate and exposing it to the same current conditions, so that there was no deposition of tungsten, so that there was a mixture of these two, acted upon by our current, would probably give us the desired separation. The metal in-

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variably contained tungsten, and then on watching this deposition of molybdenum, we saw blue threads passing out from the cathode toward the anode, little blue threads, and as they approached the anode they vanished. The idea then came to mind that if possible the electrolyte, was agitated, these blue threads, which were one of the oxides of tungsten, would not appear at all, there would be no reduction of tungsten, perhaps, it would not eliminate the molybdenum, so the agitation of the electrolyte suggested itself. In 1886 Von Klubukow agitated the electrolyte by rotating first the cathode and then the anode, and later holding the electrode stationary, and rotating the electrolyte. It was a new thought, this agitation of the electrolyte, and he said, after a great deal of experimentation, he thought the rotation of the anode was the best. His anode rotated 120 times in a minute, but he never published any results as the result of this rotation. In 1901, when molybdenum and tungsten separation was in mind, we hoped that agitation perhaps would enable us to effect this separation, and the thought came that with agitation you can increase the current, you can increase the pressure. We did not succeed in separating molybdenum from tungsten, but we put into vessels (which were exhibited) copper sulphate, mercurous nitrate, etc., and while rotating the anode, agitated the electrolyte; in other words, we were able by turning on a high current under great pressure, to throw these metals out in a few minutes.

At this point in his address Professor Smith made a series of experiments along the lines previously suggested, and told in a most entertaining and exhaustive manner the latest researches in electrolytic analyses.

At the conclusion of Professor Smith's address, the president said: "Gentlemen, in expressing the thanks of the society to Professor Smith, my only regret is that my eloquence will fall very far short of my enthusiasm. Professor Smith has shown us that from a subject that to many of us appears merely as one of the many varieties of analytical drudgery can be developed to one of inspiration."

Prof. Henry E. Armstrong, of London, England, then addressed the meeting as follows: "I count myself very happy in having accidentally come here to-day and had the opportunity of listening to the charming account given by Professor Smith of his remarkable work. Of course, every chemist has become acquainted with Professor Smith's work, but, after all, the ideas we get when we read about these things are very feeble, indeed, in comparison with the impressions we get when we come face to face with the man and have some opportunity of judging of the way in which he looks at his work. Professor Smith may or may not be a physical chemist, but it is quite clear that he is a very human person, with a peculiarly characteristic personal equation, and we have the opportunity of realizing something of the value of that equation, and we can very easily see what an influence such a man must exercise upon his students."

EXCURSIONS AND ENTERTAINMENTS.

The whole of Friday was devoted to excursions and entertainments. A special train from Jersey City at 8:30 a. m. took a large party of members and guests to the Constable Hook section in Bayonne, N. J., where the forenoon was spent. In the afternoon plants in the Newark Bay section of Bayonne were visited. At noon a lunch was served at a shore resort on the Kill von Kull.

The following plants gave permission to visit their plants, excepting to those interested in rival industrial processes: Standard Oil Company, oil refineries; National Sulphur Company, refining of sulphur; Pacific Coast Borax Company, manufacturers of borax and boric acid; Gröndal briquetting plant at the works of the General Chemical Company, the first American installation of the Gröndal process; Babcock & Wilcox Company, water-tube boilers and adjuncts; Electro-Dynamic Company, interpole motors for wide speed-variation; Electric Launch Company, submarine vessels, etc.; Industrial Oxygen Company, oxy-acetylene welding and cutting apparatus.

At 3:30 p. m. an automobile excursion around New York, starting from the Hotel Cumberland, was provided for the ladies, and at 7:30 p. m. a subscription dinner, at $2 a plate, was served to a large company at the same hotel.

Other entertainment features were provided on Saturday, including a luncheon for members and guests, including ladies, at the Columbia University Dining Hall. A smoker at the Assembly Room of the Chemists' Club was also well attended and much enjoyed.

SATURDAY MORNING SESSION.

The Saturday sessions were held in Earl Hall, Columbia University. President Baekeland called the morning session to order at 10 a. m.

The first number on the programme was a paper by R. C. Palmer, entitled "A New Electrolytic Method for the Preparation of Explosive Antimony." This was read by Professor Richards in the absence of the author, and was passed without discussion.

Another paper read by Professor Richards was one by Frank C. Mathers, on "The Influence of Perchloric Acid on Electrodeposition of Metals." This, it was explained, was preliminary to a fuller paper to be presented by the author after further experimentation. The paper was discussed briefly by Professor Carhart.

The next paper, entitled "The Laws of Electrode Losses in Electric Furnaces," was presented by the author, Carl Hering.

LAWS OF ELECTRODE LOSSES IN ELECTRIC FURNACES.

In a previous paper the author had shown how it is possible to obtain in practice the combined effects of perfect heat insulation and good electrical conductivity. He pointed out that electrodes of electric furnaces, which possess, as they should, the property of being good electrical conductors, necessarily also have the accompanying objectionable property of being good heat conductors. Hence, a way in which furnace electrodes of good electrical conductors may be made to also act as good heat insulators is of interest and importance to furnace designers. Based on this method, the author has developed the laws according to which electrodes should be designed in order to reduce the loss of power and the amount of electrode material to the least possible. The purpose of the present paper is to enunciate these laws, illustrate their application and show their derivation. The results are in some respects quite different from what has generally been supposed, hence, economies, which sometimes may be quite great, will become possible in many if not in most cases. An extended abstract of this paper will be given in an early issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

The discussion was opened by a communication from Dr. A. E. Kennelly, read by the secretary. The rest of the discussion referred mainly to the illustrations and to a previous discussion at a former meeting of the society.

The paper, "Furnace Electrode Losses," was then read by the author, C. A. Hansen.

FURNACE ELECTRODE LOSSES.

This paper was professedly only an attempt to analyze the electrode losses in a particular furnace under observation, and to supply such data concerning "constants" as is derivable from the work done in this connection. This furnace has been so charged at different times that it would finish its run at 10,000, 15,000 and 20,000 amperes, respectively, being kept at these current values for several consecutive hours in each case. The losses as determined in the cooling water under these conditions remain fairly constant, showing that in all probability an equilibrium has been established within the electrode. The temperature at the hot electrode end was found in each case to be about 3200 degrees centigrade. The cold end of the electrode reached a temperature of approximately 200 degrees centigrade. The temperature difference was therefore 3000 degrees centigrade. The author proceeded to analyze the losses to see what can affect them and how far they are determinable from published data. These were considered under the following heads: (1) Joulean heat; (2) heat conductivity; (3) contact resistance (so far neglected in formulas hitherto published). The several divisions were considered in detail at some length. A table of resistances of Acheson graphite elec-

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trodes was then given, as were also similar tables relating to National Carbon Company's electrodes. A diagram showing resistance of an electrode made by the National Carbon Company was adduced to show where the speculation as to the temperature resistance for carbon comes in. The effective lengths of electrode and contact resistance were considered together, the discussion thereon being illustrated by reference to test results of a recent run. A consideration of the electrical resistance of graphite, of heat conductivity, and a method of calculating the losses for titanium-carbide furnace electrodes, concluded the paper.

Carl Hering, opening the discussion, pointed out that some of Mr. Hansen's curves and figures for carbon might cause a misunderstanding, inasmuch as they referred to carbon which had become more or less graphitized and therefore did not gibe with the speaker's curves (also used in the paper under discussion) for carbon which was not graphitized. While characterizing the paper as a very valuable one, Doctor Hering did not agree with the author in some of his deductions. He proceeded to point his remarks at length by reference to the figures and formulas in the paper.

F. A. Lidbury, of Niagara Falls, N. Y., also contributed to the discussion, which was closed by Mr. Hansen.

The next paper was entitled "Electrode Losses and Furnace Efficiency," by E. F. Roeber. Mr. Roeber expressed his regret that his paper had not been printed, and then delivered a description under the heading of the subject of his paper.

The paper entitled "A New Method of Measuring Mean Thermal and Electrical Conductivities of Electrodes," was then presented by Carl Hering.

A NEW METHOD OF MEASURING MEAN THERMAL AND ELECTRICAL CONDUCTIVITIES OF FURNACE ELECTRODES.

The object of the present paper is to suggest a new method applicable to electrical conductors as distinguished from the refractory heat insulators, and intended chiefly for the materials used for electrodes. It has the advantage of simplicity and it is believed to be accurate, as there seem to be no sources of relatively large or uncertain errors. The basis of the method is a formula recently deduced by the writer for the relations between the temperature and the flow of heat under certain conditions. In the method of test adopted, a rod of the electrode material to be tested is embedded in a heat-insulating material, except at its ends, which are kept at a relatively low temperature, as by means of a water jacket. The heat-insulating material is assumed to be a perfect heat insulator and a method of approximating closely to this condition is given in the paper. A relatively large electric current is passed through the rod from end to end, and temperatures are measured by a thermometer or pyrometer introduced at the middle point of the rod. The temperature at the center and at the cooled ends being measured, also the current and voltage between the two terminals, the heat conductivity of the material may then easily be calculated. From the same readings of the volts and amperes in this test the mean electrical resistivity for the same range of temperature can also be ascertained. Attention was directed to a curious and interesting relation which occurred in these tests, as it bears on the voltages required in such cases. For a given temperature drop, this voltage between the two cold ends is always the same for any given material, no matter what the length or cross section of the sample is. A long or short, thin or thick rod of a given material will require the same voltage to raise it to the same temperature at its middle point, assuming, of course, that the conditions are perfect. With less than this voltage it is impossible to raise the rod to that temperature and with a greater voltage the temperature will always be higher; no changes in the dimensions of the sample will change it. The current will be different, but even it will be the same for different lengths and cross sections when their ratio is the same. The current will, of course, be less the greater the proportion of the length to the cross section. This voltage is different for different materials, and it is, therefore, quite as characteristic of the material as are the thermal conductivity and the electrical resistivity; for one degree drop in temperature it is numerically equal to 5.788 times the square root of their product. This voltage may be said to be a physical property which depends on these two properties jointly, and as it has an important bearing in the selection of the material for electrodes of electrical furnaces, the author has suggested the name "electrode voltage" for it.

The paper was discussed by Professor Richards, F. A. Lidbury and W. C. Arsem, and Doctor Hering replied to various points raised.

A paper entitled "The Practical Conductance of Electrolytes," by Joseph W. Richards and W. S. Landis, was then presented by Doctor Richards.

The paper was discussed by W. R. Whitney, T. Wolcott, M. Loeb, E. A. Sperry, Carl Hering, the President, and Prof. J. W. Richards.

A NEW THEORY FOR CORROSION.

The next subject was "A New Theory for Corrosion," by Maximilian Toch. Mr. Toch, who had no prepared paper, said in part:

The theory on which this investigation is based was really due to the experiments performed by Mr. Sperry, who in a paper before the New York Section of the American Chemical Society showed scrap steel, which had been detinned and subjected to a current of low voltage and high amperage in an alkaline solution. Such steel was immune from further corrosion. An experiment which I carried out along these lines was the electrification of sheets of steel in solution of known strength of sodium carbonate by means of currents properly measured. In every instance it was found that where the voltage was low and the amperage high, the cathode plate was protected, except where the solutions were weak, and on the side which faced the anode, and where the electricity naturally left, the corrosion would start almost immediately after taking these plates out of the solution. This process may be of commercial value for immunizing bolts, nuts, screws, etc., such as are used in bridges and all exposed structures. We know in common practice that many bolts rust and repel paint, and just as many attract paint and never corrode, so that we may in this find that the immunizing effect of those bolts which do not corrode may be due to the fact that they are cathode and remain so.

S. S. Sadtler, of Philadelphia, in opening the discussion, said he was of the opinion that one of the reasons for the corrosion of steel, especially modern steel, is the fact that it contains particles of manganese, and it is possible if that steel is made anode in a solution of carbonated soda, and a high current of great strength is passed between the plates, that the manganese may be fully oxidized and dissolved by the soda of the solution, and therefore removed from the surface of the steel, and that may account for the resistance that steel has shown to the agencies of corrosion.

Richard H. Gains, of New York, believed the whole question of corrosion depended upon the parasite to which steel properties are exposed. Some recent analyses of rust he had made for the Board of Water Supply have convinced him that part of the corrosion in the soil is at least due to bacterial activity.

Mr. Toch said he had heard of what Mr. Gaines has said about corrosion being caused by bacteria. He thought this action would probably be due to some fungi, more than bacteria, because French writers demonstrated thirty years ago that copper was corroded by means of certain fungi.

Elmer A. Sperry said he thought Mr. Toch's modest paper possessed a good deal of merit and originality. In detinning with chlorine, he found that some thirty-six per cent of the total tinning on tin plate is in the alloy zone, actually below the surface. It could be washed off with sand, at proper temperature. For anything like complete retinning, he said, we must go into the alloy zone and pull up the tin to a point of 0.4 per cent before the steelmakers will accept it. That naturally leaves a very spongy surface of the iron, and whereas, at certain high temperatures, in the presence of chlorine, nearly all of the iron will go into the iron-chlorine contents, yet no matter how well you carry that reaction out, the surface seems still to have this same bacteria upon it that Mr. Toch refers to. It contains little unseen particles of ferric chloride which are extremely microscopical, and after the scrap has been put out in the yard, waiting for the rise in price

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of steel scrap, we find we have not steel any more, but a scrap heap which consists of iron, because of the perverse action of this film, that can hardly be observed, of particles of ferric chloride. He was trying to reduce these particles, and found that no amount of washing in hot alkali, where there was a perfectly free alkali, would remove the trouble. The idea occurred to him of taking a cathode and putting a good heavy current through it, and in that way hydrogenizing the surface, as it were, and reducing this ferric chloride. He got rid at once of the acid that destroyed the steel. In one case he took two billets, five by thirteen by thirteen, one of them treated in this way, and one not treated in this way, and the one which was not treated dissolved into a little heap of iron work, and the other stood up and retained its size and shape. A piece of steel the surface of which was treated to a depth of one-eighth of an inch would be found to have retained its original elasticity. It would bend many times before breaking, whereas a piece of steel not so treated would break every time it was bent. That was the work which Mr. Toch referred to in his remarks.

SATURDAY AFTERNOON SESSION.

President Baekeland called the afternoon session to order at 2:30 o'clock. The first paper on the programme was "Evolution and Present Status of the Dry Cell," by Dr. J. W. Brown. Doctor Brown was not present, and the next paper, entitled "Dry Cell Tests," was then read by F. H. Loveridge. This paper gave rise to considerable discussion. Dr. Carl Hering proposed that a committee be appointed to formulate rules for testing dry cells, etc. This question was eventually referred to the Board of Directors.

The paper entitled "Some Characteristics of Dry Cells," by Dr. C. F. Burgess and Carl Hambeuchen, was then read by the former gentleman.

CHARACTERISTICS OF DRY CELLS.

Most of the uses of dry cells involve relatively low rates of energy delivery. Low resistance is an important qualification for dry cells, except, perhaps, where only small quantities of energy at low voltage are required. "Minimum polarization" and "rapid recovery" are other factors to which attention is called by manufacturers in advertising their dry cells. It is impossible to point out which is the most important of these qualities, since the relative importance depends upon the character of service required. Among the minor characteristics which are sought to be attained in dry-cell construction are: Absence of the leakage of the liquid, minimum increase of resistance with low temperature, convenience for connecting into circuit, and the general appearance of the cell. The factors which govern the above characteristics include these: Materials employed in construction, the proportions of materials, the chemical and physical qualities of these materials, methods of assembling. General instructions and common practices for dry-cell construction were given by the authors, who stated that the quantity of water to be added to the electrolyte depends upon the dryness of the original materials, the fineness and quality of the paper lining, etc. Starch and other forms of paste are frequently added to improve contact of electrolyte to zinc and promote distribution of action throughout the charge. Mercury is sometimes added to amalgamate the zinc. Purity of materials is an important requisite, and porosity of the granules of manganese dioxide appears to be important. The quality of the carbon filling seems to play an important part, and the increasing use of graphite for this purpose is commendable. Purity of the sheet zinc is of great consequence as tending to reduce local action to a minimum. The presence of copper is very deleterious to a dry cell. The introduction of the filling, from whatever cause, between the zinc and the paper lining is objectionable as causing certain differences of potential tending to run down the cell. Uniformity of the mixture is also a matter of considerable importance. The voltage at the cell terminals while delivering current naturally depends upon a number of factors, the principal of which are the activity of the depolarizing material and the internal resistance of the cell. The activity of the depolarizer increases as the cell is used, and even more marked is the increase in resistance with the number of ampere-hours delivered. It is very commonly believed that the increase in resistance is due to the drying out of the cell, but the drying is of very minor importance as compared with other factors. One of these is the increase in resistance due to the partial reduction of the manganese dioxide. Another is the accumulation, on the surface between the paper and the zinc, of non-soluble impurities of the zinc and the various basic salts and double salts resulting from the electrolytic corrosion. The presence of zinc chloride in the electrolyte markedly decreases the local action. Finally, rating of cells should be stated by energy rating, as determined by the usual standard methods for conducting tests.

This paper was discussed by Dr. Carl Hering, C. L. Parsons, J. A. Seede and S. P. Sharpless.

The next paper, entitled "Alloys of Copper with Electrolytic Iron," by C. F. Burgess and James Aston, was read by Mr. Burgess.

IRON-COPPER ALLOYS.

The authors preface their paper with a résumé of the work of previous investigators on the subject of iron-copper alloys, etc., and then proceed to give a detailed account of experiments carried out at the University of Wisconsin on electrolytic iron and its alloys, credit for much of the work being given to Messrs. Watts, Kowalke and Thickens. The primary element in the production of these alloys is iron of high purity, obtained by double electrodeposition. The purity of the iron was given as 99.97 per cent. The copper used was also of high purity, being obtained by electrodeposition. The charges were made up in dense electrically shrunk magnesia crucibles, each enclosed in a graphite container. The crucible was covered with a magnesia lid and was buried in an electric resistor furnace. The charges were brought to fusion in the furnace (without agitation) from the cold mixture, kept at high temperature for some time, and allowed to cool in the furnace. The ingots weighed about one pound each, were forged under the steam hammer into rods about eighteen inches long, and were then turned or ground into the finished test rods. Observations were as follows: Alloys up to two per cent copper forge well at low heats; from two to seven per cent copper they forge only (and indifferently) at a white heat; from seven to eighty per cent copper they are practically unforgeable; from eighty to 100 per cent copper they will forge at a fair red heat, but not at a normal forging heat for iron. With percentages less than five per cent copper the alloys weld easily; up to seven per cent with difficulty or not at all; above seven per cent they are practically unweldable. The hardness seemed to increase with the copper content within the range of the experiments undertaken. In the tensile tests (unannealed specimens) the rise in the ultimate strength and the elastic limit proved to be almost a linear function of the percentage of copper. The ultimate strength varied from 61,180 pounds per square inch for the 0.1 per cent (copper) alloy to 132,400 pounds at seven per cent. The yield point rises from 52,580 to 122,900. Elongation falls from 28.5 per cent to 4.0 per cent for alloys of the same percentages. Reduction of area increases from 69.2 per cent for alloys containing 0.1 per cent copper, to 72.1 per cent for alloys containing 0.6 and 0.8 per cent copper; and falls from this point to 7.3 per cent for the seven-per-cent-copper alloy. The results of annealing showed a very marked effect, especially for the higher percentages of copper, and greater consistency was obtained in the results. Comparisons with the results of other experimenters were given, and these agreed closely with those of the present investigations.

Dr. Carl Hering, opening the discussion, asked whether the copper might not perhaps, when alloyed with iron, act differently on the physical properties, depending upon the treatment of the iron; that is, whether or not the copper may not take on some temper and thus add to the hardness. In other words, the chemical analysis is hardly the criterion of what the physical properties would be.

Prof. J. W. Richards said that, speaking from a metallurgical side, this paper will be received with great interest by the manufacturers of steel in the United States. He was told privately some years ago by a chemist of one of the large steel works, for his own private information, that a great deal of their steel had from 0.5 to 0.7 copper in it, and passed all the requirements of the U. S. Government, and it was not injurious to the steel, but rather beneficial. That was then private information. Professor Burgess' paper makes it public information, and even goes further than the information that was then known. He thought it was one of the most important papers, in its commercial aspect, that have been brought before the society.

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Arthur H. Elliott said that the addition of copper to iron for certain purposes is extremely interesting, and probably the most interesting is that of its effect on the corrosion of the metal, especially in the making of pipes.

Roger C. Aldrich asked whether any experiments were made on the addition of copper to steel.

Professor Burgess replied that they did not make a series of copper alloys on the steel. They made enough accidentally to find that in the presence of carbon the copper acts in a way entirely different from that described in the paper. It makes it brittle. It makes it very short, and it is not desirable to add copper, at least, to high-carbon steel. As to the corrosion, they had been studying that quite extensively, and have several hundred alloys which are exposed to various corrosive conditions, but he was inclined to think that copper-iron is going to be a rather corrodible material.

Edward R. Taylor then read his paper, entitled "Contribution to the Electric Smelting of Iron Ore."

ELECTRIC SMELTING OF IRON ORE.

It is the opinion of the author of this paper that the necessity for large furnaces for the electric smelting of iron ores will be upon us in the very near future, and it is often the case that plans that serve for small demonstrations are not well adapted for large operations. In this connection the carbon bisulphide electric furnace now in use offers some suggestions that are worthy of consideration, and the paper is devoted almost entirely to a detailed description of this type of furnace.

Pedro G. Salom, commencing the discussion, asked if Mr. Taylor had made any measurements of the amount of current in kilowatt-hours per ton of iron.

Mr. Taylor replied that he and Mr. Hering had made some calculations along that line, but they were not in his mind at the time. It is a matter of surprise, he said, how little electric current is required for these transformations. It is also interesting to note how small the quantity of carbon is which is required for the reaction. When you dispense with the blast passing through a blast furnace, you dispense with several things—you dispense with a large quantity of nitrogen going into the furnace, a large quantity of carbon otherwise going into the furnace, and consequently you have reduced to a simple proposition a great many other things.

Prof. J. W. Richards criticized the structure which Mr. Taylor has proposed,[1] particularly in respect to the feeding of the ore separately from the fuel, and keeping them separate until they go down in the furnace. It is a wrong practice in the working of a shaft furnace, he said, to keep the ore by itself and the fuel by itself. The fine ore, particularly, packs, and the reducing gases cannot pass through it. Therefore, the possibility of utilizing the CO, and having a high percentage of CO_2 in the gases, can be attained only imperfectly with such an arrangement. He opined that the furnace is not adapted to securing high efficiency of consumption of carbon, or in the evolution of the heat of oxidation of the carbon. In connection with the name of this furnace, he asked all those present to use their influence not to have the furnace called the electric blast furnace. In Germany they call it *Elektrische Hochofen,* which is quite natural, and in France they call it *haut-fourneau electrique,* and if we call it the electrical blast furnace it will be giving it a misnomer. Let us call it the electrical shaft furnace, he said, and then we will not be committing this crime upon the English language.

C. A. Hansen said it is due as a courtesy to Doctor Haanel to use the term "shaft furnace." Doctor Haanel has contributed so largely to the literature of the shaft furnace, that he thought the suggestion of Professor Richards was well taken.

Professor Richards said that Doctor Haanel called it in his paper the "electric high furnace." He took issue with the doctor on the term, and he saw the point, and changed it accordingly.

Several others contributed to the discussion of this paper.

The next paper, entitled "Power for Electrolytic Copper Refining at the Smelting Works," was presented by the author, W. L. Spalding. There was no discussion.

Alfred Sang then read his papers on "Electro-Cementizing" and "Notes on Zinc, Copper and Brass Dusts." An abstract of the former paper follows:

ELECTRO-CEMENTIZING.

The author began with an outline of the usual methods employed in zinc-coating, with a review of the disadvantages and defects of the same. He then proceeded to describe his own (patented) process, called by him "electro-cementizing," the principle of which was by no means new, inasmuch as the Cowper-Coles "sherardizing" process, and another method described by M. Dumas as long ago as 1865, were somewhat similar as to the methods employed. The germ of the "electro-cementizing" idea lies in the fact that the articles to be coated are heated electrically by using them as resistances, and the author admitted that unless the process could be applied on a large scale it was applicable only in the case of articles of small cross-sectional area. The coating chamber or furnace of the apparatus used is made of iron plates lined with a refractory material, and is filled from the top with a mixture of crushed coal and oxide of zinc. The wire to be coated passes from the reels over and around insulated brass contact sheaves, those at each end being connected through the proper rheostat to the poles of a suitable transformer supplying low-tension alternating current. When all the strands of wire are in place and connected, the current will pass in a zigzag manner in and out of the furnace, and a wire resistance of considerable length is thus afforded. The current is turned on and regulated so that the wire is quickly brought to a bright cherry-red heat, which volatilizes adhering grease, reduces scale or rust by virtue of the contact with the reducing carbon, drives out occluded gases, and reduces the zinc oxide in the immediate neighborhood so that zinc vapor is absorbed by the pores of the wire and further condenses on the wire surface as the temperature of the wire is reduced. The quality of the product is due to the intimate alloy of the iron with the zinc and to the coating of pure zinc on top of this. The process combines in itself the annealing furnace, the cleaning process and the zinc bath, and does away entirely with fluxing and wiping. Oxides of other metals besides zinc may be used. The cost is somewhat higher than that of the hot zinc bath, but the resulting product is very superior in quality.

M. K. Thompson's paper, "On Calcium Carbide," was abstracted by the Secretary.

ON CALCIUM CARBIDE.

The following is the author's summary of the results of his experiments: 1. It was shown experimentally that the equilibrium pressure of carbon monoxide cannot be obtained by heating lime, carbon and carbide or lime and carbon alone initially in a vacuum, on account of the decomposition of the carbide into calcium and carbon and the subsequent reaction of carbon monoxide and calcium.

2. Hansen's results cannot, therefore, represent equilibrium. This was further demonstrated from theoretical considerations.

The paper was briefly discussed by Mr. Hansen. This concluded all the papers.

RESOLUTIONS.

A resolution of thanks was then passed to the various companies whose plants had been inspected on Friday by the delegates, to the Chemists' Club, Columbia University, the New York Section of the American Electrochemical Society, the Ladies' Committee, and the local Committee of Entertainment, after which President Baekeland expressed his thanks to the members for their attendance at the Convention, which had been in every way successful, and the meeting then adjourned.

Several of the papers set down on the programme were not presented, but in the main the plans of the meeting were well carried out.

[1] See Patent No. 938,351 in Record of Electrical Patents in this issue.

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ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

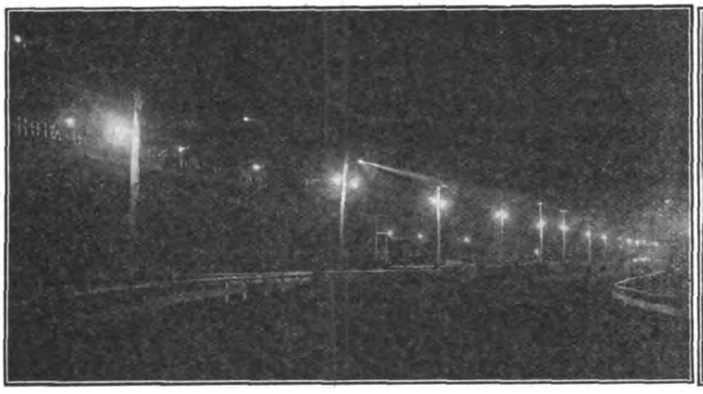
Illumination of the Minnesota State Fair.

Visitors to the fiftieth annual Minnesota State Fair, which was held September 6 to 11, unquestionably were impressed by the brilliant illumination everywhere in evidence. They no doubt had difficulty in believing that about a dozen years ago this same fair was a dark, forbidden spot after sundown each evening. Electricity and the "Night Show" were unknown to that or any other state fair prior to the fall of 1898. The comparatively primitive lighting then was effected by an old engine and two series arc machines furnishing forty lights each, with a lone searchlight of 8,000 candlepower. The "Night Show" was a doubtful experiment that year and was confined almost entirely to the grandstand show and the fireworks.

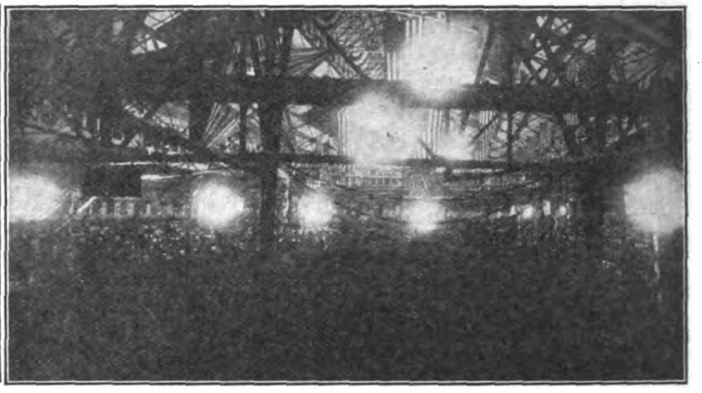
The following year another series arc machine was installed at the Dale Street substation in St. Paul, and a few additional lamps were added. The real era of electricity at the Minnesota State Fair was ushered in by the building of a temporary transformer station and making a connection with the transmission lines of the General Electric Company, running from the big power plant at Taylors Falls, fifty miles away. Since that time the current has been transmitted direct to the state fair grounds at 13,200 volts and goes to the now permanent transformer station on the grounds of 1,500 horsepower capacity.

Since the installing of the transformer station the state fair grounds have closely resembled the traditional fairyland at night, and the illumination of the fair this year surpassed that of any previous.

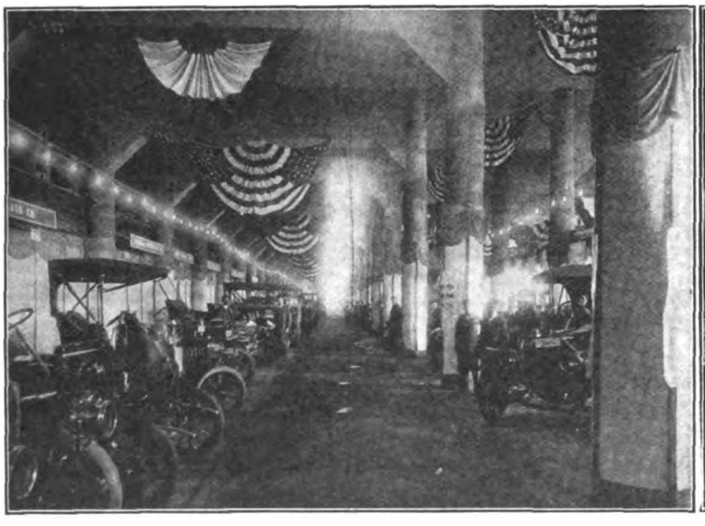
The grounds were lighted by 175 series arc lamps of 800 candlepower each, and as several sections of the grounds were used for daylight demonstrations only, these lights were concentrated in order to make brighter the 200 acres upon which the activities of the "Night Show" were most in evidence. For lighting the new $250,000 grandstand in which the "Minnesota at Gettysburg" production was held, forty Excello flaming arc lamps and about 1,600 decorative incandescent lamps of eight candlepower each were used. The



Grandstand.



Amphitheatre.



Automobile Showroom.

Approach to the Grandstand.

ILLUMINATION AT MINNESOTA STATE FAIR.

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automobile showroom, shown in one of the accompanying illustrations, was made more brilliant by ten Excello flaming arc lamps, forty multiple arc lamps and 1,000 incandescent lamps, the latter purely for decorative purposes, over and about the booths. The second floor and the main approach leading to it were lighted by eight Excello flaming arc lamps and sixteen multiple arcs.

Another item in the extensive scheme of illumination was the electric sign hung upon the approach side of the grandstand announcing "Minnesota at Gettysburg, 7:30 Tonight." This sign was twenty feet high and 350 feet long and required 1,300 four-candlepower incandescent lamps. A view of this sign, together with the exterior illumination of the approach of the grandstand, is shown herewith.

Next to the grandstand and exposition building the live-stock amphitheater was perhaps the most brilliantly lighted of any of the buildings on the grounds. For lighting the interior, twenty Excello flaming arc lamps were used and 1,500 ten-candlepower incandescent lamps used for decorative purposes.

Other buildings were illuminated in a similar manner, flaming arc lamps being the principal illuminants, with incandescent lamps for decorative purposes.

The electric-lighting and power system at the Minnesota State Fair represented an investment of $50,000.

A Fluid-Electrode Arc Lamp.

One of the latest forms of arc lamps, and one that promises a good deal as to convenience and economy, is the plastic-electrode lamp, for which a patent was secured last month by Caryl D. Haskins, of Schenectady, N. Y., and assigned by him to the General Electric Company.

In this new type of arc lamp the old form of carbon electrode is not used, but instead, the electrode material is introduced in the form of electrode "mud," which is molded and baked into electrodes as it is fed. The electrode mud, composed of powdered coke, lampblack, anthracite and bituminous coal and a suitable agglutinant, is fed into the electrode chambers in a plastic state, pushed by its own weight through the electrode tubes and baked by suitable heating coils.

Fig. 1 shows a longitudinal central cross-section of one form of this lamp; Figs. 2 and 3 are modifications.

Referring to Fig. 1, 1 and 2 are receptacles having downwardly extending tubular portions 3 and 4. Into these receptacles the fluid electrode material is put from time to time as the electrodes are fed and consumed.

As the current is turned on, the parts surrounded by the heating coils 10 and 12 are baked, this baking process taking place as long as the lamp continues to burn. Both electrodes are fed in exactly the same way as in an ordinary arc lamp. Assuming that the electrodes are in contact and the current has begun to flow, the upper electrode is lifted the proper distance by the clutch 12 operated by the

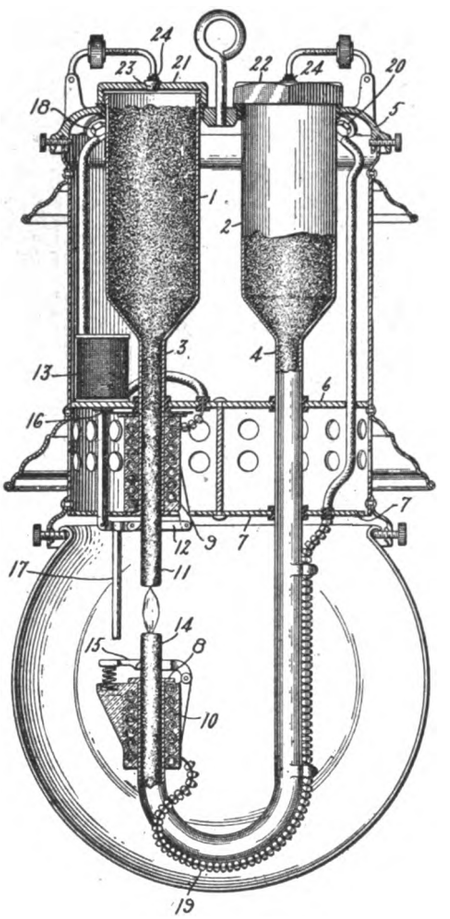

FIG. 1.—HASKINS' FLUID-ELECTRODE ARC LAMP.

electromagnet 13. When the arc breaks, the electrode drops and is again lifted. Each break of the circuit drops the rod 17 on the clutch 15. This allows the lower electrode to be pushed upward by the weight of electrode material in receptacle 2, and in this way the length of the lower electrode is expected to be kept practically constant.

The circuit of this form of lamp may be traced as follows: Beginning with the positive terminal 18, the current passes through the coil of magnet 13, thence through the heater 9 to the tube 3 and electrode 11 to electrode 14 and tube 8, thence through the heater 10 and by way of an insulated conductor 19 to the negative terminal of the lamp 20.

Instead of depending entirely on the weight of the fluid to supply the electrodes, auxiliary pressure devices may be employed, as, for example, making use of the gas pressure generated by the heat-

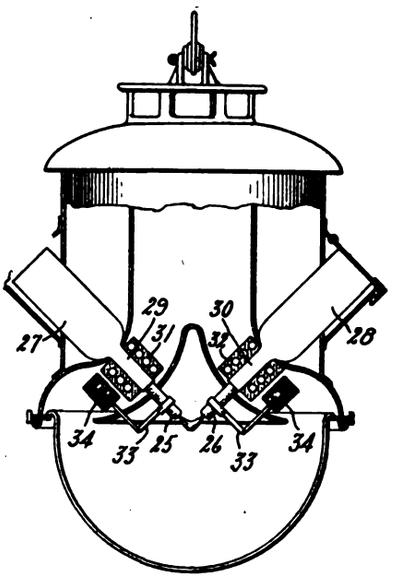

FIG. 2.—HASKINS' LAMP WITH CONVERGING ELECTRODES.

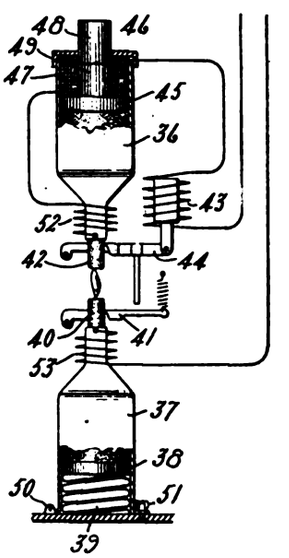

FIG. 3.—HASKINS' LAMP WITH UPPER AND LOWER CHAMBERS.

ing process. This is done by tightly closing the tops of receptacles 1 and 2 by screw-caps which may be provided with safety valves 24.

These may be regulated for any desired pressure.

Other forms of this lamp are shown in Figs. 2 and 3, the former being a type with two converging electrodes, and Fig. 3 feeding the bottom electrode by a spring and the upper by a solenoid.

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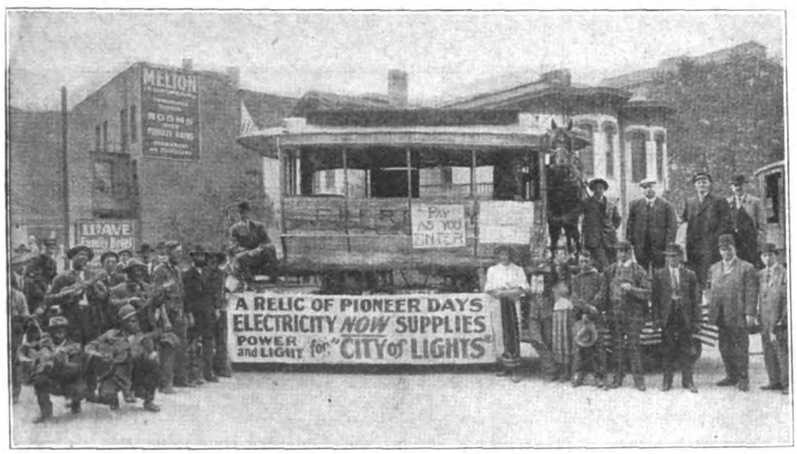
The Old and the New Strikingly Contrasted at Denver.

The new order of things was strikingly contrasted with the old at the convention of the American Street & Interurban Railway Association in Denver recently by a street exhibition of the famous Cherrelyn horse car, which is one of the sights for the tourists visiting the western city. The Denver Gas and Electric Company induced the owner of the line, which is just outside the city limits, to suspend business for a day so that the car could be used for exhibition purposes. It was placed on a flat car and brought to the door of the convention hall, where a large number of delegates had their pictures taken with the car as a background. To carry out the pioneer effect, a number of the employes of the Denver Gas and Electric Company dressed as miners and cowboys to portray conditions of the early days. The feature was greatly appreciated by the delegates to the convention.



A REMINDER OF THE OLD DENVER.

STREET LIGHTING IN THE NEW DENVER.

The new Seventeenth Street lighting was completed in time for the inspection of the visitors. This street, which leads from the Union Depot, is now the best lighted in the city. There are eight arcs to a block and the poles are artistically designed. A number of stringers were used for additional lighting for the convention and the reputation of Denver as the "City of Lights" was thoroughly lived up to.

Locomotive Headlight Tests.

The exhaustive test of the respective merits of oil and electric locomotive headlights recently begun on the Big Four Railroad near Avon, Ind., by the Railroad Commission of Indiana, a number of railroad officials and many prominent engineers, is being continued at Purdue University and is expected to result in some interesting disclosures to the railroad world.

The tests were brought about by an act of the Indiana Legislature, which instructed the Railroad Commission to investigate the merits of various types of locomotive headlights and to order every railroad in the state to put into service the type of headlight which was found to be most efficient.

The tests were made under three heads: The first was a test in which the effect of opposition headlights was utilized; the second test was simply an observation of the distances at which classification signals on the locomotive could be seen when electric and oil headlights were used on the same locomotive; and the third test was the observation of distances at which obstructions on the track could be easily distinguished.

Members of the commission have not as yet been able to agree, and the outcome of the investigation will be awaited with interest.

Gross Earnings of Boston Edison Illuminating Company Show Signs of Increase.

Charles L. Edgar, president of the Edison Electric Illuminating Company, Boston, estimates that the company will increase its gross earnings more than $600,000 a year by the new contract with the subsidiary companies of the Boston and Suburban Electric Company, to supply all the electricity to be needed in the operation of their street railroads and, by the recently consummated purchase of the electric properties in Newton, Chelsea, Watertown, Brookline, Brighton and Waltham, as well as by the disposition of the gas properties located in Newton, Chelsea and Watertown.

If the expectations as to gross earnings are realized and if expenses are only proportionately increased, the company should show a small surplus as a result of the business of the current year, even after paying ten per cent dividends. The total of the liabilities of the company amounts to $24,866,608, about thirty per cent of which, or $7,604,940, is counted as premiums on new stock. The capital stock during the year was increased by $960,000, and at the same time notes and accounts payable were decreased $645,090. Notes and accounts payable have been largely increased since June 30, as is seen by the fact that the company has petitioned the Gas Commission for authority to issue 19,452 shares of additional capital stock, proceeds of which to be used to take up notes issued for new properties acquired at a cost of about $2,870,000, also to take up notes issued from time to time to take care of the normal growth of business amounting to $1,000,000.

Telegraphy at Panama.

A contract has been entered into between the Panama Railroad Company and the Republic of Panama, providing for the construction and maintenance of telegraph circuits between Panama and Colon.

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CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

THE ADVANTAGES TO ELECTRIC COMPANIES OF CENTRAL-STATION STEAM HEATING.[1]

BY CHARLES R. BISHOP.

Before taking up the present state of district steam heating, it may be well to touch a little upon the history of the enterprise.

At the time of its conception, in the year 1876, there was no practical knowledge of anything pertaining either to construction or operation, maintenance of underground lines, the quantity of heat required in various classes of buildings, cost of generating and delivering steam, or any data upon which to base the charges for services rendered. A number of years passed before sufficient data had been collected to determine what had been the causes of excessive transmission losses, large repair bills, and generating costs so high that profitable and satisfactory operation was difficult. Notwithstanding the fact that the early results had been unsatisfactory, it appeared to those most directly interested that there remained enough of an encouraging nature to justify further effort. Experiments were continued upon a much larger scale and many different kinds of insulating materials were thoroughly tested, together with several methods of providing for expansion and contraction. In this way the enterprise progressed along lines of improvement in construction and insulation, but with little attention being paid to economy in generating steam, to methods of selling, or to general management.

In 1880, and during the early period of development, a system of steam mains was installed in Lynn, consisting of long lines of pipe of small diameter, designed to carry relatively high pressures, very imperfectly insulated and with practically no protection against the effects of water which more or less surrounded the mains. The construction of the plant was carried through without appreciation of engineering requirements, no provision made for relieving the mains of condensation except through entrainment; boiler-house economies were not considered, and the management was entrusted to men without experience and wholly incapable. The result is obvious.

About the same time, a plant was installed in Springfield, Mass., under practically the same methods of construction as were used at Lynn, but, with better management, succeeded in supplying service for over twenty years.

Other failures of steam-heating plants occurred, however, in various parts of the country, but totaled less than a dozen, with causes of failure due to the same sources in all instances, namely, poor construction and insulation of the underground system, management left to inexperienced men, a lack of proper means and methods of charging for steam consumed, and a deficiency in data of all kinds. Contrast the few failures with the great number of successes which total more than 200 cities!

In the New England states there are 172 cities having a population of over 5,000, and still in but three of them is there a district heating system of any magnitude, while Pennsylvania, having eighty-two cities of over 5,000 inhabitants, can claim central-station heating plants in at least sixty-nine cities. Illinois has fifty-one cities of 5,000 population and over, out of which thirty have more or less extensive systems of heat distribution, and in addition, there are heating plants in eight cities in Illinois of less than 5,000 population.

The question that now suggests itself is, Why are so few New England cities supplied with this service? Is it on account of climatic conditions? No, because steam heating is a success as far south as Birmingham, Ala., where snow is almost unheard of and the mean winter temperature is higher than the mean temperature of October, alone, in New England. Is it on account of the heating season not being of sufficient length? Certainly not. Is it on account of a lesser difference between the cost of fuel to the central-station company and to the consumer? No, statistics are proof of that. Is it on account of local conditions? It cannot be said that that is the reason; in fact, there is not a reason, but on the contrary every reason is decidedly in favor of district steam heating in New England as compared with any other section of the country.

The heating season here is regarded as of more than average length and severity. The cities are more compactly built, particularly the residence portions. The cost of fuel for central-station use as compared with that purchased by the individual user is in favor of district heating. The class of business available is better, and the prosperity of the community is acknowledged to be greater than in other sections.

As the methods of construction of steam-distribution plants are at last recognized to have become standardized, and descriptions have been given from time to time in the various engineering publications—or for those who may not have read such articles, information can be procured from manufacturers and contractors—it would be of greater interest at this time to touch upon that phase of the enterprise designated as "Results of Operation," under which there are two principal subdivisions: (1) Results comprising the operation of "live-steam" plants, or those which supply no other public-utility service other than steam for heating. (2) Results of "exhaust-steam" plants, or those which supply steam for heating, but only utilizing for this purpose the exhaust steam resulting from the operation of electric plants.

Since this association is composed of representatives of electric-light and power companies, let us devote ourselves to a consideration of the "Commercial Possibilities of Operating an Exhaust-Steam-Heating Plant in Connection with the Operation of Present Stations."

Is there a market and demand for a

[1] A paper (slightly condensed) read before the New England section of the National Electric Light Association, at Newcastle (Portsmouth), N. H., September 9, 1909.

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central-station supply of steam for heating purposes? I think you all will agree that there is, and no doubt many of you have been approached by owners of business blocks or residences to furnish a supply of heat, and others have been disappointed that their solicitors of contracts for lighting and power have not succeeded in procuring a considerable amount of additional business which would readily have been secured had you been able to supply steam for heating as well as electricity for light and power from your present central-station facilities.

Is there as good a market for steam heat as there is for electric light and power? I believe there is a better market. In a sense, electric light can be regarded as a luxury; so also can a public distribution of water, of gas, or of street-railway service. To no one of us is a public service of any of the above-mentioned commodities necessary. In this locality we can live without artificial light; if we arise with the sun and work until it sets, we would labor more hours than the average man now works; we need not have our residences or places of business supplied by a water company, since we can live without such service, taking our supplies from waterways, wells or cisterns; in place of riding on street cars, we could live downtown, walk, ride a bicycle, or drive a horse. But heat is recognized as an absolute necessity for the maintenance of human life; it cannot be secured in this latitude from nature's sources during winter; it cannot be successfully stored for long periods of time; it must in some manner be manufactured for immediate consumption; and, therefore, it is demanded of public-service companies to a greater degree than are the other named commodities.

Can your company supply heat at a cost comparable with that at which an individual himself can produce it? It is a fact that many of you are manufacturing heat in the form of steam, but what becomes of it? From eight to fourteen per cent of it is converted into mechanical energy in the form of electricity, and the balance thrown away, either into the atmosphere or into condensers. The plant operating non-condensing may have eight per cent heat efficiency, and the condensing plant a possible fourteen per cent conversion. Why not sell this large amount of otherwise lost energy for a price which will pay the original total fuel cost, including also such other expenses as water, oil, waste and labor, in boiler and engine room? Can it be done? Yes. Others are not only doing that very thing, but are also earning interest and depreciation on the cost of the steam-distributing system. In this connection, let me cite the results of a few companies:

PLANT NO. 1.

Electrical output	1,902,970 kilowatt-hours
Coal consumption	16,383,649 pounds
Water, all purposes	145,302,510 pounds
Coal cost	$21,091.82
Water cost	692.77
Oil and waste	596.36
Boiler-room labor	2,473.37
Engine-room labor	2,008.88
Total	$26,863.20
Steam receipts	37,190.35
Average net rate	40 cents per 1,000 pounds
Steam investment outside of station, including street mains, services, trenching, repaving, street traps and meters	$122,070.16
Space heated, approximately, October 1, 1908, to May 25, 1909	10,000,000 cubic feet

Combination plant, operated three seasons. City of 17,500 population.

PLANT NO. 2.

Electrical output	541,767 kilowatt-hours
Coal	6,768,661 pounds
Water, all purposes	48,131,094 pounds
Coal cost	$ 7,974.55
Water cost	463.20
Boiler-room labor	1,029.00
Total	$ 9,466.75
Steam receipts	12,497.85
Average net rate	40 cents per 1,000 pounds
Steam investment, approximately, October 1, 1907, to May 1, 1908	$45,000.00

Combination plant, operated five seasons. City of 10,000 population.

PLANT NO. 3.

Electrical output	1,081,150 kilowatt-hours
Coal	14,448,399 pounds
Water, evaporated	86,296,235 pounds
Coal and water cost	$22,904.05
Oil and waste	568.01
Boiler-room labor	2,305.45
Engine-room labor	1,271.65
Total	$27,049.16
Steam receipts	35,053.45
Average net rate	60 cents per 1,000 pounds
Electrical receipts for same period	$43,359.64
Steam investment, approximately, heating season October 1, 1908, to June 1, 1909	$45,000.00
Space heated	7,976,796 cubic feet

Combination plant, operated eight years. City of 10,000 population.

PLANT NO. 4.

Electrical output	2,498,508 kilowatt-hours
Coal	24,837,136 pounds
Water, all purposes	177,053,950 pounds
Coal cost	$15,523.21
Water cost	1,072.39
Oil and waste	370.48
Boiler-room labor	4,432.97
Engine-room labor	2,378.86
Total	$23,777.90
Steam receipts	25,931.68
Average net rate	27 cents per 1,000 pounds
Steam investment, approximately, October 1, 1908, to June 1, 1909	$103,000.00
Space heated, approximately	16,000,000 cubic feet

City of 43,000 population.

Note.—Steam rate should be at least 60 per cent higher.

Another interesting manner of studying the foregoing results would be to add to actual generating costs, interest and depreciation on the investment for steam mains, which is not properly an item of generating cost, but is included in order to get any cost whatever per kilowatt-hour.

PLANT NO. 1.

Boiler and Engine-Room Costs.

8,191 tons bituminous coal at $2.575 per ton	$21,091.82
Wages, firemen and helpers	2,473.37
Wages, engineers	2,008.88
Water	692.77
Miscellaneous supplies	596.36
Total	$26,863.20
Add to the above 10 per cent for interest, depreciation, etc., on steam investment	12,207.01
Total	$39,070.21
Receipts from sale of steam	37,190.45
	$ 1,879.76

Totalized switchboard cost per kilowatt-hour, including interest and depreciation on steam investment, $1,879.76 divided by 1,902,970 equals 0.0987c.

PLANT NO. 2.

3,334 tons, 661 pounds coal, costing	$ 7,974.55
Boiler-room wages for seven months	1,029.00
Engine-room wages (assumed) for seven months	980.00
Water	463.20
Oil and waste	100.00
Total	$10,546.75
Interest and depreciation at 10 per cent on steam investment, approximately, of $45,000.00	4,500.00
Total	$15,046.75
Heating receipts	12,497.85
	$ 2,549.90

Totalized switchboard cost per kilowatt-hour, including interest and depreciation on steam investment, $2,549.90 divided by 541,767 equals 0.47c.

Note.—As their heat customers are heating for only about two-thirds of the previous cost to them when generating with their own apparatus, this company's rate should be 50 per cent higher, with a corresponding increase in revenue.

PLANT NO. 3.

7,224 tons, 399 pounds coal, including water	$22,904.05
Wages in boiler room	2,305.45
Wages in engine room	1,271.65
Oil and waste	568.01
Total	$27,049.16
Add to the above 10 per cent for interest and depreciation on investment of, approximately, $45,000 in steam mains	4,500.00
Total	$31,549.16
Heating receipts	35,053.45
Surplus	$ 3,504.29

Note that after paying all generating charges, also interest and depreciation on investment in steam mains there remained a totalized switchboard surplus per kilowatt-hour of $3,504.29 divided by 1,081,150 equals 0.324c.

PLANT NO. 4.

12,413 tons, 1,136 pounds coal, costing	$15,523.21
Wages in boiler room and hauling coal and ashes	4,432.97
Wages in engine room, including oilers	2,378.86
Water	1,072.39
Oil and waste	370.48
Total	$23,777.91
Add to the above 10 per cent for interest and depreciation on investment of $103,000 in steam mains, etc.	10,300.00
Total	$34,077.91
Heating receipts	25,931.68
	$ 8,146.23

Totalized switchboard cost per kilowatt-hour, including interest and depreciation on steam investment $8,146.23 divided by 2,498,508, equals 0.325c.

Note.—These results being obtained while selling steam for practically 50 per cent of what should be charged and compete with cost of fuel to individual users in that city.

Let us now consider the results secured by companies operating plants which supply no public utility other than steam heat.

PLANT NO. 5.

Season 1908-1909.

Fuel	32,644,166 pounds
Water consumption, all purposes	261,216,438 pounds
Total operating cost, fuel, water, boiler-room labor, including salaries, taxes, repairs, etc.	$34,598.72
Income from sale of steam, maximum rate of 40 cents per 1,000 pounds	57,004.68

This company pays regularly a 6 per cent annual dividend and has created in addition a surplus of approximately $60,000.00, which surplus is equal to 50 per cent of capital stock (no bonds issued).

Space heated	22,811,900 cubic feet

PLANT NO. 6.

Fuel	40,337,248 pounds
Water consumption	302,917,521 pounds
Cost coal hauling, removing ashes, etc.	$27,529.51
Cost of firing, water, boiler-house labor, taxes, salaries and sundries	19,340.50
Income from sale of steam	72,071.16

Net earnings for the past season approximately 14 per cent, which is about the average result of this plant.

Space heated	15,939,907 cubic feet
Plant investment, including real estate	$176,618.67
Capital stock issued (no bonds)	177,000.00

You will note by a comparison of these two live-steam plants, that the latter com-

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pany manufactured over fifty-seven per cent more steam per cubic foot of space heated than the first-named company, and this difference is almost wholly accountable by the fact that one company charges for steam furnished upon the basis of consumption as shown by meter records, while the other company operates entirely under the flat-rate method. Applying the revenue per 1,000 cubic feet of space of the latter company to the space heated by the former, the gross revenue of the first named would then be approximately $103,110, or nearly eighty-one per cent greater than the present income.

Recently, an officer of that company was asked why they did not charge at least a sixty-cent rate, which would not increase the cost of heating beyond a point where the consumers could save money by operating their own plants, and his answer was: "Should we make such an increase in rates, either a new heating company would immediately be formed, and with a more modern and efficient plant compel us to reconstruct under today's standardized and improved methods of construction and insulation in order to compete with them, or force us out of business. As a second condition, our consumers would probably appeal to state authorities for an examination of our affairs to ascertain if such increase in rates was due to a lack of sufficient profit under present rates, and such an examination would show that in all probability we are earning a greater profit than the companies in this city now profitably operating such plants as electric light, street railway, gas or water."

I have chosen the two plants referred to, because they are operated in cities of approximately the same size, in the same state, under the same climatic conditions, and occupy the same class of territory.

I think you will all agree that the results given prove that exhaust-steam heating can be profitable in any city, and that plants furnishing no service other than steam heat are also profitable.

Influencing the degree of success of district steam-heating plants, there are several conditions, viz.: (1) The climatic conditions should be such as to insure a good market for the sale of steam. (2) The generating station should be reasonably adjacent to the districts which it is proposed to serve, simply in order to reduce the investment necessary to reach the business. (3) The local conditions under which steam is sold for heating should be such as will permit fixing a rate, which, while well within economic limits from the standpoint of the consumer, can still be sufficiently high to pay a satisfactory profit on the investment over and above the cost of manufacturing steam, including depreciation and amortization. (4) Efficient management. (5) The meter system of charging. (Measured service.) (6) The total amount of business secured to the total amount procurable. (7) The installation of the plant under standardized methods of construction which have proven efficient through years of actual operating experience, and by reason of which the transmission losses are reduced to a minimum, and depreciation low. An eighth condition should be included for "live-steam plants" operated purely as such, viz.: (8) A suitable and economical boiler plant and equipment.

In any city where a central heating plant is constructed, a sufficient territory must be reached by the underground system to insure a volume of business in which the profit existing between generating cost and selling price does not exceed fixed burden. Where the heat is supplied by exhaust steam a sufficient volume of business should be secured at least to utilize, during minimum-demand heating, the full amount of exhaust steam from any single engine unit. Station piping should be so arranged that any engine can be operated, condensing, non-condensing, or under back-pressure while furnishing steam for heating, without reference to the manner of operating any other engine in the station. This can be accomplished without much additional cost for piping, but is very often neglected, resulting in back-pressure being carried on a portion of the engine plant without compensating advantages. To secure maximum results, the demand for steam for heating should be slightly in excess of the maximum amount of exhaust steam available at all times.

Considerable care should be taken in the design of a proposed underground system of steam mains, and in order properly to determine its cost, gross and net earning power, the average and peak demands, and the probable effects upon present operating conditions, the method of procedure is generally as follows:

A careful examination is made of all the territory, both business and residence, within a distance of from one to one-and-three-quarter miles from the generating station, depending upon local conditions. Manifestly, unfavorable districts are then eliminated; a scaled map is made of the balance of the territory upon which is shown the location and cubic feet of space of each of the buildings contained therein. Upon this map there should also be noted the type of building construction (wood, brick or stone); classification indicated (retail or wholesale business, manufacturing, public building, hotel, boarding house, apartment house, theatre, residence, etc.). Information is also secured from local records, or from the nearest source, covering the maximum, minimum and mean monthly outdoor temperatures, average monthly wind velocity, and average monthly relative humidity. Then with this information collected and using compiled data covering average and peak monthly heat demands in the various classes of buildings to which service has been rendered in other cities having similar climatic conditions, the average, peak and total steam demands in each block can be determined and noted on the map. In this manner the steam demand is calculated for each block from the extreme point of delivery back to the station, resulting in a fairly accurate estimate of quantity of steam that will be required for the heating season, each month and at peak demands. The size of mains from the station and in the various blocks is determined by using tables of carrying capacities of modernly constructed and properly insulated underground steam mains, operated under a maximum initial pressure of five pounds above atmosphere, and transmission drops of one-quarter pound per 1,000 lineal feet of main. As much or as little of the ultimate completed system may then be installed as is deemed desirable for the first year's construction, and these mains will be of proper size to meet the inevitable growth of the plant, without eventually resulting in serious overloading, with its attendant excessive back-pressure, or impaired service.

When available, monthly station records of coal and water consumed in the manufacture of electricity are plotted graphically, the monthly demand for steam is likewise plotted, hourly and monthly electrical output considered, and thus the extra amount of fuel and water required is found. With the known cost of fuel, water, etc., it becomes a simple matter to calculate what will be the increased operating expense. The curve of steam demand at the generating plant is made up of consumers' demand, trans-

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mission losses, and unaccounted-for steam.

The next step is to establish a rate at which the steam is to be sold, and this depends strictly upon local conditions. As a general rule, the average rate per thousand pounds steam sold is approximately ten per cent of the cost to an individual user of a ton of anthracite coal, if that is the kind of fuel generally used. As an example, where anthracite coal is sold to the consumer at $7 per ton, the central-station company should receive an average of seventy cents per thousand pounds of steam, which rate would be slightly in favor of the consumer on a basis of actual heat-unit efficiency. Cumulative sliding-scale rates are usually adopted in order that automatically the larger consumer should pay a lower average price per thousand pounds of steam than the smaller consumer, the justness and reason of which is apparent.

The investment is made up of cost of power-plant connections, street-distributing mains, service mains, trenching and paving, consumers' and street meters and street traps. With these costs known, together with the cost of generating and operating, amount of transmission loss (which is a fixed quantity dependent upon the number of square feet of surface of underground mains), and probable income from the different buildings, the profit which will accrue when serving any given percentage of the total available business in the whole territory or any portion of it, may be estimated within a reasonable degree of accuracy.

It is not necessary nor would it usually be advisable to cover the full amount of territory in the first year's installation, but a sufficient amount should be covered to insure profitable operation.

Another very important factor must also be considered, namely, the additional amount of electrical business that can be secured through your ability to furnish, not only electric light and power, but heat, with the additional profit resulting from such increased electrical sales. A feature of possible greater importance is the fact that with an extensive heating plant operated in connection with electric light and power, you are practically insured against a competing plant being installed, even though the threatened competition may be of hydroelectric nature. I make this statement understandingly. Illustrative of this feature, I will cite the following instance:

In a certain city there existed a company furnishing all the gas and electricity used with the exception of the street-railway load. It had a station equipped with boilers, engines and generators, to be used in emergency times; it had its own hydroelectric plant, but of somewhat limited capacity, and it also had a contract with a nearby hydroelectric company, covering a long term of years, which agreed to furnish any amount of current up to a maximum of 30,000 horsepower, at a price close to 0.25 of a cent per kilowatt-hour, monthly bill being based upon the average of the highest, daily, one-minute peaks occurring during the month, but with no "firm horsepower" restrictions. The company sold current at rates which averaged less than a cent per kilowatt-hour.

In the same city there was a company operating an extensive system of district steam heating, which company installed a thoroughly modern steam-electric generating plant, consisting of well-designed. single-cylinder, four-valve engines, alternating-current generators, etc. Within six months they secured a majority of the commercial lighting business, practically all of the residence electric-lighting load and a fair amount of the smaller and higher-priced power business. This was accomplished without any cutting of rates, but due in a large measure to better and more uniform service, which is always true of a steam-driven electric plant as compared with a hydroelectric plant, with its usual long and extensive high-voltage distribution lines.

The competing companies were consolidated into a third company, with the company first in the electrical field in control of the stock of the consolidated company. An interesting fact now appears. In view of the favorable contract held by the company for the purchase of all the current ever likely to be needed, and with electric demand far in excess of the ability of the steam-generating plant ever to serve and not exhausting to the atmosphere, what method of operation would be adopted? Would the plant be kept for stand-by purposes, shut down as an electric plant, or continued in operation? Without changing any of the conditions the consolidated company continued for six months the operation of the steam-electric plant to determine, for themselves, the manufacturing costs under the combination of generating current and selling exhaust steam. The results were such that they then bought and installed additional steam engines and generators which more than doubled the former capacity, and have since, during heating seasons, operated the generators, not only to their full capacity, but with heavy overloads during peak-demand hours. Even throughout the night hours electricity is manufactured, although current could be supplied from the outside hydroelectric company at no cost to the local or purchasing company—due to the already-mentioned fact that the company purchases current on the one-minute peak basis, and the peak had already occurred, thereby fixing the bill for the twenty-four hours' service, this condition existing on account of the desire to increase the amount of exhaust steam.

More complete details and additional records of results in other cities can be given to companies desiring same.

It may be of interest to learn how transmission losses may be determined. At low points in the system of underground steam mains, at intervals of from 500 to 1,000 feet, depending upon local conditions, street traps are placed in manholes and the condensation discharged through meters. Service connections are always taken from the extreme top of the steam mains, so that practically all of the condensation of steam occurring in the distributing system reaches the traps and is measured by the street meters. This loss in modern system does not exceed the transformer core losses of most electric plants. It may be stated that the percentage of transmission losses and unaccounted-for steam is considerably less than the percentage of transmission, transformer and unaccounted-for losses of electrical distribution.

While it must be recognized that the construction cost of a steam-distributing system greatly exceeds the construction cost of an electrical distribution system, still it is a well-known fact that the average consumer pays many times more for heat than he does for light. The number of hours of steam service is fully thirty per cent greater than the total number of lighting hours of the year, and steam heating has the added advantage of being continuous during the twenty-four hours of each day throughout the heating season.

The rates for steam service supplied by an electric company should be based on the assumption that all steam sold will be manufactured expressly for heating service, and then there would be no question of there being a profit for all steam furnished in excess of the exhaust steam

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utilized. Upon this basis no company need have any fear of contracting for additional heating business, being limited only by the capacity of the generating plant.

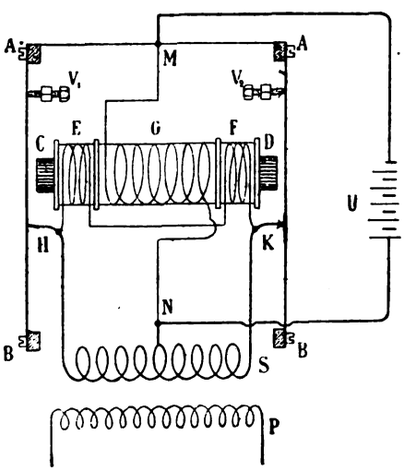
In conclusion, let me call special attention to a few important facts brought out in the foregoing: (1) Experimental period has passed—present development equal to that of other public utilities. (2) Underground construction standardized. (3) Meters developed to a high degree of accuracy. (4) Live-steam heating is profitable. (5) Exhaust-steam heating is more profitable.

Supplying heat from your present electric stations will increase: (1) Value of present investment. (2) Number of boiler-horsepower-hours, and the boiler efficiency. (3) Number of engine-and-generator horsepower-hours, resulting in increased electrical efficiency. (4) Number of heat units actually utilized of the total number manufactured, and very materially so. (5) Load and power-factors. (6) Kilowatt output. (7) Income from electric sales. (8) Income from plant operation. (9) Net earnings. (10) Dividends.

In addition it will improve the position of the company to keep out a competing company and to keep out isolated plants.

Vibratory Alternating-Current Rectifier.

A vibratory alternating-current rectifier capable of operating at all the usual commercial frequencies without previous adjustment has been constructed by A. Soulier. As shown in the diagram herewith, two sheets, A B and A′ B′, are held between two points, so that they can vibrate in the manner of a telephone receiver diaphragm, which follows all the different vibrations of the human voice. In the center each of the sheets carries a contact which, during the vibration, touches a fixed insulated contact, H or K. A soft iron core, C D, magnetized by a solenoid through which flows direct current or rectified current derived from the apparatus, carries at its ends two other magnetizing coils, E F, fed by alternating current from the supply wires. The polarized electromagnet so constituted communicates to the sheets a vibratory movement in synchronism with the alternating current. Two screws, V_1 V_2, serve for adjusting the distance between the sheets and insulated contacts and thus varying the duration of the contact. Normally the sheets do not touch the contacts, but they remain in connection with them for a longer or shorter period when the electromagnet exerts sufficient attraction. At small amplitudes this system vibrates in synchronism with the usual alternating-current frequencies of twenty-five to 100 cycles per second. The rectification of the current is obtained by connecting the two insulated contacts H K to the terminals of the secondary of a transformer S. Each sheet thus comes alternately in contact with one of the poles and transmits one or the other wave. The consuming devices, as accumulators U, are joined on one side to the neutral point N, and on the other M to the two sheets, which are electrically connected. The efficiency of an apparatus of this kind furnishing fifteen amperes at 110 volts is about ninety-four per cent. Three-phase current may also be rectified on this principle by employing three vibrating sheets. —*Abstracted from L'Industrie Electrique, Paris, September 25, 1909.*



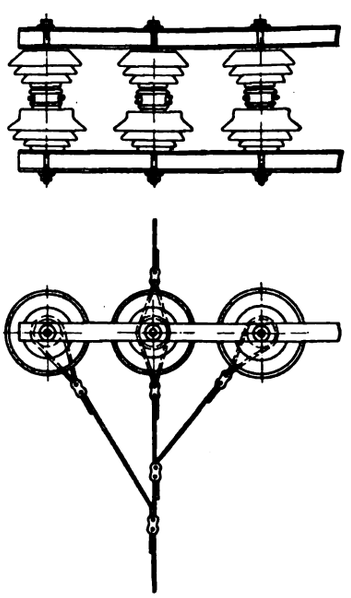
THE SOULIER VIBRATORY ALTERNATING-CURRENT RECTIFIER.

A New Radium Factory.

A new radium factory is in process of being built in Limehouse, London, Eng., whereof the foundation stone was laid on October 16 last by Sir William Ramsey. The factory will be controlled by the British Radium Corporation, and Sir William's own secret process for extracting the precious substance will be used in what is understood to be the first attempt to manufacture radium on a commercial scale. The pitchblende ore from which the radium will be extracted will come from the Trenwith mine, Cornwall, and meanwhile a plant has been erected near the mine at St. Ives, Cornwall, where the rough ore will be crushed and concentrated before being sent to London for final treatment.

Safety Suspension for High-Tension Electric Conductors.

The employment of protective netting below or entirely surrounding high-tension conductors has so far been usually required at the crossings of important streets or roads in Europe. Experience has shown, however, that these protective measures possess many imperfections. An arrangement proposed by Dr. Klingenberg, and recently carried out by the Allgemeine Elektrizitaets Gesellschaft, is illustrated in the accompanying diagrams. If the conductor is fastened to only one insulator and an arc should form between the conductor and the support in consequence of over-tension or breaking of the insulator, the conductor may be fused and fall to the ground. It is therefore carried by three insulators, so that even after the rupture of two insulators the third one will maintain the conductor in nearly unchanged position.



SAFETY SUSPENSION FOR HIGH-TENSION CONDUCTORS.

In order to increase the mechanical strength, either special tension-relieving insulators between two cross-arms are employed, or with ordinary insulators the supports are strengthened. The connection of the two auxiliary wires at the sides with the main conductor is best effected by means of special cable locks, the mechanical strength of which has been previously tested. The overhead crossing of low-tension lines by means of this safety suspension has been permitted by the German Imperial Post Office Department and also by the Minister of Public Works.—*Abstracted from Elektrotechnische Zeitschrift, Berlin, September 23, 1909.*

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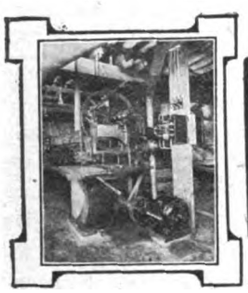
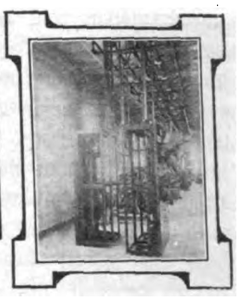


Industrial Power



INSTALLATION, OPERATION, CARE AND REPAIR OF ELECTRIC MOTORS IN INDUSTRIAL OPERATIONS.—III.

BY C. E. DANIELS.

GENERAL INSTRUCTIONS FOR ALTERNATING-CURRENT MOTORS.

Alternating-current induction motors are of the single-phase and polyphase (two-phase and three-phase) types. Single-phase motors are operated on circuits fed by single-phase generators or on the individual phases of polyphase circuits. In the latter case the total motor capacity should be evenly distributed among the several phases, so as to keep the polyphase circuit balanced. A single-phase motor must necessarily have some automatic feature in order to be self-starting, and consequently is more complicated than either a direct-current motor or a polyphase induction motor. However, single-phase motors are now available which are automatically self-starting with load and with no starting devices other than line switches, and which at the same time will run for long periods with almost no trouble nor expense for repairs.

Two-phase induction motors are operated on two-phase four-wire circuits or on two-phase three-wire circuits, both of which can be fed by two-phase generators or by three-phase generators with phase-changing transformers. Transformers may, of course, intervene between the generators and the motors in either case. Two-phase motors should not be operated on two phases of three-phase circuits, except in emergencies. Two-phase three-wire circuits are seldom used on account of liability to unbalancing.

Three-phase motors are operated on circuits fed by three-phase generators, with or without intervening transformers. Three-phase motors should not be operated on two-phase three-wire circuits except in emergencies. In either of the emergency cases just mentioned the efficiencies of the motors are reduced thirty or forty per cent.

All polyphase induction motors, whether two-phase or three-phase, are of two general classes, according to the rotor windings, namely, those having squirrel-cage rotors and those having phase-wound rotors with slip rings. Almost all polyphase induction motors of either class below five horsepower in size can be started by switching them directly on to the circuit with an ordinary knife switch. Fuses should be installed on the line-circuit side of the switch for overload protection.

Squirrel-cage motors larger than five-horsepower capacity should have at least one step of reduced voltage for starting. One step is usually enough, and it is best obtained by means of auto-starters or compensators. These devices consist of auto-transformers, usually two in each case, and switching devices. The switch is so arranged that its first movement connects the auto-transformers to the line and simultaneously connects two phases of the motor primary across portions of the auto-transformers; the second movement disconnects the auto-transformers and simultaneously connects the motor primary to the line.

The starting voltage applied to a squirrel-cage motor should be high enough for the starting torque, but not much in excess. If the voltage is greater than is required, the motor starts too suddenly and the starting current is too high. In such a case the maximum starting current, taken at the instant the starting voltage is applied, depends only on the voltage. This current decreases very promptly to a value proportional to the torque and then continues to decrease more slowly as the speed increases and the required torque decreases. For most practical purposes a starting voltage of sixty-five per cent of the line voltage is enough; but provision is usually made in the starting device for making the starting voltage higher or lower, according to the requirements.

Slip-ring motors larger than five-horsepower capacity are started by first closing the secondary circuit through a resistance

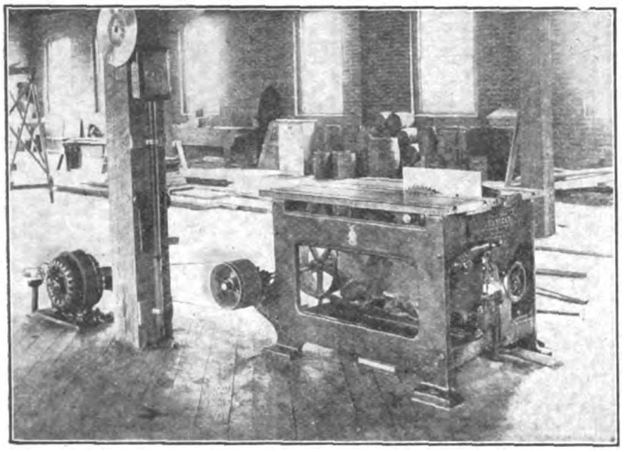


FIG. 14.—1,500-HORSEPOWER VERTICAL MOTOR OPERATING CENTRIFUGAL PUMP.

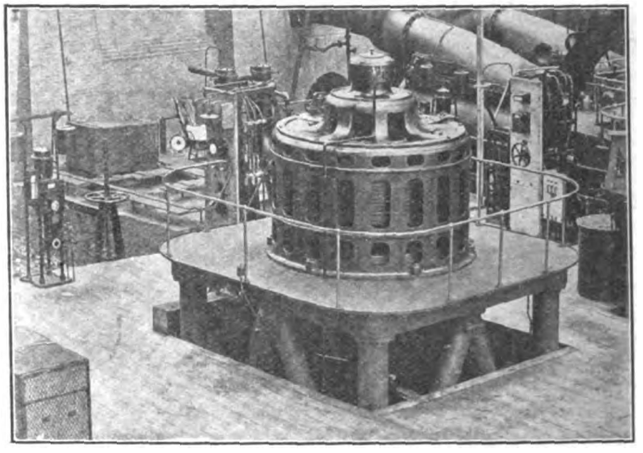


FIG. 15.—FLOOR-MOUNTED ALTERNATING-CURRENT MOTOR BELTED TO COMBINATION SAW.

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and then cutting out this resistance in steps, the process being much the same as in starting direct-current motors. The greater the resistance in the secondary circuit of an induction motor, the greater the slip; hence, the speed of slip-ring motors can be readily controlled by means of variable resistance. This method of speed control gives the same inherent speed regulation as direct-current motors with resistance in the armature circuits, namely, varying speed with varying load. Starters and controllers for slip-ring induction motors are simply rheostatic in principle, although they may assume various forms.

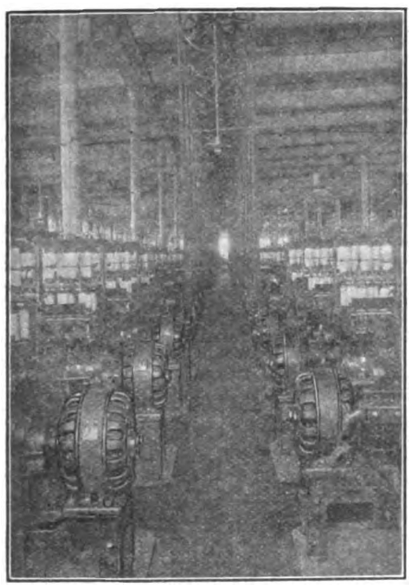

FIG. 16.—ALTERNATING-CURRENT MOTORS DRIVING SPINNING FRAMES.

Reversing.—The method of reversing a single-phase motor depends so much on the design of the motor that no general instructions can be given. To reverse the direction of rotation of a two-phase four-wire motor, the two leads of either phase are interchanged, and on a two-phase three-wire motor the two outside wires are interchanged. To reverse a three-phase motor, the two leads of any phase are interchanged. These changes can be made at the motor terminals, or by a reversing switch at any convenient location.

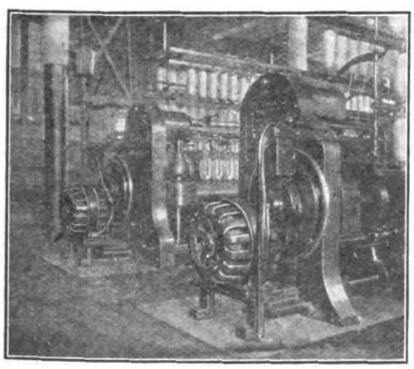

FIG. 18.—ALTERNATING-CURRENT MOTORS DIRECT-CONNECTED TO WOON-SOCKET SPEEDERS.

Voltage and Frequency.—For best results, induction motors should be operated at their normal voltage and frequency. Some variation, however, is almost always allowable, the usual limits specified by most manufacturers being about ten per cent either way from normal. The voltage and frequency should never be varied simultaneously in opposite directions, and ordinarily both should not be varied at the same time to the extreme limits given. With any variation of either the voltage or the frequency from normal conditions the following changes from normal operating characteristics must be expected:

	Power-Factor.	Torque.	Slip.	Full-Load Efficiency.
Voltage high	Dec.	Inc.	Dec.	Approx. same
Voltage low	Inc.	Dec.	Inc.	Approx. same
Frequency high	Inc.	Dec.	Inc.	Approx. same
Frequency low	Dec.	Inc.	Inc.	Approx. same

In general, any change from normal frequency should be accompanied by a change of voltage proportional to the square root of the frequency. For example, a 400-volt sixty-cycle motor on 66 2/3 cycles will give very nearly normal operating characteristics if the voltage is made 422 volts ($=400\times\sqrt{66\ 2/3\div 60}$).

For decreased frequency, however, it is not recommended that motors be operated on less than normal voltage on account of increased current and temperature. The application of the foregoing rule for higher than normal frequency gives on the contrary reduced temperature rise.

Power-Factor.—The actual power in watts taken from the supply circuit by a motor, if measured by a wattmeter, is less than the product of the volts and amperes measured independently. The ratio of the wattmeter reading to the volt-amperes measured independently is the power-factor. Low power-factors are undesirable, as they indicate considerable idle, or wattless, current in the generators, lines and transformers, resulting in unnecessary heating.

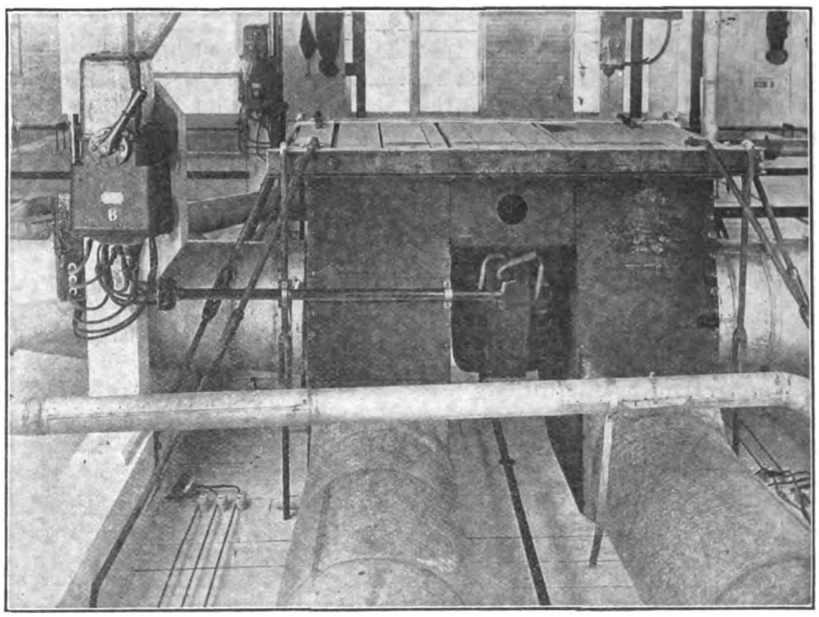

FIG. 17.—ALTERNATING-CURRENT MOTOR DIRECT-CONNECTED TO BLOWERS FOR DUST AND SHAVINGS CONVEYOR.

Slip.—At no load an induction motor runs at practically synchronous speed; with a load the motor speed is below synchronous speed by a percentage known as the slip. That is, if the synchronous speed is 1,800 revolutions per minute and the full-load speed 1,700 revolutions, the slip at full load is 5.5 per cent. The slip of any induction motor depends on the voltage drop in the secondary cir-

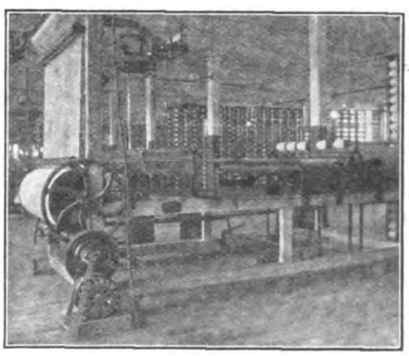

FIG. 19.—ALTERNATING-CURRENT MOTOR DIRECT-CONNECTED TO WARPER IN TEXTILE MILL.

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cuit, *i. e.*, on the product of the secondary resistance and current. The greater the secondary resistance, the higher the starting torque with a given current, the greater the slip, and the greater also are the losses and the lower the efficiency.

Efficiency.—The losses in an induction motor are: (1) Primary iron loss—constant at all loads if the electromotive-force is constant. (2) Primary copper loss, consisting of an approximately constant loss, due to the wattless magnetizing current and a loss varying with the square of the load. (3) Secondary copper loss, which corresponds to the percentage slip, *i. e.*, if the slip is 5.5 per cent, the secondary copper loss is the same. (4) Other losses, consisting of secondary iron loss, which is usually very small, and friction of bearings and air.

[*To be continued.*]

Curing Ham by Electricity.

Ham curing by electricity was discussed by the American Meat Packers' Association, on October 18 last, at its third annual convention at the Hotel La Salle and was declared to be practicable. The idea of applying the cure to meat originated in Ohio and is said to have been in practical operation for over three years on a small scale as a commercial process. The electric curing was hailed as a possible means of reducing the cost of making ham and bacon.

The most remarkable thing about electrically cured meat was said to be its keeping qualities, J. C. Lincoln, of Cleveland, declaring in a paper that:

"Two or three years ago, as an experiment, several pieces of electric-cured bacon were put into an open box, protected by wire netting, about one-half-inch mesh, to keep out mice and rats, but large enough to allow insects to enter, and shipped to Vera Cruz, Mexico. This point was selected particularly because Vera Cruz is about as hot and damp as any point in the Western hemisphere. The meat, of course, was inspected by the government inspector before shipment, and inspected by him upon its return to Cincinnati, and pronounced perfect. In fact, a piece of this same bacon is on exhibition. It is three-and-one-half years old and shows no sign of decomposition."

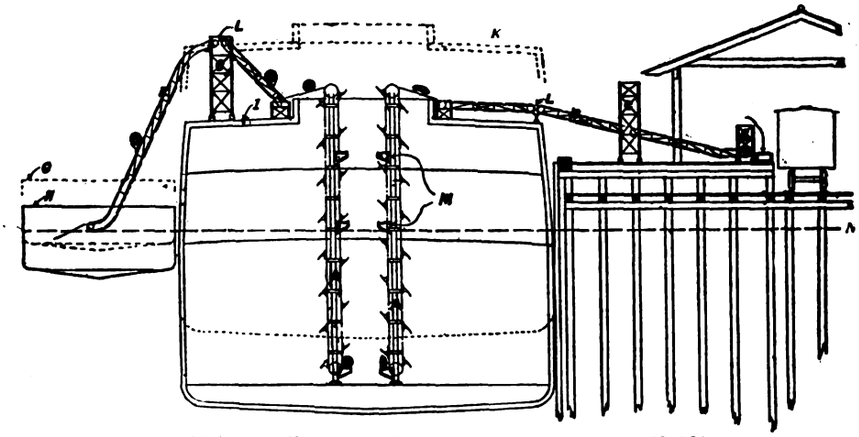
The method employed in an electric curing is only slightly different from the ordinary curing process. The meat is placed in large vats, filled with a pickle of sugar, salt and saltpeter, and an electric current is then passed through.

A Motor-Driven Cement Unloader.

The Panama Railroad Company has recently contracted for a motor-driven cement unloader to be installed at Cristobal, Canal Zone, to facilitate the unloading of cement from the ships arriving at that port. There are about 4,000,000 barrels, or over 800 tons, of cement yet to be imported at Cristobal, for use in constructing the Panama Canal locks and for other work.

The vessels employed in the cement-carrying business in this connection are the twin steamships *Ancon* and *Cristobal*, each of 10,000 tons capacity, the cargoes being usually divided about equally between cement and general freight. Each ship makes one round trip a month between New York and Cristobal.

The following description of the unloader, and the accompanying diagram, are taken from a recent issue of *The Canal Record*, which is published weekly at Ancon, C. Z.



MOTOR-DRIVEN CEMENT UNLOADER FOR PANAMA.

The diagram shows the arrangement of a conveyor unit for bags and one for barrels. The unit for bags is composed of three parts: (1) A vertical elevator (*A*, in illustration) for raising the bags of cement from the hold to the deck of the ship, consisting of a vertical shaft on which revolves an endless chain of brackets; (2) a portable apron conveyor (*B*) at right angles to the ship, built in sections twenty feet long, which conveys the bags from the deck of the ship to the pier, and which has two towers (*C*) for adjusting the aprons as the vessel lightens and rises in being unloaded, there being a difference of twelve feet between loaded and empty drafts; (3) a stationary apron conveyor (*F*), built lengthwise on the pier, which delivers the bags to any point along the railroad track.

The conveyor unit for barrels is composed of two parts: (1) A vertical elevator, the same as in the unit for bags; (2) a barrel lowerer (*E*), with an adjusting tower, which conveys the barrel of cement from the deck of the ship into the hold of the barge alongside. In the diagram, (*G*) shows the position of the barge when empty, (*H*) when it is loaded; (*I*) and (*K*) the positions of the ship when loaded and empty, respectively; (*L*) is a universal joint and coupling; (*M*), the loading stationary brackets, and (*N*) the surface of the water.

Hand labor will be required at three points only with the conveyor system, viz., in placing the bags, or barrels of cement in position on stationary brackets, located on each of the three decks of the hold, so that the brackets on the vertical elevator can raise them; on the pier, in transferring the bags from the stationary conveyor to the freight cars, and in the hold of the barge, in removing the barrels from the lowerer and stowing them away.

Each vertical elevator in the conveyor system will be operated by a ten-horsepower electric motor, each barrel lowerer by a five-horsepower motor, each complete portable apron conveyor by a three-horsepower motor, and each section of the stationary apron conveyor on the pier by a 7.5-horsepower motor, making a total of 20.5 horsepower for each bag conveyor unit, and fifteen horsepower for each barrel conveyor unit. All motors will be totally enclosed and will be dust and moistureproof. Electricity for the motors will be supplied from the power house of the Gatun handling plant.

It is expected that one complete unit of the conveyor system will be in operation by December 1, and that at least two units a month will be completed and in operation thereafter until finished.

The contract for the unloader was awarded to the Alvey-Ferguson Company, of Louisville, Ky.

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POWER ON THREE-PHASE CIRCUITS WITH UNITY POWER-FACTOR.—(1) If a three-phase circuit having unity power-factor and Δ connection has placed an ammeter in one of the mains and a voltmeter between two of the three wires, does the product of the volts and amperes give the watts on the corresponding phase, or is this product to be multiplied by $\sqrt{3}$? (2) With a four-wire Y-connected three-phase circuit and a voltmeter connected between one of the three main wires and the neutral wire and the ammeter in one of the three mains, does the product of the volts and amperes and $\sqrt{3}$ give the watts on that phase? (3) If a voltmeter were connected between two of the main wires, what would the watts be?—G. W. H., Bismarck, N. D.

In all these answers it is assumed that power factor is unity. In case (1) the product of volts and amperes divided by $\sqrt{3}$ gives the watts consumed in one phase of the receiving circuit. With a four-wire Y-connected circuit, in case (2), the product of the volts and amperes will give the watts on any phase between neutral and one of the main wires. In case (3), with a similar circuit and a voltmeter connected between two of the three main wires, the watts taken by the circuit connected between these two wires would equal the product of the volts and amperes divided by $\sqrt{3}$. Assuming the circuits to be completely balanced, the total power received in the latter case would equal the product of the current in any of the main wires multiplied by the voltage between two of them and by the $\sqrt{3}$, that is, it is three times the power consumed in each phase. In case the power-factor is not unity, then in each of the cases cited, the products must be further multiplied by the value of the power-factor.

REVERSING MOTOR.—Recently, while running our generator with a forty-horse-power gasoline engine, we left it for about two hours, everything being in good running order. On coming back we found everything running all right, but one of our customers claims that his motor started to run backward in the meantime. We feel sure that our engine never came to a dead stop, or else it would not have been running on our return. It might have missed and slowed down and then picked up again. What could have caused the motor to run backward? On shutting down the power and starting up again the motor ran in the proper direction.—J. H. S., Elgin, Ill.

The only thing that could have made the motor reverse, if it was a direct-current shunt, series or compound motor, or an alternating-current motor, would be a reversal of either the field or armature circuit, or one of the phases. This means that someone must have tampered with the machine or intentionally reversed it in the manner referred to. The stoppage of the engine should have had no result other than stopping the motor. Even if the engine had been reversed so that the polarity of the generator was changed, it would have reversed the current in both the field and armature circuits of the motor, which does not reverse its direction of rotation.

ELECTROLYSIS OF WATER - SERVICE PIPES.—We are having trouble with electrolysis on the cross-service pipes where they pass under the electric-railway tracks. It has occurred to me to connect these service pipes to the rails and thereby form a direct metallic path for the current, but I am not able to tell what effect this might have on the large water mains nor whether it will overcome the trouble. Kindly give me some information on this subject.—W. D. E., West Milton, Ohio.

The subject of electrolysis of underground pipes and cables has been studied quite extensively, and the causes therefor and the most effective remedies are generally quite well known. The exact remedy to be applied in every instance depends somewhat, however, upon the topography of the town and the layout of both the underground systems and the railway tracks, as well as the location of the power houses. It is well known that if the underground piping or cable systems afford a better or more direct path for the return trolley current to the power house the current will leave the rails and follow the underground path. The mere passage of a current through any pipe or lead cable does not deteriorate it whatever, but if this path is discontinuous, as, for instance, at joints in piping where current passes through the ground around the joint, it is found that where the current has left the pipe, corrosion is noticeable. Similarly in the neighborhood of the power house, where the current leaves the underground piping to return to the negative side of the generator circuit, the corrosion is apt to be very marked. The general remedy for elimination of electrolytic corrosion is: (1) To thoroughly bond the rails of the traction system so as to make them a perfect return path for the current; (2) to connect any underground piping or other metallic structures in the neighborhood of the power house by means of heavy copper cables with the negative busbar in the power house. The latter provision is so as to insure that any current which may have entered the underground pipes may reach the negative side of the circuit. In the particular instance of corrosion noticed on the cross-service pipes where they pass under the railway tracks it is probable that at some remote point the current has entered the piping system and is leaving it to return to the tracks at the point in question. Therefore, the connection of the pipes at this point with the tracks should be of considerable value, at any rate in stopping the corrosion at that point. Without an exact knowledge of the layout of the piping and railway system, it is impossible to say whether such a connection may not bring about trouble at some other point, by affording a better path for current to follow.

INSULATION OF PLIERS.—How can I insulate a pair of pliers with hard rubber or mica?—L. J. M., Chicago.

If the pliers are provided with straight handles it may be a comparatively simple matter to slip a piece of hard-rubber tubing upon the handles and tape them in place. If the handle is curved or of odd shape, it will be necessary to provide a specially shaped piece of hard rubber to fit, or to mold rubber upon the handle and then vulcanize it. Ordinary mica sheets cannot very easily be applied to handles of pliers on account of the difficulty of keeping them in place. There is obtainable in the market now a grade of pulverized mica which can be combined with a cement and applied to the pliers so as to form a fairly thick and durable coating.

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Statement of the New York, New Haven & Hartford Railroad Company.

The general statement of the affairs of the New York, New Haven & Hartford Railroad Company for the thirty-eighth fiscal year ended June 30, 1909, has recently been issued.

In accordance with the by-laws of the company, the board of directors have caused to be prepared a statement of its affairs as follows:

FOR TWELVE MONTHS, JULY 1, 1908, TO JUNE 30, 1909, INCLUSIVE.

Operating revenue:		
Freight revenue	$26,595,969.67	
Passenger revenue	22,852,741.77	
All other revenue from transportation	3,713,867.46	
Revenue from operations other than transportation	1,185,052.07	
Total operating revenue		$54,347,630.97
Operating expenses:		
Maintenance of way and structures	$ 6,130,606.46	
Maintenance of equipment	5,906,356.68	
Traffic expenses	308,999.73	
Transportation expenses	22,491,376.16	
General expenses	1,242,967.51	
*Total operating expenses		36,080,306.54
Net operating revenue		$18,267,324.43
Net revenue from outside operations	$ 1,214,306.52	
Net earnings, The Connecticut Co.	3,644,314.86	
Total		4,858,621.38
Total net revenue		$23,125,945.81
Taxes		3,446,125.98
		$19,679,819.83
Income from other sources:		
Dividends on stocks	$ 1,959,333.14	
Interest on bonds	674,432.55	
Miscellaneous income	1,609,581.25	
Rents received	350,141.94	
Total income from other sources		4,593,488.88
Total income		$24,273,308.71
Deductions from income:		
Interest on bonds, debentures and other liabilities	$10,424,931.76	
Rentals and leased lines	3,956,293.81	
Rentals other than above	1,978,281.31	
Hire of equipment	460,430.13	
Miscellaneous	23,142.72	
Total deductions from income		16,843,079.73
Net income		$ 7,430,228.98
Dividends Nos. 116 to 119, inclusive, 2 per cent each		7,883,842.00
Deficit		$ 453,613.02

*The operating expenses and taxes were 72.73 per cent of the total operating revenue.

The six-track construction of the Harlem River & Port Chester Railroad has been continued, and ninety per cent of the total work has been completed. The installation of an automatic signal system is now under way, and will be completed on or about January 1, 1910.

The electrification of the New Canaan branch has been completed, and trains have been operating electrically over this branch during the past year. Work is now in progress at Glenbrook, Conn., on the erection of approximately one mile of four and six-track catenary construction, beginning at the easterly terminus of the present overhead construction, a short distance east of Stamford. Contract has been awarded for two electric freight locomotives. This work is for experimental purposes to determine future standards in connection with a proposed extension of our electric service.

By a decree of the Supreme Judicial Court of the Commonwealth of Massachusetts of May, 1908, in the suit of the Attorney-General against the New York, New Haven & Hartford Railroad Company, the company was enjoined from holding directly or indirectly the stock of any Massachusetts street railway after July 1, 1909. In consequence of this decree it became necessary to sell the stocks and indebtedness of the Worcester & Webster Street Railway Company and of the Webster & Dudley Street Railway Company, which came into the treasury of your company through the merger with the Consolidated Railway Company of May 31, 1907, thus closing out the last financial interest of the company in Massachusetts street railways. The only interest not eliminated is the indorsement upon the shares of the Springfield Railway Companies and the New England Investment and Security Company. These indorsements under decrees of the courts thus far rendered, we must apparently continue until the liquidation of the trusts they represent, but the earnings of the properties owned by both trusts seem to be ample to enable them to meet all obligations without calling upon the company to make any payments under the terms of its guaranty. The obligation may therefore be considered more a nominal than a material one.

By reason of the substitution of electric motive power for steam within the limits of the city of New York, required by law, and the need for larger facilities at the Grand Central Terminal, involving the expenditure of a large amount of money, it was deemed advisable to join with the New York Central & Hudson River Railroad Company in a new agreement for the use and occupancy of the terminal. This agreement is now in effect, and, while it entails an additional expense to the company for its use of the terminal, it is recognized as a natural sequence to legal requirements and the changed conditions.

The General Court of the commonwealth of Massachusetts, at its 1909 session, authorized the incorporation of the Boston Railroad Holding Company for the sole purpose of acquiring and holding the whole or any part of the capital stock, bonds and other evidences of indebtedness of the Boston & Maine Railroad and of voting on all certificates of stock so acquired and held, and of receiving and collecting dividends and interest upon said stock, bonds and other evidences of indebtedness.

Under the authority of this act the Boston Railroad Holding Company has organized and entered into contracts for the purchase of the large block of Boston & Maine Railroad stock representing a substantial control of the outstanding stock of that company, which was formerly acquired in the interest of the New York, New Haven & Hartford, and the directors have entered into agreements to purchase all the stock and bonds of the Boston Railroad Holding Company that will be issued for payment of the same.

The result of this transaction will be to give the company an indirect control of a stock interest in the Boston & Maine Railroad through the ownership of all the outstanding capital of the Boston Railroad Holding Company.

This very satisfactory conclusion of the controversies which grew out of the purchase by the New England Navigation Company of a large stock interest in the Boston & Maine Railroad about two years ago, is anticipated by the directors to be of large advantage to the company in the building up of a distinctively New England Railroad system devoted to the interests of that section, securing more advantageous arrangements with connecting lines and a more economical administration of the properties when run in a common interest than has resulted heretofore. Much will have to be done before the estimated results will be realized, but that immediate improvement in the business of both companies will result is confidently anticipated.

Telephone Opportunities in Latin America.

A report has been received from an American legation in a Latin-American country stating that a local telephone company has been authorized to construct a local and long-distance telephone system, connecting all important points in the country. Particulars about the decree can be obtained by interested firms upon application to File No. 3995, at the Bureau of Manufactures, Washington, D. C.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

LAKE SHORE ELECTRIC.

The report of the Lake Shore Electric Railroad Company for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$108,206	$104,072
Expenses and taxes	49,842	49,648
September net	$ 58,364	$ 54,424
Interest	34,804	34,012
September surplus	$ 23,560	$ 20,412
Nine months gross	835,061	787,209
Expenses and taxes	439,691	439,497
Nine months net	$395,370	$347,711
Interest	309,093	287,719
Nine months surplus	$ 86,277	$ 59,992

YONKERS RAILROAD.

The New York Public Service Commission has issued a report covering the operations of the Yonkers Railroad Company for the year ended June 30, 1909, as follows:

Operating revenue	$487,552
Operating expenses	489,241
Net deficit	$ 1,689
Taxes accrued	25,751
Operating deficit	$ 27,440
Other income	509
Total deficit	$ 26,931
Interest charges	52,737
Net corporate deficit	$ 79,668
Previous deficit (company's books)	344,827
Previous deficit (receiver's books)	16,269
Deficit, June 30, 1909	$440,764

BIRMINGHAM RAILWAY, LIGHT AND POWER.

The report of the Birmingham Railway, Light and Power Company for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$ 188,364	$ 177,388
Expenses	105,753	107,566
September net	$ 82,611	$ 69,822
Nine months gross	1,646,825	1,581,763
Expenses	917,679	928,148
Nine months net	$ 729,146	$ 653,615

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$ 645,197	$ 583,876
Expenses	270,035	276,588
September net	$ 375,162	$ 307,287
Charges, taxes and preferred dividends	140,250	138,666
September surplus	$ 234,911	$ 168,621
Nine months gross	5,176,419	4,765,801
Expenses	2,432,567	2,372,024
Nine months net	$2,743,852	$2,393,776
Charges, taxes and preferred dividends	1,248,510	1,145,122
Surplus	$1,495,342	$1,248,654

JAMESTOWN STREET RAILWAY.

The report of the Jamestown (N. Y.) Street Railway Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total operating revenue	$ 52,194	$ 45,589
Total operating expenses	28,503	28,939
Net operating revenue	$ 23,690	$ 16,650
Taxes accrued	1,454	1,403
Gross income	$ 22,236	$ 15,246
Total deduction from gross income	15,956	14,729
Net corporate income	$ 6,280	$ 517

BINGHAMTON RAILWAY COMPANY.

The report of the Binghamton (N. Y.) Railway Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total operating revenue	$ 84,837	$ 80,255
Total operating expenses and taxes	55,898	46,944
Net	$ 28,939	$ 33,311
Charges	23,040	23,396
Surplus	$ 5,899	$ 9,914

PACIFIC TELEPHONE AND TELEGRAPH.

The report of the Pacific Telephone and Telegraph Company for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$1,045,832	.....
Expenses	724,600	.....
September net	$ 321,232	.....
Interest charges	104,051	.....
September surplus	$ 217,181	.....
Nine months gross	9,002,289	$7,738,528
Expenses	6,293,153	5,727,001
Nine months net	$2,709,136	$2,011,527
Interest charges	946,920	754,742
Nine months surplus	$1,762,216	$1,256,785

DETROIT UNITED RAILWAY COMPANY.

The report of the Detroit United Railway Company for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$ 751,818	$ 668,489
Expenses	477,850	423,136
September net	$ 273,968	$ 245,353
Other income	11,762	5,028
Total income	$ 285,730	$ 250,381
Charges, taxes, etc.	158,124	135,049
September surplus	$ 127,606	$ 115,332
Nine months gross	5,963,431	5,324,855
Expenses and taxes	3,702,532	3,395,252
Nine months net	$2,260,899	$1,929,603
Other income	108,205	45,055
Total income	$2,369,104	$1,974,658
Charges, taxes, etc.	1,409,507	1,218,860
Nine months surplus	$ 959,597	$ 755,798

PACIFIC TELEPHONE AND TELEGRAPH.

For the nine months ended September 30, the net earnings of the Pacific Telephone and Telegraph Company show an increase of $697,609 over the corresponding period of 1908. The net earnings were $2,709,136. The gross earnings for the nine months were $9,002,289, with expenses of $6,293,153, an increase in expenses of $566,152 over last year. The surplus is placed at $1,762,216, showing an increase of $505,431.

There has been a steady increase in earnings during the nine months. At the end of the fiscal year 1908 there was a balance of $559,327 available for dividends on the common stock, or 3.1 per cent on the $18,000,000 outstanding, after deducting $1,080,000 payable in dividends on the preferred.

The surplus available for common dividends at the end of nine months was at the rate of seven per cent per annum, but the net earnings for August alone were at the rate of almost eleven per cent on the common stock, and it was this increase that probably gave rise to the report that a dividend would be declared, which report was declared without foundation by President Scott.

Preferred dividend requirements for the nine months ended September were $952,216.

AMERICAN CITIES RAILWAY AND LIGHT.

The American Cities Railway and Light Company reports the combined earnings of its operating companies, for the month of September and nine months ended September 30, 1909, compared as follows:

	1909.	1908.
September gross	$ 488,795	$ 458,218
Expenses and taxes	287,470	276,210
September net	$ 201,324	$ 182,007
Interest and sinking fund	106,724	105,456
Surplus	$ 94,601	$ 76,551
American Cities proportion of surplus on basis of stock ownership	$ 83,661	$ 67,654
American Cities preferred dividend	34,530	34,530
Balance applicable to stock and reserves	$ 49,131	$ 33,124
Equivalent on American Cities outstanding stock to	5.48%	3.69%
Nine months gross	$4,226,102	$3,987,293
Expenses and taxes	2,454,247	2,407,989
Nine months net	$1,771,855	$1,579,304
Interest on sinking fund	956,361	938,225
Surplus	$ 815,493	$ 641,079
American Cities proportion of surplus on basis stock	720,640	561,623
American Cities preferred dividend	310,774	310,774
Balance applicable to stock and reserves	$ 409,865	$ 250,848
Equivalent on American Cities outstanding common stock to	5.08%	3.10%

SYRACUSE & SUBURBAN.

The report of the Syracuse & Suburban Railroad Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total operating revenues	$30,599	$30,209
Total operating and taxes	24,062	14,964
Net operating revenues	$ 6,536	$15,244
Other income	83	406
Gross income	$ 6,620	$15,651
Total deductions from gross inc.	7,235	7,309
Net corporate income	*$ 614	$ 8,341

*Deficit.

DRY DOCK, EAST BROADWAY & BATTERY.

The New York Public Service Commission has issued a report covering operations of the Dry Dock, East Broadway &

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Battery Railroad Company, receiver for the year ended June 30, 1909, as follows:

Total operating revenue	$629,680
Operating expenses	444,729
Net operating revenue	$184,950
Taxes accrued	25,613
Operating income	$159,337
Interest charges	66,930
Net corporate income	$ 92,407
Previous surplus	14,227
Additions, adjustments, prior period	13,836
Total surplus	$120,470
Taxes prior period	2,079
Surplus June 30, 1909	$118,391

TOLEDO RAILWAYS AND LIGHT.

The report of the Toledo Railways and Light Company for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$ 217,737	$ 222,892
Expenses	121,779	111,900
September net	$ 95,958	$ 110,992
Other income	358	61
Total income	$ 96,316	$ 111,053
Charges and taxes	75,483	71,976
September surplus	$ 20,833	$ 39,077
Nine months gross	1,981,435	1,864,822
Expenses	1,134,049	1,019,823
Nine months net	$ 847,386	$ 844,999
Other income	2,198	3,072
Total income	$ 849,584	$ 848,071
Charges and taxes	652,202	635,743
Nine months surplus	$ 197,382	$ 212,328

AMERICAN LIGHT AND TRACTION.

The American Light and Traction Company's surplus and earnings account, for the twelve months ended September 30, 1909, compares as follows:

	1909.	1908.
Net earnings (12 months)	$3,089,190	$2,579,266
Preferred dividend	854,172	854,172
Common dividend	740,353	446,886
Common dividend stock	1,056,010	.....
Balance	$ 438,655	$1,278,208
Previous surplus and construction reserve	4,992,027	3,905,819
Bal. surplus, Sept. 30, '09.	*$5,430,682	$5,184,027

*Includes reconstruction reserve fund, which amounted to $2,355,000 on September 30, 1909.

NORTHWESTERN ELEVATED.

The Northwestern Elevated Railroad Company's report for the year ended June 30, 1909, compares as follows:

	1909.	1908.
Gross	$2,540,883	$2,463,188
Expenses	995,818	965,118
Net	$1,545,064	$1,498,070
Charges, taxes, etc	1,189,288	1,147,183
Surplus	$ 355,776	$ 350,887
Earnings on $5,000,000 preferred stock, per cent	7.1	7.0

The earnings, expense in detail and the principal statistics compare as follows:

GROSS EARNINGS.

	1909.	1908.
Main line	$1,913,515	$1,857,553
Other earnings, including loop dividends	627,368	605,434
Total	$2,540,883	$2,463,187

OPERATING EXPENSES.

Maintenance of way	$ 45,037	$ 40,114
Maintenance of equipment	147,045	130,381
Transportation	699,843	693,759
General and legal	103,893	100,861
Total	$ 995,818	$ 965,116
Passengers carried		37,419,286
Daily average		102,238

The Northwestern Elevated's daily average passengers were 112,207, or 9.75 per cent increase. President Starring says the worst of the competition from traction rehabilitation has passed. Increased expenses were caused by opening new lines and higher taxes and one costly accident, also a more liberal maintenance. Evanston line territory is developing rapidly. The company has received from the Central Trust Company, New York, $334,000 first-mortgage bonds of the Union Elevated Railroad Company, which are now in this company's treasury. Stocks of Chicago & Oak Park Elevated Railway Company, obtained pursuant to plan of reorganization, and the Lake Street Elevated Railroad Company have recently been delivered to this company and are included in item "stocks and bonds." Company's floating debt was reduced by proceeds of sale of $3,000,000 bonds heretofore authorized, which have been sold and delivered.

It is the expectation of the management that the earnings will warrant a continuance of dividends upon the preferred stock, and that the maximum rate provided therefore will be ultimately attained.

THIRD AVENUE SURPLUS $1,265,132.

The New York Public Service Commission has given out the reports of the companies in the Third Avenue Railroad system for the fiscal year ended June 30, 1909. The reports showed surplus on the entire system after payment of operating expenses, taxes, and of the $769,157 interest charges still in force, of $1,265,132.

This is reached without providing for either the old rental on the Third Avenue stock or the interest on its $37,560,000 of general mortgage bonds, which are in default. The figure compares closely with the estimates submitted to the Public Service Commission when the reorganization plan now turned down was before the commission last June.

The gross earnings on the Third Avenue system were $6,975,362, and its net income, after deducting operating expenses and taxes and taking in miscellaneous income, $2,034,278. Interest charges amounted to $769,157, and after miscellaneous and other charges and allowances of a minor nature, the surplus stood at $1,265,132 for the year.

At present the Third Avenue Road proper reports a total surplus of $885,525, the Dry Dock Road a surplus of $118,390, the Forty-second Street, Manhattanville & St. Nicholas Avenue Road a surplus of $373,693, and the Union Railway a surplus of $360,687—these surpluses making no allowance for securities in default. The Southern Boulevard Company has a deficit of $79,371, the Yonkers Railway a deficit of $440,764, and the Westchester Electric Railway a deficit of $738,448.

GENERAL ELECTRIC.

Gross sales of General Electric for October will show a total of slightly less than $4,750,000, or at the rate of $57,000,000 per annum, which is the highest ratio of sales for any single month since the current fiscal year began February 1. General Electric sales have shown a decidedly creeping tendency for the past few months. There has been a slight gain, but the big jumps that came in the earlier months of the spring are not now being recorded. In fact, for the last four months the increase in new orders booked has not been over three per cent. For the full fiscal nine months, however, the gain has been thirty-five per cent.

The General Electric Company continues to show an improvement in business and its orders are running about eighty-five per cent of what they were in the best year since the company was organized. Although sharp competition has narrowed the margin of profit on certain electrical apparatus, the showing of the company for the current fiscal year will be much more favorable than in the preceding year. A substantial surplus after the payment of the eight per cent dividend will be shown.

The General Electric Company has been spending millions of dollars for the purpose of remodeling and systematizing its plants, and the result has been a very material reduction of operating costs. Besides, the company has under construction work that will add several hundred thousand square feet to its floor space.

MASSACHUSETTS ELECTRIC COMPANIES.

The Massachusetts Electric Companies has issued its statement for the quarter ended September 30, 1909. It compares as follows:

	1909.	1908.
Gross	$2,626,388	$2,483,710
Expenses	1,289,727	1,341,817
Net	$1,336,661	$1,141,893
Charges and taxes	432,058	417,493
Surplus	$ 904,603	$ 724,400

The Massachusetts Electric Companies' fiscal year ends September 30. The following are the figures for the twelve months ending September 30, compared with those for the preceding year:

	1909.	1908.
Gross	$8,052,355	$7,809,010
Expenses	5,148,396	5,001,517
Net	$2,903,958	$2,807,492
Charges and taxes	1,778,129	1,784,437
Surplus	$1,125,829	$1,023,054

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AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing is always interesting. "Actualities," the actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

HOLMES BROS., Indianapolis, Ind., have been awarded a contract for the installation of a new electric-light plant at Pendleton, Ind. S.

THE WESTINGHOUSE ELECTRIC COMPANY, Pittsburg, Pa., has secured the contract for the electrical equipment of the electric-light plant at Bear Creek, Mont., from N. S. Poole. Work on construction will be commenced at once.

THE BATES MACHINE COMPANY, Joliet, Ill., has secured the contract for the installation of a Corliss heavy-duty engine, sixty-six by thirty-six, at Le Sueur, Minn.

THE MINNEAPOLIS ELECTRIC MOTOR COMPANY, Minneapolis, Minn., has secured the contracts for the following: Jonas F. Brown & Co., building at 19 Washington Avenue North, wiring and furnishing a complete line of Tungstolier fixtures; T. H. Bastian, building corner Eighth and Hennepin, wiring for offices on second floor; Crystal Theater; Greek Church, Tenth Avenue South and Lake Street; all in Minneapolis.

THE NASHWAUK ELECTRICAL COMPANY, Duluth, Minn., has secured the contract for wiring the houses recently erected by the Oliver Iron Mining Company at its new mine, the Mississippi, near Keewatin. The Oliver Iron Mining Company has eleven houses completed at the new location and more are under course of construction.

W. S. BARSTOW & COMPANY, New York, N. Y., reports the building of a transmission and distributing system for the Delaware County Electric Company in Delaware County, Pa. The contract amounts to about $200,000 and will be expended entirely upon pole line, substations and such equipment. The current for the company will be purchased from the Philadelphia Electric Company. This work is well in hand, but there is considerable material yet to be purchased.

THE MIDLAND ELECTRIC COMPANY, Des Moines, Ia., was recently awarded the contract for wiring the Merchants' Transfer Building.

THE DES MOINES ELECTRIC CONTRACTING COMPANY, Des Moines, Ia., has been awarded the contracts for wiring the Methodist Hospital and installing a special signal service system throughout the entire building. The same firm has also secured the contract to do all of the electrical work in the new Des Moines Edison intake.

R. WILLIAMSON & COMPANY, Chicago, Ill., have been successful in their bid for installing light fixtures at Cape Girardeau, Mo.

THE RICHARDSON ELECTRIC COMPANY, Duluth, Minn., has secured the contract for furnishing an engine and generator to the City Counciil of Svashwauk, Minn.

THE MOUNTAIN TELEPHONE COMPANY will extend its lines to Topton, Lyons, Bowers and Kutztown. The contract for poles was awarded to Ed. De Long and the contract for the electric supplies was given to the Western Electric Company. The exchange for the new line will be located at Mertztown.

THE DES MOINES ELECTRIC CONTRACTING COMPANY, Des Moines, Iowa, in competition with firms of Chicago and St. Louis, has been awarded the contracts for wiring the Methodist Hospital and the addition to the Des Moines Electric Company's plant.

THE NATIONAL COMPANY, South Bend, Ind., has secured the contract for the construction of an electric-light and waterworks plant at Valley, Neb.

THE TAYLOR COMPANY, New York, has recently received a contract for all of the engineering of the American Central Railroad of Texas—some 500 miles in length—and will start some ten corps of engineers to work at once, expecting to finish about January 1, 1910. The Taylor Company has recently leased a large suite of offices in the Hudson Terminal Building, 30 Church Street, New York.

THE SYLVESTER ENGINEERING COMPANY, Spokane, Wash., has been awarded a contract for the construction of the waterpower electric plant to be put in at the cement works of the Lehigh Valley Cement Company at Metaline, Wash. A forty-foot dam will be built at the outlet of Sullivan Lake and another dam will be built on Sullivan Creek some miles further up.

THE IDEAL ELECTRIC AND MANUFACTURING COMPANY, of Mansfield, Ohio, is installing individual electric-motor drive in the new mill of the Mansfield Elastic Web Company. The equipment consists of seventy motors for individual drive on elastic-web looms; three 400-ampere, alternating-current, motor-driven, low-voltage generators for electroplating service, and one 2,500-ampere and two 1,500-ampere similar dynamos. The company also has orders for two 250-kilowatt belted alternators for the Buckeye Mining and Smelting Company, Big Pine, Cal.; one seventy-five-kilowatt alternator for Clay Center, Neb.; a similar alternator for the Turnbull Elevator Manufacturing Company, Toronto, Canada; nine fifteen-horsepower slip-ring induction motors for elevators in the E. M. F. Automobile Works, Detroit, Mich.; fifteen squirrel-cage three to sixty-horsepower motors for the M. C. Peters Mill Company, Omaha, Neb.; and numerous other orders for motors and elevator equipments. The company is running its shops fifteen hours per day in trying to keep up with the contracts taken during the past thirty days, which aggregate several thousand horsepower in motors alone.

FRANK B. GILBRETH, INC., 60 Broadway, New York city, has just secured the contract for the construction of the new residence for Fred C. Sayles, at Irvington, N. Y. The building will be forty-five by ninety feet, three stories and basement, constructed of cut stone, with fireproof floors, and will have the most approved plumbing, electric wiring, steam heating, electric bell system, marble and tile work, and hardwood finish throughout. The work is to be started at once. The architects are Rowe & Keyes, 161 Devonshire Street, Boston, Mass.

HUTCHINSON & COMPANY, Alameda, Cal., have secured a contract from the Southern Pacific Railway Company for street work to be done in Alameda in exchange for its electric-line franchises, granted to it by the City Council. The construction company will start work next week on the job, which will involve a $50,000 expenditure.

Power Company Files Mortgage.

The Mojave Water and Power Company, of San Francisco, has filed notice with the county clerk of San Francisco of the creation of $15,000,000 five per cent forty-year bonds. This company, which was organized in October, 1908, with a capitalization of $20,000,000, owns water rights, lands and franchises in San Bernardino County, Cal., formerly belonging to the Columbia Colonization Company, of Chicago.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

HIGH-EFFICIENCY TRANSMISSION CIRCUIT FOR TELEPHONE TRAIN DISPATCHING.

BY H. L. BURNS.

The use of the telephone for the handling of trains is not by any means new. For several years a number of railroads have been using the ordinary local battery, bridged telephone, for this purpose, the various stations being called by code ringing. This arrangement was found to serve very well for short lines with not very many stations. When the attempt was made to use this arrangement on longer lines, with a larger number of stations, it was found that the transmission would be seriously impaired when one or more of the receivers were off the hook at the same time. This difficulty was very noticeable later on when selectors began to be used and the telephone was introduced upon the more important and busier roads.

Fig. 1, herewith, shows schematically the usual arrangement of a local-battery telephone. Originally this arrangement was used at both the dispatchers and way stations. From the sketch it will be seen that the bridge during conversation consists of a condenser, receiver and secondary of the induction coil in series. The total impedance of this bridge to talking currents is approximately 600 ohms, about 300 ohms of which are in the receiver, and therefore active for receiving purposes. It is obvious that when a number of these sets are bridged across the line at once, the joint impedance of the bridges in parallel is very low and the transmission correspondingly difficult between terminals or widely separated stations.

An improvement on this arrangement, so far as transmission is concerned, was effected by using a larger induction coil having a low-impedance primary and a high-impedance secondary. The larger coil improved the outgoing transmission considerably, but this arrangement is not so efficient for receiving, so that the gain resulting was not great.

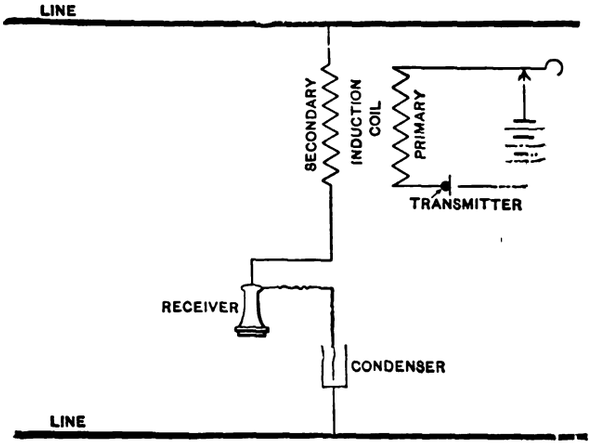

FIG. 1.—USUAL ARRANGEMENT OF A LOCAL BATTERY TELEPHONE.

To meet conditions imposed by this class of service, the Western Electric Company has devised the circuit shown schematically in Fig. 2. The dispatcher's equipment is substantially the same as shown in Fig. 1, except that special apparatus is used. In order to provide the dispatcher with the best possible receiving he is provided with instruments of fairly low impedance. A head receiver is used, and is in series with the induction coil; the latter is specially designed to give the best possible transmitting consistent with good receiving. A locking transmitter key is provided, inasmuch as the dispatcher will ordinarily require both hands for his work. The transmitter itself is of the chest type and is special for this purpose.

It will be noted that the way-station circuit is radically different from that shown in Fig. 1. In order that a number of stations may be listening at once without serious detriment to the transmission, it is apparent that each must constitute, when listening takes place, a bridge of very high impedance. Further, in order to give efficient receiving, a large proportion of this impedance must be in the receiver itself. This precludes the possibility of having the receiver in series with the induction coil, because when transmitting, all the secondary talking current passes through the receiver. The high impedance of the receiver would cut down the transmitted current, and in addition to this there would be the serious objection of excessive side tone.

A study of these conditions led to the

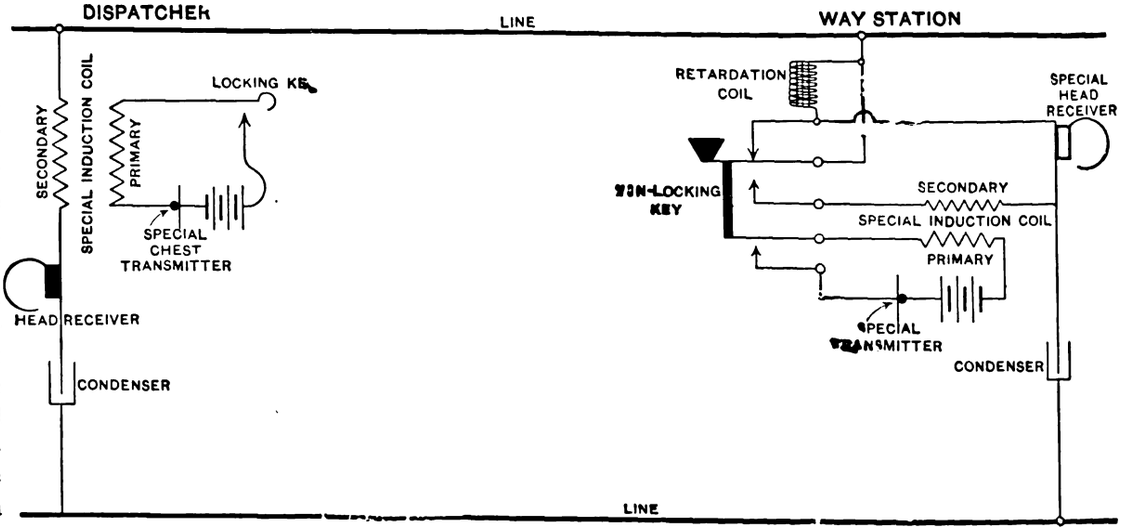

FIG. 2.—HIGH-EFFICIENCY TRANSMISSION TELEPHONE CIRCUIT.

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conclusion that the use of a push-button or key which in its normal position gives the best possible receiving conditions, and in its operated position gives the best possible transmitting, would be advisable. By referring to Fig. 2, it will be noted that normally, *i. e.*, in the listening condition, there is a current through the receiver and condenser in series directly across the line. When the key is thrown to the talking position it is seen that the receiver in series with a retardation coil (normally short-circuited) is put in parallel with the secondary of the induction coil, and these bridged across the line through the condenser.

When the key is normal the receiver is directly across the line through a condenser which gives the best possible receiving conditions. The receiver is specially wound, and the impedance of the bridge at this time is about 2,400 ohms to talking current, practically all of which is in the receiver and consequently active for receiving. When the key is operated, the induction coil being bridged directly, across the line through the condenser gives the best possible condition for transmitting. The function of the retardation coil is to prevent excessive side tone in the receiver when talking, also by raising the impedance of the receiver circuit, more of the transmission is forced upon the line. This retardation coil is so designed that in case the dispatcher wishes to break in, a sufficient volume of the dispatcher's voice currents will pass through the receiver to attract the operator's attention.

The induction coil and transmitter are also special for this purpose. Three cells of dry battery or their equivalent are used for transmitter battery, the latter being in use only during the time the operator is actually talking. In developing this circuit and apparatus, the problem has been studied as a whole, rather than as a problem of transmitting or of receiving alone. The various pieces of apparatus have been designed to work together, having in view the best possible results as a whole.

Glass That Conducts Electricity.

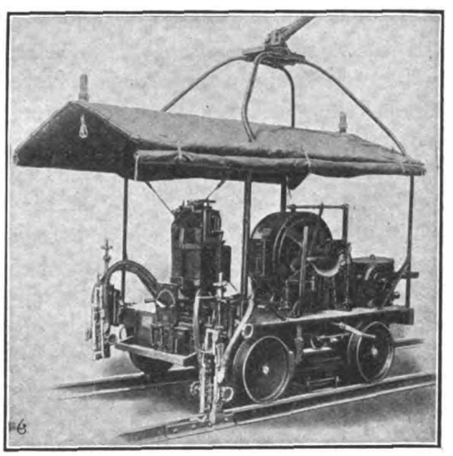
A kind of glass that conducts electricity is described in a recent issue of *Cosmos*, of Paris. It is said that the conductivity is about 1,000 times that of ordinary glass and that the new material should prove of use in making the disks of electrometers, electroscopes and similar appliances.

Electric Welding for Bonding Electric Railways.

To keep the conductivity of the track return circuit high and eliminate all trouble from defective bonds, some street-railway managers have installed return cables. This is an expensive solution of what is regarded as a serious problem to all electric railway systems which employ the track for the return circuit.

An electric welding outfit has been perfected which insures perfect bonding at a very low cost. By perfect bonding is meant bonds which will not deteriorate from moisture but will hold indefinitely because a true weld is obtained between the bond and the rail.

There are two methods adopted to obtain the perfect weld, each of which requires a satisfactory flexible bond. These



ELECTRIC WELDING MACHINE.

methods are electric welding and, so-called, copper welding.

In the first method a heavy current is passed through the bond and the rail at the point of the weld, heating both to a sufficiently high temperature to weld them together. This requires a current of approximately 2,000 amperes at five volts. This is obtained from the trolley line by means of a Westinghouse standard eighteen-kilowatt rotary converter and a special transformer which lowers the voltage to the required amount.

The secondary terminals of the transformer are one of copper and one of carbon, so arranged as to clamp the bond and rail at the point of the weld. The flow of current heats the carbon terminal to incandescence and brings the rail and the copper bond to the welding point in from forty-five to sixty seconds.

When the bonding is to be done by copper welding, molten copper is poured into a suitable mold and first heats the bond and the rail and then forms the weld. The mold is of such shape that a large reservoir of metal is formed before the bond itself is covered. This insures thorough heating of the parts and is not wasteful of copper, as the reservoir is readily chiseled off after hardening, as but a small neck connects it to the weld itself. This welding is particularly adapted to heavy bonds, return-feeder cable, and around special work.

The illustration shows the outfit as supplied by the Electric Railway Improvement Company, of Cleveland, Ohio. It will be noticed that the rotary converter may be used as a motor to propel the car. As high a speed as thirty miles per hour may be attained.

In order to remove the car from the rails to prevent interruption to the traffic, a jack-screw is fixed under the center of the car. The weight of the equipment on the car is distributed to balance about the center, so that it is an easy matter to turn the car and roll it to one side and allow a regular car to pass. Economical bonding may be done on lines maintaining a five-minute service.

For grinding the rail before welding, a small electric grinder with leads and starting box complete is provided.

For rebonding lines in city streets, this apparatus requires the removal of the paving blocks from a space of but a few inches wide and as long as the bond itself, which makes it economical for either new or old work.

A New Printing-Press Motor Controller.

In no application of individual electric drive to industrial purposes is the desirability of a properly designed controller better exemplified than in printing. The requisites of a wide speed variation and an ability to bring the driving motor to a quick stop have necessitated a special design of controller for this industry. The General Electric Company has perfected a printing-press motor controller known as CR-171, which should meet the demands of the most exacting service.

The complete controller is shown in Fig. 1, and Fig. 2 is a view with the enclosing cover removed. As will be observed, the control is obtained by means of a single handle which projects through a slot in the front of the case. All external wiring passes through a slot at the bottom.

A range in motor speed of three to one is obtained by armature and field resistance. The operating handle will remain on any resistance point for forward run-

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ning, but will automatically spring back to the "off" position from the reverse point.

A valuable feature of this controller is the use of a contactor for making and

FIG. 1.—GENERAL ELECTRIC PRINTING-PRESS MOTOR CONTROLLER.

breaking all main circuits. The movement of the handle energizes the contactor and closes the motor circuit. An overload device protects the motor from too rapid acceleration or an overload at

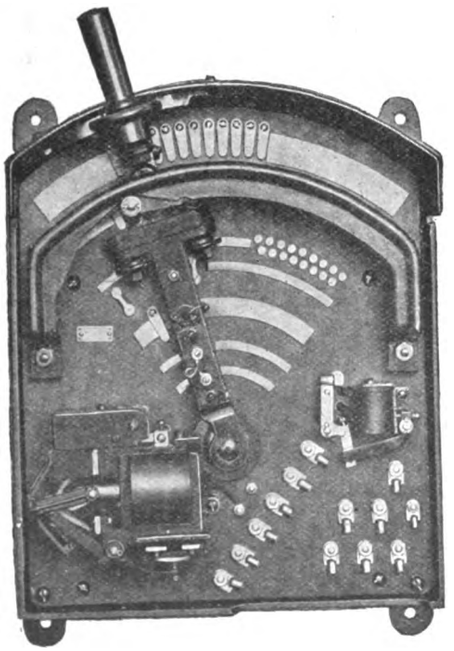


FIG. 2.—CONTROLLER WITH COVER REMOVED.

any time. Should the contactor drop out, either by reason of an overload or failure of voltage, the operating lever must be returned to the "off" position, before the contactor can again be energized.

A reliable and quick-acting braking effect is provided by means of a dynamic brake resistance, acting automatically when the motor circuit is broken.

A feature of especial value to the printing trade is the remote push-button control. A single push-button may be used to either start the motor or bring it to a quick stop from any running position. This gives the operator perfect control when "setting up." Push-buttons may be installed at any number of convenient points.

The armature and brake resistances are contained in separate boxes, and are arranged for mounting on the wall or any other convenient place. The resistance is made up of single units, which may be easily replaced. Ample ventilation is provided, thus insuring a low operating temperature.

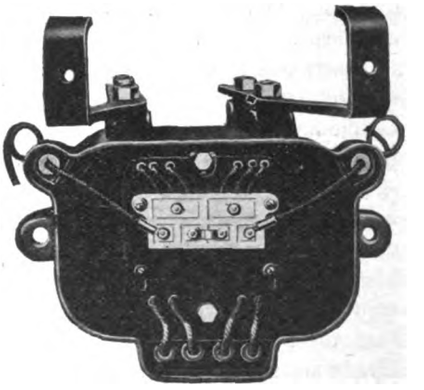
Allis-Chalmers Lighting Transformers.

Allis-Chalmers oil-insulated lighting transformers designated as the type A. L. and designed for operation on 1,050 to 2,100-volt circuits, are made in sixteen sizes, ranging from 0.6 kilovolt-amperes to fifty kilovolt-amperes. They are intended for lighting work on a normal frequency of sixty cycles per second (7,200 alternations per minute), but can be operated on any frequency from fifty to 140 cycles, the efficiency being somewhat better on the higher frequency than on the lower. They can also be operated on any voltage not over ten per cent above or below normal, but all data regarding efficiency and regulation, etc., are based on operation at normal voltage of 1,050-2,100 and normal frequency of sixty cycles per second.

A. L. transformers are of the so-called core type; that is, one magnetic circuit with coils on the two longer legs of the rectangular-shaped core.

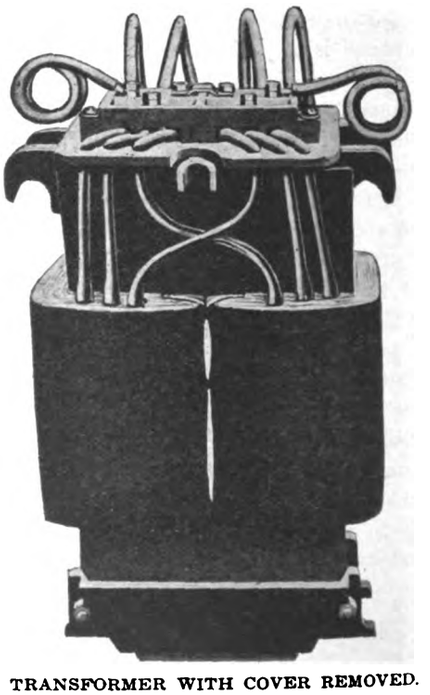
Allis-Chalmers Company guarantees its cores to be made of such good material that they are non-aging, and transformers will have the same core loss at the end of one year's operation as when installed. This company has made every effort to reduce the exciting current to a minimum and has produced a line of transformers with very small exciting current. The smallest have an exciting current below eight per cent, the majority below two per cent, and the larger sizes below one per cent.

All transformers are wound with four low-voltage coils and four high-voltage coils, two high-voltage and two low-voltage coils on each leg. The two low-voltage coils are wound first, then the cylindrical insulation between the high-voltage and low-voltage coils placed on the low-voltage winding. The two high-voltage coils are then wound upon this



TOP VIEW OF TRANSFORMER, SHOWING TERMINAL CONNECTIONS.

insulation in reverse direction, one coil on each half of the insulation. This method of winding makes it unnecessary to bring out the start of the high-voltage coils; all leads from the coils are on the outside surface of the coils and are easily and safely insulated. Also, winding the high-voltage winding in this manner makes the number of turns per layer and the voltage per layer one-half of what it would be if the high-voltage winding were wound in one coil per leg. In A. L.



TRANSFORMER WITH COVER REMOVED.

transformers the volts per layer are not over ninety volts, and in most cases much less.

The insulation between the high-voltage and the low-voltage coils is varnished cloth and mica. The mica alone is suffi-

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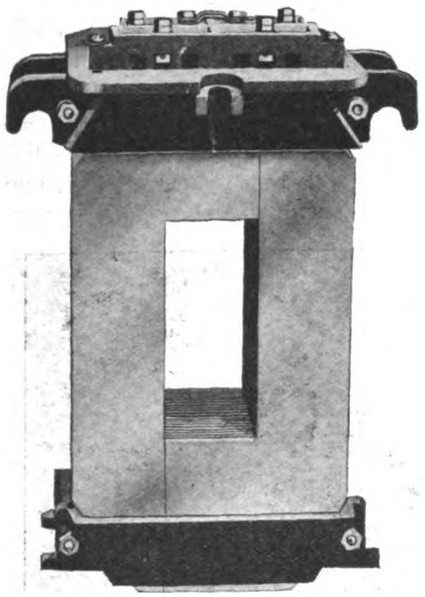
cient to stand a test of 10,000 volts, and makes a fireproof insulation between the high-voltage and low-voltage coils, insuring the high-voltage winding being insulated from the low-voltage, even if the transformer is overloaded sufficiently to burn it out.

After the coils are wound, they are dried out under a vacuum, and when thoroughly dry are impregnated with an oil-proof compound, hermetically sealing up the coils.

A. L. transformers are provided with taps on each end of the 2,100-volt windings. This enables normal secondary voltages, viz., 105/210 volts, to be obtained from either five per cent or ten per cent below 2,100 volts supplied to the primary winding. With 2,100 volts supplied to primary, either 100, 105 or 110 per cent of normal secondary voltage can be obtained. With 1,050 volts supplied, one ten per cent tap on the primary winding is available. In other words, these transformers can be used to step down from 2,100 volts in the ratios four-and-one-half, four-and-three-fourths, five, nine, nine-and-one-half, ten, eighteen, nineteen, or twenty to one, and can be used to step down from 1,050 volts in the ratios two-and-one-fourth, two-and-one-half, four-and-one-half, five, nine, or ten to one. That is, A. L. transformers can be used to step down from any voltage within ten per cent above or below 2,100 volts in nine different ratios and can be used to step down from any voltage within ten per cent above or below 1,050 volts in six different ratios. Any increase in primary voltage gives proportional increase in secondary voltage. Allis-Chalmers Company guarantees A. L. transformers to carry full load in kilovolt-amperes on any tap, if operated within ten per cent of normal voltage.



ASSEMBLY OF CORE OF ALLIS-CHALMERS TRANSFORMER.

These transformers will carry full load continuously with a temperature rise of forty-five degrees centigrade, and will carry twenty-five per cent overload for two hours immediately following full-load run, with a temperature rise of fifty-five degrees centigrade, and will carry twenty-five per cent overload continuously with a temperature rise of sixty-five degrees centigrade. These temperatures may be measured by thermometer or by the resistance method, or by both.

All transformers are given rigorous tests as soon as completed, comprising resistance of windings, polarity, ratio, core loss, impedance and insulation.

A. L. transformers are given an insulation test of 10,000 volts between the high-voltage winding and the low-voltage winding and core. An insulation test of 2,500 volts is given between the low-voltage winding and core. These tests are applied for one minute. All transformers are operated for five minutes at three times normal voltage and also at 150 per cent load for twenty minutes.

Drawback on Imported Lamp Bases.

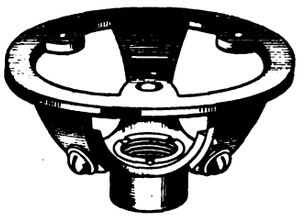
The United States Treasury Department has issued a ruling to the effect that on the exportation of Edison incandescent electric lamps, manufactured by the General Electric Company, of New York, with the use of imported bases, drawback will be allowed equal in amount to the duty paid on the imported material used, less the legal deduction of one per cent. To secure this drawback it is required that the preliminary entry must show the marks and figures of the shipping packages and the number of lamps contained in each package and in the shipment.

The drawback entry must show the total number of lamps exported and the number of imported bases used in the manufacture thereof, and in addition to the usual averments, that said lamps were manufactured of the materials and in the manner set forth in the manufacturer's sworn statement, which has been filed with the collector of customs.

In liquidation the number of imported bases which may be taken as the basis for the allowance of drawback may equal the number used as declared in the drawback entry after official verification of the exact quantities, provided it shall not exceed one base for each lamp. A. F. T.

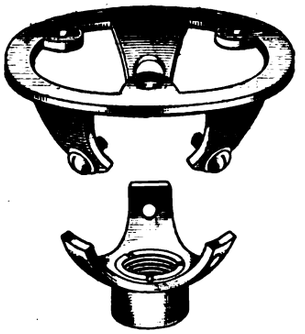
Emery Adjustable Tripod.

The Fairmount Electric and Manufacturing Company, 2324 Market Street, Philadelphia, Pa., has recently placed on the market a two-piece separable and adjustable tripod or crowfoot for the suspension of lighting fixtures.



EMERY ADJUSTABLE TRIPOD.

As the upper portion, shown in one illustration, can be screwed to the ceiling before the fixture is hung, the workman is relieved of the support of any extra weight, making it easy to fasten the tripod securely. Furthermore, the bottom portion may be adjusted so that even though the ceiling is irregular or the threading not true, the fixture will hang vertically. This, of course, obviates any necessity of placing blocking under the tripod. The assembled tripod is shown in the accompanying illustration.



ADJUSTABLE TRIPOD DISSEMBLED.

Graphite in Lubrication.

The National Fire Protection Association's Committee on Artificial Refrigeration recommends "That wherever in any system graphite can be used as a lubricant in compression cylinders, that it be done. This especially applies to air compressors used in dense air systems and for air compression for purposes other than refrigeration, as the temperature of the compression cylinders undoubtedly rises in some air systems to a point where inflammable vapors may be generated from lubricating oil." The use of unctuous, soft, pure graphite, manufactured by the International Acheson Graphite Company, Niagara Falls, N. Y., is recommended for the above purpose, as well as for lubrication in general.

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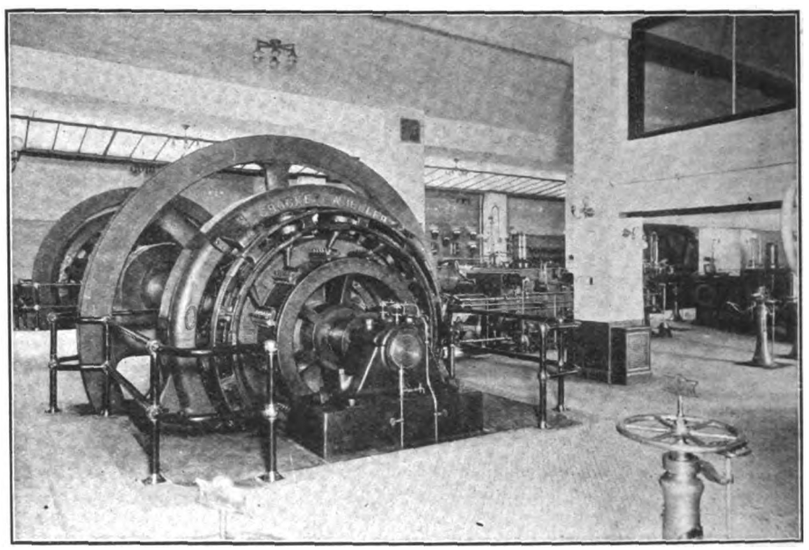
Lighting and Power Plant of the Metropolitan Building.

One of the things that aided the extraordinary exhibition of lighting in New York city during the Hudson-Fulton Celebration, was the fact that many modern office buildings supplied their own current from their own isolated plants. This was the case with one of the most remarkable light exhibits, namely, the Metropolitan Life Insurance Tower on Madison Square. The photograph herewith, taken between daylight and dark, startling as it is, gives but a faint impression of the effect secured by the great tower during the illumination. The current for the Metropolitan Tower and Building is supplied by the Metropolitan power plant in the southeast corner of the building.

ILLUMINATION OF METROPOLITAN BUILDING.

This plant is a model equipment in every sense of the word. The principle of publicity which is so strongly emphasized in the prominent construction of the building has been carried out thoroughly in the location of the engine room. The room used for the electric plant in many buildings seems to be chosen for that purpose mainly because it cannot conveniently be used for anything else. Here, on the other hand, a spacious section, fifty feet wide and over 100 feet long, is utilized. In the center of the plant is situated a large glass-enclosed observation gallery, from which a visitor may view the entire equipment. The effect of this publicity on the appearance of the equipment has been unmistakable. The unusual cleanliness of floors, walls and machinery has made the plant a show feature of the building. Another noticeable condition is the entire absence of hum and vibration. The plant contains four 120-volt, 100-revolution-per-minute, Crocker-Wheeler direct-current generators with a combined capacity of 1,100 kilowatts. Its appearance is well brought out in the accompanying illustration.

The tower of this building is lighted by special reflectors installed by the firm of I. P. Frink, 551 Pearl Street, New York. The special lighting effects produced by these reflectors are truly wonderful. The clock dials are distinct and impressive. The lantern at the extreme top is over seven feet in diameter and has the appearance of one mass of fire. It indicates the hours by flashes of white light. Red flashes indicate the quarter-hours: One for the quarter-past each hour, two for the half-hour past the hour, three for the three-quarters past the hour.



VIEW OF ENGINE ROOM, METROPOLITAN BUILDING.

A Novel Turbine Installation.

The Allis-Chalmers Company has recently received an order from the Diamond Rubber Company, of Akron, Ohio, for a rather novel installation. This will be a low-pressure turbo-generator set receiving its steam supply from the exhaust of the vulcanizers and other apparatus. The set has a capacity of 1,000 kilowatts when running at 1,500 revolutions per minute and will furnish twenty-five-cycle, two-phase, 240-volt current. The turbine will have a continuous overload capacity of 1,250 kilowatts. The initial steam pressure will be about sixteen pounds absolute and the vacuum vary from twenty-six to twenty-eight inches, depending on the temperature of the condensing water at various seasons of the year. In connection with this turbine, Allis-Chalmers Company is furnishing a special condenser outfit. The condenser head, which is similar to that used on their type "C" condensers, will be connected to the expansion joint of the exhaust line where it leaves the turbine. The mixture of steam, water and air coming from the head will be removed by a centrifugal pump driven by a small impulse steam turbine. The dry air pump will be driven by a small reciprocating engine. Both these auxiliaries will run on high-pressure steam, and the exhaust from them, which will be at atmospheric pressure, will be used in the large low-pressure turbine. This makes the most economical arrangement possible.

Junior Electrical Engineer, Geological Survey.

The United States Civil Service Commission announces an examination on November 23-24, 1909, to secure eligibles from which to make certification to fill a vacancy in the position of junior electrical engineer in the Technologic Branch of the Geological Survey, at a salary ranging from $960 to $1,200 per annum, and vacancies requiring similar qualifications as they may occur. Those interested should write to the commission at Washington, D. C., for Circular No. 624

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, OCTOBER 22.—The Bremer flame arc lamp patent, which is owned by the British Westinghouse Company, was held to be invalid in the law courts this week, on the ground of want of subject matter. It was further held that the patent has been anticipated by the patent granted to Graham in 1882 and therefore is also invalid on this ground. The learned judge held that the Bremer patent merely covered a mechanism for feeding the carbons in a specified type of arc lamp when, as a matter of fact, the same mechanism had already been used in other types of arc lamp. Consequently, as the patent covered a matter which was already within public knowledge, there was no invention. This decision was given in connection with an action taken by the British Westinghouse Company for infringement of their patent by another arc lamp maker and importer named Braulik and in view of the fact that the Westinghouse company had alleged that practically every flame arc lamp here infringed the Bremer patent, this decision will be hailed with delight by British makers of flame arc lamps. The Westinghouse company, however, has given notice of appeal, so that the fun is not ended yet.

There is also going to be some excitement in connection with metal-filament lamps. I mentioned a few weeks back that the famous gas-mantle company, known as the Welsbach Company, had suddenly put a metal-filament lamp upon the market, with a wonderful offer to install them for carbon lamps in any existing installation, free of charge. I believe, as a matter of fact, that this offer was very soon withdrawn, for no expressed reason. Nevertheless, the company is pushing the new lamp very vigorously, in fact too vigorously for some of the existing metal-filament lamp makers. The mystery attaching to the lamps exploited by the company is that they have the trade name of "Aur," when it has always been accepted that the original "Aur" patents belonged to one of the leading companies in London. We now hear that summonses are being taken out against the Welsbach Company for applying a false trade name to their goods, and as the later have challenged any aggrieved person or persons to take the matter into court, some interesting proceedings are likely to take place.

Yet another piece of legislation is going on in connection with electrical work, viz., an alleged infringement of a British patent for the electrical driving of printing presses by Kohler Brothers, the latter having, I believe, made a special journey to this country to contest the action. The proceedings, however, are against the owners of the newspapers in whose premises the alleged infringing machines are used. In this case also it is alleged by the opposition that the British patent in question is invalid for want of subject matter and also by reason of anticipation, but judgment has not yet been delivered.

An interesting and important report—in so far as it is impartial—has just been issued upon the question of electrically driven textile machinery by a committee formed by the Bradford Engineering Society. The result of this report is absolutely in favor of electrical driving, especially in relation to flexibility, ease of extension, saving in floor space, saving in initial cost of plant where power is taken from an outside source, and less liability to stoppage. All this has been arrived at by actual experiments in mills, as has also the conclusion that the regularity of drive is more pronounced with electrical than with mechanical transmission of power. This report is in a different category to the usual report upon this subject, in as much as it was undertaken by a disinterested society with the sole object of arriving at definite opinions from actual experiments in mills under working conditions.

The Engineers Standardized Publications' Association was formed in London a little while ago in order to introduce some degree of uniformity into the publications of engineering firms in the way of catalogues, etc. The movement appears to have met with some support and an advisory committee has been formed in order to actively pursue the objects for which the association was started. Up to the present the greatest measure of co-operation has come from central-station engineers, and a start is now to be made to bring engineering firms into line.

Not satisfied with the multifarious lamps to be seen in the city of London for the purposes of street lighting, the city corporation has just sanctioned the carrying out of further experiments, although what form these are to take is not made clear. At present we have within the famous square mile, high and low-pressure gas lamps on posts, high-pressure gas lamps on brackets, ordinary arc lamps and flame arc lamps on posts and flame arc lamps strung across the streets.

The District Railway Company is faced with the difficulty of dealing with somewhat large arrears of interest upon its guaranteed and preference stock, and a scheme for funding seventy-five per cent of the arrears into a security and writing the balance off has been placed before the stockholders. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, OCTOBER 23.—In Italy there has been constructed a hydraulic plant which ranks among the largest in the country to be used for electric furnace work. It supplies current to the new electro-chemical works located at Narni. The Societa Industriale of Valnerina controls the electrolytic plant, as well as the power station, and at present it is turning out a considerable amount of products, especially carbide of calcium. The hydraulic plant has an electric outfit which is supplied by the Milan branch of the Oerlikon company, and at present there are six turbine-alternator units installed in the station. This latter is located on the Cervara River at Terni, and the water is brought from the barrage in an open canal of 390 metres length to a large settling basin, from which there run two parallel flumes, cut in the mountain side for a distance of 520 metres. A total head of water of nineteen to twenty-three metres is obtained in this case.

Electric train lighting is being adopted on a large scale by the Paris-Orleans Railroad, and the company recently placed an order with the Paris branch of the Brown-Boveri firm, whose factory is located in the suburbs, for 900 train-lighting outfits of their new system, for lighting passenger cars. The Brown-Boveri method uses a special forty-eight-sixty-four-volt generator, whose voltage is variable, and the generator is of small capacity. By means of an automatic voltage regulating device the lamps can be run with a maximum voltage variation of two-and-one-half volts, no matter what may be the speed of the train. This latter is between twenty and eighty miles an hour.

It has been decided to proceed with erecting a hydraulic plant of considerable size in the region of Naples, and it is to furnish current for that city. The power station will be located at the sources of the Volturno stream and is about forty-five miles distant. Current will be brought over a high-voltage, three-phase power line, working at 45,000 volts, at least. It is expected to secure about 16,000 horsepower for the new plant, and the alternators will use a standard voltage of 5,000 volts. The construction of such a plant had been talked of for some time past, but it is only within a late period that the question has been actually decided. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., OCTOBER 30.—The Rio de Janeiro Tramway, Light and Power Company, a Canadian corporation, has declared an initial quarterly dividend of one per cent.

A syndicate consisting of manufacturers of Oshawa, Ont., will build an electric road from Cobourg to Toronto. The new line will be called the "Toronto and Eastern." Work will be well advanced within a year.

A special general meeting of the shareholders of the Mexican Northern Power Company will be held at Montreal on the 17th of November, for the purpose of considering a by-law to increase the capital stock of the company from $10,000,000 to $15,000,000, and also for the purpose of considering an increase in the amount of the company's bonded indebtedness from $7,500,000 to $10,000,000.

Port Arthur, Ont., has been notified by the Dominion government that a license will not be granted to the United Wireless Telegraph Company, to build a station at Port Arthur, for which arrangements had been made between the Town Council and the company. It is the intention of the government to retain control of all wireless communication, and it is likely that three stations, enough to protect the lake shipping, will be built about the Great Lakes in the next couple of years.

The Montreal Street Railway Company has sent a statement to the City Council showing that, for the current year, the city of Montreal will get, on the earnings of the company, the sum of $259,171. Last year the sum received by the city was $241,967. The total earnings of the company for the current year, upon which the percentages to the city are based, was $3,261,145. According to the city's contract with the company, it gets from four to fifteen per cent. The percentage on the first million dol-

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lars is four per cent, and then the percentages gradually increase until the limit of fifteen per cent is reached.

The Southwestern Traction Company, which runs from the city of London, Ont., to St. Thomas and Fort Stanley, has been sold at public auction for $535,000. The actual bid was $455,000, but the purchaser has to bear a lien of $80,000. The sale was rendered necessary by the large overhanging debt which was incurred at the start. For the last two or three years the enterprise has been a splendid paying proposition, but the financial obligations retarded its work.

The Trenton Electric Light and Water Company is trying to get an agreement through the Council for the town of Trenton, whereby all the privileges held by the town, under the Dominion government, in the Trent River waterpowers, are to be conveyed to the company in perpetuity, and for what are claimed to be nominal considerations. The town has now an opportunity, by defeating the by-law, to throw off the thrall of the company, which has a forty-year exclusive franchise on the streets of the town for lighting purposes and control of the water system. The Town Council favors the company, but, under the new provincial law, the agreement is to be voted on by the ratepayers on November 1:

Signor Marconi, who has returned from his visit of inspection to the transatlantic station at Glace Bay, Nova Scotia, confirms the announcement that he hopes to have the transatlantic system in regular operation by the first of the year. "The work of rebuilding is in progress at Glace Bay now," said he, "and we hope to have the installation complete before the end of the year. It is only a matter of getting the building ready to house the apparatus. As soon as the installation is complete, I expect that the contract with the British post office will come into effect. Under that agreement, they give us the same facilities as they give the cable companies; that is, each post office in the United Kingdom would be a collecting and distributing agency for us. Until the new apparatus was installed I had not been anxious to bring this contract into operation, as the old plant at Glace Bay might not have been equal to the handling of the large number of messages we are likely to get." Signor Marconi stated that the stations taken over by the British government were six in number and were used for the purpose of communicating with ships. The company still retains four or five stations. The British government has not taken over any of the rights of the company in regard to transatlantic messages, nor in regard to the transmission of messages from shipboard. Signor Marconi also stated that if the land telegraph lines in Canada do not give the company the same terms as they give the cable companies, then his company will build its own stations throughout the country.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

TO DAM THE GILA RIVER—A syndicate of Denver and Colorado Springs capitalists will build a dam across the Gila River, fourteen miles below San Carlos, Arizona, and establish a system of irrigating canals and ditches at an estimated cost of more than $1,000,000, if it succeeds in plans which are now under way. It is reported that the syndicate will also erect a large hydroelectric plant and build transmission lines to towns and mining camps in the surrounding territory.

NEW EXTENSIONS IN BROOKLYN—The Kings County Electric Light and Power Company, of Brooklyn, has applied to the New York Public Service Commission for permission to issue $5,000,000 of six per cent convertible debenture bonds, payable twelve years from date and convertible into stock at par at any time after three years from the date of issue. The proceeds are to be used for construction and extension, as follows: $3,539,660 to reimburse the Kings County company and the Edison Electric Illuminating Company, of Brooklyn, which joins in the petition, for expenditures for improvements and payments already made, and $1,460,340 for improvements to be made during this year and 1910. Improvements for the Edison company will be paid for by demand notes of that company issued to the Kings County company upon its advancing the funds obtained from the sale of the debentures. The $5,725,000 four per cents of the Edison company, authorized but not issued, are to be held for unknown contingencies. Both companies hold franchises in Brooklyn, but the Edison company operates the property of both, while the Kings County company is the financing company and owns all the stock of the former.

LARGE MEXICAN POWER PROJECT—The syndicate of Montreal, Canada, which has already invested many millions of dollars in electrical and railway enterprises in Mexico, particularly in the vicinity of Mexico City, has recently extended its operations to Northern Mexico, where it has just let the contract for the construction of a great dam across the Conchos River in the state of Chihuahua for the purpose of forming a reservoir of water to afford the initial power for its proposed hydroelectric plant to be installed there. A separate company has been organized to carry out the plans for this new project. It is called the Compania Agricola de Fuerza Electrica. The contract for building the dam was awarded to S. Pearson & Son, Limited. Its cost will be about $7,500,000 gold. Embraced in this contract is the building of a system of irrigation canals and ditches which will be operated in connection with the electrical enterprise. The dam will be the second largest dam on the American continent, it is said. It will form a reservoir which will have a capacity of 1,840,000,000 cubic metres of water, which will be 180,000,000 cubic metres more than the capacity of the great Tonto Basin Dam in Arizona. The proposed hydroelectric plant will have a capacity for generating 25,000 horsepower. It is stated that contracts have already been made for the utilization of practically all of this power. It will be transmitted to the towns of Chihuahua, Parral, Jiminez, Santa Rosalia and a number of smaller places and to several large mining camps within a radius of 200 miles of the plant. The company has also let the contract for the construction of a standard-gauge railroad about twenty miles long, which will run from the site of the proposed reservoir to a connection with the Mexican Central Railroad at Santa Rosalia. This road will be built immediately so as to afford a means of transporting the material and supplies to the building site.

LIGHTING AND POWER.

(Special Correspondence.)

WEWOKA, OKLA.—This city has voted bonds to establish an electric-light plant.

LINDSTROM, MINN.—It is reported that an electric-light plant will be installed shortly. C.

HARROLD, S. D.—The new electric-light plant has been started and found to be satisfactory. C.

TACOMA, WASH.—The Board of Public Works is advertising for 40,000 pounds of copper wire.

KENMARE, N. D.—The Kenmare Light and Power Company has installed a twenty-four-hour service. C.

BUFFALO, MO.—The Big Naungua Power Company has been incorporated, with a capital stock of $490,000.

LAFAYETTE, ORE.—A franchise has been granted for the establishment of an electric-light plant here.

MANDAN, N. D.—The Bismarck Electric Light Company will furnish the power to be used in the plant here. C.

ROCHESTER, MINN.—A vote will be taken October 26 on the construction of a municipal electric-light plant. C.

PIERRE, S. D.—The Metallic Electric Purification Company has been incorporated, with a capital of $1,000,000.

TOWNER, N. D.—The Council has employed an engineer to prepare the cost of installing an electric-light plant. C.

DE QUEEN, ARK.—The De Queen Ice and Light Company has been incvorporated, with a capital stock of $50,000.

DURANT, OKLA.—This city is to vote on a bond issue of $50,000, part of which is to establish an electric-light plant.

TOWNER, N. D.—An estimate of the cost of installing an electric-light plant is being prepared by E. D. Jackson, engineer, St. Paul, Minn. C.

WATERTOWN, S. D.—Mr. Ferris, manager of the electric-light plant, is considering the erection of an up-to-date plant near the Sioux River. C.

McKINLEY, MINN.—The contract for the installation of a boiler at the electric-light plant was let to Fairbanks, Morse & Company, of St. Paul. C.

HOQUIAM, WASH.—The Montesano Planing Mill Company has been granted a franchise to install an electric plant to supply the city with light.

CENTRAL CITY, NEB.—The construction of an electric-light plant will shortly be commenced by D. Y. Clark, who has the contract for its erection. C.

SAN BERNARDINO, CAL.—The Board of Supervisors have accepted the bid of the California Edison Company for lighting the streets of the town of Highland.

EUREKA, CAL.—The Smith River Electric Company will furnish light to Humboldt and Del Norte counties in California and to Josephine County in Oregon.

AUBURN, CAL.—The Board of Supervisors have granted Dr. Robert Pears a franchise for an electric transmission line along the county road between Colfax and Auburn.

AINSWORTH, NEB.—A stock company has been formed, Walter Williams, secretary, to build a dam at Plum Creek, fifteen miles northeast, for the purpose of furnishing the city with electricity. C.

BOSTON, MASS.—The Edison Electric Illuminating Company, of Boston, has applied to the gas commission for authority to issue 19,452 shares additional capital stock, the proceeds to take up notes issued for new properties acquired last

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month at a cost of about $2,870,000; also notes issued from time to time to take care of the normal growth of the business amounting to about $1,000,000.

ODESSA, WASH.—The City Council has passed an ordinance granting a franchise to the Washington Water Power Company of Spokane to install an electric-light and water system in Odessa.

SAND POINT, IDAHO—The Northern Idaho & Montana Power Company will begin the construction of a power house and a substation here before long. The power house will cost $100,000. A.

OAKVILLE, WASH.—W. A. Shoemaker, who has sold his power plant at Buckley, has been granted a franchise by the City Council to install an electric-light and water system in Oakville.

SPOKANE, WASH.—The Kettle River Water Power Company has been incorporated here, with a capital stock of $500,000, by E. L. Tate, R. L. Thompson, W. W. McCreary, Chas. Grant and R. H. Voorhies.

WASHTUCNA, WASH.—W. A. Gildersleeve, who is putting in an electric power and lighting plant at this place, is planning the extension of a transmission line to La Crosse to supply that place with light.

MONTEREY, CAL.—The Monterey County Gas and Electric Company is preparing to extend its transmission line from this place to Salinas and other points. The extensions will total about thirty miles.

EUGENE, ORE.—The Junction City electric-light plant has been purchased by the Northwestern Corporation. This company will supply the city with light and power from the plant now being constructed on the McKenzie River.

WASHBURN, WIS.—The Washburn Electric Light and Power Company has placed an order for the material for the receiving station to be established here. The contract has also been let for building the line to the city limits of Ashland. C.

CRESCENT CITY, CAL.—The Smith River Electric Company will start operations on a large power plant on Smith River, ten miles from Crescent City, within the next two months. About 3,250 horsepower will be generated by this plant. A.

WHIPPLE BARRACKS, ARIZ.—Sealed bids will be received at the Constructing Quartermaster's Office here up to November 10 for furnishing labor and material required for the construction of an electric-lighting system at Whipple Barracks.

DEMING, N. M.—B. P. Small, who with others is planning the erection of a central power plant at this place, writes from Wichita, Kan., that he has closed a deal with the Western Construction Company for the construction of the plant.

PORTERVILLE, CAL.—S. E. Henley and others of this locality are planning to develop about 4,000 horsepower of electric energy at a site near Springville, in this county. The plant will be built by a company which is now being organized.

BIRMINGHAM, ALA.—The incorporation of the Birmingham Water, Light and Power Company, capital $25,000, has been perfected. The plant is to be located on the Sipsey River, in Walker County, and supply power to Birmingham and other cities.

LOS ANGELES, CAL.—Mayor Alexander has sent a special message to the City Council recommending that the question of issuing bonds to the amount of $3,500,000 for developing power from the Owens River Aqueduct be submitted to a vote of the people.

BOSTON, MASS.—The committee to investigate the needs of the Marblehead Electric Light and Power Plant recommends the town to make an appropriation of $28,000, of which $13,000 is for additional new equipment and the balance for renewal and rearrangement.

TOLEDO, OHIO—The Village Council, of Genoa, Ohio, has entered into a contract with the Toledo, Port Clinton & Lakeside Company, to supply the town with electric-lighting system. There will be at the start twenty arc lamps distributed through the various streets. H.

NORWICH, CONN.—The Falls Company, manufacturer of textile fabrics, has begun the erection of an electric power plant at the dam near the Chelsea File Works. It is proposed to generate 200 horsepower and to transmit it over high-tension wires to the company's plant.

DUNSMUIR, CAL.—The Siskiyou Electric Power and Light Company's pole line from the power plant on Fall Creek to Dunsmuir is practically completed. The line is sixty-five miles in length and will furnish electric power and lights to the towns of Dunsmuir, Sisson, Weed and intermediate stations. The company, which has its headquarters in Yreka, now has close to 200 miles of power line, serving, in addition to the towns named, Yreka, Ashland, Montague, Hornbrook, Fort Jones, Greenview and Etna Mills. The company supplies power to several mines and dredges as well. The main power plant is on Fall Creek, fourteen miles up Klamath River from Klamathan. A smaller plant is on Shasta River.

FRANKTON, IND.—A right-of-way is being condemned across farms from Elwood to this city, a distance of six miles, for the purpose of placing poles and stringing wires, in order to carry out a contract to furnish electric lights for Frankton. S.

JAMESTOWN, N. Y.—The Municipal Lighting Commission has adopted a resolution recommending the purchase of the system of the Jamestown Lighting and Power Company, the private plant for $90,000 and the appropriation of $30,000 for consolidating it under one roof with the municipal plant.

SALISBURY, N. C.—The board of aldermen by a 5 to 3 vote has granted a franchise to parties interested in building an interurban electric line into the town from Concord, twenty-three miles south, the Salisbury franchise to become operative when ten miles of the interurban tracks toward Concord have been completed. L.

BELLINGHAM, WASH.—L. H. Bean, manager of the Whatcom Railway, Light and Power Company, has left for the East to arrange for the doubling of the company's plant on York Street in this city. It is planned to spend about $140,000 in this work. A new waterwheel will also be put in at the company's generating plant on the Nooksack River.

HELENA, MONT.—The following bids were received for the construction of an electric-light plant: The Sheffield Power Company, Kansas City, Mo., $20,000, and the Kilborn & Clark Company, Seattle, Wash., $26,000, each plant to be 400-horsepower. An order temporarily restraining the city from entering into the contract has been issued by Judge J. Miller Smith. C.

DURANGO, MEXICO—Charles von Brandis, of Durango, is arranging to construct a hydroelectric plant at the El Salto waterfall, situated fifty miles west of that city. The electric power will be distributed to towns and mining camps within a radius of one hundred miles, it is said. The federal government has granted a concession for the enterprise. D.

JAMESTOWN, WIS.—At the monthly meeting of the board of electric light commissioners last week it was voted to recommend to the Common Council that there be submitted to the people a proposition to issue $120,000 in bonds for the purchase of the plant of the Jamestown Light and Power Company, for the purpose of consolidating it with the municipal plant.

INDIANAPOLIS, IND.—The custodian of the Indiana Capitol Building is asking for bids for supplying light and power for the building for two years. The Board of Control has employed a competent engineer to estimate the cost and advisability of erecting and equipping a plant to supply electricity for light and power for the State House and State Soldiers' Monument. S.

DODGEVILLE, WIS.—A movement has been started at Dodgeville to construct a system of dams and reservoirs on the several creeks around here emptying into the Wisconsin River, in order to develop waterpower. There is a large amount of power available and dams used only be built. The several mining camps in this region would use all the power generated. C.

PORTLAND, ORE.—A building permit has been issued to the Portland Railway, Light and Power Company by City Auditor A. L. Barbur, for the building of the company's new barns at Sellwood. Pits, tracks and the foundation for the buildings have been built already and the work on the superstructure will start at once. The permit says the improvement will cost $55,000.

PORTLAND, ORE.—The Portland Water Power and Electric Transmission Company has established offices in the Chamber of Commerce Building in this city and has taken preliminary steps toward the building of a power plant on its recently-acquired property two miles from Estacada. W. H. Hurlburt, president of the company, will have the active management.

NEW WESTMINSTER, B. C.—A magnificent station will be erected in this city shortly by the British Columbia Electric Company. The building, which will be the hub for the tram lines netting the Fraser Valley, will have the ground floor finished with marble. The upper stories, the structure consisting of three at first, and eventually five, are to be used for offices.

AUTLAN, MEXICO—It is reported that the concession which was granted by the Mexican government four years ago to L. O. Harnecker for the construction of an electric railway between Autlan and the Pacific port of Chamela is about to pass into the hands of a German syndicate. If the transaction is consummated it is said that the construction of the line will soon be started. D.

SOUTH SAN FRANCISCO, CAL.—The Board of Trustees of this place has refused a permit to the Sierra and San Francisco Power Company (the company which is to supply the United Railroads of San Francisco with power) to erect its transmission towers and line in this city pending an investigation of the report that the company has agreed with the South San Francisco Light and Power Company not to sell current in South San

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Francisco. As the Sierra and San Francisco Power Company must carry its line through South San Francisco in order to enter San Francisco, the work on the transmission line has been temporarily stopped.

MEXICO, MEX.—It is reported that plans have been completed by a $10,000,000 power company for building a dam and the erection of a 20,000-horsepower hydroelectric power plant on the Nazas River, twenty-five miles above Torreon, Coahuila, Mexico. The names of the persons interested in the foregoing enterprise may be obtained from the Bureau of Manufactures, Washington, D. C.

FERGUS FALLS, MINN.—The Otter Tail Power Company will purchase additional power equipment for the Dayton Hollow station. The dam was not damaged by the recent series of disasters at Fergus Falls. A contract has been entered into between the company and the city for lighting service. Plans for additional machinery are being drawn by Edw. P. Burch, engineer, Minneapolis, Minn. C.

ATHOL, MASS.—The Massachusetts Gas Commissioners have approved an issue of $174,800 additional capital stock, par value $100, of the Athol Gas and Electric Company. The proceeds of 685 shares are to be used to refund outstanding bonds, coupon notes and a complete payment for the plant of the Orange Gas and Electric Light Company, the remaining 1,030 shares for the payment and cancelation of an equal amount of obligations of the company.

GREENVILLE, S. C.—The Southern Power Company is erecting a modern substation near the city through which current from Great Falls for the Monoghan mills and the Woodside cotton mills, will be handled, and the high-voltage transmitted current reduced to lower voltage and made available for any of the numerous mills about Greenville. There has been some delay in completing the transmission lines, but final surveys are now being made and the current will be brought to the city shortly. L.

SPRINGFIELD, ILL.—The Springfield Light, Heat and Power Company will have its new 1,500-kilowatt direct-connected alternator in running order in time to carry the extra load that it will have during State Fair week. The company will have in addition to the extra lighting a load of 5,000 eight-candlepower lights that will be used for street decorations for the Fair and will also have the extra lighting of the individual merchants, who will use the lights for streets in front of their places of business. V.

OROVILLE, CAL.—General Manager H. D. Sinclair, of the Great Western Power Company, states that preliminary work on the company's permanent dam will begin at once. The temporary dam is now being put in shape to resist the winter's storms. The transmission line will be raised to a voltage of 100,000 during the present month. The company has entered into contracts to supply the shops of the Western Pacific Railroad Company at Oroville, Sacramento, Oakland and Oakland Mole with power.

ASHEVILLE, N. C.—An order has been made in federal court here by Judge J. C. Pritchard confirming the sale of the Rock Hill, S. C., Water, Light and Power Company by the receiver, P. A. Wilcox, of Florence, S. C., to Martin Maloney, the highest bidder for the property, at $80,000, and also the sale by the same receiver to the same purchaser, Mr. Maloney, of the Carolina Water, Light and Power Company, of Darlington, S. C., at $51,000, and the property of the Marion, S. C., Light and Power Company to Mr. Maloney for $50,000. L.

URBANA, ILL.—The University of Illinois will begin construction at once of a new power plant, arrangements for which are in charge of a committee consisting of W. L. Abbott, of the Board of Trustees, W. F. M. Goss, dean of the College of Engineering and Prof. James M. White, supervising architect of the university. Contracts for boilers, stokers, chimneys, engines and generators have already been closed. W. C. Zimmerman, Illinois State Architect, Steinway Theatre Building, Chicago, is the architect for the building, and W. H. Zimmerman, of Chicago and Lansing, Mich., is consultinng engineer.

HAMILTON, ONT.—The special power committee met on Thursday last week and passed a recommendation to the City Council to sign the contract with the Hydro-Electric Power Commission for 1,000 horsepower, under the terms offered last June by the Commission, with the option of entering fully into the project by December 21, 1910. If the Council adopts this course, it will put an end to a question which has overtopped in importance anything else that has arisen in municipal circles within the last three years. Though the power committee passed the above recommendation, it was not unanimous, Mayor McLaren and two aldermen stating that they would reserve till the next Council meeting what they would have to say on the question, which indicates that the struggle is not yet over, though a majority of the aldermen are known as "hydro" aldermen and, it is said, are in favor of entering into the contract with the Commission.

ELECTRIC RAILWAYS.

(Special Correspondence.)

OGDEN, IOWA—It is expected that the Fort Dodge, Des Moines & Southern will build a line to Ogden next spring. C.

ABERDEEN, S. D.—The Aberdeen Railway Company is taking estimates on the cost of constructing a street-car line, four miles of which are to be completed by December 1, 1910. C.

DOUGLAS, WASH.—The Waterville Railway Company has been organized to construct an electric freight and passenger line to Waterville, a distance of five miles. George C. Wiley, secretary and treasurer. C.

TOLEDO, O.—The Northern Ohio Traction & Light Company will build a spur from Wadsworth to Seville, O., connecting with the Cleveland & Southwestern line. It is estimated that the extension will cost in the neighborhood of $300,000. H.

PHILADELPHIA, PA.—The Northern New York Construction Company has been formed at Vineland for the purpose of building a trolley line between Vineland and Bridgeton, the county seat. Dr. G. H. Burgess, of Philadelphia, is among the directors.

ONTARIO, CAL.—Engineer Dunn, of the Pacific Electric Railway Company, of Los Angeles, has asked for a franchise for an electric railway line in the northern part of this city. The proposed line will give an entrance to the new line from Claremont.

STEVENS POINT, WIS.—The survey for the Chicago & Wisconsin Valley Electric Railroad has been started. The first link of the line will be built between Stevens Point and Portage. The chief engineer is Allen T. Russell, of Baltimore, who surveyed the Chicago, Aurora and Elgin road.

BOSTON, MASS.—The Boston & Northern Street Railway Company expects to open its new line through Middlesex Falls in about two months. The route is nearly straight, and will give the quickest connection between Boston and Stoneham that their geographical positions warrant.

MEMPHIS, TENN.—Following the disposition of $350,000 first-mortgage bonds and $87,500 preferred stock, the officials of the Lakeview Traction Company have started the laying of rails for the interurban railway which is to connect Clarksdale, Collierville and Covington with Memphis.

GLENDALE, CAL.—The franchise for the right-of-way along Fourth Street between Glendale and Brand Boulevard, which has been held for the past four years by the Pacific Electric Company, of Los Angeles, has been abandoned by that company and a transfer of franchise will be made to E. D. Goode.

EVANSVILLE, IND.—Capitalists of Chicago held a conference with local men of this city October 21, in the interest of a traction line projected from this city to Olney, Ill. It is the declared intention of the promoters eventually to build the line to Robinson and Bridgeport, Ill., in the Illinois oil belt. S.

PLACERVILLE, COLO.—It is stated that great preparations are being made by the Southern Pacific to continue work this winter on the dam being erected to furnish power for a mammoth electric plant, which will be used by the company in electrification of the lines about the bay. Three camps have been established for the winter and vast quantities of provisions are being installed.

CLARKSDALE, TENN.—Work on the interurban railway between Memphis, Collierville and Clarksdale has been started, the sale of $350,000 first-mortgage bonds and $87,500 preferred stock having been made to a representative of the Mercantile Trust Company, of St. Louis. According to Chief Engineer W. W. Hayden, the road will be ready to receive freight and transportation as far as Lakeview by the 1st of April next year.

DECATUR, ILL.—The Illinois Traction Company has taken out incorporation papers for the two belt lines that they will build at Edwardsville and at Decatur. The capital stock of each is $2,500 and the incorporators are the same for both, namely: George M. Mattis, W. H. Carnahan, Charles Zilly, B. E. Bramble, C. E. Cox, all of Champaign. The work of extending the interurban from Norris to Fairview, Ill., will be commenced at once. The company is building the fences and will commence the grading at once. V.

VINELAND, N. J.—The Northern New York Construction Company has been formed here to build a trolley line between here and Bridgeton. The directors elected are: George E. Stevenson, proprietor of the Baker House here; B. F. Patterson, a trolley magnate of New York; G. H. Burgess, of Philadelphia; Frank Parvin, owner of Parvin's Pond, on the proposed line; H. C. Bartlett, former solicitor of the Borough of Vineland, and T. H. Coggey, retired capitalists, of New York. Mr. Stevenson was made president and Patterson and Parvin vice-presidents; Coggey, secretary, and H. C. Bartlett, treasurer. There has been considerable talk in regard to developing this line, but the

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people now feel that it is a sure thing. A survey is being made and the right-of-way solicited. The Hebrew colonies, which will be touched, have subscribed $29,000 worth of stock and held another mass meeting tonight to advance the project.

TOLEDO, O.—The Riggs & Sherman Company is busy surveying the preliminary route of the Columbus-Cincinnati Air Line, which will be exactly one hundred miles long. It will connect Cincinnati with the capital city, and work will be started in the spring. H.

CUMBERLAND, MD.—The contract for the building of a street-car line from Fairmont to Fairview or Amos, W. Va., was awarded to Talbott Brothers, contractors, of Fairmont. The line will be built from Fairview to Federal first, and the route will then be decided upon from Federal into Fairmont. The engineering corps is now at Liberty to push its survey from Fairview to Blacksville to connect with the Waynesburg line.

LEAVENWORTH, KAN.—Work on the new interurban line between Kansas City and St. Joseph, Mo., is now under way, and the two Missouri cities will soon be connected by trolley. J. D. Phillips, a representative of the construction company, states that the construction work is progressing rapidly and that the line has been laid several miles outside of St. Joseph already, one part of which is through a twenty-six-foot cut.

MORRICE, MICH.—Fifty men and twenty teams have been started here to begin work on the grading of the new Saginaw-Lansing interurban road. Morrice is the central point between the two cities and the work will be pushed in both directions. Already a huge boarding camp and stable have been erected to care for the men and horses. North of Morrice the line will be built along the wagon road which leads almost straight to Owosso and from here to Lansing it will parallel the Grand Trunk tracks.

COLUMBUS, O.—Papers have been filed with the secretary of state, increasing the capital stock of the Fostoria & Fremont Railway Company from $10,000 to $300,000. The officers of the company are: President, F. D. Carpenter; vice-president, J. H. Goeke, general manager and the attorney for the Western Ohio; secretary and treasurer, J. D. McDonel. Both the Lake Shore Electric and Western Ohio are to be represented on the board. The new line will be bonded for $250,000 and there will be $150,000 preferred and the same amount of common stock. Of the preferred, $30,000 has been allotted to Fostoria and Fremont in equal amounts, the remainder being sold.

PORTAGE, WIS.—The Chicago-Wisconsin Valley Railroad Company has been organized at Portage to construct an electric interurban line between the towns of Janesville and Merrill, Wis. This proposed road will pass through the towns of Madison, Lodi, Briggsville, Friendship, Grand Rapids, Stevens Point, Wausau and ending at Merrill. It will open up a territory now without electric interurban transportation and a rich farming and stock raising region. It is stated that work will be started at once. The officers of the company are as follows: F. G. Frost, of Stevens Point, president; J. W. Powers, Friendship, first vice-president; J. P. Barnes, Waupaca, second vice-president; A. J. Behmeyer, Indianapolis, secretary; J. F. Jones, Portage, treasurer; F. J. Tynall, Briggsville, assistant treasurer, and Allen Russel, Baltimore, general manager. M.

GUTHRIE, OKLA.—Two railroad companies, the Lawton & Fort Sill Electric Railway Company and the Coffeyville & Nowata Railroad and Power Company, have been granted state charters. The Lawton company has $200,000 capital stock and proposes to build twenty miles of electric railway in Lawton and from Lawton to the Fort Sill military post, Medicine Park and other points in Comanche County. The incorporators are: Simon Smith, of Oklahoma City; J. D. Sleeper, of Lawton; O. L. Sleeper, J. H. Miller and W. H. Pattie, of Tulsa. The Coffeyville & Nowata Railroad and Power Company proposes to build twenty-three miles of railroad from Coffeyville to Nowata. The capital stock of the company is $200,000 and the incorporators are: John D. Pollard, of Kansas City; W. P. Brown, of Coffeyville, Kan., and J. C. Denton, W. V. Thraves and J. A. Tillotson, of Nowata.

ST. LOUIS, MO.—The St. Louis-Kansas City Electric Railroad Company, a $5,000,000 corporation, has obtained a charter at Jefferson City to construct an electric railway to connect the two principal cities of Missouri. St. Louis, Kansas City, Chicago and Denver capitalists are interested in the venture. The capital stock is divided into 50,000 shares, with a par value of $100 each. The road is to be 295 miles long and traverse the counties of St. Louis, St. Charles, Lincoln, Warren, Montgomery, Callaway, Boone, Howard, Saline, Lafayette and Jackson to Kansas City, with a branch line from Glasgow through Charlton to Brookfield, in Linn County. The directors, who are the stockholders, number fifteen, as follows: D. C. Nevins and Charles A. Loomis, Kansas City; H. V. Johnson, W. Weston and B. L. Dorsey, Denver; J. H. Reeder and H. E. Insley, Kansas City; W. A. Hamilton, Chicago; L. M. Nevins and Seldon P. Spencer, St. Louis; George A. Anderson, Denver; W. H. Griffitts, Hays, Kan.; W. B. Cawthorn, Columbia, Mo., and Randall B. Young, Kansas City.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

McINTOSH, S. D.—The Dakota-Montana Telephone Company is building into the city. C.

BEEVILLE, TEX.—The Beeville Light Company has been granted a forty-year franchise here.

HIGBEE, MO.—The Citizens' Electric Light Company has been incorporated, with a capital stock of $5,000.

CHAPPELL, NEB.—The Chappell Telephone Exchange has been incorporated, with a capital stock of $10,000.

ST. PAUL, NEB.—The Howard County Telephone Company has been incorporated, with a capital stock of $100,000.

GRAFTON, N. D.—A rural telephone company has commenced the construction of a telephone system near here. C.

SUMMERFIELD, GUILFORD COUNTY, N. C.—The Farmers' Telephone Company has been incorporated, with headquarters here. L.

CHILLICOTHE, MO.—This city will vote on the issuance of bonds to the amount of $150,000 for waterworks and electric-light purposes.

BARTON, N. D.—A franchise has been granted by the county board to the Barton Farmers' Telephone Company to construct a telephone line. C.

GLADSTONE, MAN.—Fire damaged the building occupied by the government telephone system and other buildings to the amount of $60,000. C.

CRAWFORD, NEB.—The foundation for the Moyer telephone central has been completed and work will shortly be commenced on the superstructure. C.

TONOPAH, NEV.—Edward Clifford has purchased from J. C. McCormick the telephone line from Tonopah to Clifford and will extend it to Ellendale. A.

NORTHFIELD, WIS.—The Northfield Farmers' Telephone Company, H. L. Hanson, secretary, is considering the construction of a telephone line to Merrillan. C.

KAUKAUNA, WIS.—C. E. Raught, E. T. O'Brien and others have incorporated the Kaukauna Telephone Company, with a capital of $5,000, to build several rural lines. C.

NASHVILLE, N. C.—The Home Telephone Company, operating in a number of towns, is completing a new system here. F. C. Topleman is general manager of the Home Company. L.

JACKSON, CAL.—R. W. Barnett, of Lancha Plana, has been granted by the Board of Supervisors the right to erect poles in township No. 2 for the Farmers' Telephone Line, a local association.

SAN FRANCISCO, CAL.—Duncanson & Haroldson, Inc., have been awarded the contract for the substation of the Sierra and San Francisco Power Company in Visitacion Valley, south of San Francisco.

COEUR D'ALENE, IDAHO—The Silverton Engineering Company has been awarded the contract for the construction of the power development plant which will operate the Lehigh Valley Cement Company plant, to be built at Metaline, on the Pond Oreille River.

SAN FRANCISCO, CAL.—Superintendent F. P. Bergen, of the Sacramento Valley Power Company, has placed orders for wires, insulators and poles and all equipment necessary for the construction of a power line between Chico and Redding. A substation will be constructed a few miles out of Chico.

CRAWFORDSVILLE, IND.—The Crawfordsville Home Telephone Company has purchased the Darlington telephone exchange and will extend the system to Garfield. The company will build two new full copper-circuit lines from Crawfordsville to Darlington and make other improvements to the acquired property. S.

RICHMOND, VA.—The corporation commission report of values of public utilities up to June 30, 1909, for taxation for the current year shows that telephone and telegraph companies occupy fifth place in the list, being valued at $2,617,000, while electric railways hold fourth place, with a total valuation of $8,643,000. The total State tax on these items will amount to more than $100,000. L.

OMAHA, NEB.—Officers of the Continental Telephone and Telegraph Company, a recently incorporated independent concern, with an authorized capital of $50,000,000, announce that they have purchased the property of the Independent Union Telephone and Telegraph Company, which operates telephone lines in a territory reaching from Newburgh, N. Y., on the east, to Erie, Pa., on the west. The new owners announce that they will put the property into shape to handle telegraph as well as telephone business.

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ELECTRICAL SECURITIES.

In a recent report of the United States Steel Corporation, whose stocks may be regarded as a barometer of financial conditions, the favorable state of the trade in securities was quite well brought out. That this improvement also applies to the electric companies may be seen from some of the following reports:

Business with the telegraph companies, especially in the south, has recently increased to such an extent that it is becoming difficult to secure enough skilled operators to take care of the messages. The telegraph companies are now showing record net earnings.

President Duntley, of the Chicago Pneumatic Tool Company, says that the business has established a high record and is expanding at such a rate as to justify the expectation of dividends at the old basis now and a higher basis later. The management of the Chicago Pneumatic Tool Company states that a resumption of dividends may be expected early in 1910.

The Massachusetts railroad commissioners have approved an issue of 9,850 additional shares of Old Colony Railroad at $195 per share, to pay bonds of the Boston, Clinton & Fitchburg, maturing January 1.

At the annual meeting of the International Traction Company, of Buffalo, Morris Cohn, Jr., and Porter Norton were elected directors, to succeed H. J. Pierce and Arthur Robinson. Other directors were re-elected.

At the annual meeting of the Northwestern Elevated Company, Chicago, directors were re-elected. Directors of the Northwestern Elevated have re-elected the officers.

DIVIDENDS.

American District Telegraph Company; quarterly dividend of one per cent, payable November 15.

Connecticut Railway and Lighting Company; quarterly dividend of one per cent on the common stock and one per cent on the preferred, both payable November 15.

Ohio Traction Company; an initial dividend of one per cent on its common stock; also the regular quarterly dividend of one-and-one-fourth per cent on its preferred stock; both dividends payable November 1 to holders of record October 25.

Pacific Gas and Electric Company; a dividend of $1.50 per share on the preferred stock, payable November 15.

Pensacola Electric Company; semi-annual dividend of $3 per share on the preferred stock; also a dividend of $3 per share on account of deferred dividends accumulated since December 1, 1907, payable December 1 to stockholders of record November 15.

Public Service Investment Company; quarterly dividend of two per cent on preferred, payable November 15.

NEW YORK.

	Nov. 1.	Oct. 25.
Allis-Chalmers common	15⅜	14
Allis-Chalmers preferred	52⅜	50
Amalgamated Copper	86⅛	79½
American Tel. & Cable	*80	*80
American Tel. & Tel.	141¼	139¾
Brooklyn Rapid Transit	75⅝	76½
General Electric	163	159
Interborough-Metropolitan common	19⅝	17⅛
Interborough-Metropolitan preferred	50⅛	48⅜
Kings County Electric	129	128
Mackay Companies (Postal Telegraph and Cables) common	91	90⅛
Mackay Companies (Postal Telegraph and Cables) preferred	75¼	74
Manhattan Elevated	141	141
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	123½	123½
U. S. Steel common	90	86⅝
U. S. Steel preferred	127⅞	126
Western Union	76½	76
Westinghouse common	86	84½
Westinghouse preferred	140	132

*Last price quoted.

BOSTON.

	Nov. 1.	Oct. 25.
American Tel. & Tel.	141¼	139¾
Edison Elec. Illuminating	..	252
General Electric	163	159
Massachusetts Electric common	18¼	16½
Massachusetts Electric preferred	82	..
New England Telephone	134	134½
Western Tel. & Tel. common	10½	10
Western Tel. & Tel. preferred	88	88

PHILADELPHIA.

	Nov. 1.	Oct. 25.
American Railways	45½	45½
Electric Company of America	12¼	12⅜
Electric Storage Battery common	58	59½
Electric Storage Battery preferred	58	59½
Philadelphia Electric	13¼	12⅞
Philadelphia Rapid Transit	25¾	25½
Philadelphia Traction	89½	89¼
Union Traction	51¾	52

CHICAGO.

	Nov. 1.	Oct. 25.
Chicago Railways, Series 1	104	107
Chicago Railways, Series 2	35	35
Chicago Subway	7	7¼
Chicago Telephone	136	136½
Commonwealth Edison	119	119½
Metropolitan Elevated common	16	17
Metropolitan Elevated preferred	50	50
National Carbon common	95½	95¾
National Carbon preferred	118	118

PERSONAL MENTION.

FRED L. BAER has become superintendent of equipment for the Home Telephone Company, of San Francisco.

C. F. ELWELL, who has acquired the American rights for the Poulsen system of wireless telegraph and telephone, has returned to San Francisco from Europe and has opened offices in the Foxcroft Building there. A.

W. A. LAYMAN, vice-president and general manager of the Wagner Electric Manufacturing Company, of St. Louis, Mo., was a prominent attendant at the convention of the National Metal Trades Association held at Cleveland last week. Mr. Layman finds a very satisfactory condition of affairs throughout the entire metal industry and reports the Wagner Electric Manufacturing Company very busy and extremely well satisfied with its share of orders.

E. C. SORNBORGER has become identified with the Allis-Chalmers Company, of Milwaukee, Wis., in the capacity of sales engineer in its pumping engine and hydraulic turbine department. Mr. Sornborger received his early training and practical experience in the shops of the United States Navy, where he was later appointed a cadet engineer. Shortly after he was enlisted in the merchant service as assistant engineer, in which position he remained for a number of years. Attention has frequently been called to the value of the Navy as an industrial school, and this is reflected in the engineering career of Mr. Sornborger; while his subsequent work with the Buffalo Steam Pump Company, the Gordon Steam Pump Company and the Snow Steam Pump Works emphasizes its value commercially. Lieutenant Sornborger still retains his interest in naval affairs, being the commanding officer of a division of the Naval Militia of Buffalo.

OBITUARY.

GEORGE O. LINES, fifty-two years old, who formerly owned the street-railway line between Bridgeport and Stratford, Conn., died on October 26, at Stratford.

NEW PUBLICATIONS.

PREVENTION OF ACCIDENTS, OR A SAFER AMERICA—The Museum of Safety, of New York city, has recently published copies of a lecture by Dr. William H. Tolman entitled "Prevention of Accidents, or A Safer America." Dr. Tolman explains the causes for many of the accidents so frequent in manufacturing plants and outlines methods of preventing them.

UNITED STATES NAVAL INSTITUTE PROCEEDINGS—The September number of this quarterly, published by the Institute at Annapolis, Md., has just come to hand. Among other articles are the following: "Some Notes on Parsons Turbine Construction," by Captain A. B. Willits, U. S. N., "On the Approximate Formulas for Areas and Volumes, and Their Comparative Accuracy," by W. Woolsey Johnston, and "Main Engine Repairs Under Way," by Lieut. E. C. Kalbfus, U. S. N.

ELECTRIC MEASURING INSTRUMENTS—Circular No. 20, issued by the Bureau of Standards, Washington, D. C., entitled "The Testing of Electrical Measuring Instruments," gives, in addition to the list of fees for testing instruments, an outline of the characteristics of the various types of instruments now commercially used. The descriptive matter covers ammeters, voltmeters, wattmeters, watt-hour meters, recording meters and instrument transformers. The subjects of "Sources of Error," "The Liability of Electrical Instruments" and "Apparatus for Checking Instruments" are fully discussed.

THE HUDSON-FULTON CELEBRATION—A series of thirty-two illustrations prepared chiefly from photographs of the New York Edison Company, illustrating the lighting effects accompanying the Hudson-Fulton Celebration in New York city, has been published in pamphlet form. It formed part of an illustrated address before the Franklin Institute, of Philadelphia, which was delivered by Arthur Williams, of the New York Edison Company, on the evening of October 20. The illustrations are from excellent engravings and give a very good idea of the grandeur and magnitude of the lighting display which attracted hundreds of thousands of people to New York city. A number of the illustrations appeared in the columns of this journal in recent issues.

STATE REGULATION OF PUBLIC UTILITIES—The address of John H. Roemer, member of the Railroad Commission of Wisconsin, which was delivered before the Wisconsin State Bar Association at its meeting on September 1 in Milwaukee, has been reprinted in pamphlet form. The title of this address is "Some Features of State Regulation of Public Utilities." After a general introduction on the broad principles underlying government control the speaker dwelt at some length on the organization and work of the Railroad Commission of Wisconsin, which is the public service body of that state. This is a valuable address in pointing out the working of the Wisconsin public utility law, which is one of the broadest and most equitable on this subject ever enacted in any of the states.

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PROPOSALS.

POST OFFICE, BELLEVILLE, ILL.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 16 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Belleville, Ill., in accordance with the drawings and specifications, copies of which may be had from the custodian of the site at Belleville, Ill., or at the Supervising Architect's office.

POST OFFICE, ROCK ISLAND, ILL.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 18, 1909, for the construction (including plumbing, heating, wiring and standard clock system) of the extension of the United States Post Office at Rock Island, Ill., in strict accordance with drawings and specification, copies of which may be had at the office of the custodian at Rock Island, Ill., or at the Supervising Architect's office.

POST OFFICE AND CUSTOM HOUSE, NEW HAVEN, CONN.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 15 for the construction (including plumbing, gas piping, heating apparatus, electric conduits, wiring, and lifts) of an extension, remodeling, etc., to the United States Post Office and Custom House, New Haven, Conn., in accordance with drawings and specifications, copies of which may be obtained from the custodian at New Haven, Conn., or at the Supervising Architect's office.

INDUSTRIAL ITEMS.

THE PACIFIC ELECTRIC HEATING COMPANY, Ontario, Cal., is distributing a novel booklet devoted to electric irons.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., has recently distributed Bulletin No. 1000, devoted to mine telephones.

THE CENTRAL ELECTRIC COMPANY, 264-270 Fifth Avenue, Chicago, announces that hereafter it will make no extra charge for packing and cartage except on fixtures and glassware.

I. P. FRINK, 551 Pearl Street, New York city, has just been awarded the grand prize for reflectors by the Alaska-Yukon-Pacific Exposition. Any problem regarding the illumination of hotels, stores, picture galleries or public buildings is solved by this concern.

THE CUTLER-HAMMER MANUFACTURING COMPANY, of Milwaukee, Wis., has recently issued a folder devoted to pressure-controlled speed regulators for use with boiler-draft fans, boiler-feed pumps, gas-pressure systems, etc. This publication contains some valuable data.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., describes at some length, in Bulletin No. 1614, recently issued, the Manhattan high-pressure, fire-service system as operated by Allis-Chalmers six-stage, centrifugal, fire-service pumps, driven by Allis-Chalmers induction motors.

THE D & W FUSE COMPANY, Providence, R. I., has recently distributed bulletins Nos. 112 and 113. Bulletin No. 112 is devoted to a description of service switches and fuse boxes for national code fuses for 250 and 600 volts. Bulletin No. 113 describes fuses and cut-outs for inductive circuits.

THE CENTRAL ELECTRIC COMPANY, CHICAGO, ILL., is distributing a new circular descriptive of the new Central type weighted push button, for which several advantages are claimed, also a new folder descriptive of guy anchors, which should prove of interest to central-station managers. Copies of these publications will be sent on request.

THE NERNST LAMP COMPANY, Pittsburg, Pa., is sending out a folder to central-station companies calling their attention to the excellent returns made by putting out Nernst lamps free. A comparison is drawn between the revenue derived on this basis and the revenue obtainable from the renting of tungsten lamps, giving very closely the equivalent illumination.

THE BRISTOL COMPANY, Waterbury, Conn., has recently issued the following bulletin No. 108, devoted to William H. Bristol indicating electric pyrometers for hardening furnaces; No. 112, devoted to Bristol recording thermometers; No. 113, devoted to Bristol patent steel belt lacing, and No. 115, devoted to indicating and recording units of William H. Bristol electric pyrometers for annealing furnaces.

THE OHIO BRASS COMPANY, Mansfield, Ohio, is very busy on some large orders for 110,000 and other high-voltage link-type insulators for the Ontario Hydroelectric Commission, for the Helena (Mont.) Water Power, Land and Townsite Company and for a number of other projects developing and transmitting electricity at high voltages. A representative of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN witnessed, in the company of a number of prominent electrical engineers from Indianapolis, a 200,000-volt test of these insulators at the Akron works of the Ohio Brass Company last week.

F. B. BADT & COMPANY, Suite 1504 Monadnock Building, Chicago, Ill., electrical engineers and western selling agents for Weston electrical instruments and Ward Leonard rheostats, reports a constantly increasing demand for these well-known lines. F. B. Badt & Company's business, so far this year, has made such strides that the total business for the year bids fair to equal the best year in the company's history.

THE ANDERSON CARRIAGE COMPANY, Detroit, Mich., has absorbed the Elwell-Parker Electric Company, Cleveland, Ohio, and will take over the entire electrical and mechanical product of this well-known and old-established company. The Anderson Carriage Company will increase its line of taxicabs, trucks and other electric carriages. M. S. Towson will remain in Cleveland as general manager and consulting engineer.

THE JOHN A. ROEBLING'S SONS COMPANY, Trenton, N. J., has received ten grand prizes, the highest awards, for its exhibit at the Alaska-Yukon-Pacific Exposition. A grand prize was awarded the company for its general exhibit and similar prizes were bestowed for different articles shown. Among the Roebling products thus honored were iron telephone and telegraph wire; steel, brass and copper wire, and insulated wires and cables.

THE ADAMS-BAGNALL ELECTRIC COMPANY, Cleveland, Ohio, is very busy on orders for the Adams-Bagnall regenerative flame arc lamp. H. J. Worbs, secretary of the company, is enthusiastic over the reception which has been accorded this new lamp and states that out of a large number of shipments which have already been tested out, an entirely satisfactory showing has been made and that repeat orders are coming in in considerable volume.

THE ELECTRIC CONTROLLER AND MANUFACTURING COMPANY, Cleveland, Ohio, manufacturer of electric controllers, has recently issued a catalogue devoted to lifting magnets. This company's ten years' experience in developing lifting magnets has enabled it to place on the market a magnet that fulfills all conditions as they exist in practice. In addition to convincing arguments the catalogue contains some data and illustrations that should prove beneficial to those interested in the subject.

THE WHEELER REFLECTOR COMPANY, 156 Pearl Street, Boston, Mass., is distributing a folder which shows in a simple yet striking manner the advantages of the Wheeler fluted reflector for tungsten street fixtures. In comparison with the ordinary convex reflector for this purpose it is shown to give about twenty-three per cent more useful light, *i. e.*, below the horizontal. These reflectors have become very popular for this service since they were placed on the market some eighteen months ago.

THE NATIONAL METAL MOLDING COMPANY, of Pittsburg, Pa., is distributing a set of illustrated post-cards showing the new terminal station for the Chicago & Northwestern Railway at Chicago. This building covers an area of about ten acres, and with the attendant track changes which were necessitated by its construction will, when completed, have cost over $20,000,000. It has a capacity to handle over quarter of a million passengers per day. Throughout this beautiful depot exclusive use is made of "Sherarduct" rust-proof, non-corrosive conduit, made by this company.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has just published Bulletin 116, which gives some points on the operation and care of Exide vehicle batteries. This bulletin is really a reprint of a paper read by H. M. Beck, engineer of the operating department of the company at Chicago, before the recent convention of the Society of Automobile Engineers. The details of the particular methods of charging and the general care of the batteries are not given exhaustively, but the general principles are laid down in a very clear manner, and the principal points that are the cause of trouble are explained at some length.

THE GENERAL ELECTRIC COMPANY reports very gratifying sales of tantalum incandescent lamps. The sales of this lamp are more than double what they were a year ago and the lamp appears to be sharing with the demand for high-efficiency lamps created by the introduction of tungsten lamps. The tantalum lamp, as at present supplied, is giving most excellent life service. Contrary to general belief, these lamps will give good commercial life on alternating current of sixty cycles or less. Their life on this frequency will average well above 600 hours. An interesting tantalum-lamp order recently received called for 1,900 lamps for the United States war vessels attending the Hudson-Fulton Celebration in New York city.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., announces that during the month of September it shipped a total of twenty-one steam turbines, none of which were of less capacity than 300 kilowatts. Although this figure does not represent a record of shipments, it nevertheless serves to give a fair idea of the large number of Allis-Chalmers steam turbines being placed in operation at various points throughout the country. The following is a list of September shipments, a number of which include more than one unit to a customer and some

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of which will augment previous installations of machines from the same builders: Industrial Works, Bay City, Mich.; Lowland Worsted Company, Woonsocket, R. I.; Anderson & Middleton Lumber Company, Aberdeen, Wash.; Noblesville Heat, Light and Power Company, Noblesville, Ind.; North Adams Gas Light Company, North Adams, Mass.; Nashawena Mills, New Bedford, Mass.; Clinton Sugar Refining Company, Clinton, Iowa; Fraser River Lumber Company, Fraser Mills, B. C.; National Conduit and Cable Company, Hastings-on-Hudson, N. Y.; City of Columbus, Columbus, Ohio; Oak Park Power Company, Flint, Mich.; Merchants' Light, Heat and Power Company, Indianapolis, Ind.; Northwestern Gas and Electric Company, Walla Walla, Wash.; Eastern Pennsylvania Railway Company, Pottsville, Pa.; Wilkesbarre Gas and Electric Company, Wilkesbarre, Pa.; Colorado Springs Electric Company, Colorado Springs, Colo.; Royal Weaving Company, Pawtucket, R. I., and Virginia Electric Power and Water Company, Virginia, Minn. A considerable percentage of the above represents low-pressure units for use in connection with existing high-pressure steam plants.

DATES AHEAD.

National District Heating Association. First annual meeting, Columbus, Ohio, November 10 and 11.

Alabama Light and Traction Association. Annual convention, Birmingham, Ala., November 15 and 16.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 to 18.

Boston Electrical Show. Mechanics' Building, Boston, November 15-25.

Empire State Gas and Electric Association. Annual convention, New York city, November 17 and 18.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual meeting, Lima, Ohio, November 19 and 20.

International Independent Telephone Association. Annual convention, Chicago, December 7, 8 and 9.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) October 26, 1909.

937,759. PROCESS OF AND APPARATUS FOR THE PRODUCTION OF IONS. Lucien I. Blake, Denver, Colo. Filed May 16, 1908. The ions are produced and delivered into the air by being electrically charged by an external source of electromotive force in the flame, etc., in which they are developed by dissociation.

937,761. TROLLEY. Orson W. Brenizer, Philadelphia, Pa., assignor of one-third to James Franklin and one-third to Charles G. Wilfong, Philadelphia, Pa. Filed April 21, 1905. The harp has as an extension a bifurcated guard.

937,832. TELEPHONE-EXCHANGE SYSTEM AND APPARATUS. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Filed November 15, 1904. A combined signal and cut-off magnet having two windings, one on each limit, can be energized to close or to open the local signal circuit.

937,839. AIR-BRAKE. Lorenzo E. Morel, St. Hyacinthe, Quebec, Canada. Filed July 14, 1909. The exhaust is electrically controlled.

937,855. PROCESS OF PRODUCING AND REFINING STEEL. Frank C. Perkins, Buffalo, N. Y. Filed May 11, 1908. An iron bath is treated by an electric current which traverses an electrode containing iron in the presence of the iron bath and a slag-producing medium is supplied at the arc from this electrode.

937,857. PENDANT SWITCH. Johann G. Peterson, Hartford, Conn., assignor to the Arrow Electric Company, Hartford, Conn. Filed January 5, 1909. Describes a form of double-acting push-button switch.

937,858. COMBINED LAMP-SOCKET AND AUTOMATIC SWITCH. James W. Phelps, Detroit, Mich., assignor to the Electro-Ad Company, Detroit, Mich. Filed December 31, 1908. Includes a thermodynamic switch.

937,859. MOTOR-VEHICLE. Henri Pieper, Liege, Belgium. Filed January 25, 1907. Describes a form of gaso-electric vehicle with a reversible dynamo-motor and an auxiliary storage battery.

937,867. STRAIN-INSULATOR FOR ELECTRIC LINES. Edward E. Rose, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. Filed January 10, 1908. Has an outer casing yieldingly secured to the strain members so as not to be subjected to strain itself.

937,877. TRANSFORMER. Frank M. Slough, Elyria, Ohio, assignor to Dean Electric Company, Elyria, Ohio. Filed September 11, 1907. A signaling system includes a pole changer to supply current intermittently to the primary winding of a transformer, the secondary winding being connected to the signaling apparatus, and a reactive means is automatically included in circuit with the secondary winding when current is delivered from the latter.

937,897. STRAIN-INSULATOR. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. Filed January 10, 1908. Similar to No. 937,867.

937,901. TELEPHONE REPEATER APPARATUS. Nathaniel G. Warth, Gallipolis, Ohio. Filed December 20, 1907. The transmitter includes a case and a vibrating diaphragm united to form a granule-containing chamber, the arrangement being devised so as to promote free movement of the granules and eliminate packing.

937,908. SPARK-PLUG. Otto C. Winestock, Perkinsville, Vt. Filed September 1, 1908. The (movable) inner electrode has a disklike head of crenelated outline.

937,909. METHOD OF WIRING TELEPHONE-SWITCHBOARDS. Charles S. Winston, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed December 27, 1904. The cord circuits may be differently grouped by connecting terminals in various ways.

937,918. ELECTROLYTIC APPARATUS. Arthur Brichaux, Brussels, Belgium, assignor to the Solvay Process Company, Syracuse, N. Y. Filed October 4, 1898. The electrodes are arranged respectively in contact with layers of non-miscible electrolytes of differing densities.

937,919. ELECTRIC ALARM. Ralph C. Bronson, Chicago, Ill. Filed October 12, 1908. Relays in local circuits have associated with them a ringer circuit for each relay, etc.

937,941. ELECTRIC PROTECTION SYSTEM. Ole Jacobson, Hamilton, Ohio. Filed November 23, 1908. Describes an electric protective system for the combination lock of a safe.

937,957. ELECTRIC-SWITCH MECHANISM. Johann G. Peterson, Hartford, Conn., assignor to the Arrow Electric Company, Hartford, Conn. Filed December 10, 1908. Describes a form of commutator for a rotatory snap electric switch.

937,971. STARTING DEVICE FOR VAPOR-CONVERTERS. Percy H. Thomas, Montclair, N. J., assignor to Cooper Hewitt Electric Company, New York, N. Y. Filed May 11, 1905. The cathode activity produced by causing current to flow in the rectifier in a direction opposite to normal is utilized to overcome the starting resistance of the normal cathode.

937,984. INSULATOR-BRACKET. Edward V. Brown, New Albany, Ind., assignor of one-half to Adolph Day, New Albany, Ind. Filed February 27, 1909. A vertical insulator is supported by horizontal arms projecting from and integral with a wall plate.

938,026. LOCKING AND SIGNALING SYSTEM FOR TELEPHONE-REGISTERS. Alexander S. Spiegel, Chicago, Ill., assignor to American Telephone and Telegraph Company. Filed June 10, 1907. A device having differential windings controls one of the meters, the current distribution in these windings being varied by a resistance-varying device governed by another of the meters.

938,030. LATHE HEAD-STOCK. Harry B. White and Perry E. Medford, Washington, D. C. Filed March 26, 1908. The headstock includes an electric motor direct-coupled to the live spindle or mandrel.

938,038. INCANDESCENT LAMP-SOCKET. Homer A. Bretz, Chicago, Ill., assignor to the Federal Electric Company, Chicago, Ill. Filed March 4, 1907. Renewed March 5, 1909. The socket includes an electromagnet in series with the lamp circuit.

938,039. APPARATUS AND SYSTEM FOR MEASURING TELEPHONE SERVICE. Sidney H. Browne, Pittsburg, Pa., assignor to American Telephone and Telegraph Company. Filed January 17, 1905. Includes a line switch (connected to a meter) adapted to select automatically an idle trunk line, and electromagnetic means automatically operating the meter by a single energization to register only connections with other telephone lines.

938,060. APPLIANCE FOR USE WITH TELEPHONE-TRANSMITTERS. Charles J. Kintner, New York, N. Y., assignor to

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the Miniature Telephone Booth Company, New York, N. Y. Filed June 1, 1909. A transmission tube, pivotally secured to a vertical standard which frictionally secures it to the supporting standard of a portable telephone set, surrounds and encloses the mouth of the transmitter.

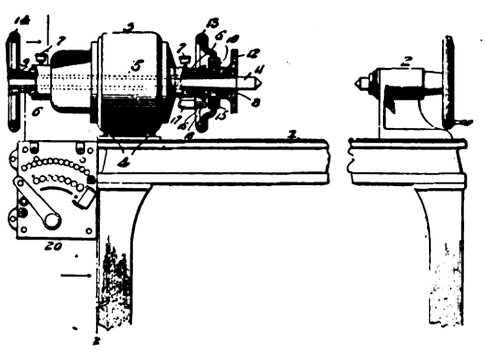
938,092. STRAIN-INSULATOR. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed June 8, 1907. Renewed June 24, 1909. Comprises a metal tube having taper ends, taper metal bushings seated therein, and taper metal plugs located within, and insulated from, the bushings.

938,108. SPARK-PLUG. William S. Bechtold, Newark, N. J. Filed June 24, 1909. A bent sparking terminal attached to the socket associates with a straight sparking pin located centrally through the plug.

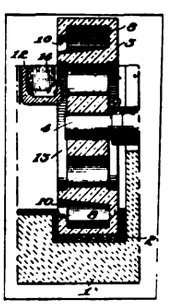
938,123. ELECTRIC IGNITER FOR GAS-ENGINES. James A. Charter, Chicago, Ill., assignor to Austin Manufacturing Company, Chicago, Ill. Filed July 28, 1908. Normally closed electrodes are separated by a trip-released spring-actuated mechanism.

938,127. ELECTRIC HEATER. Harry W. Denhard, San Francisco, Cal., assignor to George B. Katzenstein, Jr., San Francisco, Cal. Filed June 25, 1908. The liquid contained in a fluid chamber is heated by its own resistance to a current of electricity.

938,137. LIGHTNING-ROD. Julius F. Goetz, Hartford, Wis. Filed April 6, 1908. Overlapping tube sections in electrical contact are joined at their ends by threaded plugs and sleeves.



938,030.—LATHE HEAD-STOCK.



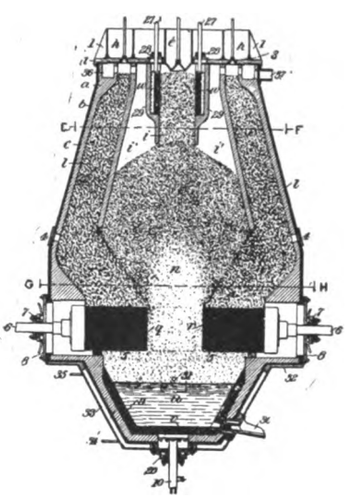
938,191.—CIRCULATING DEVICE FOR MERCURY.

938,191. CIRCULATING DEVICE FOR MERCURY. Jasper Whiting, Boston, Mass., assignor to the Whiting Company, Boston, Mass. Filed December 16, 1908. In combination with the decomposing and oxidizing compartments of an electrolytic cell having a cathode of mercury, is a circulating device for mercury comprising a disk or cylinder mounted for rotation, pockets for mercury in the peripheral portion of this disk, lateral discharge orifices for the pockets, and a receptacle for mercury in proximity to the discharge orifices in their uppermost position.

938,203. ELECTRIC DETONATOR. George A. Allen, Western Springs, Ill., assignor to the Ætna Powder Company, Chicago, Ill. Filed May 26, 1909. Electric wires for the igniting member lead into the shell containing the explosive through a cap which is crimped to exclude moisture.

938,212. ELECTRIC-LAMP-SOCKET FASTENING. Hjalmar Christensen, Seattle, Wash. Filed December 3, 1908. One side of a clamping member for the socket is formed into a cam surface.

938,213. ELECTRIC-LAMP-SOCKET RETAINER. Hjalmar Christensen, Seattle, Wash. Filed March 29, 1909. Similar to the preceding.



938,351.—ELECTRIC SMELTING FURNACE.

938,142. ATTACHMENT FOR MUSICAL INSTRUMENTS. Hermann Günther, Leipzig-Gohlis, Germany. Filed October 10, 1908. Translucent bands on a rotatable picture drum are electrically illuminated when contacts are made by the rotatable shaft of the drum.

938,154. TELEPHONE SYSTEM. Oscar M. Leich, Genoa, Ill., assignor to Cracraft-Leich Electric Company, Genoa, Ill. Filed June 19, 1908. A number of telephone instruments are associated with a metallic circuit (provided with continuity-maintaining repeating coils); a number of groups of telephones arranged tandemwise are also associated with the circuit so that intercommunication may be held between the telephones of each group; and repeating coils are provided for preventing telephonic intercommunication between the first aforesaid telephones and the grouped telephones.

938,155. SIGNALING SYSTEM. Oscar M. Leich, Genoa, Ill., assignor to Cracraft-Leich Electric Company, Genoa, Ill. Original application filed December 10, 1908. Divided and this application filed February 15, 1909. Describes a form of telephone system.

938,160. SYSTEM OF ELECTRIC-MOTOR CONTROL. Joseph N. Mahoney, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. Filed January 10, 1908. The trolley and a gathering reel (adapted to receive energy from a supply circuit) for the controller are connected by two independently operated switches which are automatically prevented from being simultaneously closed.

938,175. ELECTRICALLY-OPERATED RELEASE FOR DOORS. William H. Snyder, Ashbourne, Pa. Filed April 6, 1909. A retaining device opposing a means which tends normally to move a bolt to unlocked position, is electrically controlled, and a means operated by the energization of an alarm circuit is provided for closing the (normally) open circuit which controls the retaining device.

938,188. SPARK-PLUG. Fred H. Weinhauer, New York, N. Y. Filed May 11, 1909. Has a shell electrode co-operating with an electrode projecting laterally from a pin disposed axially and centrally through the plug.

938,237. ELECTRICALLY-OPERATED WATER-HEATER. John A. Hunnewell, Lowell, Mass. Filed April 4, 1908. The electrical heating coil is contained in a U-shaped receptacle for the water to be heated.

938,238. ELECTRIC ATTACHMENT-PLUG. Seykichi W. Ito, San Francisco, Cal. Filed March 18, 1909. Describes an attachment plug for lamp sockets.

938,260. INCUBATOR. Edward A. Maisch, Anderson, Cal. Filed January 23, 1909. Includes electric heating coils.

938,271. METALLIC INCUBATOR. Frank C. Perkins, Buffalo, N. Y., assignor to Cyphers Incubator Company, Buffalo, N. Y. Filed August 28, 1908. The egg tray is supported under an electric heater.

938,285. ELECTRIC-SIGNAL RECORDER. Nathan H. Suren, Needham, Mass., assignor to the Gamewell Fire-Alarm Telegraph Company, New York, N. Y. Filed October 16, 1908. The tool for cutting the tape has an inverted triangular pyramidal end.

938,286. ELECTRIC-SIGNAL RECORDER. Nathan H. Suren, Needham, Mass., assignor to the Gamewell Fire-Alarm Telegraph Company, New York, N. Y. Filed May 14, 1909. The marker is adapted to cut slots of varying lengths in the recording tape to form tongues and means are provided for severing the tongues so formed.

938,312. BATTERY. William Gardiner, Chicago, Ill., assignor to Ajax Battery Company, Chicago, Ill. Filed February 17, 1908. Molybdenum enters into the composition of the anode, or the cathode, or both.

938,313. STRAIN-RELIEF FOR ELECTRICAL DEVICES. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Filed June 30, 1908. An electrical device has an insulating body and terminal plates with a strain-relief comprising binding screws and clamping strips to embrace and grip the insulated portions of the wires adjacent to the binding screws, the latter securing the clamping strips.

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938,324. AUTOMATIC CIRCUIT-BREAKER. Joseph N. Kelman, Los Angeles, Cal. Filed April 22, 1907. Describes a form of high-potential switch and circuit-breaker.

938,331. BLOCK-SIGNAL SYSTEM. John D. Nix, Ferriday, La., assignor of one-fourth to Lewis M. Dalgarn, Natchez, Miss. Filed September 11, 1908. Each engine is provided with a dynamo and motor, the shaft of the latter being adapted to open a valve which controls a pair of cylinders provided with pistons, one of which operates a brake lever and the other a throttle valve. The motor is caused to operate by the approach of another engine in the same block.

938,337. TELEGRAPHY. John F. Richardson, Montreal, Quebec, Canada. Filed January 11, 1907. A pivoted member closes a local circuit when released from the electrical pull of an arc-shaped solenoid.

938,345. ELECTRICAL SIGNALING SYSTEM. Frank M. Slough, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Filed June 19, 1906. Describes such a system, including a central station and a number of subscribers' stations.

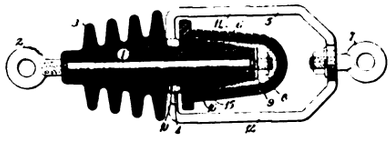
938,351. ELECTRIC SMELTING-FURNACE. Edward R. Taylor, Penn Yan, N. Y. Filed June 12, 1908. Has concentric feed passages discharging together in the zone between horizontal electrodes in the lower part of the furnace.

938,352. ART OF ELECTRIC SMELTING. Edward R. Taylor, Penn Yan, N. Y. Original application filed June 12, 1908. Divided and this application filed March 3, 1909. Similar to the preceding.

938,354. TYPEWRITER ATTACHMENT. Webster A. Tompkins, Portland, Ore. Filed August 26, 1905. The keys when depressed make electrical contacts for a solenoid, the core of which operates a rockshaft.

938,368. ELECTRIC CIGAR-LIGHTER. Solomon A. Campbell, Newton, Mass., assignor of one-half to John R. Learned, Newton, Mass. Filed August 14, 1908. Has one movable and one relatively fixed electrode.

938,373. PROTECTING-BOX FOR ELECTRIC WIRING. Harold W. Eden, Detroit, Mich., assignor to P. R. Manufacturing Company, Detroit, Mich. Filed December 16, 1908. Slots extending the body of the box are notched along the edges and on opposite sides of the walls of the box, and a correspondingly shaped fillet engages with the notches.



938,409.—STRAIN-INSULATOR.

938,394. CIRCUIT CLOSING AND BREAKING DEVICE FOR ELECTRICALLY-OPERATED ANNUNCIATORS AND THE LIKE. Augustus May, New Orleans, La. Filed March 25, 1909. Pivotally mounted weighted arms are electrically connected to a conductor, and a device carried by the car has insulated contact means which engage respective arms during the travel of the car.

938,399. ELECTRICAL EXERCISING APPARATUS. Walderma C. Schaufler, Amsterdam, N. Y. Filed July 9, 1908. The elastic cords of the apparatus comprise electric conducting means associated with a source of current and an induction coil, etc.

938,409. STRAIN-INSULATOR. Curtis F. Boldman, Canton, N. C., assignor to Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. Filed April 22, 1908. A strain rod extends completely through an insulating sleeve, around which is clamped a strain member.

938,414. CONFECTIONER'S MELTING-TABLE. George F. Dickson, Chicago, Ill., assignor to Confectioners' and Bakers' Supply Company, Chicago, Ill. Filed October 19, 1908. An open-top heating chamber is adapted to contain water, which is electrically heated.

938,429. MECHANISM FOR DANGER-SIGNALS FOR RAILROADS. Roy E. Murphy, Colorado Springs, Colo. Filed September 16, 1907. A torpedo magazine is electrically operated.

938,441. MESSAGE-RECORDING APPARATUS. Francis A. Skelton, Newton, Mass. Filed October 28, 1908. Has an electrically-operated carrier.

938,445. GLASS STORAGE-BATTERY CASE. Frank L. O. Wadsworth, Sewickley, Pa., assignor to Pressed Prism Plate Glass Company, New York, N. Y. Filed July 27, 1907. Opposite sides of the cells are formed of glass plates having ribs of trapezoidal section, the thin edges of the ribs outermost from the plates.

938,451. PROCESS OF MAKING ACTIVE MATERIAL FOR STORAGE-BATTERY ELECTRODES. Jonas W. Aylsworth, East Orange, N. J., assignor to Edison Storage Battery Company, West Orange, N. J. Original application filed April 28, 1905. Divided and this application filed February 6, 1908. The active material consists of nickel peroxide electrolytically deposited from a cyanide solution of the metal.

REISSUE.

13,027. ELECTRIC FURNACE. Aldus C. Higgins, Worcester, Mass. Filed October 12, 1908. Original No. 856,061, dated June 4, 1907. A number of electrodes depend into a relatively long and narrow furnace chamber, the walls of which are cooled by means of a cooling medium in order to effect the production of a commercially uniform product in the furnace.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 1, 1909:

485,181. DYNAMO. William H. Elkins, Cambridge, Mass.

485,220. DYNAMO-ELECTRIC MACHINE. David Pepper, Jr., Philadelphia, Pa.

485,221. AUTOMATIC GOVERNING DEVICE FOR ELECTRIC PUMPS. Francis A. Pocock, Lynn, Mass.

485,238. DEVICE FOR TREATING PATIENTS BY ELECTRICITY. Edmund M. Thomas, Little Rock, Ark.

485,239. REGULATOR FOR DYNAMO-ELECTRIC MACHINES. Elihu Thomson, Lynn, Mass.

485,252. UNDERGROUND ELECTRIC TROLLEY SYSTEM. Ruben B. Ayres, New York, N. Y.

485,279. COMBINED TELEGRAPHY AND TELEPHONY. Wm. W. Jacques, Newton, Mass.

485,284. ARMATURE CORE FOR ELECTRIC MOTORS AND DYNAMOS. Anton J. Lehman, New York, N. Y.

485,287. ELECTRIC LIGHTING SYSTEM. William H. McKay, Roanoke, Va.

485,293. ELECTRIC ARC LAMP. John A. Mosher, Chicago, Ill.

485,297. SIGNAL BELL. Englebrecht Olsen, Walkerville, Mont.

485,311. TELEPHONE. Anthony C. White, Boston, Mass.

485,319. GALVANIC BATTERY. Walter A. Crowdus, Memphis, Tenn.

485,327. ELECTRIC ARC LAMP. Edward R. Knowles, Middletown, Conn.

485,334. ELECTROMAGNETIC TELEGRAPH APPARATUS. Alfred G. Safford, Washington, D. C.

485,337. CIRCUIT SWITCH. Marvin E. Sullivan and John Doss, Denver, Colo.

485,343. METHOD OF AND APPARATUS FOR ELECTRO-DEPOSITION OF METALS. Charles R. Fletcher, Boston, Mass.

485,347. ELECTRIC ARC LAMP. Henri Japy, Beaucourt, and Oscar Helmer, Paris, France.

485,352. ELECTRIC SIGNAL. George McIntosh, Stonington, Conn.

485,367. ELECTRICAL DOOR-TRIP FOR ENGINE HOUSES. Adam Bosch, Newark, N. J.

485,379. ELECTRIC BELL. John R. Hard, New York, N. Y.

485,424. ELECTRICAL HEATER. Henry G. O'Neill, Louisville, Ky.

485,425. ELECTRIC INTERMUTATOR. Henry G. O'Neill, Louisville, Ky.

485,473. ELECTRIC DANGER SIGNAL FOR MOVING TRAINS. James McCart and Arthur G. Judkins, Trenton, Mich.

485,478. INCANDESCENT ELECTRIC LAMP. Edward Pollard, Cambridge, Mass.

485,537. ELECTRICAL ARC LAMP. Edgar A. Edwards, Cincinnati, Ohio.

485,555. UNDERGROUND ELECTRIC CONDUIT AND TROLLEY BAR FOR ELECTRIC RAILWAYS. John S. Moss, Martinsburg, W. Va.

485,558. ELECTRIC SWITCH. James C. O'Neil, Cleveland, Ohio.

485,587. SOCKET FOR INCANDESCENT ELECTRIC LAMPS. John S. Potter, Newton, and David J. Cartwright, Boston, Mass.

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CONTENTS.

EDITORIAL:
Hydroelectric Power in the Central West 915
The Interurban-Railway Situation in Massachusetts 916
Does It Pay to Condense? 917
Art in Public Lighting 917
The Boston Electrical Show 918
Chicago Electric Club 918
Japanese Commissioners at Pittsburg 919
Mr. Howe Talks on Factory Lighting at Grand Rapids 919
Fifth Annual Meeting of the Western Association of Electrical Inspectors 920
Joint Pole Lines in New York City 920
Annual Meeting, American Trade Press Association 921
Lewis Institute Branch, American Institute of Electrical Engineers 921
New Method of Instantaneous Roentgen Photography 922
Electrical Exports for September 922
Joint Laboratories at Madison for Forest-Products Investigation 924
Synchronizing Device for Closed-Current Motors 924
Domestic and Foreign Registration of Trade Marks 925
Independent Telephone Situation 925
ELECTRICAL NOTES FROM GREAT BRITAIN 926
Preservation of Telegraph and Telephone Poles and Railroad Ties 927
Electrical Development in Victoria 928
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
Street Lighting Abroad 930
Enclosed Arc Lamp 933
CENTRAL-STATION PRACTICE:
Electrically Heated Household Appliances 934
The Storage Battery in the Electric Lighting Plant 936
ELECTRIC TRACTION:
The New Electric Locomotives for the Simplon Tunnel 938
Single-Phase Electric Road in Norway 941
ELECTRICAL ADVERTISING AND SELLING:
Getting Back to First Principles 942
A Unique Manner of Interesting Central-Station Customers 944
INDUSTRIAL POWER:
Installation, Operation, Care and Repair of Electric Motors in Industrial Operations 945
Causes of Breakdowns in Electrical Machinery 948
TELEGRAPHY—TELEPHONY AND WIRELESS:
Train Dispatching by Telephone 949
High-Speed Wireless Telegraphy 949
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 952
INDUSTRIAL SECTION:
Western Electric Arc Lamp Displays at Hudson-Fulton Celebration 954
Inauguration of Triumph Companies' New Plant 954
Kozesnik Safety Third-Rail System 955
Gas-Electric Motor Car for Third Avenue Railway Company, New York City 956
Benjamin Reflector Sockets 956
Storage Batteries for a Crane Load 957
Telephone Train Dispatching on "Nickel Plate" Railroad 957
Electrically Heated Oil Tempering Bath 958
CURRENT ELECTRICAL NEWS 959
DIRECTORY OF ELECTRICAL AND ALLIED ENGINEERING AND SCIENTIFIC SOCIETIES 966
RECORD OF ELECTRICAL PATENTS 968

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HYDROELECTRIC POWER IN THE CENTRAL WEST.

Great opportunities exist for the use of hydroelectric power in the Central West, and comparatively little has been done to take advantage of them thus far.

From Chicago to New Orleans, and from Omaha and Kansas City to Cleveland and Cincinnati, including St. Louis, Indianapolis, Columbus, Louisville, Memphis and Galveston, the prominent hydroelectric plants are very few in number.

In this great territory extending more than seven hundred miles east and west and more than eight hundred miles north and south, with its tens of millions of people, hundreds of thousands of horsepower could be used from hydroelectric plants. Much the largest hydroelectric plants now operating in this territory are that on the Chicago drainage canal at Lockport, and that on the Tennessee River at Hale's Bar, the former designed for an ultimate capacity of 43,000 and the latter for 50,000 horsepower in electric generators.

In the meantime, half a dozen large rivers and numerous smaller ones are falling hundreds of feet on their way through this great central region to the sea. According to the recent report of the United States Board of Engineers on the proposed fourteen-foot waterway from Chicago to New Orleans, the 10,000 cubic feet of water per second that the Sanitary District of Chicago is authorized to divert from Lake Michigan is capable of developing 100,000 horsepower before it reaches the Illinois River at Dresden Heights. In its course of some 325 miles from this point to its mouth on the Mississippi the Illinois River falls about 126 feet, and even with this gentle slope it is believed that the flow of 10,000 cubic feet per second can be made to develop tens of thousands of horsepower.

From Dubuque, Iowa, to the Gulf of Mexico, the Father of Waters falls 585 feet along its course of 1,672 miles, with rapids at Rock Island and Keokuk. Between Le Claire and Muscatine, Iowa, a distance of forty-three miles by the river, the Mississippi falls thirty-two feet, passing Rock Island on the way. Again, from Montrose to Keokuk, Iowa, the Mississippi falls twenty-three feet in a distance of twelve miles. While the possible heads of water between these points are thus moderate, the great volume of the Mississippi might suffice to develop powers large enough to warrant transmission to Chicago, which is about 150 miles from Rock Island, and to St. Louis, which is about 140 miles from Keokuk.

From Omaha, Neb., to its mouth on the Mississippi the

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Missouri River falls 555 feet in a distance of 660 miles, or less than 0.9 foot per mile. Between Plattsmouth and Nebraska City, Neb., however, the fall is 65 feet along fifty-six miles, and from Waverly to Dewitt, Mo., a distance of thirty-two miles, the fall is thirty-one feet.

Of course a local investigation is necessary in every instance to determine whether it is practicable to develop a waterpower, and in broad, low parts of the valley of rivers that have only gradual falls, like those just noted on the Missouri, the cost of dam construction and of land damages may forbid any development. Where a long gradual fall in a river is continuously confined between high banks, however, and land is of little worth, the very fact of a gradual fall may add greatly to the value of the waterpower, because of the storage area and regulation of flow thus made practicable. Take, for illustration, the Missouri River between Plattsmouth and Brownsville, Neb., with its fall of sixty-five feet, if the river were confined between high banks along this stretch of fifty-six miles, and other conditions made it practicable to create a reservoir of this length, the storage area thus obtained would obviously add greatly to the earning power of a possible development.

Along the Ohio River, from Pittsburg to its mouth at Cairo, Ill., the distance is 963 miles and the fall 425 feet, or only 0.44 foot per mile. The only substantial fall in the Ohio at any one point is at Louisville, Ky., and from that city to New Albany, Ind., the drop in the river is twenty-seven feet along a distance of four miles. Waterpower is now developed at this point, but no investigation has been made to determine whether a substantial increase of power could be obtained by further improvements.

From Tennessee Pass in Colorado to Hutchinson, Kan., the Arkansas River has a length of 626 miles, and from Hutchinson to Wichita, a distance of thirty-nine miles downstream, the fall in the river is 278 feet. This stretch of thirty-nine miles on the Arkansas River is distant about 130 miles from Topeka, and 180 miles from Kansas City.

Logansport, Ind., is 155 miles from the source of the Wabash River, and the distance from Logansport to Lafayette is fifty miles downstream. Along this stretch of fifty miles the Wabash River falls seventy-seven feet, and the distance from this part of the stream to Indianapolis is some sixty-five miles.

Cleveland, Ohio, is no more than 200 miles from Niagara Falls, so that the transmission of energy from the cataract to that city would be only forty miles longer than that to Syracuse and Auburn. Another additional stretch of 200 miles would carry Niagara power into Cincinnati. While a transmission of Niagara power over a distance of 400 miles to Cincinnati may or may not be practicable from the financial point of view, it is, of course, entirely possible as a feat of engineering.

The Tennessee River is one of the great power streams of the United States, for its flow below Chattanooga ranges between 5,000 and more than 300,000 cubic feet of water per second, and it falls 345 feet from that city to its mouth on the Ohio at Paducah, Ky., a distance of 452 miles. In spite of its moderate average slope, the Tennessee River has sufficient fall at a number of points to make power development on a large scale practicable. At Hale's Bar, thirty-three miles below Chattanooga, a fall of thirty-nine feet has been developed, and a hydroelectric plant designed for 50,000 horsepower constructed, as mentioned above.

About 170 miles downstream from Chattanooga, in a stretch of thirty miles between Milton Bluff and Florence, the Tennessee falls 127 feet, and thus offers opportunity for the development of a far greater power than that at Hale's Bar. This stretch of river with the fall of 127 feet is distant about 200 miles from Memphis, Tenn.

THE INTERURBAN-RAILWAY SITUATION IN MASSACHUSETTS.

Two electric interurban-railway projects of general interest are at present before the Massachusetts Railroad Commission seeking certificates giving them the right to build high-speed lines between Boston and several important cities lying in the northeastern portion of the state. The proposed railroads differ from the interurbans that thread the highways and byways of the East in avoiding grade crossings of any kind, and by their assignment to the work of bringing communities from fifteen to thirty miles from the primary terminal city into immediate touch with the larger center of population and affairs. The capitalists and engineers behind each project hope to bring the areas tapped within the critical limit of running time where the patron whose hours are valuable forsakes the comparatively slow street railway for the less-frequent but swifter steam train. The older project is that of the Boston & Eastern Electric Railroad Company, and the other that of the Boston, Lowell & Lawrence Electric Railroad Company. Both are trying to get a foothold under a law passed about three years ago which recognized the need of an entirely new type of transportation in Massachusetts, occupying a position midway between the steam railroad and the street railway, and fulfilling functions that neither the urban rapid-transit system extended nor the cross-country highway trolley line could achieve.

Without going into the details of the proposed lines, it is noteworthy that the technical aspects of each project have been studied with the most painstaking care by engineering organizations of national reputation. The questions of location have been considered on the basis of detailed surveys of every foot of the proposed route in each case; the estimates of cost have been prepared only after the most thorough study of schedules and power requirements; and the probable earnings have been deduced from tabulations of the populations and their growth in the territory to be served. It is safe to say that preliminary expenses of the two railways, including investigations, reports, estimates, plans, and the fees of counsel

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appearing at hearings have easily reached $75,000. The thoroughness with which each case has been worked out, however, proves that on large enterprises of this character, representing a combined investment of probably $18,000,000, it is of the utmost importance, from every point of view, to take account of all possible contingencies, and to present before the reviewing commission data so complete that engineering objections can in all cases be faced with confidence.

Naturally the two projects have encountered the active opposition of the steam and street-railway companies now operating in the territory through which it is proposed to run the lines. The commission must take all such facts into account in deciding whether these roads shall be built or not, having due regard for the existing investments as well as the public accommodation. Since the law enacted in 1906 provided, however, for the creation of a new type of electric railroad especially adapted to handle a class of traffic which the slow-running street car cannot handle satisfactorily, and which the overburdened steam lines cannot cope with, the prospects are on the whole favorable for the ultimate construction of the road. Matters have gone far enough to show that the promoters are in earnest, and there is no question that the possibilities of modern equipment on an unrestricted right-of-way in a territory as thickly populated as Eastern Massachusetts are capable of quickening the pulse of traffic and stimulating the prosperity of those rather conservative communities in a most interesting and beneficial fashion.

The effect on the present facilities in the territory cannot be predicted at long range, but if the fears of the existing companies are realized we shall be greatly surprised. It is going to be settled before many years that suburban traffic cannot be properly or efficiently handled by the steam locomotive; and that ample track capacity is essential for taking care of this class of business even where electrified service is in operation. The steam roads operating in our larger cities have had time enough now to make up their minds in regard to the desirability of electrification, and if other people are sufficiently far-sighted to enter the field of suburban-traffic handling, there should be no complaint. The railroads might as well realize now as later that the public is going to demand electrical operation within certain districts with a more insistent voice each year, and if this clean, swift and frequent service is not provided by the railroads, it will be established by others. Doubtless in some cases the cost of additional right-of-way will be so great that new lines will have to be built, either by the railroads themselves or by companies like those now fighting their way in Massachusetts for a standing place on the face of the earth.

As for the street-railway lines in districts which the high-speed interurban is preparing to enter, it is clearer each year that the short-haul traffic is the life of the trolley system, and that if it is operated to the fullest extent of its physical and commercial possibilities as a collector and distributor for the new type of interurban, with due cultivation of local patronage, the coming of a new and fast line may actually be a benefit instead of a rival. Electrical methods in every field are so flexible and so powerful in attracting patronage that where a new field is developed there is on the whole reason to anticipate a general gain in public and private welfare.

DOES IT PAY TO CONDENSE?

Under the above caption *The Electrical Engineer,* of London, England, prints the following item:

"At one of the London power stations it has been found that the energy required to work the air pump, circulating pump and fans for the cooling tower costs more than the saving made by condensing. In other words, in this station it would pay to exhaust to atmosphere. The engines are of a very high-class make, with Corliss valves guaranteeed to use under twenty pounds of steam per kilowatt-hour, and yet the whole station is taking nearly forty pounds. It is clear, therefore, that the condensing arrangements and auxiliaries require overhauling, and no doubt there are many stations which would do with a thorough overhaul by an expert mechanical engineer. Chief engineers of electric power plants are usually electrical men who overlook the smaller mechanical details."

This would seem to indicate a most lamentable state of affairs. If it is true, which is doubtful under the circumstances quoted above, that the engines are really high-class, then the installation of the plant and the design of the auxiliaries must be very far from "high-class." Condensation may be not worth while with certain kinds of high-speed single-acting engines, but with Corliss engines properly designed and installed there should be no question of the advisability of condensation. If the exhaust steam were used to operate a low-pressure turbine or if it were sold for heating purposes, no doubt a considerable economy would accrue, but that is another matter. Even with the existing installation, condensation should pay, if properly carried out. And why should an electrician, knowing nothing of steam-engine practice, be put in complete charge of a steam-driven plant?

ART IN PUBLIC LIGHTING.

While public lighting is no longer the chief source of revenue to central stations, it is a very important feature for many reasons, the chief one being its ever-ready answer to the query, "Are you giving the best service that can be obtained?" Cities that have good street lighting as a rule have good central-station service.

Now, good street lighting is a broad term, and it surely does, and should, include fixtures whose appearence is a welcome addition to a city's streets. That we have much to learn from Europe in this respect would seem evident from the article in this issue by Mr. H. Thurston Owens on "Street Lighting Abroad," but that we can and will accomplish results in every way comparable with the older cities of Europe, goes without saying. It is only a question of time, and that time should be short, for the best interest of all concerned.

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The Boston Electrical Show.

As has been previously announced in these columns, the first electrical exposition to be given in Boston, will be held in the Mechanics' Building, November 15 to 25, inclusive. The interest taken in it by the large manufacturers of electrical appliances throughout the country is doubtless due to several causes. It will be the first comprehensive exhibit of electrical appurtenances ever held in the New England states. Owing to extensive advertising, the show will interest not only the general public that is usually attracted by things electrical, but the electric-light and power companies throughout New England, who are expected to send many representatives to see the latest electrical developments. This is of particular interest to the manufacturers, as it will enable them to reach at small expense a large number of prospective customers.

The association which is giving the exposition is a co-operative one, since it is composed of the exhibitors. These have joined the association on the payment of a merely nominal fee, and in the event of a successful show, for which all indications are favorable, the profits will be distributed in the shape of rebates pro rata on the amount of space subscribed for.

The arrangements are practically completed for a harmonious general decorative scheme. The exhibits are being rapidly installed and everything points to complete readiness when the show will open next Monday. The management of the show is in the hands of Chester I. Campbell, 5 Park Square, Boston. The admission fee has been placed at twenty-five cents, and it is believed that Mechanics' Building will see some enormous crowds of visitors within the next twelve days.

Chicago Electric Club.

A very interesting address was delivered Wednesday, November 3, following the regular weekly luncheon of the Chicago Electric Club, by Dean P. B. Woodworth, of Lewis Institute, Chicago. The co-operative forces which were recently established at the University of Cincinnati, Cincinnati, Ohio, have attracted the attention of educators and manufacturing concerns over the entire country. The courses are so planned that the students taking them work alternate weeks in the engineering college at the university and at the manufacturing shops of the city. Professor Woodworth is now engaged in establishing a similar plan in connection with Lewis Institute, and this work was made the subject of his address.

In introducing this subject, Professor Woodworth explained that this educational scheme has been in progress since last January, but owing to the uncertainty as to the results, no efforts were made to attract attention to it. The apprentice system, as developed in combination with Lewis Institute, is a modification of the system now being successfully operated in Cincinnati. Regarding the details, the speaker said substantially as follows:

When the scheme was inaugurated various manufacturers were approached and requested to nominate two or four boys to alternate between the Institute and the shops. In the case where two boys are nominated, one boy was to be at school a week while the other is at work. Several companies responded and a class of forty-seven was started.

The subjects studied are so arranged that the morning periods are devoted to such subjects as physics, mathematics and English, and the afternoons are generally devoted to shop and laboratory practice, thus accomplishing much in a day without overtaxing the minds of the students. Students in these courses attend throughout the entire year, thus averaging approximately the same number of hours as the regular students. The matter of co-operation of the instructors has much to do with the rapid advancement of the students. For instance, if a class carries out an experiment in the physical laboratory, the mathematics instructor acquaints himself with the nature of the experiment and during the mathematics period instructs the class in the mathematical phase of the experiment. In the same way the instructor of English requires the class to write an essay on the experiment. In this way each day is a complete unit.

Figures presented by Professor Woodworth, giving the results up to the present time, show that the scheme will undoubtedly be successful. While out of the forty-seven pupils who started only twenty-four still remain, those who have left have given reasons which do not in any way affect the feasibility of the scheme. The ages of the students average from sixteen to twenty years, and there are students whose previous schooling was very limited, and others who are graduates of high schools. When starting, each pupil receives ten dollars per month from the manufacturer, which amount is increased as the efficiency of the young man increases.

In concluding, Professor Woodworth stated that since the experimental stage of this scheme has been successfully passed, the Institute will give it publicity, and he believes that much good will be derived therefrom. It is encouraging to the officials of the Institute to note how interested these apprentice students are in the work, and in several instances they have advanced quickly and become more efficient than the regular students.

The Traction Situation in Detroit.

On Monday last, November 8, in Detroit, Mich., Mayor Philip Breitmeyer turned over to the Common Council Franchise Committee and the Citizens' Committee of Fifty (which is endeavoring to work out a settlement of the traction question) the appraisal of the property of the Detroit United Railway, made by Engineer F. T. Barcroft. It places the total valuation of the company's holdings in Detroit at $11,284,606. There also is property valued at $1,550,000, which is excluded from the appraisal, such as unused real estate, pavements, etc. The company has a total mileage in the city, exclusive of extensive suburban lines, of 170.41, and operates 998 cars.

An appraisal of the company's physical property by an engineer employed by the company fixed the total value at $24,708,375. Franchises on sixty-six miles of the company's trunk lines expire on November 14.

"Readiness-to-Serve" Rates Approved in Wisconsin.

The Railroad Commission of Wisconsin, in rendering its decision of the settlement of rates for the city of Marinette, Wis., said: "Electricity should be considered a service rather than a commodity. It is not fair that a consumer who uses ten kilowatts for ten hours per day should pay as much as one who uses 100 kilowatts, but uses it all in one hour."

This opinion was not handed down by the commission until it had made a very thorough and exhaustive investigation which, it is understood, covered a period of about six months. This opinion practically orders the cities of Wisconsin to adopt the "readiness-to-serve" rate basis. —From a paper on "Lighting Rates in Towns of Over 15,000 Population," by N. G. Linn, of Bloomington, Ill., read before the recent convention of the Illinois State Electric Association.

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Japanese Commissioners at Pittsburg.

Friday, November 5, was a strenuous day, and yet one of the most interesting, in the itinerary of the Honorary Commercial Commissioners of Japan, who are now making a tour of this country. The day was spent in visits to the great industrial plants around Pittsburg. Practically all the morning was required to inspect the famous mills of the Carnegie Steel Company at Homestead, Pa. The visitors and their escorting committee were the guests of the Carnegie Steel Company at an informal luncheon at these works.

Early in the afternoon a special train carried the party to East Pittsburg, where the shops of the Westinghouse Machine Company were first visited. Here was observed the construction, assembling and testing of steam turbines, gas engines, steam engines and condensers.

The visitors were then escorted to the works of the Westinghouse Electric and Manufacturing Company, where a number of Japanese guides took them in charge and showed them through the numerous departments of this great establishment. Besides observing the manufacture and testing of generators, motors, transformers and other auxiliary apparatus of all types and sizes, considerable attention was directed to the large electric locomotives being built for the New York terminals of the Pennsylvania Railroad.

A trip was then made by special train to the works of the Westinghouse Air Brake Company at Wilmerding. During the inspection of these shops the visitors witnessed a demonstration of how the air brakes are applied on a train of fifty to 100 cars.

From Wilmerding a group of the leading Japanese visitors was taken to East Liberty as the special guests of a number of officers of the Westinghouse companies, who gave a dinner in their honor at the Rittenhouse. Covers were laid for thirty, among whom were the following specially honored Japanese guests:

Baron E. Shibusawa, chairman of the commission, president First Bank.

Mr. Buei Nakano, member of the House of Representatives, president of Tokio Stock Exchange and Tokio Chamber of Commerce, director of Tokio Electric Railway Company, Limited.

Mr. Michio Doi, president of Osaka Chamber of Commerce, Osaka Electric Light Company, Limited, and Naniwa Electric Railway Company, Limited, director of Osaka Godo Cotton Spinning Company, Limited, and Ujikawa Hydri-electricity, Limited.

Mr. Jihei Nishimura, president of Kyoto Chamber of Commerce, director of Kyoto Shoko Ginko and Kyoto Textile Fabric Company, Limited, member of House of Representatives.

Mr. Kahei Otani, director of Yokohama Water Works Bureau, president of Yokohama Seventy-fourth Bank, and Japan Tea Manufacturing Company, Limited, director of Yokohama Electric Wire Company, Limited, member of Yokohama Chamber of Commerce.

Mr. Tominosuke Katono, managing director of Meiji Ginko and Nippon Cars Manufacturing Company, Limited, director of Nagoya Electric Power Company, member of Nagoya Chamber of Commerce.

Mr. Heizaemon Hibiya, president of Kanegafuchi Cotton Spinning Company, Limited, director of Fuji Gassed Cotton Spinning Company, Limited, and Tokio Woolen Textile Company, Limited.

Mr. Sakutaro Satake, president of Tokio Electric Light Company, Limited, and Tenth Bank, Kofu, director of Kabuto Beer Brewery, Limited.

Mr. Kaichiro Nezu, member of House of Representatives and Tokio Chamber of Commerce, director of Tobu Railway Company, Limited.

Dr. Riuta Hara, doctor of engineering, engineer of Yokohama Water Works Bureau.

Mr. Narazo Takatsuji, director and chief engineer of Kanegafuchi Cotton Spinning Company, Limited.

Mr. W. M. Zumoto, editor and proprietor, *Japan Times*.

Consul-General K. Midzuno.

After partaking of the fine dinner thus provided, a number of brief but appropriate addresses were made. The success of this dinner was due to the excellent arrangements that had been made by W. M. McFarland, acting vice-president of the Westinghouse Electric and Manufacturing Company, who was also toastmaster, and whose personal greeting to each guest was greatly appreciated.

Mr. Howe Talks on Factory Lighting at Grand Rapids.

The Grand Rapids-Muskegon Power Company, Grand Rapids, Mich., entertained over two hundred manufacturers at a dinner given at the Pantlind Hotel on Wednesday evening, November 4, which was followed by an address and demonstration on factory lighting by C. A. Howe, manager of the Chicago office of the Holophane Company. Many of the city's manufacturing companies were represented, as well as manufacturers from the nearby cities of Lowell, Belding, Kalamazoo, Muskegon, Coopersville and Grandville.

One of the objects of this meeting was to stimulate good feeling between the representatives of the power company and the representatives of the manufacturers. The power company, therefore, had about twenty-five of its different heads of departments present, while many of the guests were superintendents of factories and engineers. In addition, a goodly number of factory proprietors accepted the invitation sent them and were present.

The banquet hall was artistically decorated and presented some novel features in illumination. The table decorations were intermingled with miniature lamps which burned independently of portable table lamps placed at short intervals around the table. After the first course of the dinner the lights were turned off and the large manufacturers' monogram, "G-R-M," standing for Grand Rapids Manufacturers, was switched on. The incandescent lamps were so arranged that at times only carbon lamps were used and then tungsten lamps were lighted, showing a marked contrast between the two illuminants. Another novel lighting effect was produced by several mercury arc lamps, which, when lighted, afforded much amusement.

H. W. Hillman, manager of the Grand Rapids-Muskegon Power Company, gave a brief history of lighting, starting with the candle, and relating the rapid advancement of the various illuminants up to the present tungsten lamp.

Following this brief introduction, Mr. Hillman introduced Mr. Howe, who discussed factory lighting in a very practical manner, void of technicalities, and illustrated his talk by means of various lighting appliances. He said that there is no set rule for factory lighting, as each factory must be arranged according to its needs, and if properly engineered, the lights can be very easily controlled and directed. To illustrate the progress of illuminants, Mr. Howe lighted a number of carbon lamps which he said consumed 2,788 watts. This illumination he compared with an equal number of tungsten lamps which gave better light at a consumption of only 960 watts. He exhibited and explained various shades and reflectors, particularly the new angle reflectors, showing how the rays of light can be diffused or concentrated as desired to meet any need.

In conclusion, Mr. Howe said the power company favored the tungsten lamp, which used much less current than the carbon lamp, because it appreciated the value of a satisfied customer.

Following Mr. Howe's address, the manufacturers inspected the different lamps, shades and reflectors exhibited.

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Fifth Annual Meeting of the Western Association of Electrical Inspectors.

The fifth annual meeting of the Western Association of Electrical Inspectors was held at the Employers' Association Hall, Stevens Building, Detroit, Mich., October 26 to 28. The programme followed at this meeting included the reading of several interesting papers, reports of various committees and tours of inspection of the various electrical industries in Detroit.

The first meeting was called to order at 10 o'clock Tuesday morning by Vice-President Frank R. Daniel, who presided on account of the illness of President George D. Boyle. The report of Secretary W. S. Boyd was read and showed the association to have made a nominal gain in membership. Various new business was brought up, which was followed by the report of the committee on "Uniformity of Rulings," and later the reports of the committees on "Grounding of Conductors for Safety" and "Public Safety."

Tuesday evening the members of the association attended an informal dinner and were entertained by James E. Cole, commissioner of wires, Boston, Mass., who addressed the delegates on the subject of "Municipal Control of the Electrical Hazard." Mr. Cole's address related principally to the past and present conditions of electrical wiring in Boston, and to methods of preventing the large number of fires in Boston caused by defective wiring.

Wednesday morning was devoted to a number of inspection tours. The afternoon session was opened by the reading of a paper by Alexander Henderson, of the American Circular Loom Company, entitled "The Effect of Inspection on the Manufacture of Electrical Appliances." Mr. Henderson's paper emphasized the benefits the manufacturers derived from having electrical appliances standardized.

This paper was followed by an address by J. B. McCarthy, president of the Electrocraft Publishing Company, on the subject of "The Technical Press and Its Relation to Electrical Inspection Work." Mr. McCarthy appealed to the electrical inspectors to co-operate with the technical journals in the matter of publicity of their findings, so as to keep the electrical field informed of proper and approved appliances and installations.

The discussion of metal molding, which followed Mr. McCarthy's address, was led by R. L. Daniel, of the General Inspection Company, Minneapolis, Minn., and was entered into by a number of the delegates. The discussion resolved itself into an experience meeting, and its object was principally to emphasize the points in favor of metal molding so that it will eventually become generally used.

Following this discussion, another was entered into on illuminating engineering. This discussion was led by H. C. Harris, of the General Electric Company, and was also participated in by a number of the members. It related principally to the difficulties encountered in electric-wiring installations in damp places, numerous experiences being given, and several valuable suggestions made. The Wednesday session was concluded by a brief discussion on the difficulties arising in electrical inspection work.

The inspection tours were continued on Thursday, the delegates visiting the plants of the Detroit Fuse and Wire Company, Detroit Insulated Wire Company, American Heating Company, and the American District Telegraph Company. The afternoon session was opened by a report of the committee on architects' specifications. The report of this committee was listened to with interest, as it was the opinion of some of the inspectors that standard sets of specifications could be drawn up and followed by architects in their plans. The question was left to this committee, which reported that it was impossible to draw up a standard set of specifications which would apply to all buildings.

Following this report, the report of the committee on instructions to the public concerning the safe operation and maintenance of electric wiring, was read. This report was a series of "don'ts" written in such language as to be understood by the public at large. The report of the committee on installations and operation of induction motors recommended that larger wire be used in the installations of these machines. The reports of the committees on construction and installation of electric signs and show-window and display lighting were read by the respective chairmen and following brief discussions were adopted by the association. Following the various reports, a discussion of the inspection tours taken by the members was participated in by many members who had made notes on the different subjects they thought worthy of discussion.

For the ensuing year the following officers were then elected: Fred G. Dustin, Minneapolis, Minn., president; W. J. Gilsdorf, Lexington, Ky., first vice-president; H. G. Young, Streator, Ill., second vice-president, and Wm. S. Boyd, Chicago, Ill., re-elected secretary and treasurer. Omaha, Neb., was decided upon as the place for the next annual meeting, which will be held in October, 1910, the days to be decided upon later.

In addition to the inspection of various electrical plants, the delegates inspected a theatre equipped with auxiliary emergency lamps supplied with current from a storage-battery station. They were also taken on an enjoyable river excursion and visited Livingston Cut. En route the party stopped on the Canadian side for luncheon, and before returning visited the Del Ray plant of the Detroit Edison Company.

Joint Pole Lines in New York City.

Commissioner O'Brien, of the Department of Water Supply, Gas and Electricity, city of New York, which includes the electrical inspection service of the city, has announced the withdrawal of a rule relating to joint use of pole lines, which appears on page 21 of the printed electrical rules of the department, and reads:

"25. Conductors must not be placed upon fixtures erected or maintained for supporting wires of another class, except at crossings when approved by said department."

For the above rule the following has been substituted:

"25. a. Electric light and power wires must not be placed on the same cross-arm with telegraph, telephone or similar wires, and when placed on the same pole with such wires the distance between the two inside pins of each cross-arm must not be less than twenty-six inches.

"b. Electric light and power wires must not be placed on the same pole with telegraph, telephone or similar wires unless the former are placed above the latter and separated therefrom by a vertical distance of at least four feet, and where the voltage does not exceed the following normal operating values:

Constant-potential metallic circuits..... .....5,000 volts
Alternating-current series circuits..... .....5,000 volts
Direct-current series circuits....7,500 volts
Direct-current railway circuits... 700 volts

"c. In the event of electric light or power wires passing down a pole carrying signal wires, the former must be enclosed in a grounded metallic covering and be suitably protected against mechanical injury, from the lowest electric-light cross-arm to the ground or to a point three feet from the center of the pole, measured horizontally.

"d. Mast arms and other conducting fixtures or rigging located below the lowest electric-light and power cross-arm must be grounded. Transformer cases must be grounded unless the secondary circuits are grounded.

"e. Mast arms, etc., transformers with ungrounded secondaries, and shields for conductors running down the pole must be grounded at the pole to which they are attached, and messenger cables for elec-

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tric light and power must be grounded at least every five hundred feet, either by independent ground wires or by bonding to ground wires already in place.

"f. Transformers must not extend below and cable boxes must not extend above their respective cross-arms, unless the distance between the two groups of cross-arms be suitably increased."

Engineers Lacombe, Sever and Wynkoop, who have given the subject much attention in Brooklyn during the past four or five years and in Manhattan and the Bronx since the reorganization of a year ago, submitted the following report in connection with the recommendation for a change in the rule, which the commissioner has accepted:

The old rule, the abandonment of which we are recommending, has been inherited from the Board of Electrical Control and was undoubtedly appropriate to the wire conditions and to the state of the art at the time of its adoption. With the infinitely better construction which finds favor today and with the gradual reduction of wire congestion on our principal highways, it is believed to be good policy to restrict the number of poles by requiring that all overhead conductors erected on any street be carried, so far as practicable, on one line of poles. It is believed also to be sound engineering to support upon one series of poles conductors for signaling and those for electric light and power, provided, first, that the signal wires, which are the less substantial, be placed underneath so that they may fall away from rather than upon the electric light and power wires; and second, that the voltage of the electric light and power circuits be limited to the value which the consensus of electrical opinion throughout the country endorses for this situation.

The policy of requiring grounded metallic coverings for wires carrying dangerous potentials when brought down within reach of the public or even within reach of the signal linemen has met with some objections either technical or financial—at the hands of the various electric companies in this city, but these alleged obstacles are not insurmountable, and, therefore, we believe should carry no weight where human life lies in the other side of the balance.

At the meeting of Franklin Institute, Philadelphia, Pa., that was held on the evening of November 11, Jacob S. Goldbaum, of the University of Pennsylvania, delivered an illustrated lecture on "Advances in Electro-Analysis."

Annual Meeting, American Trade Press Association.

The annual meeting of the American Trade Press Association was held at the Hardware Club, 253 Broadway, New York city, on Friday evening, November 5. This was the twentieth anniversary of the association, and seventy-three members and guests sat down to the annual dinner. The gathering was found to be an unusually pleasant one by all who attended.

No set papers were read or discussed at this meeting, it being given over largely to retrospect covering the past history of the association and forecast for the future. The strength and influence of the association, which is composed of the most representative trade journals of the country, has steadily grown, as is evident from the membership and the length of the annual reports; the fourth annual report covered four pages, the nineteenth 151 pages.

The following officers were elected for the ensuing year:

President, John Clyde Oswald, of the *American Printer.*

First vice-president, Emerson P. Harris, of *Advertising and Selling.*

Second vice-president, E. A. Simmons, of the *Railroad Age Gazette.*

Third vice-president, H. M. Swetland, of *The Automobile.*

Director to serve four years, Franklin Webster, of the *Insurance Press.*

Secretary and treasurer, L. J. Montgomery, 280 Broadway, New York.

Navy Department Supplies.

The Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., will open bids on the dates given below for the following electrical equipment and supplies. Bidders should without delay make application to the Bureau for copies of schedules, being careful to give the schedule number. Copies can be obtained on application to the Navy Pay Office nearest each navy yard.

NAVAL SUPPLIES.

Date of Opening.	Article.	Quantity.	Delivery at Navy Yard.	Schedule.
November 16, 1909..	Cable, night signal	Miscellaneous	Various	1870
	Cable, interior communication	"	"	1870
	Conductor, silk, double	"	"	1870
	Conductor, silicon bronze	"	"	1870
	Conductor, double, plain	"	"	1870
	Conductor, twin	"	"	1870
	Conductor, single	"	"	1870
	Card, telephone	"	"	1870
	Globes, type "F"	2,000	Norfolk, Va	1875
	Strips, front door, searchlight	Miscellaneous	Various	1870
	Tape, insulating, cotton	600 pounds	Norfolk, Va	1875
	Wire, silicon bronze	30,000 feet	Brooklyn, N. Y	1870
	Wire, platinum, silver coated	300 feet	" "	1870
	Wire, bell	Miscellaneous	Various	1870
	Wire, magnet	"	"	1870
	Wire, resistance	"	"	1870
	Wire, telephone	30,000 feet	Brooklyn, N. Y	1873
	Wire, rubber-covered	68,500 feet	" "	1873
	Wire, telephone	10,000 feet	" "	1894
November 23, 1909..	Generating sets, turbo and motor	Two turbos and one motor	Factory	1903

Lewis Institute Branch, American Institute of Electrical Engineers.

The beginning of the third year of active work of the Lewis Institute Branch of the American Institute of Electrical Engineers was marked by the meeting held on November 3 in the auditorium of Lewis Institute, Chicago. The meeting was a distinct success, being attended by nearly four hundred engineering students. The speaker of the evening, Alex. D. Bailey, of the Commonwealth Edison Company, gave an interesting talk on "Central-Station Operation in Chicago." He spoke of the rapid development of central stations throughout the country, and especially the growth of central-station service in Chicago. The Fisk Street and Quarry Street stations were cited as examples of the most modern central stations extant, and some interesting figures concerning their operation were given.

The boiler rooms of these two stations contain 104 boilers with a total heating surface of nearly fourteen acres, capable of evaporating over 2,500,000 pounds of water per hour, and converting it into steam at 200 pounds pressure and 150 degrees superheat. This requires nearly fifty carloads of coal per day. The coal used is commonly known as Illinois screenings. It is taken from the cars and conveyed to the bunkers over the boilers, whence it is fed into the furnaces by means of mechanical chain-grate stokers. The ash drops from the end of the grate and is taken away in the outgoing cars.

The turbine rooms contain thirteen turbo-generators of a total capacity of 215,800 horsepower. Each turbine comprises a complete station in itself, having its own set of boilers, condensing system, coal-handling machinery, and boiler-feed piping, thus carrying out the unit system to the minutest detail. Each unit is in this way entirely isolated from and is an exact duplicate of every other unit, which greatly facilitates the operation of the station and minimizes the danger of mistakes and accident.

The current is generated at 9,000 volts and twenty-five cycles and passes directly to the switch house. The operation of the switches in the latter is carried on from the operating gallery in the turbine room with the remote-control system. Therefore no pressure exists on the operating board over 110 volts.

From the switch house, the current is transmitted to the various substations of the system for distribution to the thousands of consumers.

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A New Method of Instantaneous Roentgen-Photography.

It is well known in technical circles that the Roentgen method, though fourteen years have passed since its discovery, is still not appreciated by a sufficiently large number of physicians. The reason for this is the complicated technics of the method, on one hand, and also the fact that the quality of the radiograms leaves much to be desired. The time of exposure at present necessary is much too long, for it is known that the thorax of a human being partakes of the vibration caused by the blood circulation, and radiograms of the same produced by long exposure will therefore not faithfully reproduce its structure. A new process invented by Engineer F. Dessauer seems likely to bring about a revolution in this field. He departs from the method of producing strong induction impulses and does not employ the usual alternating-current transformer and interrupter, but uses a single induction impulse of extraordinary intensity. The simplified apparatus consists of only two elements—a particularly large induction coil capable of withstanding extraordinary loads for a short time, and an explosive "cartridge" connected across the capacity. The inertia of the interrupter is thus eliminated and the discharge takes place automatically. The cartridge consists of a thin silver or copper wire, which is fused at the moment when the current intensity has attained the desired value. The suddenness of its destruction is increased by additions to the mass covering the wire. The photographic process is extremely simple and requires only the operation of a switch. The explosion of the cartridge causes the interruption of the primary circuit with unusual suddenness and an induction impulse of extraordinary intensity follows. A spark forty centimetres in length is sufficient for a radiogram of any part of the body, and the entire time of exposure varies from one-fiftieth to one-one-hundred-and-twentieth of a second at a secondary load of about 260 milliamperes. It is thus possible to make from forty to fifty exposures in an hour; the wear on the tubes is reduced to a minimum, and the entire process is highly economical. It also brings us closer to the realization of cinematographic photography of the heart and the functions of other parts of the body, and thus opens up many still unknown fields. —*Abstracted from Elektrotechnischer Anzeiger (Berlin), September 30.*

Electrical Exports for September.

A summary of the electrical exports from the United States for the month of September has just been completed by the Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C. The totals shown below indicate a healthy improvement over the figures both for the preceding month and the corresponding month last year. The exports of electrical appliances (including electrical instruments and apparatus for scientific purposes, telegraph and telephone instruments) during September were the heaviest shipments for any month for nearly two years. This fact more than counterbalanced the reduction in exports of electrical machinery as compared with September, 1908. The total shipments of electrical appliances for the nine months of this year show that the 1909 total will come pretty near the heavy total of 1907. In electrical machinery, however, there continues a steady falling off from the record totals of 1906 and 1907.

The comparative monthly totals are as follows:

	Sept., 1909.	Sept., 1908.	Aug., 1909.
Electrical appliances.	$ 686,049	$430,785	$ 590,864
Electrical machinery.	480,835	568,525	448,976
Total	$1,166,884	$999,310	$1,039,840

The principal countries to which electrical products were shipped from the United States during last September, with the values of these exports, are as follows:

Exported to—	Electrical Appliances.	Electrical Machinery.
United Kingdom	$ 56,852	$46,912
Belgium	8,454	.....
France	2,697	7,511
Germany	10,595	2,826
Other Europe	5,543	54,820
British North America	200,336	37,220
Central American States and British Honduras	37,691	8,697
Mexico	90,471	90,039
Cuba	18,606	8,252
Other West Indies and Bermuda	7,355	225
Argentina	20,539	14,799
Brazil	151,166	23,206
Other South America	28,456	6,901
British East Indies	.....	1,408
Japan	10,923	89,696
British Australasia	9,105	68,065
Philippine Islands	14,388	200
British Africa	10,025	18,620

Recent Wave-Length Experiments.

In the August number of the *Physical Review* there is given an account of the experiments recently carried out by H. W. Webb and L. E. Woodman at Columbia University on the lengths of the waves emitted by generators of short electric waves.

Boltzmann's method was employed and rod, cylinder, Righi and other generators were tested. It was found that for apparatus of the same type, the wave length is proportional to the linear dimensions of the apparatus.

The Predetermination of Earthquakes.

An Italian physicist, Padre Maccioni, has exhibited before the Academy of Siena an instrument capable of indicating earthquakes at least a few minutes in advance. In the construction of his apparatus Maccioni has been guided by the theory that electromagnetic waves emanate from the source of an earthquake before the occurrences of an actual shock. He employs a suitably arranged detector for recording the electric waves. After many unsuccessful experiments he was led to the construction of a special form of coherer which responds to all wavelengths and in which the quantity of iron filings between the end cylinders varies according to the distance between the coherer and air gap. The alarm apparatus consists of a small battery, in the circuit of which a sensitive galvanometer relay and the new coherer are connected. One of the poles of the coherer is joined by a wire to a metal plate buried vertically in the ground. The relay serves for closing the circuit of a strong galvanic element containing a writing instrument, a clock arrested at twelve and an alarm bell. The time elapsing between the arrival of the electrical and the arrival of the mechanical waves is determined from the time indicated by the alarm arrangement and that shown by a sensitive seismograph. Last April Maccioni was able to predict by the aid of this apparatus two earthquake shocks which occurred at a distance of twenty-two kilometres from the observatory, four minutes in advance.—*Abstracted from Die Umschau (Frankfort a. M.), October 9.*

Electrical Development in Uruguay.

From Montevideo, Consul F. W. Goding reports that an offer has been made to the Interior Department of Uruguay by a French concern to establish electric power houses in the interior which will supply light and power to the inland towns.

The enterprise binds itself to furnish apparatus, light and energy to the state, as well as to the citizens, at a price at least equal to the lowest price now paid in any of the towns. The concession is asked for twenty-five years, after which time the power houses, kept in perfect condition, will become the property of the state. The sum to be employed in the first installations, in the eighteen towns not now provided with plants, will be 500,000 pesos ($517,000), and the work will be completed within eighteen months after the concession has been granted.

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Western Permits for Waterpower.

Evidence tending to confirm the report that the past seven or eight years has witnessed a general demand throughout the West for power sites is contained in a statement prepared by the interior department at Washington, D. C., showing that 244 permits have been issued to date under the act of February 15, 1901. The fact that each and every one represents a revocable easement emphasizes to what extent corporations are going in order to develop waterpower in that section of the country.

The following schedule by states shows the number of permits issued by the interior department under the act of February 15, 1901, to date:

Arizona, 45; California, 87; Colorado, 43; Idaho, 12; Montana, 14; Nevada, 18; New Mexico, 7; Oregon, 7; South Dakota, 2; Utah, 2; Washington, 5; Wyoming, 2.

Of the above 244 permits eighty-seven are for lands in forest reserves. All are said to be for reservoirs, canals, pipe, and transmission lines and power sites to be used for the purpose of generating and transmitting electric power. Of the permits granted forty-four have been revoked principally in Arizona, California and Colorado because in forest reserves and for non-construction.

The New Haven's Developments.

A recent dispatch from New York states that the acquisition by the New York, New Haven & Hartford Railroad Company of new trolley interests in Westchester County, N. Y., together with its plan of extending its New York and Westchester line northward in that county, are believed in New York railroad circles to forecast an important ultimate railroad plan.

By its New York and Westchester line through the Bronx, the New Haven will ere long acquire by subways a new entrance into New York, which, to some extent, will divert business from the Grand Central terminal. On the other hand, from the upper end of its Westchester extension only a small gap will remain to be spanned to connect with the New Haven system at or not far from Brewsters Station.

With that connection made, along with its new entrance into New York, the New Haven company would have an additional line into New England which can be used for freight, and to a much less extent passenger business, and, what is of greater importance, a close connection with its Poughkeepsie bridge system and its Ontario and Western line for western and coal business. This, it is believed, is one of the most significant features of the New Haven's terminal work at New York and its Westchester extension.

Brooklyn Subway Contract Signed.

A contract was recently signed between the city of Brooklyn and the Tidewater Building Company and Thomas E. Bryson for the construction of the fifth section of the (Brooklyn) Fourth Avenue subway. Work will accordingly be begun immediately on this section, which covers that part of the subway running under Fourth Avenue from Tenth Street to Twenty-seventh Street. The price for the railroad proper is $1,945,640, and for the pipe galleries $251,076.

This makes the third section of the Fourth Avenue subway for which the contracts have been signed. Two sections were let to William Bradley and extend from Willoughby Street to Ashland Place, and from Ashland Place to Sackett Street.

There remain to be signed contracts for three more sections; the first section, from Nassau to Willoughby Street, for which James P. Graham was the successful bidder; the fourth section, from Sackett Street to Tenth Street, and the sixth section, from Twenty-seventh Street to Forty-third Street, the contracts for both of which were awarded to the E. E. Smith Contracting Company, of Philadelphia.

The Utilization of Coal Dust.

The burning of coal dust can be accomplished under much better conditions than that of coal in lumps, for the quantity of air necessary for its combustion can be exactly regulated and high temperatures thus obtained. Coal dust has an advantage over gas in that the loss of heat in the gas generator is avoided. Very long flames—eighteen metres in length, for instance—may be obtained by its use. The coal dust is introduced into the furnace by injectors similar in form to the water injectors on steam boilers. More or less compressed air is sent through tubes provided with nozzles into which the coal dust falls. The coal most suitable to be burnt in this manner is that containing much volatile substance, as lignites; but any kind of coal dust otherwise unfit to be burned may be utilized in this way. The most serious objection to the process is the danger of explosion on account of accidental production of an explosive mixture from the air and dust. But this may be prevented by ventilating the localities and washing or dampening the walls by water or steam jets. Ashes rarely cause any inconvenience, as they are carried off with the gases of combustion, and for this reason it is possible to utilize fuel of low value and containing a large proportion of ashes.—*Abstracted from l'Industrie Electrique (Paris), September 30.*

Copper Imports and Exports for September.

Advices from the Bureau of Statistics, Department of Commerce and Labor, Washington, D. C., show that the value of the imports of copper in September, 1909, was $1,657,760, as compared with $2,282,468 in September, 1909, and for the nine months ended September, 1909, $21,319,805, as compared with $15,160,211 in the same period of 1908 and $32,514,647 in the same period of 1907.

The value of the copper exported, not including ore, in September, 1909, was $6,770,310, as compared with $6,254,518 in September, 1908, and for the nine months ended September, 1909, $69,413,852, as compared with $70,488,923 in the same period in 1908 and $68,485,954 in 1907.

Human Endurance Decision in Indiana.

Owing to the many complaints of trainmen being required to work long hours on the interurban railways, the Indiana commission has issued a state circular to the railway companies. A number of cases have been reported where trainmen worked more than sixteen consecutive hours, and returned to work with less than eight hours' rest.

While the attorney-general has decided that the sixteen-hour law of 1907 does not apply to interurban roads, the commission instructs the roads that they are amenable to the penalties of the acts and recommends that prompt and efficient steps be taken to limit the hours of service in accordance with the acts. S.

Moving Sidewalk in New York.

The Continuous Transit Company, of New York, has offered to build a moving platform under Broadway, between Fourteenth and Forty-second streets. Chief Engineer Henry B. Seaman of the Public Service Commission, recommends that the routes proposed by the company be laid out, and an early installation of one of them required.

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Joint Laboratories at Madison for Forest-Products Investigation.

Preparations have been completed for the transfer of all the government's forest-products work to Madison, Wis., where the United States Forest Service Products Laboratory will be located, and to Chicago, where the headquarters of the office of wood utilization will be established.

The new Forest Products Laboratory being erected at Madison by the University of Wisconsin, which will co-operate with the government in its forest-products work and which is to cost approximately $50,000, is now in the course of construction. The laboratory will be a fireproof building and is expected to be ready for occupancy on January 1. In the meanwhile temporary offices will be located at 1610 Adams Street, Madison.

On October 1 the Yale Timber Testing Laboratory was discontinued and the Forest Service equipment there shipped to Madison. The laboratory at Washington, D. C., was discontinued at the same time. The Timber Testing Laboratory at Purdue, Ind., will be operated until the middle of December, when it will be discontinued and its equipment shipped to Madison.

McGarvey Cline will be director of the Madison laboratory. The work of this laboratory will be assigned to five offices, as follows: Wood preservation, which will study all problems related to the impregnation of wood with preservatives and other substances; wood chemistry, which will handle all work bearing on the chemical utilization of forest products—wood distillation, paper pulp and other fiber products, chemical analyses of creosotes, turpentines, etc., being the principal lines handled by this office; timber tests, which will have charge of all tests to determine the strength and other mechanical properties of different woods; technology, which will study the microscopic structure of wood, methods of seasoning and drying it, and other problems of a purely technical character; maintenance, which will have charge of the filing and computing, also being responsible for the purchase of supplies and general care of the entire laboratory.

The class of work in the laboratory may be separated into three kinds, as follows: (1) The investigation of problems in experimental research. (2) Experimental work in co-operation with commercial plants to verify laboratory experiments on a commercial scale. (3) Co-operation with outside parties for the purpose of assisting them in applying principles and processes of recognized commercial value with which the Service is thoroughly familiar.

The work of the office of wood utilization at Chicago will consist of studies of the wood-using industries of various states, the study of woods in manufacture and of the methods of disposing of mill waste, the collection of statistics on the price of lumber at the mill and at the principal distributing markets of the country, and the study of specifications and grading rules. The office will also secure statistics of forest products of importance to the experimental work of the Service and the study of the movements of lumber and of the conditions of the principal lumber markets. This office will be in charge of H. S. Sackett.

Synchronizing Device for Closed-Circuit Motors.

The employment of three-phase induction motors with closed-circuit rotors, when such machines work under conditions that allow their starting without load and running at constant speed, is preferable to the use of motors with collector rings on account of their simpler and less expensive construction. However, the starting of such motors presents well-known difficulties, which are the greater the more powerful the machine. Very large motors are usually started under no load by small auxiliary motors. In order to connect the three-phase motor to the line conductors its speed must be as near as possible to synchronism, for the heavy current impulse which otherwise results is injurious to the central station as well as to the motor.

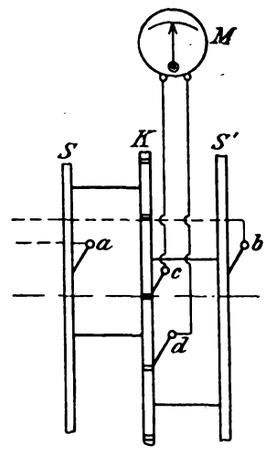

DIAGRAM OF SYNCHRONIZING DEVICE.

Dr. Felix Horschitz has devised a new and simple arrangement for indicating when the motor is in synchronism. This is shown in the accompanying illustration. Two narrow slip rings S S' and a narrow commutator K, with as many segments as the motor has poles, are fastened on the shaft of the motor. Brushes *a b*, each connected to one line wire through a low-tension transformer, bear on the slip rings. An ordinary polarized voltmeter with its zero in the center and permitting indications to the right and left, is connected to two other brushes, *c* and *d*, bearing on the commutator in such a way that they are displaced by exactly one segment.

Assuming the motor to be in synchronism, the alternating current sent into the instruments is commutated during one-half period and is not commutated during the next half period. The form of current obtained in the instrument thus depends on the time at which commutation takes place with respect to the original wave. When there is any slip the point of commutation is retarded and the instrument needle begins to oscillate, the more strongly the greater the slip. When a motor is started from a position of rest a slow vibration of the needle will at first be observed. Its movement will become slower and more distinct with increase in speed. At half synchronism the amplitude of vibration becomes zero, and from this moment on it increases until, in the neighborhood of synchronism, the needle moves more slowly and stops entirely when perfect synchronism has been attained.—*Abstracted from Elektrotechnische Zeitschrift, Berlin, September 2.*

The American Society of Mechanical Engineers.

Among the forthcoming meetings announced by the American Society of Mechanical Engineers is one to be held in Boston on Wednesday evening, November 17 next, which will be devoted to a topical discussion on Low-Pressure Steam Turbines. The speakers will include W. L. R. Emmet, of the General Electric Company, Schenectady, N. Y.; H. G. Stott, of the Interborough Rapid Transit Company, New York; Richard H. Rice, of the General Electric Company, West Lynn, Mass., and Prof. E. F. Miller, of the Massachusetts Institute of Technology.

The next annual meeting of the society will be held in the Engineering Societies Building, New York, December 7 to 10. Further particulars will be announced later.

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DOMESTIC AND FOREIGN REGISTRATION OF TRADE MARKS.[1]

BY C. D. AND W. R. DAVIS.

The person who first uses in this country any lawful trade mark in connection with goods of a given kind has exclusive right to continue the use of it, and he may prevent all other persons from using the same trade mark on the same kind of goods, or from using any mark which the ordinary buyer would be likely to mistake for that belonging to the first user. If a person who had no right to use it should register it as his own, this fact would confer no right upon him. When it is desired to establish the date at which the use of the mark began the registry of the trade mark in the Patent Office is useful, because it will show that the person who registered the mark was using it at least as early as the date of registration. His opponent, even though he had the same design in use before that time, may have some difficulty in establishing that fact by satisfactory proof.

In a great many foreign countries title and exclusive right to a trade mark depends upon priority of registration, and not upon first adoption and use. Many American firms have discovered this to their great cost. The daily press and trade journals have recently published many instances in which American firms have suffered from a most pernicious form of blackmail in Cuba and Japan, and our consular reports from other foreign countries are full of warnings to American manufacturers to register their trade marks in all foreign countries in which they are doing business. In many of these countries the registration of the marks gives to the registrant absolute title thereto and also gives him the right to have goods bearing such marks seized at the customs house and confiscated.

It should be strongly impressed upon American merchants and manufacturers who are seeking to develop their export trade that their trade marks and trade names should be registered in every country where they are seeking a market for their goods.

In a recent report of the Commissioner of Patents this matter was carefully considered and the following quotation may be of interest:

"The importance of having trade marks protected abroad, and in many countries registration is necessary to protection, has been forcibly impressed upon American manufacturers who, sending their goods into some foreign country, have found the very trade mark which has become valuable to them registered in that country by some citizen of that country who made application for registration for no other purpose than to enable him to demand of the American manufacturer a price for the right to sell goods marked with that trade mark in that country. As in a number of European countries registration of a trade mark is attributive of property in such mark and is granted, not to the first adopter and user of the mark, but to the first applicant for registration, and as in these countries the registrant under the laws there in force can forbid the importation of goods marked with the trade mark registered by him, or even compel the seizure of such goods, it is evident that such registrant has the manufacturer at his mercy so far as trade in that country is concerned."

As an instance of how the scheme has been worked in Germany we quote from a report of Consul-General Frank H. Mason of Berlin:

"It appears necessary to recall the attention of American exporters to a very peculiar provision of the German law for the registration of trade marks, which is not infrequently used to the great and unjust disadvantage of Americans and other foreigners. Under the German statute, any person may register and secure right to any name or other device used as a trade mark which has not previously been registered here by some other firm or person. In other words, the officials before whom the application is brought make no inquiry to ascertain whether the applicant has ever used the proposed trade mark or has any right to it, but simply look over the record to ascertain whether it has been registered in Germany. If not, it is admitted to registration without further inquiry or delay.

"The readiness with which such a practice can be abused is apparent. When, years ago, American bicycles began to be imported into Germany, certain persons interested in blocking the trade got the trade marks of two or three makers registered in their own names, and either obliged the legitimate American owners of the trade marks to buy them off—in other words, to pay a species of blackmail—or to change the marks on all bicycles exported to Germany.

"In a recent case, the trade mark on a special brand of American preserved fruit was registered here by an outsider so that the real owner had to buy from the usurper the right to use his own trade mark in this country.

"This abuse has become so notorious that a leading patent attorney of Berlin, writing in a recent number of the *Technische Rundschau,* says of the law that its effect is to legalize and facilitate the theft of a trade mark.

"The obvious suggestion to all American exporters is that before exporting or seeking to export to Germany any kind of merchandise covered by a well-known name, they should have such name or trade mark duly registered in this country, where all such rights are carefully protected and prosecutions for infringements easy and effective."

This form of blackmail has also been carried on in other European countries.

[1] The above communication from Davis & Davis, patent lawyers, of 220 Broadway, New York, and Washington, D. C., on the necessity of foreign registration of trade marks is of importance to manufacturers.

Independent Telephone Situation.

The case of Herman C. Stifel, of St. Louis, against the Toledo Home Telephone Company has recently got into the courts, both in Toledo and Indianapolis. Mr. Stifel, who is a voting trustee of the Toledo Home Telephone Company, states that the company refused to allow him to examine its books. He asks that the company be enjoined against removing the books from the jurisdiction of the court. Mr. Stifel has also brought a similar suit in Marion County, Ind., asking for an inspection of the books of the New Long-Distance Telephone Company, of Indianapolis.

At the time that James S. Brailey, Jr., president of the Toledo Home Telephone Company, bought controlling interest in the Cuyahoga, United States and other independent telephone companies it was reported that he was allied with the Bell Telephone Company in an attempt to control the telephone situation in the middle states. Mr. Brailey, however, denies any connection with the Bell company. A later report is that the alliance is with the Postal Telegraph Company.

As a measure of protection against any possible telephone monopoly resulting from these deals, there was a meeting held on October 29 at Columbus, Ohio, of more than 100 independent telephone men. A committee has been appointed and authorized to bring proceedings under the anti-trust law if they find that there is evidence of an attempted monopoly.

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Electrical Notes From Great Britain.

By Our British Correspondent.

The month of October is always the time for the English engineering and scientific societies to resume their gatherings after the vacation. For some reason or other the Institution of Electrical Engineers (London) reopens later than nearly all others, and after its own provincial sections have got to work. It also holds weekly instead of fortnightly meetings toward the end of the session, and sits on into May. From programmes that have come to hand it is possible to see what are some of the principal subjects coming forward this winter. At the Glasgow section, after the inaugural address of the chairman, E. G. Tidd, W. A. Kerr will bring on direct-current boosters and balancers, and later in the session R. M. Neilson will read a paper on "The Most Economical Vacuum for Turbine Power Stations." At the Leeds meeting of the institution, following the presidential address of W. M. Rogerson, there was a paper, on October 27, on "Notes on Superheated Steam," by A. B. Mountain. Other subjects arranged for are experiments on single and stranded fuses, the possible beneficial effects of metallic-filament lamps on supply undertakings, equitable charges for tramway supply, notes on overhead lines, and electrical machinery for iron and steel works. The Manchester section commenced on October 22 with an address by S. J. Watson, the chairman. Manchester has a progressive students' section and has arranged a good programme, in which are included the testing of electrical machinery, electric cranes, direct current versus alternating current for railway traction, high-tension spark discharge in air, faceplate-type starters and control apparatus, commercial side of the electrical industry, a modern telephone exchange, and the application of the cradle dynamometer to the testing of electrical machinery. This section is also going to have a joint meeting with the Junior Gas Association of the Manchester district to debate the question of "Gas Versus Electricity for Heating and Power Purposes." This is a capital idea. Gas and electrical engineers in England seldom meet, save in combat in the press or on consumers' light and power bills. Perhaps the rising generation of engineers in both departments will, by meeting in friendly debate, come to see the wisdom of more of a co-operative spirit than of a mutually handicapping rivalry.

Mr. Mountain's paper at Leeds on "Superheated Steam" dealt with the following points: The method of superheating steam by separately fired superheaters and other types of superheaters; practical limits of superheat; the advantages of increased evaporation of boilers, increased efficiency of engines, reduced losses in piping, etc.; the danger of applying superheated steam to engines which have not been specially designed; and lubrication (the difficulty of selecting suitable oil, testing the same, and methods of feeding).

The presidential address of W. N. Twelvetrees to the London Civil and Mechanical Engineers' Society advocated, among other things, an effective union of engineering organizations in England, different institutions continuing their separate existence but entering into bonds of union one with another for the purpose of furthering the good work conducted by all. At the Society of Engineers (London) an evening has been devoted to a prize paper by G. Allan Thomas on "The Status of the Engineering Profession." Mr. Thomas mentioned the chief hindrances to the advancement of the profession, and proceeded to advocate the election of a central organizing body from members of the three most important institutions—the Civil, Mechanical and Electrical Engineers, respectively—which body should endeavor to obtain recognition as a legalized corporation by act of Parliament, and should have supreme organizing and judicial powers in all matters relating to the profession. They should also devote attention to registration, education, minimum fees, organizing funds to aid invention and research.

Prof. W. E. Dalby, in concluding a paper before the Institution of Mechanical Engineers (London) on "Heat Transmission," made certain recommendations. He said that considering the mass of work which had already been done, the century of accumulated practical experience in the design, construction and working of steam boilers, the numbers of able engineers who have devoted their attention to boiler construction and design, and the distinguished men who today control and influence the industry, "it would almost seem that present practice represents the survival of the fittest, and that there is hardly a necessity for further research." But recent years, he added, have been fruitful in researches in other directions, and Professor Callendar, by his brilliant work in platinum thermometry, has placed at the disposal of engineers a practical way of measuring temperatures unknown to early experimenters. We have now a means of accurately measuring the temperatures at different parts of a boiler directly. Professor Dalby therefore suggested that a research be undertaken in which steam boilers of different types, working under practical conditions, may be made the subject of experiments in which all the elements of their working be measured, together with temperature measurements for the purpose of establishing the temperature gradients at different parts of the heating surface. Although such a research would be costly, he believed it would be well worthy of the institution.

In connection with electrolytic disinfectant installation at Poplar, it has now been decided, owing to the low cost of production of the fluid and its efficiency, to duplicate the plant at a cost of $2,150. Four patent electrolyzers for an output of twenty-five gallons of fluid at a strength of four grammes of chlorine per litre, and two stirring machines; also a 240-volt motor to hang vertically, driving two stirring machines, form part of the new apparatus.

Not long ago it was the fashion in some quarters to argue that small electrical exhibitions were more expense and bother to the manufacturer than they were worth. Sometimes it was grumbled that firms which did not exhibit secured trade as a consequence of the enterprise of others who might not be able to trace direct business as a return. It was thought, too, that the electric supply authorities stood to gain so much from a well-got-up and representative display of illumination and devices, that they ought to bear a larger share of the burden. Really, at bottom the opposition was due to the desire of some parties to run occasional big shows and not to patronize the smaller local ones. But time has proved that there is a useful place for each to fill. Though there is no big scheme, such as that of last year at Manchester, actually on foot at the moment, there are several smaller ones of local character, and there is no doubt whatever that these will do valu-

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able educative work among the general public. The East London electrical exhibition, arranged by several municipal authorities conjointly, is in progress at Shoreditch. An exhibition of electrical domestic appliances in another part of London by the municipal authority of Hampstead was particularly strong on the heating and cooking apparatus side, being supported by those interested in nearly every new device that has been introduced in this department.

Fears have been entertained[1] lest the increasing hostility among colliery workers toward electrical installations would give a setback to the use of electricity in mines. The hostility is due to certain accidents that have happened, the precise cause of which has not been ascertained, so that miners fear hidden dangers lurking in the apparatus. The trouble has been to some extent stayed by the decision of the government to have the electricity in mines regulations further considered. Meanwhile prosecutions have been set on foot on behalf of the Home Office calling in question the action of mine officials in allowing alleged defective electric apparatus in the mines, thus creating danger through accidental shock or fire in contravention of the acts of Parliament bearing on the subject. Another case has also been heard lately in which a pit repairer has been awarded $1,000 compensation for injuries received in a Fife colliery. It appeared that he, acting under orders, went to switch on the current for the ventilation of the seam. He did not anticipate danger, and was ignorant of the dangerous character of the gas with which the seam was impregnated. Immediately he started the motor an explosion occurred, precipitating a number of men down the shaft, and severely burning the claimant. He declared that the accident was due to the owners not providing a proper system of ventilation, and they admitted their liability in the matter.

The opening of the London & Brighton Railway Company's single-phase line, of which some particulars have already appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, has had to be deferred until December, owing to certain alteration work being necessary in connection with the signals. There is being brought forward just now a $17,500,000 scheme for an eight-mile electric tube line, extending from Victoria Station, London, out to the Crystal Palace. An accelerated service of electric trains has been introduced on the Hampstead, "Bakerloo" and Piccadilly tube railways. During times of rush traffic the Hampstead runs forty-two trains per hour, the "Bakerloo" forty, and the Piccadilly thirty, including a number of "non-stop" trains.

According to figures just issued by the London County Council, the tramways system of that body consisted in March, 1909, of 85 5-8 miles of electric lines, and forty-two miles of horse lines, the capital expenditure having been about $17,500,000. The year's receipts and expenses for the electric lines were: Total receipts, $7,861,255; working expenses, $4,481,430, leaving a surplus of $3,379,825. From this, interest and other financial charges have to be deducted, leaving $538,000 net balance. As arranged, renewals have to be provided for at the rate of two-thirds of a penny (one-and-one-third cents) per car-mile run, and after this $93,900 remains. This amount has been transferred to the renewals fund, toward the deficiencies of past years. Passengers to the number of 344,705,937 were carried, and 31,962,784 car-miles were run on the electric lines. The operating expenses were 7.48 cents per car-mile run.

A couple of years ago the Bradford Engineering Society appointed a committee of inquiry, consisting of representatives of textile, engineering and electrical interests, to investigate the electric driving of textile factories. The first report of this committee has now been made public. Experiments were carried out to determine the actual cyclical variation occurring in prime movers and electric motors and in the shafting and machinery driven by them. Among the conclusions so far arrived at are the following: (1) That in good installations there is practically no difference in cyclical variation between mechanical and electrical transmission when measured at the end nearest the main drive; (2) that any initial cyclical variation which may exist at the driving end of the shaft is liable to be increased if transmitted through long shafts; this can in many cases be controlled by known methods of destroying synchronous vibrations; (3) that, so far as any irregularity is concerned, excluding breakdowns, electrical transmission will maintain its condition better than mechanical transmission. A further conclusion that we may quote is one stating that electrical transmission is likely to be most efficient under the following circumstances: (1) Where there are long lengths of shaft from which power is not taken off at intermediate points; (2) where machinery is distributed and requires starting and stopping frequently during the day; (3) where machines require to run at various speeds and have those speeds altered during motion; (4) where there are excessive lengths of shafting, making it desirable to separate these into two or more lengths. The relative advantages obtained from taking supply from one's own generating station and from an outside source, are also set out in the report.

ALBERT H. BRIDGE.

London, October 30, 1909.

[1] See editorial on "Electricity in Mines" in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, October 30, 1909, p. 820.

Preservation of Telegraph and Telephone Poles and Railroad Ties.

Millions of feet of timber and finished lumber rot every year in railroad ties, bridges, trestles, piles, farm buildings, fences, poles, and mine props. The lumber-consuming public of the United States pays perhaps thirty to forty million dollars a year to make good these losses.

These great drains are a source of more and more concern each year. Chemists and engineers who have to do with the uses of wood are working unceasingly on the problem of stopping this loss. The United States Forest Service has men who devote their whole time to it, and its importance cannot be overestimated. Millions of dollars are annually saved by preservative treatment of timbers, but much yet remains to be learned.

Wood decay is caused by fungus, a vegetable growth, sometimes so small that it can be seen only with the microscope. Its roots or branches, like minute hairs, force their way into the wood tissues and absorb or eat away the solid parts. The collapse which results is called decay. Timber is artificially preserved by forcing into its cells and pores certain substances which prevent the growth of fungi. As long as this substance is present in sufficient quantity, the germs of decay—the threads and spores of fungus—cannot enter, and the wood is preserved. This often means doubling, and sometimes trebling the life of the timber.

The United States Government considers the investigations of the preservative treatment of timber of such importance that the business of one office of the United States Forest Service, that of Wood Preservation, with new headquarters at Madison, Wis., is given over entirely to the work of experiments, in cooperation with railroad companies and other corporations and individuals, in prolonging the life of railroad ties, mine props, bridge timbers, posts, poles, etc.

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Electrical Development in Victoria.[1]

It will be interesting at the start just to glance at the development that is taking place in public-supply undertakings in Victorian towns outside of Melbourne. There have been issued about twenty-one orders-in-council granting powers to municipalities, and in some cases to private enterprises, for the public supply of electricity. Some of the towns concerned boast of populations not greater than about 1,000 inhabitants, and on the basis of this population there are yet about forty-four towns which are likely in the near future to require a supply. Of the twenty-one towns holding orders, Ballarat, Bendigo and Geelong are by far the most important. A system of public supply has been in operation in each of these three places for many years, covering not only lighting, but tramways, in the case of the first-named two, while such are projected in the case of Geelong Progress in the latter town has been very marked, when compared with the anticipated results when the plant was first put into operation about eight years ago. Difficulties in obtaining data from several of the towns prevent a further analysis of the progress of events outside Melbourne.

Taking all the supply undertakings in Victoria, not omitting those in the Melbourne area and including tramways, it is found that a large sum of money has been already invested in plant in connection therewith. The capital expenditure on all these undertakings approximates to about $8,000,000, which has been spent on generating and distributing plant of a capacity of about 16,000 kilowatts, of which about 11,000 kilowatts is installed within the metropolitan area of Melbourne. The gross annual revenue from all these undertakings amounts to about $1,250,000.

Taking those undertakings within the metropolitan area of Melbourne, it is found that, excluding tramways, but including those Government buildings supplied with light by the Railway Department, there are at present connected to the distributing mains of the various undertakings no less than 255,800 sixteen-candlepower lamps or their equivalent. The progress during the last six years has been most pronounced.

So rapidly is the demand for current for power purposes growing that it can only be a matter of time when such demand will be of greater importance than the lighting. This result will, no doubt, be assisted by the introduction of the metal-filament lamp, with its low consumption of current for equivalent light.

As far as electrical tramways development in Melbourne is concerned, there is little progress to report, the only ones in operation being the St. Kilda line, worked by the Railway Department, and the Essendon line, owned by the North Melbourne Tramway and Lighting Company.

In many districts in the Melbourne area no public supply of electricity is yet available, although in some of these, statutory powers have been obtained for giving such a supply. For example, orders-in-council have been granted in the cases of Hawthorne, Williamstown, Footscray, Port Melbourne, Brighton and others, but so far no supply is available. Some of these powers have been lying dormant for many years, and it seems only fair that the bodies to whom such were granted should be forced by the Government to work their orders, or have them canceled. In the latter case there would be, I am sure, no lack of private enterprise desirous of developing these areas. It is interesting to note that whereas the population of the Melbourne metropolitan area (that is within a radius of ten miles) is over half a million, the population within the areas in which a supply of electricity is available amounts to only about 260,000.

In regard to the likely growth in the demand for electricity for power purposes, one has only to look at the Government Statist's annual return of factories, to come to the conclusion that Melbourne is not yet a manufacturing center. Especially is this the case in the city area. The return for the year 1907, which is the latest published, shows that the actual horsepower used in factories during that year amounted to about 35,000, of which steam accounted for 27,000, gas and oil 4,000, and electricity 4,000. Taking the figure for steam power, and deducting those representing the electric power houses, tramways, etc., we obtain a net figure of about 20,000 horsepower, which, together with that representing the gas and oil power, gives us about 24,000 horsepower remaining as a possible field for development. In passing, it may be of interest to note that of this amount of steam, gas and oil power the city area can only claim about 8,000 horsepower, the balance being situated in the surrounding portion of the metropolitan area.

C. H. Merz, in his report on the "Generation of Electric Power in Victoria," recently presented to the Victorian Government, estimated the power that will be required in factories in Melbourne in 1916 at 55,000 horsepower. A perusal of this report will show that this estimated amount of power is based on the Government Statist's figures for the year 1906, which give the actual power used in factories for that year at about 30,000 horsepower, which, it should be noted, includes not only the power of the present power houses, but that of the motors which were at that time connected to their mains, totaling about 9,000 horsepower. For the purposes of this estimate, therefore, the factory power in 1906 should be reduced from 30,000 to 21,000 horsepower. Mr. Merz estimates that by 1916, in consequence of the development of industries due to a cheaper bulk supply, the increase in factory power will amount to 20,000 to 25,000 horsepower. If such be realized, then the total estimated horsepower in factories in 1916 would be 46,000 horsepower instead of 55,000 horsepower. To obtain this result it would be necessary to increase yearly at the rate of 2,500 horsepower for factories alone, which is a result that even under the special conditions that a special bulk supply is supposed to create, may be considered rather optimistic. It is pleasing to know, however, that such a hopeful future has been estimated for Melbourne by a man of Mr. Merz's undoubted experience.

The following table has been prepared with the object of showing the cost to various trades in the city area for a supply, under present conditions and prices:

	Horsepower of Motors Installed.	Revenue per Rated Horsepower.
Printers	307.50	$22.18
Newspaper offices	368.25	16.97
Clothing and boot manufacturing	247.75	39.29
Metal and wood-working	624.75	23.16
Dairy produce merchants	142.25	14.85
Refrigerators, etc.	59.50	37.60
Elevators, hoists	510.50	14.62
Miscellaneous	121.50	20.72

The great bulk of the consumers in the various trades mentioned take their supply during the ordinary workshop hours, that is, for about eight hours per day. In some cases the demand during these hours is fairly constant, or in other words, the load factor is comparatively high, and in such cases the consumers avail themselves of the option to be charged for their power at the maximum demand rate.

It will be noticed that in the case of

[1] Abstract of presidential address delivered by H. R. Harper, City Engineer of Melbourne, before the Electrical Association of Victoria, Australia.

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newspaper offices, the maximum demand is heavy in proportion to the total energy taken, and the revenue per horsepower is very low. Fortunately this class of power, in the case of the morning papers, is taken at a time when the demand on the supply station is small. A still lower revenue is obtained from elevators, on account of their very intermittent demand. But for the fact that the diversity factor of such machines is high, this class of business would, comparatively speaking, be undesirable. On the other hand, refrigerator plants run for a great number of hours daily, and in consequence the revenue per horsepower is correspondingly higher. It must be noted that the figures in the table are based on the rated horsepower of the motors installed, and not on the maximum demand of the supply, which is not easily obtainable in these cases where the charge for electricity is made at the ordinary or flat rate.

The great bulk of the power at present connected to the mains of the several undertakings in the metropolitan area comprises those installations of but moderate size, in which the price of electricity is not of so important a factor as it will be in the larger installations at present run by steam and other forms of power, and to these the question of cost is one of vital importance. Further, in the latter class will be included a number which, owing to the special conditions surrounding their operations, such as excellent individual load factor, are able to generate their own power as cheaply as, if not cheaper than, at which any public undertaking with its less favorable load factor and its distributing losses could supply. The present development of a power demand on the supply undertakings has been greatly instrumental in reducing the cost of production by the building up of a day load on the plant, which otherwise to a large extent would have been lying idle, and there is every reason to expect that with further development of such demand, and the installing of larger and more efficient generating units, the cost of production will still further be reduced.

Many tests have been carried out by the Electric Supply Department of the City Council, on tungsten lamps, which confirm what has already been said in regard to the efficiency and life of such lamps. Many of the lamps tested ran for several thousand hours, and then showed only a very small increase in the consumption per candlepower. Although the price of tungsten lamps is high, there is every possibility of their being greatly reduced as the methods of production improve. Taking present prices, however, it seems that after about 120 hours' burning the saving in current at present rates of supply pays for the first cost of the lamp, and during the subsequent life of the lamp the cost of burning is about one-third of that of the old carbon-filament lamp, for equal candlepowers. Owing to the great brilliancy of the filaments, the installation of these lamps should be carefully thought out, with the object of preventing as far as possible the direct rays of light striking the retina of the eye. Here that new brand of engineer, the illuminating engineer, should step in, and with his superior knowledge educate the user as to how to get the best results for the minimum expenditure of money.

There is a decided tendency on the part of consumers, and shopkeepers especially, to fix these lights at too low a level evidently with the idea of attracting notice. This practice should be as far as possible discountenanced, and the lamps should be placed at such a height that with the aid of well-chosen and efficient reflectors, such as the Holophane, uniform distribution is obtained without undue sacrifice of economy. Some form of reflector is absolutely necessary with these lamps, as owing to the disposition of the filament in the lamps, most of the light is given off horizontally, leaving only about ten per cent thrown down vertically. In the larger lamps fitted with spherical bulbs, it will be found desirable to frost the lower half of the lamp in order to get the best results. The manufacture of these lamps in the higher candlepowers, such as the 100, 200 and 300 candlepower, will be very advantageous for the lighting of large spaces, such as public halls and large shops. The ordinary sixteen and thirty-two-candlepower carbon lamps were failing altogether to meet the demand for such lighting, and it seemed likely at one time that the high candlepower gas lamps would take their place. All this has now been changed, and in this particular field, electric light has nothing to fear from the competition of gas. A further advantage should accrue from the use of metal lamps, in that the cost of installations per candlepower should be much less than under the old conditions.

With the same current density of subcircuits and a similar number of subcircuits, a far greater amount of candlepower can be installed, or expressed in another way, a less amount of wiring should suffice for a given candlepower. Further, in places of bunches of lights, involving the use of elaborate fittings, can now be installed single, high-candlepower lamps giving equal light, but at less installed cost. Fortunately for the supply undertakings the introduction of the metal lamp into this country has been much later than in the old countries. Following quickly on the heels of the low-voltage lamp has come the high-voltage lamp, and the fact that, so far, the minimum size of the latter is fifty candlepower, has retarded, and, we hope, will prevent, that reduction of output and revenue that has been such a feature of many of the supply undertakings in the old country. The high-voltage lamp will help the supply undertakings here to avoid the introduction to any great extent of that additional and unnecessary link, the auto-transformer. While these great improvements have been taking place in electric incandescent lighting, our gas friends have also been hard at work raising the efficiency of their lamps. It is said that imitation is the sincerest form of flattery. Well, we can congratulate ourselves on the fact that gas lighting in its recent developments has endeavored to copy many of the features of electric lighting, not excepting even the external appearance of some of our accessories. This may be considered a strong testimony as to the convenience and other attributes of electric lighting. Nevertheless, our gas friends are keen after business, and competition between the two kinds of light is at the present time a severe one. From the efficiency of twenty candles per cubic foot of gas in their ordinary mantles, they are now producing, by aid of inverted mantles and compressed gas, lamps for which they claim an efficiency as high as sixty candles per cubic foot. This progress, but for the metal lamps, would have been a serious handicap for the electrical industry. At the present time, however, the prospects of electric lighting can be considered very satisfactory, and judging by the inquiries and interest taken in the introduction of metal lamps among the city consumers, there seems every likelihood of great future expansion.

Third Avenue Foreclosure Sale.

The foreclosure sale of the property and franchises of the Third Avenue Railroad Company has again been postponed by Judge Lacombe in the United States District Court until January 11, 1910.

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ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

STREET LIGHTING ABROAD.

BY H. THURSTON OWENS.

The subject of public lighting in Europe is indeed a broad topic, but the conditions as well as the lighting are so entirely foreign to those found at home that we may readily discuss the problem as a whole.

Speaking broadly, it is safe to say that in Europe the lighting fixtures are better in both appearance and design, the different types of lamps are used more judiciously, and last, but not least, the lately developed or improved types in general use far outshine anything which America has to offer.

The foregoing remarks may hardly be considered as new, for similar statements can be found in the columns of the technical press for years, if not decades.

That these conditions will not always remain true is the earnest hope of all interested, and this matter is presented by the author in the hope that the subject will receive increasing attention from those who are so actively aiding the cause of general civic improvements in the ever-growing municipalities on this side of the Atlantic Ocean.

LONDON.

The world's metropolis is notable among the large cities of the globe for the homogeneous character of its population, this being due in large part to the small percentage of foreign born. In the matter of government the many cities and boroughs, which combine to give London its position, cling tenaciously to their authority and privileges, and this is nowhere more strikingly shown than in their public lighting.

London not only has the largest number of public lamps but also the greatest variety. If all of the various types were investigated by a visitor there would probably be little left to ponder over, for how street lighting should not be done is exemplified as well as how it should be.

The lamp in the foreground in Fig. 1 is an open arc and the lantern has panes of roughed glass. Now while it is undoubtedly true that we want diffusion, we can obtain it with less loss of light and also without such an ungainly lantern. This has been done in the case of the lamp in the background, by using an opal globe. It might also be said in passing that this is one of the few wide streets in London.

A somewhat more elaborate fixture is shown in Fig. 2 and is a fair example of the art standard in lamp-post design which one may find in that city. The fire-alarm lamp is lighted by means of gas, and its already unsightly appearance is not improved by the sign, "Cars stop here if required."

Probably the handsomest installation in the city is on Oxford Street, shown in Fig. 3, where twin flame arcs have been erected down the center of the roadway. The lamps have inclined carbons and their light is pink in color. The lighting effect is altogether too uneven to be called good, but, of course, is a long step in the right direction.

A number of the narrow streets have the same type of lamp centrally suspended by means of wires, and these probably are doing the best lighting service. This method of suspension was recently recommended by the deputation which the City of London sent to the Continent last spring.

FIG. 1—ARC LAMPS IN THE HEART OF LONDON.

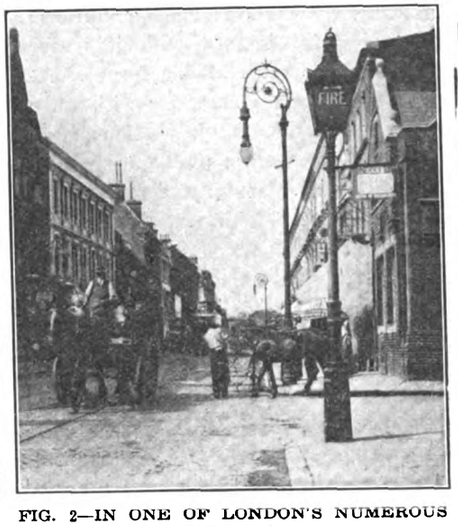

FIG. 2—IN ONE OF LONDON'S NUMEROUS SUBURBS.

FIG. 3—LONDON. TWIN FLAMING ARCS ON OXFORD STREET.

THE HAGUE.

Another example of central suspension, which surely ranks as a novelty, is shown in Fig. 4, where the feed wires run down the center of the narrow street much the same as an overhead trolley. The lamps are incandescent clusters in clear glass

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enclosing globes. The use of small units for public lighting is quite generally confined to gas throughout Europe, but the most successful use of electricity for this purpose is with the flaming type of arc lamps, such as the one shown in Fig. 5.

FIG. 4—THE HAGUE. SUSPENDED INCANDESCENT CLUSTERS.

In this case, however, the arc is only used until midnight, when it is turned off and the incandescent lamp, with which the post is also equipped (note the left-hand side), is then turned on.

The practice of suspending the trolley wires from buildings is quite in vogue,

FIG. 5—THE HAGUE. ORNAMENTAL POLES FOR ELECTRIC LIGHT AND POWER CIRCUITS.

but upon wide streets very often the lamp-post has an arm for the purpose of carrying these wires. This is not the only method by which unsightly poles in excessive number are done away with, for the tower shown in the background of Fig. 5 carrying wires, above the tops of the buildings, is only one of many.

BERLIN.

Among the large cities of the world there is probably none which would furnish greater food for thought among Americans interested in civic improvements than Berlin. This is especially true, as, owing to its location and environments, it is more like the kind of city which our municipalities are destined to grow into. It is level, with great square blocks of business buildings in its center which make it out of all reason to improve by means of parkways, but as soon as one reaches the growing outlying sections the effects of modern comprehensive city planning are at once evident.

Practically the only breathing space in the heart of the city is the celebrated "Unter den Linden," which extends from

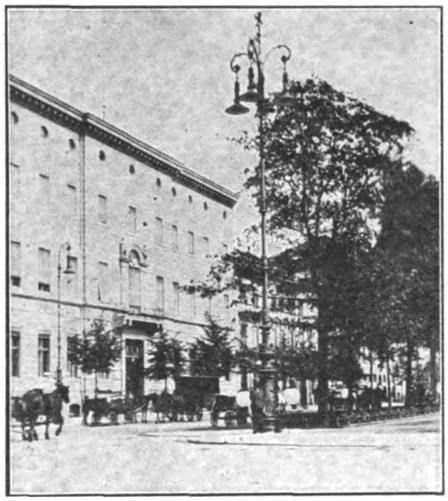

FIG. 6—BERLIN. OPEN ARCS, UNTER DEN LINDEN.

the palace of the Kaiser to the "Central Park" of Berlin, the Thiergarten. This is lighted by means of open arcs with opal globes, and that they are installed in profusion and upon posts which are ornamental as well as massive may be judged from Fig. 6, where the trimmer is at work upon a cluster of globes which have been lowered.

This illustrates two features of street lighting abroad which are much in evidence. Reflectors are used upon practically all lamps except the modern flaming arcs, and lowering gear seems to be regarded as quite an essential, even the high-pressure gas lamps having this feature.

Where Unter den Linden meets the Thiergarten the famous Brandenberger Thor (gate) is located, and in the center of the plaza undoubtedly the most massive public-lighting fixture in the world has been erected. This is shown in Fig. 7. The lamps are fifty-nine feet above the pavement and are of the inclined carbon type, giving a white light with clear globes, the four lamps of each set consuming 4,400 watts. This combina-

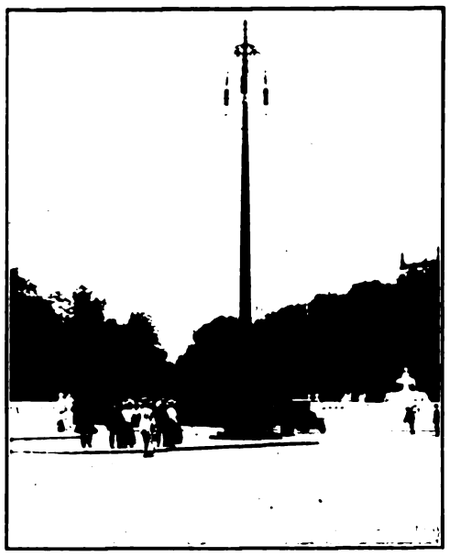

FIG. 7—BERLIN. THE FAMOUS BRANDENBURGER PLATZ.

tion produces the most startling lighting effect the writer has ever seen in public lighting, due principally to the great volume and the high intensity of illumination.

The inverted high-pressure gas lamps are not used in a similar manner and therefore they are not at all comparable. They are used principally upon wide

FIG. 8—POTSDAM, GERMANY. NEAR THE PALACE OF THE KAISER.

boulevards with trees and are hung less than twenty feet above the pavement. These streets represent the best lighting that is done by means of this illuminant in the world and incidentally the intensity of the illumination is several times

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that of anything the writer has seen in this country.

From a lighting standpoint, the best electric installation which the writer saw abroad was also in this city upon Friederich Strasse, where Alba vertical carbon,

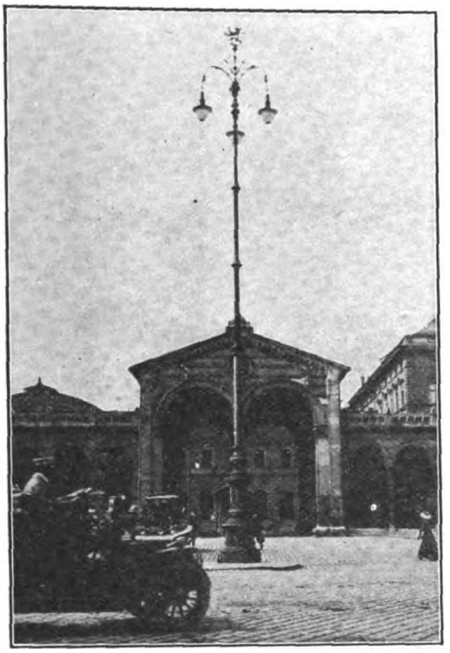

FIG. 9—MUNICH. IN THE HEART OF BAVARIA.

white-flame arcs are hung by means of wires about twenty feet above the pavement. Both the distribution and the color of the light is far more effective

FIG. 10—MUNICH. THE OLD AND THE NEW.

than that from the inclined carbon, pink-flame lamps.

The lighting fixtures in Berlin do not compare favorably with those of the same recent models to be found elsewhere in Germany, one in use at Potsdam being shown in Fig. 8. This town is the Windsor of Germany and, as in the latter place, the fixtures include a crown among their decorative features.

MUNICH.

The German Empire in its outward aspects is still the federation of states brought into political unity by Kaiser Wilhelm der Grosse nearly four decades ago. To the ordinary traveler Bavaria might be regarded as an independent kingdom as far as outward appearances are concerned, but to the engineer the evidences of modern progress bring the state in closer harmony with its sisters. On arriving at the central railroad station we find the plaza decorated as well as excellently illuminated by means of flame lamps upon handsome posts, as shown in Fig. 9, the crest at the top being the celebrated Bavarian lions.

The change from the old to the new is

FIG. 11—LUCERNE. COMBINED LAMP-POST AND FLAGPOLE.

illustrated in Fig. 10, where the low-pressure gas lamp has been displaced by its newer and larger brother, the flame arc, and in the latter we again see the effort to build something which is attractive as well as utilitarian.

LUCERNE.

Lucerne, the Mecca of all Alpine tourists, like other cities in beautiful Switzerland, has many lighting fixtures which add to its attractiveness, but the one shown in Fig. 11 certainly has the additional merit of novelty. Flame arc lamps upon handsome standards are surely not novelties, but the two, of which one is shown, are surmounted by flagpoles of no mean height.

The building shown, by the way, is not a place of justice nor a city hall, but the railroad station. The matter of appearances is not neglected where but few of the public would take notice, for in Fig. 12 we have a typical railroad-yard lighting equipment.

PARIS.

The lighting of Paris has become almost a byword in the minds of so many that a word of criticism may not be amiss.

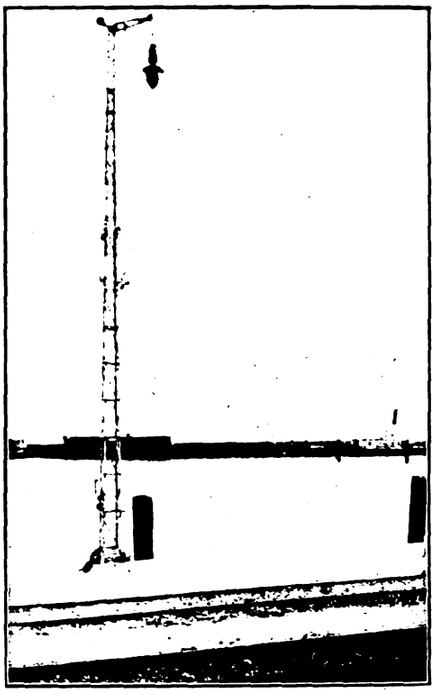

FIG. 12—LUCERNE. TYPICAL RAILROAD YARD LIGHTING EQUIPMENT.

The providing of the most magnificent boulevards based upon the largest and most comprehensive plan which has ever been carried out and lighted in a man-

FIG. 13—PARIS. IN THE SHADES OF THE LOUVRE.

ner which has been the envy of all the world is the record of Paris. What was true five years ago in lighting, however, is not true today, for scarcely any other branch of applied science has advanced more rapidly, and Paris has responded

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but feebly to the demands for more modern methods, with the result that many of her celebrated installations have been outdone.

The greatest criticism, however, is to be made regarding what she has done. The prominent people who have not strolled down Avenue de L'Opera are few indeed, and the compliments paid upon the former lighting have reached to the ends of the earth, but in order to satisfy the demands for higher intensities Paris has done at least one thing which is apparently inartistic.

Inclined carbon, pink-flame arcs have been placed close together upon the streets, in three rows, one on each curb and one down the center, but they are hung only twenty feet high!

The only possible excuse could have been the desire for uniformity in the design of the fixtures, for they are somewhat similar to that shown in Fig. 13, which follows the general lines of the electric posts in use throughout the entire city.

A New Electric Miner's Safety Lamp.

In a recent number of *Electrical Engineering* (London) there is described an interesting electrical safety lamp with some rather unique features. It consists of a metallic-filament lamp placed in front of a strong parabolic reflector and behind a glass lens, so that a beam of twenty candlepower measured along the focal axis is obtained. This is operated from a four-volt cell contained at the base of the lamp.

In conjunction with this, however, at the back of the lamp is a small oil lamp protected both with a glass shield and a piece of gauze, which is intended for testing for gas in the usual way. A switch is arranged whereby the light from the electric lamp can be turned off, and simultaneously a current is passed through a platinum wire, by means of which the oil lamp is ignited. In order to prevent both oil lamp and electric light glowing simultaneously, when the latter is switched on, a snuffer over the oil lamp is brought into operation, so that they cannot both burn at once. Moreover, in a gassy mine, an arrangement is supplied on the lamp for shutting off the air supply to the oil lamp in order to extinguish the flame. The weight of the whole equipment, which is intended to burn from fourteen to twenty hours continuously, is only five pounds, and it is possible to produce a lighter lamp to burn for an eight-hour shift.

Enclosed Arc Lamp.

A recent improvement in the enclosed arc lamp is disclosed in an American patent recently granted to Adrian Denman Jones, of London, England. This lamp uses electrodes treated with calcium tungstate, calcium fluoride and sodium tungstate or potassium sulphate. The high vapor density of the gases given off when this mixture fuses insures a comparatively small arc, the effect being that the vapors are heated to an extremely high temperature. The lamp efficiency is consequently high.

As the lamp is air-tight, or practically so, it was necessary to provide a suitable system of chambers for the circulation of the gases. This circulation is effected through the three tubes (*A*), (*E*), and (*D*), shown in the accompanying diagram.

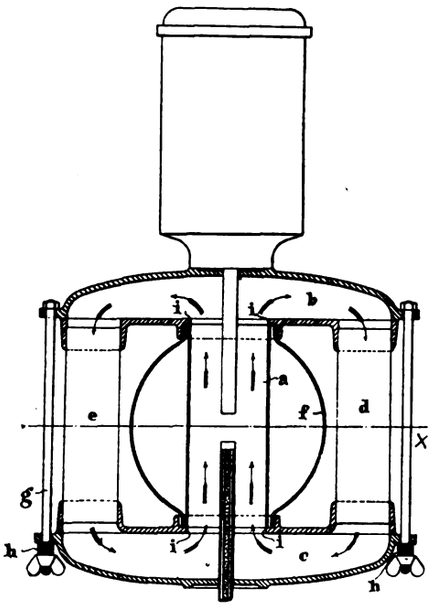

DIAGRAM OF JONES LAMP.

(*A*) is a transparent or translucent tube surrounded by a suitable globe (*F*). The surrounding globe has a tendency to increase the temperature of the chamber (*A*), and thus prevent the formation of a deposit therein.

Electric Lighting for Irish Cathedral.

It has been decided to take out the entire gas fittings of St. Patrick's Cathedral, Dublin, Ireland, and replace them by electric-light fixtures. The contract, which was awarded to the firm of W. Coats and Son, calls for an expenditure of nearly $5,000. Electrically driven rotary blowers are to be substituted for the hydraulic blowers at present in use for working the organ. Evidently St. Patrick's is not to be outdone by the Bombay Cathedral in keeping up with the march of progress.

Electric Light and Power on Governor's Island.

Governor's Island, the picturesque military post lying almost at the gateway of New York harbor, was probably one of the best-known depots of its kind in the world. It was ceded by the city of New York to the United States Government in the early days of the republic, and has been used for military purposes upward of a century. It is now the headquarters for the Atlantic Division of the United States Army and the department of the East. It has a population of about 400, exclusive of the 300 military prisoners confined in Castle William—the old-fashioned, round-tower fortress at the northwest corner of the island.

Until three or four years ago, strange as it may seem, this community, with its generals, colonels and captains—its pretty villa houses—its public buildings and barracks, situated almost within a stone's throw of the great metropolis of America, possessed no modern system of illumination and was lighted exclusively by the flame of kerosene oil. About the time mentioned, the government laid a cable from Brooklyn to Governor's Island, and contracted with the Edison Illuminating Company, of Brooklyn, to supply electric energy to the island. The company delivers primary current to this cable on the Brooklyn side, which is transformed and distributed at the rotary station on the island. Every building is wired and the entire island, including the streets, is now lighted exclusively by electricity.

Electrical energy is now to be used on the island for another purpose—to provide adequate protection against fire. The means hitherto used for this purpose have been humorously primitive. Power pressure in cases of fire has been supplied by the engine of the little ferry boat which plies between the island and the Battery, in Manhattan. If a fire broke out while this boat was on its way to Manhattan, there was nothing to do but wait for its return to the island. In the first part of October a fire occurred while the ferry boat was away from its island moorings and considerable damage resulted before the conflagration could be extinguished. Uncle Sam's eyes were opened at last, and it was proposed by the authorities at Washington to install an up-to-date, high-pressure, fire pumping plant. The plant, which will consist of an electric motor with six-inch, three-stage turbine pump, throwing a four-inch stream, is now being installed and will be ready for use in two or three weeks.

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CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

Electrically Heated Household Appliances.[1]

The load curve of the average distributing station usually presents an appearance resembling the profile of the Rocky Mountains, the valleys representing the average load for twenty-four hours, and the highest peaks representing the maximum load for short intervals, at which time the generating apparatus is taxed to its utmost. If we average the "altitudes" of the peaks and the valleys, and divide this value by the maximum power demanded during a certain period of twenty-four hours, we obtain what is called the "load factor." Sometimes the load factor is defined as being the ratio of the average load during a given period of time to the normal capacity of the station.[2]

The load factor of the central station is a subject which materially affects the financial success of the station. Therefore, progressive managers throughout the entire country have turned their attentions toward making the ratio above referred to as high as possible. The cost of managing the system and distributing the electrical energy is not merely the operating expense of the station but includes the depreciation on the equipment and interest on the money invested. The operating expense may be divided into two classes, one class dependent on the load, and the other class independent of the load. It is, therefore, evident that a station with a large kilowatt output will have a cheaper operating cost per kilowatt-hour than will a similar station of smaller kilowatt-hour output. It has been found by experience that it is almost as economical from an operating standpoint to deliver two kilowatt-hours as it is to deliver one kilowatt-hour, assuming, of course, that the plant is of sufficient capacity to take care of the large load. It will, therefore, be seen that a high load factor, meaning a high kilowatt output, would considerably lower the cost of operation of a given station. Medium and large size stations consider a load factor of thirty-five per cent to be very good, indeed, and a load factor of fifty per cent to be excellent.

Of course, to increase the load factor, it is necessary to fill in the "valleys" above referred to, and in the case of stations, the majority of whose load is a lighting load, can best accomplish this result by securing a daylight load.

The daylight load is secured by the installation of motors and heating devices. How many central managers are there who walk down their brilliantly lighted thoroughfares in a blaze of light from electric signs, which have been placed on the system by the strenuous efforts of solicitors? The electric sign business is undoubtedly profitable to the central stations, but if you will stop a moment and consider the effect which would be obtained if electric signs were in use during the morning, the noon and the evening meal hours, you will find an incentive in instituting a vigorous campaign in behalf of electrically heated devices. In other words, suppose that you had an equivalent connected load of heating devices in service during the morning, noon and evening meal hours, do you not agree that the load factor would be materially improved, and the cost of generation per kilowatt-hour materially reduced? The experience of companies that have extensively exploited electric heating devices will confirm the truth of such arguments. Think of the energy lost while operating a large generating plant at the reduced efficiency ensuing from a small load. Suppose that the central station in which you are interested had connected to its lines fifty or one hundred cooking outfits, and that the average loads of such outfits were represented by the values given in the table below.

Then notice the contrast with the table representing an average lighting load.

I wish to call your particular attention to the flatiron load herein enumerated, and to the advantageous time during which it is in service.

The above values were taken from actual experience and may be considered as being a fair average for a family consisting of three or four persons. In the particular case above referred to, the consumer used current during the previous year to the amount of $35 for light, and after the installation of the heating and cooking devices, his bill was increased to approximately $110 per year, showing an increased income to the central station amounting to about 200 per cent for this particular residence. This case illustrates what can be done, and what should be done, in exploiting the electric heating business. Notwithstanding the great increase in revenue to the central station, the consumer's bill was approximately the same as it had previously been when using gas and coal for cooking purposes.

In introducing heating and cooking devices, public demonstrations are of great value, but under no condition should the demonstration be in the hands of a person incompetent and unfamiliar with the details of the devices. A great amount of interest is always shown in displays

COOKING AND HEATING DEVICES.

	Breakfast, 6:30-8:00	Baking, 8:00-11:00.	Ironing, 7:00-11:00.	Dinner, 11:30-1:00.	Misc. Day.	Supper, 4:30-8:00.	Misc. Night.	Total.
Monday....	¾ kw.-h.	1 kw.-h.	0 kw.-h.	1½ kw.-h.	¼ kw.-h.	½ kw.-h.	0 kw.-h.	4 kw.-h.
Tuesday ..1	kw.-h.	0 kw.-h.	2½ kw.-h.	1½ kw.-h.	½ kw.-h.	1 kw.-h.	½ kw.-h.	7 kw.-h.
Wednesday	¾ kw.-h.	3 kw.-h.	0 kw.-h.	¾ kw.-h.	0 kw.-h.	½ kw.-h.	0 kw.-h.	5 kw.-h.
Thursday..	¾ kw.-h.	0 kw.-h.	0 kw.-h.	1 kw.-h.	¼ kw.-h.	0 kw.-h.	0 kw.-h.	2 kw.-h.
Friday 1	kw.-h.	0 kw.-h.	0 kw.-h.	1 kw.-h.	0 kw.-h.	½ kw.-h.	½ kw.-h.	3 kw.-h.
Saturday...	¾ kw.-h.	3 kw.-h.	0 kw.-h.	¾ kw.-h.	1 kw.-h.	½ kw.-h.	0 kw.-h.	6 kw.-h.
Sunday.....	½ kw.-h.	0 kw.-h.	0 kw.-h.	2½ kw.-h.	0 kw.-h.	0 kw.-h.	1 kw.-h.	4 kw.-h.
Total....5½	kw.-h.	7 kw.-h.	2½ kw.-h.	9 kw.-h.	2 kw.-h.	3 kw.-h.	2 kw.-h.	31 kw.-h.

LIGHTING LOAD.

Monday	0 kw.-h.	0 kw.-h.	0	kw.-h.	0	kw.-h.	0	kw.-h.	1	kw.-h.	½ kw.-h.	1½ kw.-h.		
Tuesday....	0 kw.-h.	0 kw.-h.	0	kw.-h.	0	kw.-h.	0	kw.-h.	¾	kw.-h.	¼ kw.-h.	1 kw.-h.		
Wednesday.	0 kw.-h.	0 kw.-h.	0	kw.-h.	0	kw.-h.	0	kw.-h.	1	kw.-h.	½ kw.-h.	1½ kw.-h.		
Thursday...	0 kw.-h.	0 kw.-h.	0	kw.-h.	0	kw.-h.	0	kw.-h.	1	kw.-h.	1	kw.-h.	2	kw.-h.
Friday.....	0 kw.-h.	0 kw.-h.	0	kw.-h.	0	kw.-h.	0	kw.-h.	¾	kw.-h.	¼ kw.-h.	1	kw.-h.	
Saturday....	0 kw.-h.	0 kw.-h.	0	kw.-h.	0	kw.-h.	0	kw.-h.	1	kw.-h.	½ kw.-h.	1½ kw.-h.		
Sunday.....	0 kw.-h.	0 kw.-h.	0	kw.-h.	0	kw.-h.	0	kw.-h.	¾	kw.-h.	¾ kw.-h.	1½ kw.-h.		
Total....	0 kw.-h.	0 kw.-h.	0	kw.-h.	0	kw.-h.	0	kw.-h.	6¼	kw.-h.	3¾ kw.-h.	10	kw.-h.	

[1] Abstract of a paper by A. G. Jones, read at Joint Convention N. W. Electric Light and Power Association and Seattle Section A. I. E. E., Seattle, September 7, 8, 9, 1909.

[2] Several other definitions are also given by various authorities. [Ed.]

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and demonstrations of electric heating and cooking devices. Besides the attractive appearance of the goods, they seem to have a fascination which cannot be easily explained. They are clean, sanitary, quick in operation, and ornamental, reasons which undoubtedly appeal to the most critical housewife.

The layman usually has a more or less vague idea as to the meaning of the watts rating as will be found on the nameplate of heating devices, and, perhaps, the simplest way to make such a rating comprehensive to the public is to reduce the rating in watts to an equivalent number of sixteen-candlepower, 110-volt, carbon lamps. The standard 110-volt, sixteen-candlepower carbon lamp consumes about fifty-six watts; therefore, if the watt rating on the nameplate of the heating device be divided by fifty-six, the "lamp equivalent" will be obtained. If the consumer will, therefore, compare the lamp equivalent of the heating device which he proposes to use, he will have a very good general idea of what he might expect the operation of the heating device will cost, by comparison with previous lighting bills. If electric cooking and heating is employed extensively in any given house, it is desirable to have the entire circuit separate from the lighting circuit, and metered by an independent meter. In this way the consumer can obtain definite figures as to the actual cost of cooking or heating by electricity. Often the installing of a curve-drawing wattmeter for a short time will prove instructive both to the customer and the lighting company.

The importance of heating-device displays in the exhibit rooms or offices of central stations will not be questioned by the most skeptical manager, and in order that such a display may be most effective and interesting to prospective customers, the articles chosen should be representative and few in quantity, rather than simply a miscellaneous collection of a complete line. To be most attractive, they should be surrounded by articles in keeping with their use. For instance, a chafing-dish on a well-finished table with a few dainty dishes and some silverware will catch the eye of an apparently disinterested person much quicker than would a general conglomeration of heating devices. The coffee percolator and the toaster, when in operation, make a very attractive display. In other words, the more ornamental the appearance of the general display, the more effective it will be.

The heating units in various electric appliances vary materially with different manufacturers and with the particular article in question. The units may, however, be divided into three general classes, known as: (1) Flat unit; (2) the well-known cartridge unit; (3) a unit composed of resistance wire wound on mandrels of various shapes.

A typical flat unit consists of a stamping of the desired shape made from a solid sheet of specially prepared resistance metal of very thin cross section. This is placed between thin sheets of amber mica, and securely clamped in position, which brings the resistance material in close thermal contact with the surface to be heated. Such a unit is ideal for flatirons, percolators, small disk stoves, and other appliances where an even temperature is required over the entire surface.

The cartridge unit consists of a spiral of suitable resistance wire wound on edge, each layer being insulated by a powdered material resembling porcelain. The spiral is then encased in a metal cartridge, after which it is baked to a very high temperature. This type of unit is eminently well suited for instantaneous water heaters, and other devices which do not require uniform heating of a flat surface. The cartridge unit is also used with great success in flatirons, since the metal composing the iron can be shaped in such a manner as to produce an even temperature on the smoothing surface of the iron. This is accomplished by putting a great amount of metal in the proper place, and also by forming an air space directly beneath the cartridge unit, that is, between the unit and the surface of the iron, thus preventing the center of the iron from becoming too hot and insuring a uniform heat on the working surface. The cartridge unit has the advantage of being very easily renewable, and also has a remarkably long life.

The various heating units constructed from ordinary round resistance wire wound on suitable mandrels have many applications, but broadly speaking do not admit of the most efficient utilization of heat.

Great care should be exercised by the agent or solicitor in selling heating devices to be certain as to the voltage of the circuit upon which the device is to be used. A large percentage of the trouble with heating devices is due to using such devices on circuits of voltages varying widely from that for which the unit is designed. In order to get the maximum efficiency from a heating unit, it must be designed rather closely to its voltage limit, and for this reason heating devices should not be used on circuits varying more than five per cent from the rated nameplate voltage. An excessive voltage, of course, results in short life, and low voltage results in dissatisfaction caused by the great length of time taken for the unit to come to a working temperature.

The application of heating and cooking devices is very broad. The table given below, being taken from the Solicitor's Handbook of the National Electric Light Association, gives a very complete outline of the most useful devices. The table gives the name of the material, the energy consumed and the cost of operation per hour at five cents per kilowatt-hour:

Apparatus.	Watts.	Cents per Hour.
Broilers, 3 ht.	300 to 1,200	1.5 to 6
Chafing dishes, 3 ht.	200 to 500	1 to 2.5
Cigar lighters	75	0.375
Coffee percolators for 6-in. stove	100 to 440	0.5 to 2.2
Coil heaters	110 to 440	0.5 to 2.2
Corn poppers	300	1.5
Curling-iron heaters	60	0.3
Double boilers for 6-in., 3 ht. stove	100 to 440	0.5 to 2.2
Flatiron (domestic size), 3 lb.	275	1
Flatiron (domestic size), 4 lb.	350	1.4
Flatiron (domestic size), 5 lb.	400	2
Flatiron (domestic size), 6 lb.	475	2.4
Flatiron (domestic size), 7.5 lb.	540	2.7
Flatiron (domestic size), 9 lb.	610	3.05
Foot warmers	50 to 400	0.25 to 2
Frying kettles, 8-in. diameter	825	4.125
Griddle-cake cookers, 9 by 12 inches, 3 ht.	330 to 880	1.7 to 4.4
Griddle-cake cookers, 12 by 18 inches, 3 ht.	500 to 1,500	2.5 to 7.5
Heating pads	50	0.25
Instantaneous flow water heaters	2,000	10
Kitchenettes (complete), average	1,500	7.5
Nursery milk warmers	450	2.25
Ornamental stoves	250 to 500	1.25 to 2.5
Ovens	1,200 to 1,500	6 to 7.5
Plate warmers	300	1.5
Radiators	700 to 6,000	3.5 to 30
Ranges, three heats, 4 to 6 people	1,000 to 4,515	5 to 22
Ranges, three heats, 6 to 12 people	1,100 to 5,250	5.5 to 26
Ranges, three heats, 12 to 20 people	2,000 to 7,200	10 to 36
Shaving mugs	150 to	.75
Stoves (plain), 4.5 in., 3 ht.	50 to 220	0.25 to 1.1
Stoves (plain), 6 in., 3 ht.	100 to 440	0.5 to 2.2
Stoves (plain), 7 in., 3 ht.	120 to 600	0.6 to 3
Stoves (plain), 8 in., 3 ht.	165 to 825	0.75 to 4.125
Stoves (plain), 10 in., 3 ht.	275 to 1,100	1.3 to 5.5
Stoves (plain), 12 in., 3 ht.	325 to 1,300	1.6 to 6.5
Stove, traveler's	200	1
Toasters, 9 in. by 12 in., 3 ht.	330 to 880	1.6 to 4.4
Toasters, 12 in. by 18 in., 3 ht.	500 to 1,500	2.5 to 7.5
Urns, 1-gal., 3 ht.	110 to 440	0.5 to 2.2
Urns, 2-gal., 3 ht.	220 to 660	1.1 to 3.3
Urns, 3-gal., 3 ht.	330 to 1,320	1.3 to 6.6
Urns, 5-gal., 3 ht.	440 to 1,700	2 to 8.5
Waffle irons, 2 waffles	770	3.75
Waffle irons, 3 waffles	1,150	5.75

In addition to the above table of household heating and cooking utensils, there are a number of other useful devices, such as glue pots, soldering irons, leather-finishing tools, drying tables for use in printeries and binderies, etc.

Heat energy is derived from electric

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energy by passing the current through a resistance of suitable dimensions. The amount of heat energy dissipated will depend absolutely on the product of the resistance into the square of the current. From this it will be seen that the actual number of heat units can be accurately predetermined, the efficiency of the heating unit depending upon the design of the unit itself, and the design of the device in which it is used. We, therefore, have to look to the ingenious engineer to give us heating devices of high efficiency. The short life of heating units can be often traced to poor design, inasmuch as the resistor has to work at a temperature considerably above that which would be necessary if the design of the appliance in which it is used were such as to utilize the maximum amount of heat produced.

The majority of heating devices, such as the teakettles, combination cookers, water heaters, and stewpans, usually require from ten to fifteen minutes to reach the boiling point, whereas, with the grids, hot plates, and such devices as require rapid heating, they take only from two to six minutes to reach an operating temperature, assuming, of course, that the surrounding temperature is normal.

The electric coffee percolator is especially representative of the rapid strides which have been made in the art of design and manufacture of heating devices within the past several years. Actual tests on a one-and-one-half-pint size of percolator prove that water drawn from a hydrant, direct, at a temperature of eighteen degrees centigrade, required only forty-five seconds to start to percolate, and only one minute and forty seconds in the three-pint size. In either case the percolation proceeds very rapidly, and the coffee is finished in ten minutes or less. Such results are due to the improvement in the design of the heating unit, and also to the improvement in the design of the "pump" in the latter designs.

Increase in N. E. L. A. Membership.

During the recent campaign for the extension of the National Electric Light Association, the membership has increased from 1,300 to a total of 3,561. At the meeting of the executive committee on October 13, the executive secretary, T. C. Martin, gave the following as the membership at that date: Class A, 743; Class B, 244; Class D, 194; Class E, 176. The most of the increase has been through the formation of local company branches.

The Storage Battery in the Electric Lighting Plant.[1]

The life of the positive element of a storage battery in ordinary use is usually taken at from five to ten years, depending on its weight, method of manufacture and use. The negative element under the same conditions will last from seven to twenty-five or thirty years, possibly longer. As the positive element, as a rule, is only about from one-third to one-half of the total cost of the battery, it is seen that the depreciation on storage batteries cannot be very high.

The storage battery is heavy, bulky and expensive. For its weight, size and cost, it strikes one, unfamiliar with it, to have an astonishingly small amount of stored energy. This is true to a certain extent. At the same time a storage battery of ordinary construction has sufficient stored energy in it to lift its own weight from five to eight miles in the air, and a storage battery constructed with a view of lightness contains sufficient energy to lift itself to at least fifteen miles.

One of the principal uses of storage batteries is regulating fluctuations of load. We are all familiar with the use of the flywheel for this purpose, which it accomplishes admirably when the fluctuations are not heavy or long sustained. Some figures on the comparative weights and efficiencies of the storage battery and the flywheel in this connection may be interesting, and in order to make the comparison, we will suppose heavy fluctuations, but not heavier than daily occur in, for instance, an electric power plant where electric elevators are operated. In one such plant in this city (San Francisco), with an average load of about fifty kilowatts, there frequently occur fluctuations of 100 to 150 kilowatts, lasting for several seconds. These fluctuations could be taken care of by a storage battery, weighing in the neighborhood of 20,000 pounds. To obtain the same regulation, a flywheel rotating at 120 revolutions a minute would have to weigh between 150,000 and 200,000 pounds. This, of course, would be absolutely absurd and would take up much more room and cost considerably more than the equivalent storage battery. If these fluctuations instead of lasting three seconds lasted thirty, the flywheel would have to be so much larger that I hate to strain your credulity. The battery, however, would carry such an overload for fifteen minutes.

One of the uses of storage batteries is the so-called "stand-by" service. In this use the storage batteries are connected in parallel with the generators. In case of any trouble with these, the battery instantly takes up the load and carries it until another generator can be put into service. Of course, in an office building, for instance, the battery can be called upon to carry the entire night load after the generators are shut down. Stand-by batteries have a very extensive development in the electric-lighting companies of large cities, and particularly where they are dependent on waterpower and long-distance transmission lines. In Los Angeles, for instance, the Edison Company, which derives the bulk of its power from the Kern River plants, has two large storage batteries. Trouble with transmission lines, due to shorts, etc., occurs with this company on an average of two or three times a month. On these occasions the storage battery steps in and continues their service until the alternate line can be put in operation. With a storage battery under such conditions, there is no interruption of the service. Without a storage battery it might be half an hour before the alternate line could be started, as it would be necessary to start up and synchronize all of the machinery before the load could be taken up. Auxiliary steam generating plants are sometimes used for this emergency service, but the objection to these is that it takes a considerable time to get up the required steam pressure in all the boilers, as would be the case during heavy load conditions, while the storage battery is automatically and instantly available.

The largest application of storage batteries, however, is for regulation purposes. The ideal condition for a power plant is an absolutely steady full load during the entire time the plant is running. Under these conditions alone can a high efficiency be obtained. Unfortunately these conditions almost never obtain. In a great many plants, however, the fluctuations are not very heavy and are often so gradual that they can be taken care of by starting up or shutting down additional units. In these cases, of course, a storage battery is not needed. When, however, we have a heavy, fluctuating load, fluctuating violently and rapidly, there is nothing that can alleviate this condition but a storage battery. This fluctuating load occurs—to use the most

[1] Abstract of a recent paper by O. W. Lillard, read before California No. 3, National Association of Stationary Engineers.

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familiar instances—where electric elevators or hoists are used, and in the case of electric interurban railroads on which there are few trains or cars. The load fluctuates from zero to three or four times the average load, every few seconds, and this performance is kept up indefinitely. The fluctuations are so violent and rapid, that the governor of the steam engine cannot keep up with them. The engines are constantly pounding and the voltage of the system is unsteady. As the engines are running either at practically no load or at a heavy overload all of the time, their efficiency is very low. A storage-battery regulating installation alleviates all of these conditions by absorbing all the fluctuations above and below the average. The load on the generators is reduced to the average load and kept at that point within five per cent, under extreme conditions. By reducing the generator load to the average load on the plant, instead of a maximum of several times this, it is usually possible to shut down half the generators. In some cases one small generator will carry the load at all times where it was formerly necessary to run two large ones, the greater part of the time. Due to the fact that the load is maintained constant on the generator, the voltage of the system is absolutely constant, a variation of a quarter to a half per cent in voltage being the maximum obtained. The battery, of course, takes all shock, due to fluctuations, from the engines and enables them to run steadily and quietly at their point of highest efficiency, and with the least possible liability to accident. As the engine is running at its most efficient point, a large saving of fuel is obtained. In exceptional cases this may be as high as fifty or sixty per cent, and it usually exceeds thirty. Another advantage, which is not usually given full consideration, is the fact that the whole plant is running under absolutely steady conditions and similar to those used by experts when testing the installation. Under these ideal conditions it is easier to study the operation of each part of the plant, and tune it up to its best possible performance. In addition to the saving of fuel above mentioned, in the case of an office building the steam plant may be shut down at about nine o'clock at night and the load carried by the storage battery. This effects a further saving, especially when power for this purpose is being purchased from the electric lighting companies.

The storage battery, of course, lends itself most readily to the regulation of direct-current plants, but the fluctuating load condition occurs as often in alternating-current plants as it does in direct. The Gould Storage Battery Company has developed within the last four or five years a very practical system of alternating-current regulation by means of storage batteries and has a number of these plants in successful operation. The theory of this regulation is very similar to that of the direct-current system, and while very interesting from an engineering point of view, it would take too much of our time to go into it extensively.

Another interesting application of storage batteries is in competition with primary batteries, where facilities for recharging the storage battery exist. You are, of course, familiar with the fact that the telegraph companies at one time operated their lines from primary batteries. Now they use storage batteries exclusively. The storage battery is many times lighter and more compact than the primary battery. Its first cost is about the same, and while a storage battery in this use will last from five to eight years without renewals, a primary battery under the same conditions requires renewals every few months. The policy of the telephone companies has been the same as that of the telegraph companies.

In general it may be stated that a storage battery will more than save its cost, in a year's time, in competition with a primary battery. Of course, it is understood that there must be sufficient use of current to make the installation worth while. It is interesting to note, however, that in the new large hotels, etc., a storage battery is used in preference to primary batteries for operating fire-alarm systems, call bells, interior telephones, etc. The storage battery is more reliable, and in addition to taking up less room, it requires less attention.

A very large use of the storage battery occurs in connection with the electric lighting of cars on steam railroads. This may not seem a large use until you stop to consider the number of cars so equipped and the fact that the storage-battery equipment for each car will run from $500 to $1,000. You will have seen and admired the electric automobile propelled by storage batteries. This is a fast growing branch and will probably reach high development in the next few years. I do not have to tell you that the electric automobile is noiseless and practically foolproof. It may, however, astonish you to know that it is considerably faster than the highest powered gasoline automobile for traveling in crowded city streets.

Small portable storage batteries are largely used for ignition purposes in stationary, automobile and motor-boat engines, and in this service stand a wonderful amount of abuse and use. Storage batteries are also used for operating railway and other signals, by the telegraph and telephone companies, as an adjunct to gasoline and electric-lighting plants for residences, for experimental purposes (where its steady flow and constant voltage is invaluable), and for many other purposes.

The New Generating Station at Stepney, London, England.

The new Blyth's Wharf electric generating station of the Metropolitan Borough of Stepney was opened on Wednesday, October 27, says *Engineering*, of London, Eng. The station, which is conveniently situated near the river, is a steel and ferro-concrete building, and is laid out on straightforward and modern lines, so as to be capable of considerable extension. The plant, which is arranged so that the station may work in conjunction with the present direct-current supply station at Osborn Street, consists of a 2,000-kilovolt-ampere, 6,600-volt, three-phase Willans-Bruce Peebles turbo-alternator, and a 1,000-kilowatt Parsons double-current machine, consisting of two machines in tandem, and giving direct current at 230 volts or three-phase alternating current at 140 volts. The direct-current supply from the latter machine will be used for local distribution, while the alternating-current supply will be stepped up by means of Berry transformers, and will be used in conjunction with the 2,000-kilovolt-ampere machine for bulk supply to Osborn Street, where step-down motor-converters will be installed. The turbines are fitted with "Contraflo" condensers, Edwards air pumps, and Rees-Roturbo circulating pumps, while the boiler house contains three Babcock and Wilcox marine-type boilers. The most novel feature in the station is the high-tension switchgear, which is of the Reyrolle ironclad type, and it will be interesting to see, says our contemporary, if this gear will ultimately prove capable of taking care of the output of the completed station, which is projected to contain plant of 28,000 kilowatts capacity when finished.

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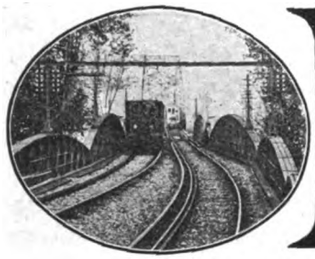
Vol. 55—No. 20

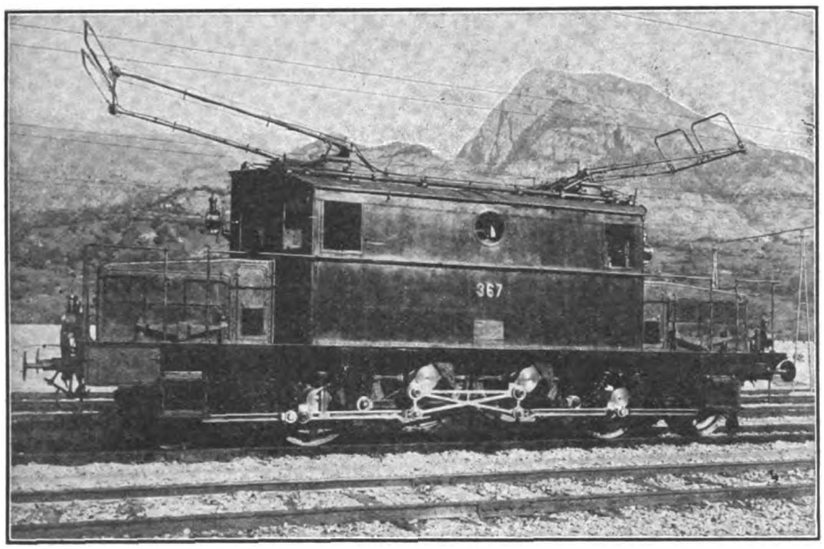


ELECTRIC TRACTION

THE NEW ELECTRIC LOCOMOTIVES FOR THE SIMPLON TUNNEL.

BY C. L. DURAND.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of February 20 last there appeared a brief account of the new three-phase locomotive built for the Simplon electric line. Since that time much more complete data upon the subject have come to hand, the manufacturing company, the Brown-Boveri firm, having made public the details of the new locomotive. It is therefore possible to present, for the first time, a series of views



GENERAL VIEW OF NEW SIMPLON ELECTRIC LOCOMOTIVE.

of the locomotive and also of the new motor. This latter is specially worthy of note, as it is a new departure in the way of three-phase working for heavy locomotives such as are designed for standard-gauge railroads.

The new motor is the first of the kind in which a rotor of the squirrel-cage type is employed, and it has another interesting feature in that it will give four different speeds, the former type of Simplon locomotive being operable only on two speeds. It is also claimed that the new locomotive is the most powerful one constructed in Europe up to the present time. Each of the two motors gives a maximum of 850 horsepower, according to the brake tests which were made at the factory.

In the old type of locomotive all three driving wheels are coupled to the motors. A running wheel of smaller diameter lies at each end of the chassis, and it is mounted in a bogie along with the next lying large wheel. The middle axle is independent and has a wide shift. In the new locomotive the two motors are mounted adjacent to one another under the middle of the chassis. There are now employed four driving wheels of the same diameter, thus dispensing with the small wheels. A stout drawbar connects the cranks of the two motors, and from one end of this bar there is a bar which connects to the first driving-wheel crank. A similar bar runs to the second wheel. The arrangement is similar on the other side, so that all four wheels are driven from the two motors conjointly.

In view of the fact that the small wheels are no longer used, all of the weight of the locomotive is utilized for adhesion, and the weight is equally distributed on all four axles. In order to facilitate the rounding of curves on the track, the outer axles are not made fast in the chassis. Instead of trucks or bogies, there is employed what is known as the Klienhinder system for the axles, and these latter have a radial as well as a side slip. This method has been found to work very well on some of the railroads on the Continent, and it is adopted therefore in the present case. To give a better running in the curves, the wheel diameter has been cut down from 1.64 metres

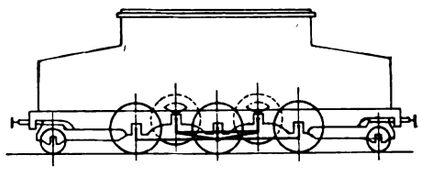


DIAGRAM OF DRIVING MECHANISM OF OLD LOCOMOTIVE.

to 1.25 metres. Provision is made at the coupling points of the bars in order to give the necessary play when rounding a curve. Owing to the fact that the cranks of both motors are coupled together, the total adhesion of the locomotive may still be used in case one of the motors should fail.

The present locomotives are designed for a higher power than is actually needed on the Simplon Tunnel section, this requiring the use of a 300-ton train at a speed of forty-three miles an hour on a 0.2 per cent grade, or a 400-ton train at twenty-one miles an hour on a 0.7 per cent grade. The extra power is provided so that the new locomotives may be used on the future extension of the line on the Italian side, from Iselle to Domo d'Ossola. It is also to be noted that the Simplon locomotives require a high power in order to run against the strong air draft which is produced in the tunnel by the two large fans, and it is estimated

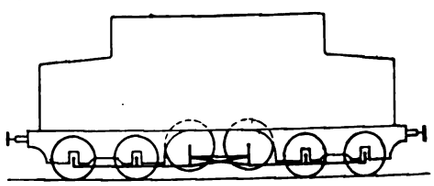


DIAGRAM OF DRIVING MECHANISM OF NEW LOCOMOTIVE.

an additional 700 horsepower is needed for this reason alone, that is, when the locomotive is running against the air current.

The principal data for the new locomotive are as follows: Wheel spread, 4.60 metres; distance between outer axles,

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1.70 metres; between buffers, 11.64 metres; weight upon each axle, nineteen tons; total weight, seventy-five tons, including mechanical part thirty-six tons and electrical part thirty-nine tons.

A departure from the usual practice in three-phase working for electric locomotives consists in the use of a squirrel-cage armature for the motors. Hitherto it does not appear that such armatures have been employed in traction motors except for those of comparatively small power. M. Aichele, one of the leading engineers of the Brown-Boveri firm, has been able to design a three-phase motor which gives as high as 850 horsepower, and there are several advantages connected with the use of such motors for electric locomotives. In designing the new motors it was desired to retain the two standard speeds of forty-two and twenty-one miles an hour, seeing that the former locomotives are designed for these speeds. The new motor also has two other speeds of thirty-two and sixteen miles an hour. It uses in the first place a pole change in the stator which gives either six or twelve poles, and, by switching over, twelve poles may be obtained. The rotor being of the squirrel-cage type, will work with any number of poles in the stator, so that a second pole combination which gives eight and sixteen poles may be employed. Such could not be done in practice with the other type of rotor, as in order to have four different pole changes at least ten collector rings on the rotor would be necessary. Such could not be used for different reasons, as will be apparent, so that the old motors were limited to the two running speeds of forty-two and twenty-one miles. Using the second pole combination the locomotive may be run at two other speeds, namely, thirty-two and sixteen miles an hour.

Using the two different windings on the stator, these can be connected in parallel when running, so that a great torque is secured in this way. The use of the squirrel cage brings about a difference in the method of working, as in this case it is not desired to put the full voltage on the motor, owing to the fact that the short-circuited rotor would cause too sudden a demand on the supply mains. For starting the motor there is used a transformer which has different sections, so that the motor is started on a lower voltage, this being then raised by degrees up to the standard voltage. Each of the two motors with its transformer, switches and other apparatus, makes a distinct set, so that the locomotive can be run independently if need be from one of the motors, the other being thrown out. As before, the overhead line uses a double wire with 3,000 volts and sixteen cycles, and this current is taken into the locomotive by the two bow trolleys on the roof of the locomotive.

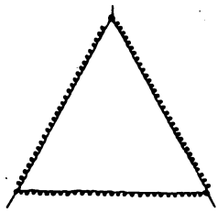


DIAGRAM OF SIX-POLE CONNECTION.

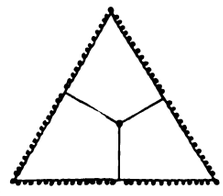


DIAGRAM OF TWELVE-POLE CONNECTION.

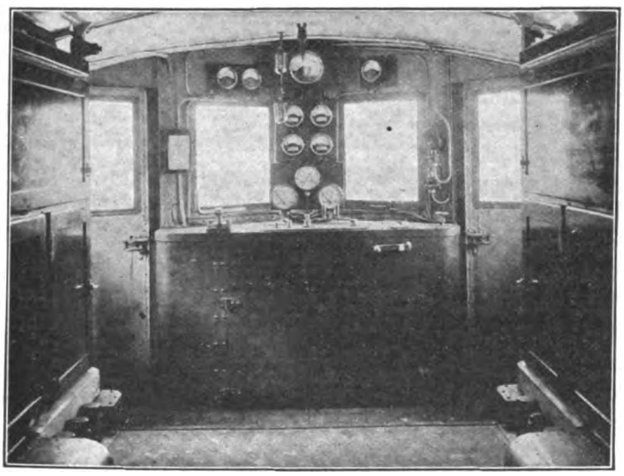
The transformers are mounted in the ends of the locomotive and are provided with ten steps in the winding. The first step gives 1,000 volts for starting the motor, and each of the succeeding steps gives 200 volts additional, so that the voltage can be increased gradually up to 3,000 volts. Beside the transformer is mounted a drum for contacts worked by chain drive from the motorman's bench.

From the transformer the current passes first into the reversing switch, and this is used to change over the direction of the current on the two overhead phases so as to run the motor in either direction. The pole-changer consists of a set of two switches. One switch makes connection for the six-twelve-pole combination in the stator, and the second switch gives the eight-sixteen-pole arrangement. A pneumatic control is used with the reverser and the pole-changer, and these are controlled from the motorman's bench, at which point the valves are located.

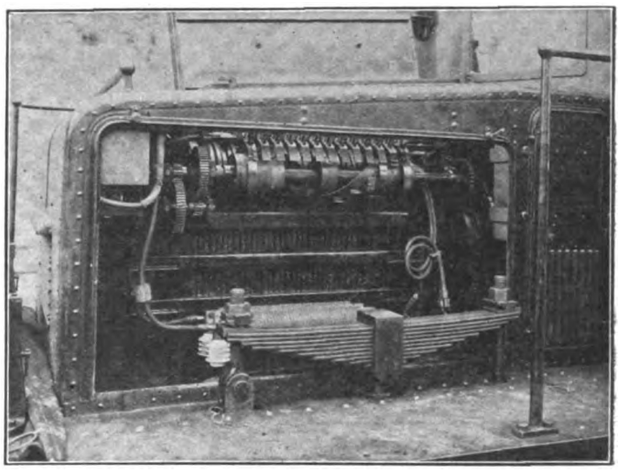
There is a similar bench at each end of the locomotive, and the pneumatic devices are symmetrical. In connection with the pole-changer there are used two circuit-breakers which work on overload current in the usual way, so that a fault can be located in any of the four circuits of the locomotive, there being one pole-changer for each motor and each pole-changer having two switches. Such circuit-breakers can also be used as emergency switches and can also be operated by hand from either of the control benches.

The pneumatic control of the apparatus is interlocking and all the valves are contained in a small device. This allows the two windings of each stator to be thrown on at once when it is desired to run the two windings in parallel, but it is impossible to put on both the pole-changes of one winding at the same time, as, for instance, the six and twelve-pole.

In order to start the locomotive under these conditions, the motorman receives advice from the conductor of the train as to the probable weight of the train, and he then puts on the transformer controller to give the voltage which is the best for starting up in the shortest



VIEW IN THE CAB OF SIMPLON LOCOMOTIVE.



SIDE VIEW OF CONTROLLING APPARATUS.

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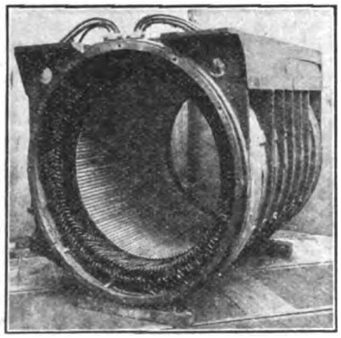
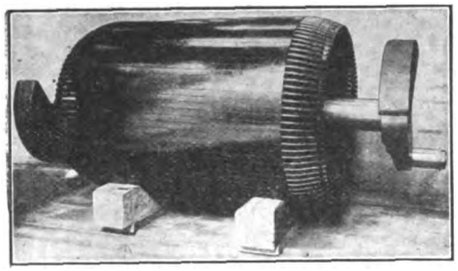
time. Then he throws the reverser in the proper direction for running the locomotive. Lastly, he closes the two switches of the pole-changer so as to put on the sixteen and the twelve-pole windings in parallel. Should the torque not be enough for starting and accelerating, he raises the voltage on the transformer up to 3,000 volts. Then he throws off the sixteen-pole winding, and the locomotive is brought up to speed (twenty-one miles an hour in this case) by the twelve-



STATOR OF PROPULSION MOTOR.

pole winding alone. Should it be desired to run at a higher speed, the motorman goes back on the transformer by several points and then switches the eight-pole winding in parallel with the sixteen-pole winding. He then runs up on the transformer to the full voltage, and after this cuts off the twelve-pole winding. In the same way he recommences the operation in order to use six poles or to bring the locomotive to the highest speed of forty-two miles an hour.

For stopping the train, the voltage is regulated down to 1,000 volts at once



ROTOR OF PROPULSION MOTOR.

and the pole-changer which had remained closed is opened. The reverser is then put to the zero or middle point. This is the usual method. In case of a quick stop, the emergency switches (circuit-breakers) are operated so as to cut off both motors by opening the pole circuits. Both trolleys can also be lowered from the wire by the use of a single pneumatic switch provided for this purpose. The current taken by the motors at the starting is from one to one-and-one-half times the standard current. The efficiency in this period is from sixty to eighty-five per cent and the phase difference 0.5 to 0.8. Instruments mounted upon the bench allow of making the readings for each motor and also for the two motors together, so that the running of each of the motors as to yield and phase difference may be observed.

The illustrations given herewith show the stator and the squirrel-cage rotor. In the present design care was taken to secure a well-closed stator and an open and well-cooled rotor. The rotor spider as well as the end plate and body are of cast-steel and have a simple form, being strong and at the same time of light weight. A new end plate of star-shaped appearance is used in order to give a good air supply to the rotor. The outer rim of the end plate has a turned fit in the end of the stator casting, and thus gives a good protection to the ends of the stator coils. Self-oiling bearings with two rings are employed here. Two separate windings are used for the stator, employing lathe-wound coils laid in slots, with good insulation. This latter is tested at 10,000 volts and is found to hold up very well in the usual running. The slot is closed over by a wood strip.

The trolley of the new locomotive differs somewhat from the usual type, as will be noted. It is made up of two long arms connected by a cross end piece, and on this is swung a short bow-piece, which comes under the trolley wire. There are two separate bows for each trolley, one for each overhead wire, and the two bows are independent of each other, being turned by a spring, cable and chain device. When running, the long arms keep fixed and the small bows are made to bear on the wire by springs. When these springs are near their limit, the springs of the main arms come into use automatically. The cross-bar which takes the friction on the trolley wire is formed of a brass rod of triangular section which is mounted so as to turn about its axis. By turning it occasionally by hand, the wear of the surfaces is equalized. These surfaces are also occasionally greased. It is found that the wear of the trolley wire itself is quite small, this being 0.12 millimetre on an eight-millimetre wire in the space of two years.

Seeing that the question of the use of two three-phase locomotives on the same train has been a somewhat disputed one, it is of interest to note the tests which were made by the Federal railroads with the use of the two new locomotives on the same train. In some cases a light and in others a heavy train was used. The tests were made at different speeds. It was found that the two electric locomotives could be run together in a very satisfactory way, placing them both at the head of the train, or again using one at each end. Furthermore, one of the new locomotives could be used with one of the old ones, in spite of the difference of wheel diameter and other differences of construction, and the train could be run very well under these conditions.

Sale of Tarrytown, White Plains & Mamaroneck Railroad.

Richard Sutro, of Sutro Brothers, representing the New York, New Haven & Hartford Railroad Company, purchased the greater part of the Tarrytown, White Plains & Mamaroneck Railroad, for $825,000, under a $500,000 foreclosure sale brought by the Knickerbocker Trust Company.

The line was sold in three sections, the first two of which were bought by Mr. Sutro. Section one extends from Mamaroneck to Tarrytown, a distance of sixteen-and-one-half miles, and was bought for $460,000. The other New Haven purchase has a route from White Plains to Scarsdale, a distance of five miles, and cost $365,000. Section three, extending from Mamaroneck to Larchmont, a distance of two miles, sold to Frederick J. Littlebrook, for $110,000. Mr. Littlebrook represented Franklin L. Babcock, secretary of the bondholders' committee of the Third Avenue Railroad Company.

Electric Tunnel Locomotive for Pennsylvania Railroad.

The first of the 4,000-horsepower electric locomotives has been delivered to the Pennsylvania Railroad and is now in operation in the Pennsylvania tunnel at New York city.

This locomotive is driven by a single motor, weighing 45,000 pounds, which is the largest railway motor ever constructed. The principles of construction of this locomotive are very similar to those of the locomotives used on the Simplon Tunnel, a detailed description of which appears in this issue.

Bonds Authorized for Brooklyn Subway.

At a recent meeting of the Board of Estimate and Apportionment a bond issue of $2,850,000 was authorized for the commencement of work on the Fourth Avenue subway. While the entire project will cost nearly $16,000,000, it is believed that this amount will cover a year's work.

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Single-Phase Electric Road in Norway.

A single-phase electric railway has recently been installed in Norway by the British Westinghouse Company. This road, which is the first of its kind to be installed in that country, connects the cities of Thamshavn and Lokken. The line runs through the valley of the River Orkia and will do much toward developing the rich ore deposits there as well as to deal with a rising tourist traffic.

The power for the line, as well as for the town of Thamshavn, the various villages along the line, and for the mines at Lokken, is derived from a waterfall near Thamshavn. The current is generated and conveyed to the various towns at a three-phase supply at 15,000 volts, fifty cycles, while the power for the railway line is converted into a single-phase supply at 6,000 volts, twenty-five cycles, by means of motor generators, in a substation at Thamshavn. This substation forms part of the main station and contains two 250-kilovolt-ampere motor-generator sets, with room for a third set, as well as for three oil-cooled three-phase, 15,000-6,600-volt transformers of 250 kilovolt-amperes each. The motor-generators each consist of a three-phase, 6,600-volt, fifty-period induction motor with slip rings direct-coupled to a 6,600-volt, twenty-five-cycle, single-phase generator.

The trolley wire voltage is automatically controlled by a Tirrill regulator. The road is single track, of one meter gauge, and is on the whole, very level and free from curves, though at one point grades up to four per cent exist. The trolley wire has a catenary suspension, and is divided into six sections by section insulators, which are normally short-circuited, but can be opened by means of a long pole when necessary.

The rolling stock consists of three locomotives, one saloon motor coach, four passenger coaches, and twenty-one freight cars. Each locomotive weighs twenty tons, and carries four motors, two on each truck. Each can exert a draw-bar pull of 6,600 pounds at a speed of eleven-and-one-quarter miles per hour. The four motors are used in two groups of two in series.

It is reported by an American consul that the Chilean Government is actively studying the electrification of the first section of the government railways from Valparaiso to Santiago, a distance of about 115 miles.

United Power and Transportation's Affairs.

The United Power and Transportation Company has filed in the Court of Chancery at Trenton, N. J., its answer to the suit instituted against it by Edward J. Moore, a Philadelphia banker, to enjoin the plan of reorganization proposed by the Interstate Railways Company, which latter concern owns 143,683 shares of the total stock issue of 143,750 shares of the former company. Mr. Moore charged that the reorganization plan was intended to work out to the benefit of the Interstate Company at the expense of the United Company. The answer denies that such would be the result of the plan, and sets forth that the properties controlled by the United Company are badly in need of betterment, and that the reorganization plan would provide funds to accomplish this.

The answer makes the charge that Moore's suit was not instituted in good faith, but that it was done with the purpose of forcing the foreclosure of the Interstate Company's properties in order that he and his associates might gain control of them.

The reorganization plan proposed involves the issuing by the Interstate Company of not more than $1,500,000 of six per cent scrip and the pledging of the stock of the United Company for the payment thereof, the money thus obtained to be used for the betterment of the United Company's property and the payment of interest on Interstate Company's bonds.

The United Power and Transportation Company owns and controls the Trenton Street Railroad Company.

Electrification Opportunities in Latin America.

An American consul in Latin America has forwarded a translation of an article published in a newspaper in his district covering a report made by a government commission appointed to study the electrification of the railway lines in that country. The consul states that it is an important undertaking, since it covers the beginning of extensive improvements that mean much to the industrial advancement of the country. If it is successfully carried out it means an opening for large quantities of electrical machinery within the next few years. Copy of the report can be obtained upon application to File No. 3990 at the Bureau of Manufactures, Washington, D. C.

Queensboro Bridge Line.

New York Public Service Commissioner Bassett conducted an investigation recently as to the right of the New York & Queens County Railroad Company to operate cars over the Queensboro Bridge. This company was refused a franchise last summer by the Commission on the grounds that it would have a fifty-year monopoly. After several months' delay a temporary grant was received from the Board of Estimate and Apportionment, James L. Quackenbush, counsel for the company, maintaining that that board had the right to authorize a permit for operation over its own property.

In opening the case Commissioner Bassett stated: "There is no question of the desirability or even necessity of this operation. The Commission is as anxious as the citizens of Queens County that the Queensboro Bridge shall be utilized for passenger traffic, but it will insist that the operation be carried on according to law. If illegal operation can be begun on desirable routes then the entire subject is in chaos, and we might as well go back to the old method when possession constituted nine points of the law, and the corporation that laid its tracks by force would succeed in carrying on transportation in the public streets."

Accidents on New York Railways.

The various traction and railroad companies reporting to the New York Public Service Commission for the First District have submitted the following list of accidents on their lines during the month of September, with comparisons:

	1909.	1908.	1907.
Total accidents	4,638	5,023	5,202
Killed	27	34	63
Seriously injured	199	276	158
Other injuries	2,827	2,900	.....
Total injuries	3,053	3,210	.....

Comparisons for injuries in 1907 are lacking, owing to a different form of report in use at that time.

Aerial Tramcars.

It is reported that a company has been formed in Vienna to exploit a system of aerial tramcars which has been invented by Captain Quoika, an Austrian aeronaut. High-tension electric cables will be laid on the ground, and airships will be connected with them by means of other cables, which will take the place of the trolley in the ordinary overhead tramcar system. Power will thus be supplied for driving the propellers of the airships, and, in addition, the airships will be kept on their right course and at a fixed height of 300 feet.

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ELECTRICAL Advertising *and* Selling

GETTING BACK TO FIRST PRINCIPLES.[1]

BY C. A. PARKER.

Henry Ward Beecher was once approached by a timid but ambitious young clergyman and asked along what lines he was in the habit of preparing his sermons.

"Well," said Beecher, "first I tell the people what I'm going to tell them, then I tell it to them, and then I tell them what I've told them."

Central-station advertising may be said to have reached the stage where the advertiser must "tell the people what he has told them." To a very large extent, the problem has become one of "singing the old song" in a new way. And the chief difficulty lies, not in the theme itself, but in composing a melody and words that will score a hit in spite of the number of times the subject matter has been repeated.

To use still another figure of speech, the whole situation is very similar to the difference between cultivating virgin soil and the tilling of well-worked ground. When the field of possible new business is still untouched, the central-station man reaps rich harvests by merely sowing the seed of advertising in a lavish and indiscriminate manner. But this sort of treatment cannot last. The soil becomes more or less overworked and refuses to bear fruit. Indeed, many central stations, especially those located in districts that are not growing rapidly, have experienced considerable alarm upon finding traces of this approaching "sterility" and for that reason have ceased aggressive advertising.

That such a course of action is mistaken is readily demonstrated by those central stations which have gone on with their advertising in the way that the farmer tills well-worked ground—*intensively*.

INTENSIVE ADVERTISING.

Intensive cultivation means nothing more nor less than scientific cultivation—nursing the ground along, returning to it in one way what has been taken out in another, letting it rest at times, and keeping constantly in mind the fact that future harvests must not be sacrificed for a present gain by wasteful methods. Central stations must advertise as extensively as ever before, if not more so. But it must be advertising of a much higher grade and more attractive character than sufficed in the early days. It must be scientific in the real sense of the word—"based upon accurate, systematic knowledge."

Fortunately, the very conditions which have made this sort of advertising necessary have also made it possible for such advertising to be produced. Advertisers in this line of work have been attending the school of experience. Mistaken ideas, the product of unchecked enthusiasm, have been shown up in their true light. Whatever has proved itself to be of lasting effectiveness has been culled out and preserved in a hundred different forms. Central stations in various parts of the country have contributed much that can be made use of by other companies. One has only to go to the literature on the subject to find a wealth of suggestion and advice.

This last consideration has had much to do with fixing the writer's determination to devote himself for the most part to outlining the fundamentals of successful central-station advertising, using actual suggestions more as illustrations incidental to his main theme.

In no field is there as great a danger of wandering from the real purpose as in advertising. And in no other field is wandering quite so costly. With this in mind, a frequent harking back to first principles is the greatest possible safeguard against misdirected advertising. If we constantly remind ourselves that the shortest distance between two points is a straight line, we are not apt to go after things by some zigzag route.

ADVERTISING IS SALESMANSHIP.

Advertising is salesmanship. To try and reduce it farther by a still finer qualification than this is as futile as trying to solve the ultimate unity of the universe. Some call advertising "news"—business "news"—and justify themselves by pointing to the Latin source, from which it is derived—*ad-verto*—to turn to or to bring to the attention of—to make known. Advertising *is* news. But it is news with a purpose, and that purpose is to sell goods or to help sell them. If advertising does not sell goods it has no right to existence. What we say about advertising in general applies to advertising electricity in particular.

Advertising electricity is nothing more nor less than selling electricity. If your advertising doesn't sell it, it simply should not be. But that it should *sell* electricity is not enough. If the same amount of business could be secured more cheaply or more effectively in some other way, then advertising is still without an excuse for existence.

CENTRAL STATIONS MUST ADVERTISE.

It will need no argument, however, to establish the right of advertising to a place in the realm of getting new business for the central stations. Experience shows readily enough that, when good, advertising not only does get the business but gets it at the minimum expense. Nor does its usefulness end here. Advertising is not the competitor of the solicitor, as some seem to think, but his strongest ally. Without it, the cleverest agent must necessarily find his road anything but a primrose path of dalliance. Not only does good advertising go before him and break down the barriers of indifference and prejudice, but it keeps prospects who are precariously balancing on the fence from falling off in the wrong direction. It stirs up new inquiries for him to close up and, if regular, keeps interest in electricity simmering instead of allowing it to grow cold. Central stations must advertise. There is no way of dodging the issue. If they do not advertise, they do not sell as much of the commodity they handle as they should. Because advertising is salesmanship.

KNOWING THE GAME.

Every good salesman must know his proposition from A to Z. So must the central-station advertiser. Now—although it may seem a good deal like going back and reciting the multiplication tables—let

[1] First of a series of articles on advertising electricity by this well-known advertising expert.

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us ask ourselves, what sort of a proposition is it anyway that the central-station man has to handle? From the salesman's standpoint—the standpoint of salability—is it a good, bad, or indifferent?

As a matter of fact, the writer can think of no business in which the possibilities are so great as in the electrical business.

In the first place electricity has the widest possible appeal. It has something for everybody. It has revolutionized the home from top to bottom, making housekeeping devoid of drudgery. It plays a vital part in every hospital. Commerce and industry would be lost without it. Even the pleasures of life are enhanced by its existence, and it all means a steady flow of golden hue into the coffers of the central-station man. With this range of activity, there must surely be something wrong with the electrical advertising that is not effective.

SOME DRAWBACKS.

There are, to be sure, certain drawbacks. Public sentiment is not always favorable to public service corporations, and while affairs are not as bad as they used to be, there is still a large percentage of the population of the ordinary city which dreads the idea of making monthly contributions to any "bloated monopoly." This last suggests another drawback that the central-station electrical advertiser must confront and overcome. And that lies in the character of the commodity offered. The central station has for sale an intangible service appreciated chiefly when a person used to its advantages must, for some reason, do without it. The variable nature of the cost, although it depends on the user, is another explanation for much hesitation.

These things, together with the difficulty that every advertiser and salesman experiences in getting people to change from the old to the new, constitute the central-station advertiser's problem. *How is he going to solve it?*

WANTED—COMMON SENSE.

Some electrical men seem to feel there was a mysterious element in their business that calls for some occult faculty or divine gift on the part of the man who does the advertising. Nothing could be farther from the truth. The same principles apply to the advertising of electricity that apply to the successful advertising of any proposition. And these principles can be boiled down to a generous application of common sense to the problems in hand.

HARMONY OF INTERESTS.

The interests of the company are the interests of the people. This is a fact that only the narrowest minds inside or outside of the company cannot see; and you cannot play upon it too strongly. As evidence of its good faith, the company should admit the public into its own family circle, so to speak. There are few of the company's activities that cannot be explained and justified by a good, square reason. Tear away the veil of secrecy that too often veils the creation and distribution of electricity. Take the public into your confidence as much as possible. It pays.

BE BOOSTERS.

If a central-station advertiser follows this policy, it will not be very long before he will find his company at the van of the town's organized "boosters." If it is not there, somebody should inquire into his fitness for his position. Remember, the louder you yell for "a brighter, bigger and busier Blankville," the louder you are yelling for a more prosperous and progressive company.

PLAY UP THE LOCAL EVENTS.

Don't let the people forget for a single minute that when it comes to the town's welfare, you're right there all the time. Use every local event of any importance at all to bring the company into the limelight.

Steps like these have succeeded in carrying more than one company into more general favor; and when they do, the obstacles that lie in the character of the proposition itself are soon overcome.

SIMPLIFY YOUR CONTRACTS.

But this is by no means time for the advertising to fall off. It should be brought into play with greater force than ever. Every effort should be bent toward clearing up any doubts that may cling to the minds of the prospects. You have still to overcome the natural fear of signing contracts that possesses the human mind—especially when it is the mind of a person inexperienced in commercial transactions. That this fear does keep people away from you is clearly shown by an actual case. A certain company found that new business was conspicuous by its absence. What was more, it didn't seem to be able to stir any up. Then some bright mind conceived the idea of stripping its contract of its superfluous verbiage and its mass of legal technicalities, and reducing it to a simple, easily understood agreement. The result was little short of marvelous. Business increased with astonishing rapidity.

SHOW THEM THAT IT'S EASY.

Another thing that cannot be forgotten is this, the uninitiated almost invariably imagine that installing electricity in their homes is practically equivalent to building a new house. They magnify the work required, the money necessary, as well as the size of the bills, far beyond all reason. If your advertising keeps silent on the matter they will take their own ideas as correct. Make it a cardinal principle to clear up every point upon which there could be the least doubt in the minds of the prospect. This is one reason why outside advertising assistance is often essential. The man in the office is too close to the matter to view it with the eyes of a "layman." For this reason many things that are clear as crystal to the central-station advertiser are vague mysteries to the outsiders.

MOVING THE INERT.

When you have won the favor of your prospective customers and overcome any doubts that may be holding them back, you have reduced your advertising problems to that of any advertiser with a commodity to sell. You must induce the people you are after to change from the old to the new.

You probably remember when you began your study of physics, you were taught the principle of inertia. Bodies tend to remain in the condition in which they happen to be. So with people. Get them started once and they come. But the difficulty lies in getting them started. Naturally you get the progressive first. They make up the body of people upon which you can depend for regular business and regular growth. For anything over and above that you must look to the "slow pokes."

So there is no reason for being discouraged or discontented when you find that it takes continual "hammering" to get them started. They will awake in the end to the value and economy of electricity. And you will reap the benefit.

THE MEANS AT HAND.

Now, having the "ends" of central-station advertising in view, the "means" to the "ends" become of first importance. In general, every available advertising medium should be used to a certain extent. Billboards, street-car cards, and newspapers for general publicity purposes. Bulletins of a general nature can be made through the press, the space

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used serving the double purpose of making the announcement and keeping the newspaper talk along the right lines. Display rooms in the company home, decorated windows, street "stunts," etc., all play an important part.

But the bulk of the work must be done through the mails. Because, for the attainment of the purposes we have mentioned, this is the most effective form of publicity possible.

THE DIRECT APPEAL.

In the first place, the direct appeal is a personal appeal. It is secondary only to an actual interview, and, indeed, is without some of the disadvantages of the latter. It brings the company and the recipient face to face, so to speak. But there are even more weighty reasons than this for "letting mail advertising do it."

The appeal of electricity varies. What interests the housewife is quite foreign to the merchant who ought to have a sign. To get these different classes with newspaper advertising, for instance, would require at least four advertising appropriations. Mail advertising does the entire work for less than what a single effective newspaper campaign would cost. Furthermore, mail matter brings the advantages of electricity to the prospect when he or she is in the very midst of the conditions which electricity improves. An advertisement for a flat-iron catches the housewife when ironing problems are occupying her mind. The power advertisement may come into the office together with a complaint about the engine, and so on.

But there is one thing upon which the success of all electrical advertising depends. And that is the spirit behind it. Lackadaisical indifference is fatal. It must be the superior product of heart and brain. It must bristle with common sense, sincerity, enthusiasm, persistency, and force. Without these, a campaign is perfunctory and of little value.

The writer is constantly impressed with the need for the *best* work in advertising electricity—the best "copy"—the best illustrations—the best forms of pamphlets, letters, circulars and mail matter generally, because, surely, such good things as electrical comfort and health and convenience are worthy of at least as good present action as any other commodity.

And—in these days—many of the other commodities are educating the public to pay but scant attention to half-baked, poorly-printed, ill-thought-out advertising matter.

A Unique Manner of Interesting Central-Station Customers.

On other pages of this issue appears a report of a dinner given under the auspices of the Grand Rapids-Muskegon Power Company to the manufacturers of Grand Rapids and vicinity. Invitations were sent to many manufacturers, and the large number of those who accepted was a pleasant surprise to everyone concerned. The main topic of this occasion was factory lighting and prominent speakers were present who gave practical and instructive talks on the subject. The banquet room was artistically decorated, a sumptuous repast was served, and as a whole the affair was voted an unquestionable success.

As the object of the central station is to sell current, it follows that anything tending to that end is of value, if the expense is justified by the result. Advertising experts throughout the country in discussing central-station advertising and methods of securing new business, emphasize the subject of co-operation and harmony between the company and the customers. It is also conceded that a satisfied customer is one of the best advertisements.

This meeting, then, in Grand Rapids probably marks a new era in central-station advertising. It showed that the manufacturers of that city were willing to co-operate with the central station for the betterment of factory illumination. Incidentally, numerous types of lamps were used in connection with the electrical decorations, and these undoubtedly created an impression, the results of which must surely be felt in the near future. However, the results of the address on factory illumination were in evidence immediately following the close of the meeting, and it is safe to prophesy that the results of this dinner will more than justify the expenditures it involved. The Grand Rapids-Muskegon Power Company has set an example that should be followed by other central stations.

While the revenue of the company may not be immediately affected as a result of this dinner, the good feeling it created in showing an impartial interest in the welfare of the manufacturers' interests will have its good effects.

Lighting and power companies in other sections of the country could hold such banquets to their great advantage. They should strike while the iron is hot. Just now the tungsten situation offers an opportune time for the central station to talk superiority and low cost of operation, and the gas companies cannot follow them. It would be difficult for a gas company to give such a demonstration. The cost of piping a large room for individual gas mantles to prove equal distribution of light would be prohibitive, if it were possible even to demonstrate by gas. Arguments against distribution of gas light in factories by individual burners would defeat the purpose of the demonstration. If a gas company were to try such a demonstration they would have to depend upon electric lamps for table decorations. There are so many arguments to prove that a gas company cannot compete with electric companies at the present state of the art, that it is wise for the lighting and power companies to take advantage of the opportunity now before them in the matter of tungsten lighting and demonstrations thereof. Another advantage for the electric company that does not pertain to gas companies, namely, the electric company is after the factory power, and the expense of such a banquet, as well as the expense of the demonstration, would be well warranted because of the prospective power business.

An Electric Humidifier.

The Indiana and Michigan Electric Company, of South Bend, Ind., recently canvassed the tobacco stores and cigar stands for the purpose of explaining how an eight-candlepower carbon lamp sealed with a waterproof socket and immersed in a jar of water would prove a much more efficient humidifier than an ordinary sponge. It suggested the use of a cut-glass globe and tinted water to give a decorative effect, and the cigar men were very enthusiastic. It was new, and saved the trouble of wetting the sponge. This idea was worth many dollars in kilowatt-hours of current consumed.

Timely Advertising.

As previously mentioned, the Denver Gas and Electric Company, Denver, Colo., is distributing a series of monthly calendars containing a timely advertisement and illustrated by prominent artists.

The November calendar, just issued, is in keeping with those previously distributed and will undoubtedly be accorded the same complimentary reception. Advertising of this kind is sure to have its effect.

Generally speaking, the people know a great deal already, but the main business of the advertiser is to keep on reminding them of what they already know.

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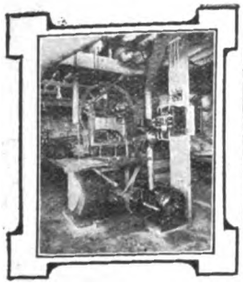
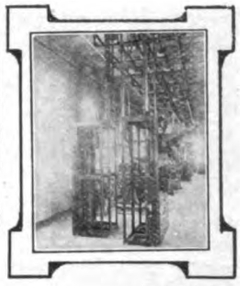


Industrial Power



INSTALLATION, OPERATION, CARE AND REPAIR OF ELECTRIC MOTORS IN INDUSTRIAL OPERATIONS.—IV.

BY C. E. DANIELS.

GENERAL INSTRUCTIONS FOR DIRECT-CURRENT MOTORS.

Starting.—All direct-current motors above the very small sizes are started by first giving the shunt field full excitation and then connecting the armature, with a starting resistance in series, to the circuit. The resistance is then cut out in steps as the motor speed accelerates, the time required to attain full speed varying approximately from fifteen seconds for small motors to one minute for very large sizes. These limits should be used with discretion, since more time is required to start with heavy torque than with light torque.

On request, connection diagrams and instructions can be obtained from the manufacturers of almost any starting or controlling device. After all connections are made according to instructions and all mechanical preparations are complete, see that all the field adjusting resistance (if used) is cut out and that the starting resistance is all in circuit. Close the circuit-breaker (if used), then the line switch, and lastly cut out the starting resistance step by step, as instructed, allowing enough time for the motor speed to accelerate smoothly. Too rapid starting results in excessive starting current and possibly flashing at the brushes. Every caution in regard to mechanical operation must be observed in starting. The motor should generally start when the armature circuit is first closed through the starting resistance, and failure to start when the second or third step of resistance is cut out is a signal to open the line switch or circuit-breaker at once and find the cause of the failure.

Stopping.—Never move a starter or controller handle to the off position under any circumstances if by so doing the shunt-field circuit of the motor is opened. The high induction of the motor field may generate electromotive-force enough to puncture the insulation. If necessary to open a shunt-field circuit it should be done slowly by a knife switch, allowing the field current to die out, owing to the resistance of the arc across the switch terminals. A better method is to install a field switch where such a necessity may occur. Several good types of field switches are available, by means of any of which a circuit is closed through a discharge resistance before that through the field is opened. If the starter or controller is provided with a low-voltage release, the line switch or circuit-breaker should always be opened first for stopping; the motor speed will then decrease until the starting resistance will be automatically cut into circuit.

Brush Adjustments.—The neutral no-load position of the brushes on all good modern motors having adjustable brush holders is marked on the rocker ring or movable portion and on the frame or bearing, so that the neutral position is easily found if the brushees are moved away from it. With the brushes set at the neutral point the motor should run practically without sparking from no load to full load in either direction of rotation; that is, the motors are suitable for reversing operation. If only one direction of rotation is required, and if the motor is to be overloaded, the brushes should be shifted slowly backward opposite the direction of rotation to the point where slight sparking begins at no-load. Sparking at the brushes when the motor is operating with load can frequently be entirely removed by shifting the brushes slowly from or toward the neutral point. In any case the correct distance of the brushes from the neutral point is very slight, and the movement should be made with great care, since too much movement will cause violent sparking.

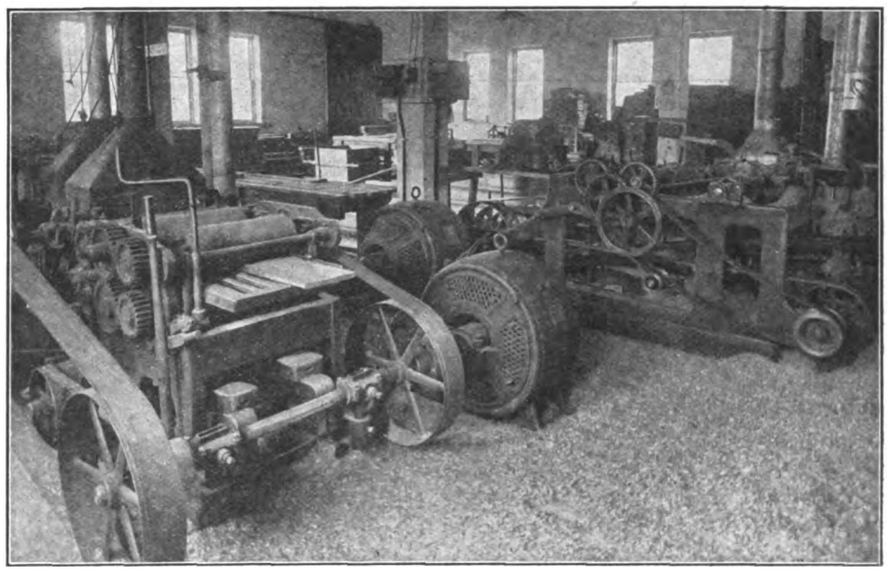


FIG. 20.—DIRECT-CURRENT MOTOR DRIVING MOLDER AND PANEL RAISER.

Care of Commutator and Brushes.—Carbon brushes are almost invariably used on modern industrial motors. The chief considerations in caring for such motors are to keep the commutators clean, the brushes properly adjusted, and the brush contact surface good. The last condition, once fulfilled, will usually take care of itself until the brushes are worn out, provided the other conditions are complied with. At intervals, depending on the service and the location, the commutator contact surface and end should be thoroughly wiped with clean canvas free from lint. A few drops of oil on the cloth or a piece of paraffine rubbed lightly across

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the commutator surface will give all the lubrication necessary. Lubricant should be used very sparingly on a commutator and no grease, oil or dirt should be allowed to accumulate on the commutator or the brushes.

The ideal appearance of a commutator surface is polished dark brown or chocolate color, and when the commutator is rotating slowly in starting and stopping the brushes squeal sharply. Such a commutator needs no attention other than cleaning when necessary. If the surface has a raw copper color, with gradual roughening, it should be smoothed with sandpaper, or, if very rough, with a piece of sandstone; emery paper or cloth should not be used for this purpose. The sandpaper should be held against the commutator by means of a block having the same curvature as the commutator. The sandstone likewise should be curved to fit the commutator.

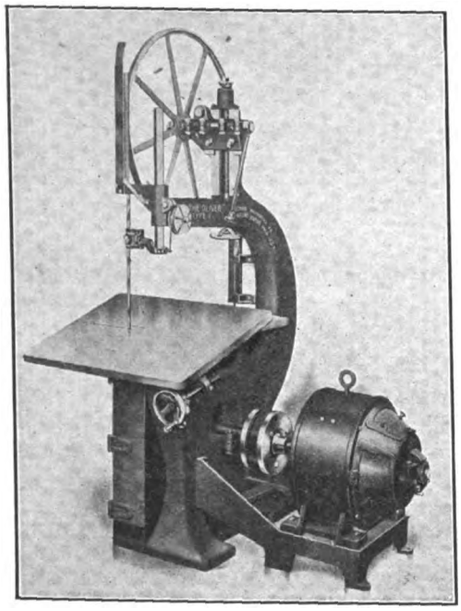

FIG. 21.—DIRECT-CURRENT MOTOR DIRECT-CONNECTED TO BAND SAW.

Grinding in the Brushes.—When making proper contact with the commutator, the face of the brush is glazed. If the glazed portion does not extend over very nearly all of the brush face, the brushes should be ground in by wrapping a long strip of sandpaper closely around the commutator with the rough side toward the brushes and then rotating the commutator and the sandpaper slowly through one or two revolutions. Shorter pieces of sandpaper held close to the commutator surface and drawn a few times back and forth under each brush or set of brushes will answer the same purpose.

Sparking.—With the proper installation, operation, and care a well-made direct-current motor will seldom give serious trouble from sparking at the commutator. If sparking does occur it is probably caused by some one or more of the following conditions, the remedy in each case being either obvious or suggested. The causes are numbered in the order of their probable occurrence. Remedies for causes 6, 7, 8, 9, 11 and 12 follow under "Repairs."

1. Excessive overload.
2. Improper brush adjustment. (See preceding instructions.)
3. Poor brush contact.

(a) Accumulations of grease or dirt may hold the brushes from the commutator.

(b) Brushes may need grinding to fit the commutator. (See preceding instructions.)

(c) Brushes may stick in the holder; grind or sandpaper them until the movement is free.

(d) Increased brush pressure may be needed; the method of adjustment will be evident.

4. Rough commutator. (See preceding instructions.)
5. Poor connection between the brushes and the holders. See that both ends of the shunts are securely fastened in place. Loose shunts are usually indicated by burned connections.
6. Loose connection of armature lead to commutator bar, indicated by the blackening and burning of this and the adjacent bars. An open circuit anywhere in the armature will cause sparking that seems to encircle the commutator when running, and burn the bars at the point of open circuit.
7. Short-circuited armature coil, indicated by heavy intermittent sparking, burned commutator bars, and excessive local heating, which may be readily found by stopping the motor after running a very short time and feeling the armature surface.
8. Grounded armature coil.
9. Loose commutator bar indicated by slight jumping of the brushes, with intermittent sparking.
10. Unequal spacing of brushes—not likely to occur unless brush holders have been dismantled and reassembled. The spacing can be verified by counting the bars between corresponding edges of the brushes or marking the distances on a strip of paper wrapped closely around the commutator under the brushes.
11. The mica segments and commutator bars may not wear evenly; that is, accumulations of oil or grease may cause the segments to become pitted below the commutator surface.
12. Flat spot, or a "flat" on the commutator, or commutator out of true; caused by rough handling, a bad belt splice, or flashing owing to a short-circuit on the line. A flat or a commutator out of true can be detected by slight jumping of the brushes or uneven motion of the commutator and brushes. These indications may also point to a bent shaft.
13. Bent shaft (for indication see foregoing paragraph). Test by holding a piece of chalk near the shaft as it rotates in a lathe. Remove the bent shaft from the armature and straighten or replace it by a new one.

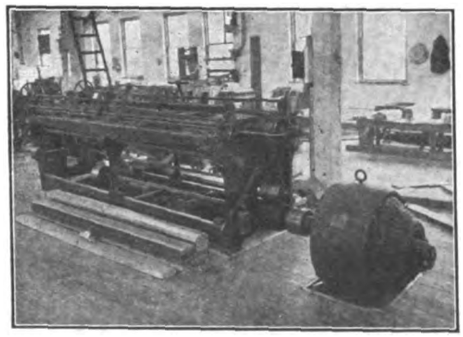

FIG. 22.—DIRECT-CURRENT MOTOR DIRECT-CONNECTED TO COUNTERSHAFT OF SPINDLE BORER.

FIG. 23.—DIRECT-CURRENT MOTOR DIRECT-CONNECTED TO COUNTERSHAFT OF SASH STICKER.

REPAIRS.

Field Coils.—An open-circuited shunt-field coil can be detected by touching the terminals of a voltmeter to the terminals of the individual coils while full voltage is applied to the field circuit. The voltmeter will show no deflection until the defective coil is reached, and will then indicate the full voltage.

A short-circuited shunt field can be found by the same test, the voltmeter deflection being least on the defective coil.

A grounded coil can be found by the process indicated in the section of general instructions.

In replacing a field coil make sure that the polarity of the pole differs from that of either adjacent pole. The polarity can be tested with a small bar magnet or a piece of steel wire suspended from its center by a string. In holding the magnet near the poles successively, it should reverse at each pole, *i. e.*, no two successive poles should attract the same end of the magnet.

Armature.—An open-circuited arma-

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ture coil not revealed by inspection can be located by disconnecting the upper leads from each burned commutator bar and applying the terminals of magnets or a lamp-testing circuit between each free end and all the other bars. A complete circuit will be indicated with all except the end of the open coil.

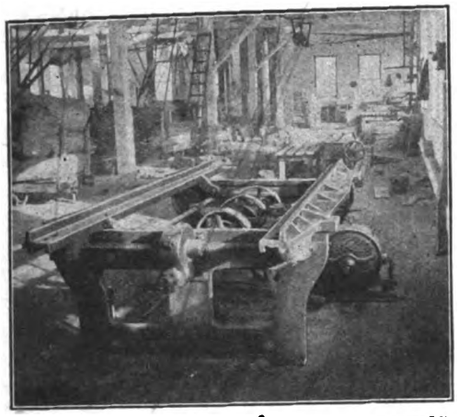

FIG. 24.—DIRECT-CURRENT MOTOR DRIVING DOOR CLAMP.

An open-circuited or short-circuited armature coil can be repaired temporarily by cutting off and taping the commutator lead from the defective coil, fastening it where it cannot injure the other leads, and short-circuiting the bar thus cut out with the next one in the circuit. Great care must be used in applying this remedy, and it should be for temporary purposes only, permanent repairs being made at the first opportunity. In case of a

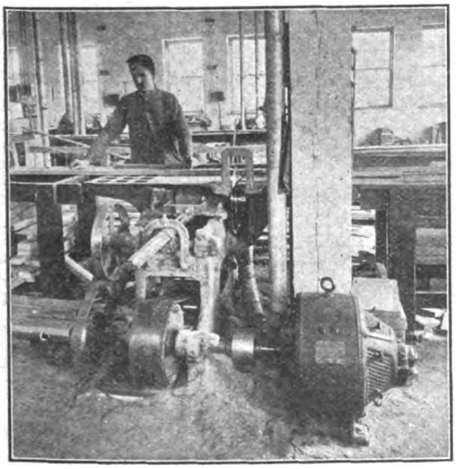

FIG. 25.—DIRECT-CURRENT MOTOR OPERATING CUT-OFF SAW.

short-circuited coil, the removal of a terminal lead from the commutator bar will not always remove the difficulty, but it is necessary to open the coil (or series of coils, in case of a wave or series winding) elsewhere, so as to prevent the short-circuit from causing a burnout. In case of a wave winding, an open circuit will result in burned commutator bars at as many different places as there are pairs of poles.

Commutator.—A commutator with loose bars (high or low) should be removed from the armature and tightened. This process requires the disconnection and reconnection of all the leads, and for best results the commutator should be in a press while the nut is tightened; it is therefore recommended that such work be done in a good repair shop.

Pitted mica segments should be repaired as soon as discovered. Clean the hole thoroughly and fill it with an insulating paste that will quickly harden and that will hold its position when the commutator is warm. The following have been used successfully: Prepared chalk or plaster paris and shellac; water glass and powdered glass. In some cases a portion of pitted segment near the end of a commutator can be cut out smoothly with a hack saw, and a piece of mica fitted and fastened in place by slightly burring the edges of adjacent segments. This burring must not be enough to endanger the short-circuiting of two segments, hence this method of repair should be used with great caution.

CAUTIONS.

Never allow the load to be removed entirely from a series-wound motor while operating, or to be reduced enough to cause a dangerously high speed. Driving by belt with a series motor is bad practice, since belts occasionally leave the pulleys, in which case a series motor would very likely be ruined. The driving connection should be positive and perfectly reliable.

Never open the shunt-field circuit of a motor in operation; otherwise the motor will race and serious damage will result.

When the shunt-field circuit of a motor or a generator is excited, never open it quickly unless a path for the inductive discharge is provided. The circuit can be opened slowly, if desired, the arc at the opening serving to reduce the field current gradually. Only one hand should be used in doing this, all other parts of the body being kept clear of the circuit. Fatal shocks have been received when opening comparatively low-voltage field circuits by holding the two portions of the circuit in the hands, so that the body bridged the opening.

In soldering connections never use an acid that will act on the insulation or the copper; an alcoholic solution of resin is a good non-corrosive soldering flux.

In soldering commutator connections do not allow bits of solder to drop down where they may short-circuit commutator bars.

Keep the commutator and brushes clean and use lubricant sparingly.

Never use emery cloth or paper on a commutator or brushes.

Hydroelectric Plant for St. Lawrence River.

Consul Henry C. A. Damm, of Cornwall, supplies the following details of the plan to develop power in the St. Lawrence River:

The Cornwall Board of Trade has petitioned the Dominion Government to grant a franchise to the St. Lawrence Power Company for utilizing the channels of the river for a hydroelectric plant. This concern, with an associated American company, has already spent $1,000,000 in purchasing sites, etc. The first dam is to be built at a cost of $4,000,000 at the foot of South Sault Channel, where 65,000 to 70,000 horsepower can be developed. Later another dam is to be constructed at the foot of Sheeks Island, on the Canadian side, and finally, when needed, a dam at the foot of Barnharts Island, across the main channel of the St. Lawrence. At dam No. 1 a lock is to be erected by which the vessels can overcome the whole forty-foot fall of the rapids in one lift, whereas now six are required in the Cornwall Canal—which, however, would not be interfered with. A saving of five hours would be effected.

The company proposes to erect power transmission lines from Cornwall to Brockville, and to supply all demands for power in this section. As yet there is not sufficient demand to warrant large expenditures of money, and the projectors are urging the communities along the line of the proposed development to induce manufacturing plants to locate here.

Developments at Panama.

The first of the three turbo-generators at the Miraflores power station, Canal Zone, has been completed, and was given its preliminary trial on Saturday, October 2 last.

This has been operated at intervals since, and as soon as some insulation troubles are cleared, will be ready to furnish current. Two wires have been strung on the transmission line to the Pedro Miguel Locks, and work will shortly commence on the new substation at that point, which is to be equipped with two 500-kilowatt converters.

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CAUSES OF BREAKDOWNS IN ELECTRICAL MACHINERY.—I.

A BRITISH INSURANCE COMPANY'S REPORT.

The report of Michael Longridge for the year 1908 to the British Engine, Boiler and Electrical Insurance Company, Ltd., which has recently been published, contains in his observations on the causes of breakdowns in electrical machinery which came under the notice of the company, many interesting lessons to the electrical world in general.

Two cases were given illustrating the danger of leaving small pieces of iron or steel near dynamos or motors, especially those of open type, with stray fields unscreened by iron or steel casings.

In the first of these the damage was caused by a small tapered pin belonging to the engine of a two-pole, underhung, direct-current, open-type dynamo. The engine had just been overhauled, and the pin, which had evidently been laid down on or near the dynamo, was attracted into the space between the armature and the pole-faces when the magnets were excited. Four of the armature bars were cut almost in two, the end connections to six others were bent, and the installation was torn off all around the engine end of the armature.

In the second case a "nailing-machine" was coupled by gearing with a two-pole, semi-enclosed, shunt-wound, two-horsepower motor running at 1,300 revolutions a minute and taking current at 250 volts. One of the nails must have fallen into the casing and, being caught in the stray field and drawn in between the armature and a pole-face, thereby short-circuited some of the armature conductors. The damaged conductors had to be entirely rewound.

An electric-driven centrifugal pump placed in a chamber hewn out of the solid rock in a coalpit was the next typical instance cited. The cause of the trouble in this case was a loosened plug in the pump casing, which permitted a jet of water to saturate the entire motor and thereby earth three of the stator coils.

Two examples were given which showed the importance of attention to lubricating oil wells.

The first case was that of a machine belt-driven by a direct-current, five-horsepower, four-pole motor running at 700 revolutions a minute and taking current at 220 volts. The armature shaft was carried in phosphor-bronze bearings and lubricated by rings running in oil wells fitted with drain-cocks having handles cast with the plugs. The belt seems to have run to one side of the pulley, caught the handle of the drain-cock, and knocked it into the open position, with the result that the oil ran out of the well, lubrication ceased, and the bearing seized.

The second instance recorded was that of a two-pole, overhung, direct-current, enclosed motor of five horsepower, running at 960 revolutions a minute and taking current at 460 volts, for driving brewery machinery by a belt. The armature shaft was carried by bearings lined with white metal and located in the end plates. Examination of the breakdown by the company's inspector showed that the oil well of the damaged bearing was so full of dirt that the lubricating ring could not revolve, and consequently the journal had ceased to receive oil and had become overheated, so that the white metal was melted out. The oil well of the other bearing was almost in the same condition, and both had evidently been neglected for a long time. In consequence, the armature had been rubbed against the pole faces, which had stripped off one of the wire binders and cut up the installation of the conductors; the fuse melted, and the motor came to a standstill.

An instance was given of the wearing of journals through neglected lubrication. The machine in question was a two-pole, overhung, compound-wound, direct-current dynamo generating 110 amperes at 230 volts when running at 940 revolutions a minute. The cause of the trouble was excessive wear of the gun-metal bearings which carried the armature shaft. Four of the armature conductors were fused under the binder next to the commutator, and three other binders were almost worn through by rubbing on the pole-faces. The wear of the bearings was attributed to neglect of lubrication.

The dangers of oil creeping were shown by the case of a two-pole, compound-wound, open-type, belt-driven, direct-current dynamo generating 200 amperes at 100 volts at 700 revolutions a minute. The commutator was earthed, the mica insulation between three of the bars was burned, the conical clamping ring at the back of the commutator was fused, and the solder which cemented the armature conductors to two of the commutator lugs was melted. The cause was attributed to short-circuits between four of the commutator bars and the clamping ring at the end next to the armature. The short-circuits were established by accumulations of carbon dust and oil behind the commutator lugs. In this case a blast of air from a compressor to keep this very vulnerable part of the commutator clean was rendered ineffective by the oil.

The result of neglect and damp was instanced in the case of a three-phase, alternating-current motor, giving ten horsepower at 750 revolutions, with current at 190 volts per phase. The motor was placed in a pit below the floor of a boiler shop, and drove plate-bending rolls through gearing. The breakdown of this motor was finally caused by the failure of the installation between the stator windings and the frame. The cause of the trouble was that the slots in the bottom coil were full of dust and oil and the installation was saturated. The stator had to be entirely reinsulated. Another very similar case was that of a motor driving hauling machinery in a mine.

[To be continued.]

Cost of Electric Haulage.

The Chiltern Valley Gold Mining Company, Victoria, Australia, says *The Electrician,* of London, Eng., recently issued a comparative statement showing cost per ton for conveyance of wash dirt to the shaft from a distance of 4,000 feet, as follows: Electric haulage, 1.14 cents; horse haulage, 4.10 cents; manual haulage, 11.96 cents. Taking into account the lighting of the surface works by electricity, electric haulage would work out to but one cent a ton for the 4,000 feet. Allowing ten per cent for plant depreciation, this cost would be increased by 0.18 of a cent per ton.

The Electrolysis Problem in Winnipeg.

Prof. Louis Herdt, of McGill University, Montreal, Can., who has made considerable researches of late on the electrolysis problem, has had his recommendations in a recent report prepared by him for the city of Winnipeg put into effect. One of three sub-power stations has recently been opened, and the others will shortly be completed. By this means, and by carefully bonding the car rails, it is expected that electrolysis will be reduced to a minimum.

At a special meeting of Armour Institute of Technology Branch of the American Institute of Electrical Engineers, held in Chapin Hall on the evening of October 28, C. C. Bailey read a paper on "Railway Block Signaling."

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TELEGRAPHY—TELEPHONY and WIRELESS.

Train Despatching by Telephone.

A recent despatch from Austin, Texas, says it is officially announced that the telephone system for despatching trains is to be installed on the lines of the Southern Pacific Company in Texas and Louisiana, and that the work of making the change will be started in a very short time. In all, more than 2,000 miles of the Southern Pacific system are to be so equipped within the next twelve months. The original order for the matter of making the change to be taken up is said to have come from the late E. H. Harriman about a year ago.

Yet another road to use the telephone for train despatching is the Norfolk & Western Railroad, which has recently put into service two telephone circuits for handling its trains, one between Roanoke, Va., and Bluefield, W. Va., 102 miles, the other between Bluefield and Williamson, W. Va., 107 miles. There are six stations on the former circuit and twenty-two stations on the latter. This equipment extends through some very mountainous country and affords a good test of telephone train despatching under very severe conditions. A feature of interest in connection with one of these circuits is that the telephone was pressed into service before being fairly completed owing to the telegraph circuits having gone out of commission.

The Santa Fe system will also use the telephone in place of the telegraph for train despatching, the first section selected for this change being the 887 miles of the Albuquerque and Arizona divisions.

The Seaboard Air Line now has in operation its new telephone train-despatching circuit between Raleigh and Monroe, N. C., 148 miles. This part of the road is single track, and handles a heavy traffic, the movement of trains being assisted by a block telephone system. The despatcher is located at Hamlet, N. C., ninety-five miles from Raleigh.

Western Electric telephones and Gill main-line bridged selectors are used throughout this equipment. There are twenty-nine selector way stations and two siding telephones located in the weatherproof booths at blind sidings. Two portable telephones are provided for wreck cars. These may be connected to the despatcher's line at any point by means of a jointed line pole.

W. F. Williams, superintendent of telegraph, who has charge of the work, states that the telephone circuit has worked perfectly ever since being put into service. He says that the transmission could not be better, and that he has heard a watch tick over the entire 148 miles of the line. The despatchers find that they can handle the business faster, more comprehensively and with less fatigue.

That the running of trains by telephone has proven satisfactory on the Sunbury division of the Pennsylvania Railway is evidenced by the fact that a force of men is now at work above Nescopeck, Pa., preparing to extend the telephone system to Wilkes-Barre and install instruments in the stations and towers between the two points. The telephones have been in use between Nescopeck and Sunbury for several months and are used to a greater extent, though not exclusively, in the running of trains.

The above are only a few of many similar changes from telegraph to telephone for use in train despatching, but these may be taken as indicative of the trend of railroad practice in this line of work.

Japanese Study Wireless.

W. Torokati, of the Investigating Bureau of Electricity in the Japanese government, is in this country studying the machinery of the United States. He will devote much time to wireless appliances, as well as electrical machinery, which may be used for manufacturing purposes. Mr. Torokati is a graduate of Tokio University, and has become the head of wireless telegraphy in his country, outside of navy circles. There are, he says, five land commercial stations in Japan, each of about five-kilowatt power, and all under the jurisdiction of the Department of Communications.

High-Speed Wireless Telegraphy.

A new high-speed automatic transmitter for wireless telegraphy was demonstrated on September 11 and 13 last, at the Cullercoats Wireless Station, near the mouth of the River Tyne, on the northeast coast of England, before officials of various British government departments and others. We are indebted to *The Electrical Times,* of London, England, for the following description:

"The Cullercoats station is fitted for working with both the de Forest spark method and the Poulsen arc method of radiotelegraphy, but it is for the latter that the high-speed transmitter is adapted. On September 11 it was shown that with the employment of the automatic transmitter a speed of sending can be obtained rivaling that realized with submarine cables. Doctor Poulsen is responsible for the design of the transmitter, but at present there is only one example of it in existence, at Lyngby in Denmark. Lyngby is about 600 miles from Cullercoats, and since it is near Copenhagen the electric waves must necessarily traverse the land for a part of the distance. The machine is worked on much the same principle as the Wheatstone automatic transmitter used in ordinary land telegraphy; that is to say, the message to be sent is represented by a series of holes punched in a continuous paper strip, those on one side of the central line being the dots of the Morse code and those on the other the dashes.

"This paper strip is fed into the transmitting apparatus, which consists essentially of a rotating contact-making device, and the holes in the paper actuate mechanism by which the continuous waves produced by the arc generator are cut up into lengths, short for the dots and longer for the dashes. Any oscillations thus emitted are received by the antenna at the receiving station and conducted to a detector, which in this case consists of a piece of tellurium pressed lightly against a surface of galena.

"A string galvanometer is employed, in which a fine metal wire, normally

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stretched in a vertical position, is deflected sideways by the action of the current received from the auxiliary circuit. This string or wire is mounted in the beam of a Nernst lamp, with a suitable optical condenser, which throws the light on a narrow slit, behind which a band of photographically sensitized paper is moved by an electric motor. The shadow of a small portion of the wire as it vibrates to and fro in response to the signals from the sending station is thus imprinted on this band, which is immediately drawn automatically, first through a developing bath, and then through a fixing bath, so that as fast as the message arrives it can be read on the paper band in the form of a wavy or zigzag line, like that yielded by the siphon recorder in submarine telegraphy.

"There was no opportunity on September 11 of seeing the transmitter itself, since, as has already been said, the only example of it yet made is in Denmark, but several experiments were carried out in receiving messages sent by it. A standard telegraphic word of five letters, 'Paris,' was sent repeatedly at the speed of fifty times a minute, the resulting record being perfectly sharp and clear. Next some other words, which had already been punched at Lyngby, were transmitted at the same speed with equal success. Then a message selected at random was transmitted with the ordinary hand key to Lyngby by wireless, and after being punched there was returned by the automatic transmitter at the same speed of fifty words a minute. Finally, as a severer test of the capabilities of the apparatus, this same message was transmitted several times over at a speed which well exceeded 100 words a minute. The power employed at Lyngby was understood to be ten electrical horsepower, and the wave length was 1,800 metres. Doctor Poulsen and his associates anticipate that they will succeed in telegraphing across the Atlantic at a speed of at least fifty words a minute with the expenditure of 100 horsepower; in this connection it will be remembered that, as Mr. Marconi stated on June 25, in his speech at the Imperial Press Conference, the present speed of wireless working across the Atlantic is twenty-five words."

Experiments with the portable wireless outfits for the German army have shown that with them communication can be maintained between Berlin and Vienna, a distance of 963 miles.

Telephones in Canada.

Independent telephones are on the increase in the Dominion of Canada. The declared policy of the independent companies is to have no arrangements with the Bell company for interchange of service over that company's lines. At the recent convention of the Canadian Independent Telephone Association, held at Toronto, it was shown that there were now over 27,000 Independent telephones in operation in Canada. In the provinces of Manitoba and Alberta, where the Bell equipment had been purchased by the provincial governments over a year ago, the mileage and number of telephones in use have increased very rapidly under government operation and control.

It was pointed out by an American visitor that, in 1895, there were only 245,000 telephones in the United States, but as a result of competition, there are now more than 6,000,000 telephones in operation in that country. The Independent companies there have installed new plants and have forced the other companies to improve theirs. Canada was considered as fortunate in having a spirit of public ownership which, it is claimed, is frowned upon by municipal officers and governments in the United States.

As the work of the Independent companies is becoming more and more of a national character in Canada, it has been decided to urge the provincial legislatures throughout the Dominion to at once introduce legislation that will bring about the provincial ownership and operation of all long-distance lines.

Measurement of Distance by Electric and Sound Waves.

The following article, attributed to *Prometheus,* appears in a recent issue of the *Scientific American:*

Debrix has invented a method of measuring a ship's distance from a shore station, by taking advantage of the difference between the velocities of sound and electric waves. A bell is set ringing and wireless electric waves are generated simultaneously on the ship. The electric waves arrive almost instantaneously at the shore station and there set in motion a stop-clock. The distance of the ship can be computed from the number of seconds indicated on the dial when the sound of the bell is first heard. The computation is facilitated by the use of a table, in which, if necessary, allowance may be made for the fraction of a second consumed in the operation of the receiving and clock-starting apparatus. In this way the distance of the ship can be obtained, but not its direction or exact position. If, however, the ship's auditory and electric signals are simultaneously received at two stations connected by telegraph, the exact position of the ship on the chart will be found at the intersection of two circles, drawn round the stations as centers, with radii respectively equal to the ship's ascertained distances from those stations. The general introduction of this system would greatly increase the possibility of aiding ships in distress.

Ocean Cables and Commercial Telegraphs.

Treating of the commercial telegraphs and ocean cable systems, it may be pointed out that in 1880 there were seventy-seven companies; in 1902, twenty-five, and in 1907, twenty-five, and it explains that the noticeable decrease since 1880 in the number of separate companies is due to numerous consolidations of formerly competing companies. The decrease since 1880 has been accompanied by a very large increase in business and equipment. It is shown that, with the exception of one unimportant unincorporated company, the entire commercial telegraph and cable industry is operated under the incorporated form of ownership, with capital stock and bonds of an authorized par value of $173,126,075 in 1902 and in 1907, $244,607,900. The outstanding par value in 1902 was $162,946,525 and in 1907, $220,293,575. The companies expended for salaries and wages $17,808,249 and for other purposes $24,071,364 in 1907. Their income was reported for 1907 only eleven paid dividends, although the total receipts of the telegraph companies exceeded those for 1902 by $10,653,830. There were but five companies not operated at a profit, and their combined loss was only $18,652. The report shows the extent to which this industry is controlled by a few companies, there being six reporting 97.7 per cent of the total income and 97.5 per cent of the operating expense. In 1902 the six largest companies reported ninety-nine per cent of the total income and expense.

Underwriters Favor Wireless for Ships.

From London comes the statement that the last year has been so disastrous to underwriters that a greatly enhanced impetus has been given to the study of new safety appliances and to the development of those now in use. The underwriters

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of Cape Town, who have been badly hit by the loss of various ships sailing under the Southern Cross, have unanimously recommended the installation of wireless telegraphy on all passenger ships.

"Such a step would be welcomed by all underwriters," stated a high shipping authority, "and it would be warmly welcomed by those in Liverpool. It would tell against underwriters as a class, for the installation of wireless telegraphy on a ship would materially reduce the amount of the premium; but on the ground of humanity we are greatly in favor of every ship having its wireless apparatus. There is no necessity for us to have a special meeting on this matter, for all Liverpool underwriters are in accord with one another on the subject. It is no use leaving it a voluntary business. To be of any use it must be compulsory and universal. Nevertheless, we cannot make a recommendation on the subject, because we recognize the tremendous cost of placing a wireless apparatus on each ship. It might not be so difficult for the great lines, but it would be almost impossible for the owners of tramp steamers. Until the cost of wireless installations is materially reduced we must not expect to see it in universal use."

Electrophoning Lord Rosebery's Speech.

Further accounts have come to hand of the electrophoning of Lord Rosebery's speech from Glasgow to London, as reported in a recent issue. It appears that Lord Rosebery spoke from 2 to 4 o'clock, and that nearly six columns of the speech were printed in the papers, which were on sale in the London streets, *before Lord Rosebery had finished speaking in Glasgow.* This most wonderful performance is said to be absolutely unprecedented. The electrophone transmitters were of a type invented by Giuseppe Angelini, an Italian.

Standard Time by Telephone.

Arrangements have been completed, says *Nature* (London, Eng.), whereby a standard clock at the Hamburg Observatory Bergedorf is connected to the trunk telephone system. A sounder automatically emits a siren-like note from the fifty-fifth to the sixtieth second of each minute—mid-European time—and this goes automatically to all the receivers connected, at that time, with the special exchange number which has been allotted to the time signal. Thus Hamburg and district are given standard time.

President Vail on Telephone Progress.

In an interview President Theodore N. Vail, of the American Telephone and Telegraph Company, is quoted as saying:

"Great as has been the progress of the telephone, its future promises much that even now is being foreshadowed. There is no doubt that as a servant to mankind telephony has been instrumental in producing results in industry, commerce and social life that could not possibly have been brought about without it.

"As for the American Telephone and Telegraph Company, the business has progressed at a rate that measures up more than satisfactorily with the expenditures made for equipment and general improvements. The recent policy of consolidation, unifying various interests in New York and New Jersey, should be productive of much good. Unification is the success of all large enterprises. In no other line of activity is this more essentially established than where the telephone is concerned.

"The great Northwest is another example of what can be done through the general use of the telephone. It is beyond a doubt that farming has been simplified through the means of transportation, and this applies equally to oral communication. But the systems today must be equipped with the best possible apparatus. This desire to improve the service has also been put into practice on the Pacific Coast, where the Pacific Telephone and Telegraph Company proves it pays to be well equipped."

Navy Wireless Tests.

A despatch from Washington states that important experiments in long-distance wireless are to be undertaken by the United States Navy on the Atlantic seaboard some time in December next. A tower 400 feet high, owned by a private company, has been erected at Brant Rock, Mass., and the necessary instruments are already installed, with a view to communicating a distance of 3,000 miles. Two United States scout cruisers, the Salem and the Birmingham, will be despatched in the early part of December on a trip which will keep them within the 3,000-mile radius of the transmitting station, and these vessels will be utilized as receiving stations for the wireless experiments. The proposed cruises will probably be in a region comprised between the coast of Scotland and the West African coast, and also in the American tropics. The vessels, which have been each equipped with a ten-kilowatt apparatus, will also experiment in long-distance work, up to a radius of 1,000 miles, between ships at sea. It is possible that one outcome of these tests will be the installation of a wireless tower at Washington.

Wireless Operation in Alaska.

More evidence of the successful working of the military wireless telepraph stations in Alaska is shown in a report from First Lieutenant F. A. Jeunett, Thirteenth Infantry, at Port Gibbon. On the night of September 23 the station at Nome worked well both ways with the steamer Minnesota, en route to Japan, about 200 miles south of Mimak Pass and about 1,300 miles from the wireless station. The Minnesota also reported hearing messages from Fort Gibbon, strong and loud. More than 500 miles of the distance traveled by the messages from Fort Gibbon was overland and the station at that place also picked up messages from the steamer at Mimak.

The Telephone Business.

In the amount of business done, the sum paid in salaries and wages and the capital invested in 1907, the telephone business was a little over three-and-one-half times as extensive as the telegraph industry, and during that year it furnished employment for more than five times as many persons.

Between 1902 and 1907 there was an addition of 8,098,918 miles of wire for the use of the telephone systems, as compared with an increase of but 259,611 in the mileage of owned and leased wire for commercial telegraph purposes. The increase in the wire mileage of the telephone systems during the five years referred to was more than six times as great as the total amount of wire added to the telegraph business since 1880.

Opportunity for Wireless Manufacturer.

An American consul reports that a company has been organized in England for the installation of a wireless-telegraph system in the South Pacific. The company will await the result of some experiments which are in progress before beginning the installation of the system, and the consul states there may yet be time for American manufacturers to make bids. The name of the person to whom communications should be addressed is given in the report. Inquiries, quoting File No. 4053, should be referred to the Bureau of Manufactures, Washington, D. C.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

MONTREAL STREET RAILWAY.

The annual report of the Montreal Street Railway Company for the fiscal year ended September 30 shows an increase in gross earnings of $197,406, in total income of $84,376, and in surplus after charges of $17,657. Following is the income account, with changes:

	1909.	Increase.
Gross earnings	$3,874,838	$ 197,406
Operating expenses	2,255,019	96,625
Net earnings	$1,619,819	$ 100,781
Interest from M. P. & I. Ry.	55,606	*16,405
Total income	$1,675,425	$ 84,376
Total deductions	445,749	*8,889
Balance for dividends	$1,229,676	$ 93,265
Dividends (10 per cent)	976,332	75,608
Surplus	$ 253,344	$ 17,657
Appropriations—		
Contingent account	$ 175,000	.....
Fire insurance account	25,000	.....
Total appropriations	$ 200,000	.....
Final surplus	$ 53,344	$ 17,657

*Decrease.

President L. J. Forget says that current gross earnings of the company continue to show satisfactory increases. The premium on the last issue of new stock, amounting to $142,685, was paid up during the year and has been credited to surplus. During the year the company expended for construction, equipment, real estate, etc., a total of $189,449.

The Montreal Terminal Railway Company showed gross earnings for the year $11,261 higher than in the previous year, operating expenses $308 more and the net surplus for the year was $5,477, as compared with a deficit of $5,162 in the year previous.

PHILADELPHIA COMPANY.

The report of the Philadelphia Company and affiliated corporations shows earnings from all operations, for the nine months ended September 30, 1909. The account compares as follows, January 1 to September 30:

	1909.	1908.
Gross	$13,210,150	$12,261,314
Expenses and taxes	7,527,754	7,453,833
Net	$ 5,682,396	$ 4,807,481
Other income	222,099	193,834
Total income	$ 5,904,495	$ 5,001,315
Charges, rent, etc	3,437,624	3,351,513
Balance	$ 2,466,871	$ 1,649,802
Preferred dividend	225,000	225,000
Surplus	$ 2,241,871	$ 1,424,802
*Proportion	2,834	1,236
Available for Philadelphia Company	$ 2,239,037	$ 1,423,566

*Proportion due to other owners of common stock of affiliated corporations.

CUMBERLAND TELEPHONE AND TELEGRAPH.

The report of the Cumberland Telephone and Telegraph Company for the month of September and nine months ended September 30, 1909, compares as follows:

	1909.	1908.
September gross	$ 533,329	$ 508,130
Expenses, taxes, etc	342,981	332,485
September net	$ 190,348	$ 175,645
Nine months gross	4,757,630	4,554,713
Expenses, taxes, etc	3,101,425	2,983,883
Nine months net	$1,656,205	$1,570,830

NORFOLK & PORTSMOUTH.

The report of the Norfolk & Portsmouth Traction Company for the month of September and nine months ended September 30, 1909, compares as follows:

	1909.	1908.
September gross	$ 158,234	$ 162,938
Expenses	88,373	94,834
September net	$ 69,861	$ 68,104
Nine months gross	1,436,199	1,395,233
Expenses	833,363	835,270
Nine months net	$ 602,836	$ 559,963

BOSTON ELEVATED RAILWAY COMPANY.

The annual report of the Boston Elevated Railway Company for the year ended September 30, 1909, compares as follows:

	1909	1908.
Gross	$14,493,853	$14,074,696
Expenses	9,488,484	9,454,386
Net	$ 5,005,369	$ 4,620,310
Other income	.....	.....
Total income	$ 5,005,369	$ 4,620,310
Charges	4,163,951	†3,780,246
Surplus	†$ 841,417	$ 840,064
Dividends	802,503	798,000
Surplus	$ 38,941	$ 42,064

*Includes charges to depreciation fund.
†Equal to 4.22 per cent on $19,950,000 outstanding capital stock as against 6.31 per cent on $13,300,000 stock last year.

EDISON ELECTRIC ILLUMINATING COMPANY, OF BROOKLYN.

The New York Public Service Commission has issued a report covering the operations of the Edison Electric Illuminating Company, of Brooklyn, for the year ended December 31, 1908, as follows:

Operating revenue	$ 3,549,784
Operating expenses, taxes, etc	2,152,615
Operating income	$ 1,397,169
Non-operating income	14,858
Total income	$ 1,412,027
Interest, rentals, etc	1,401,028
Net corporate income	$ 10,999
Net profit and loss debit	10,999

The principal operating statistics are compared as follows:

	Dec. 31,'08.	Dec. 31,'07.
Number of consumers	13,224	11,438
Number of meters	20,547	18,088
Number of meters in company's service	45	41
Number of incandescent lamps	985,062	72,174
Number of Nernst lamps	2,242	1,724
Number of arc lamps	11,861	1,654

CHICAGO CONSOLIDATED TRACTION.

The receivers of the Chicago Consolidated Traction Company report for the month of August, 1909, as follows:

Gross earnings	$251,087
Operating expenses and taxes	205,892
Net earnings	$ 45,195
Bond interest	40,526
Surplus	$ 4,669

Surplus as indicated above is in excess of interest on underlying bonds and $20,643 short of required monthly interest on $6,750,000 of four-and-one-half per cent general mortgage bonds.

Steps toward the reorganization of the company are proceeding steadily, with every prospect of complete success.

NEW YORK TRACTION LINES.

The New York Public Service Commission for the First District has issued the following statistics in connection with passengers carried and revenues derived from operation on traction lines of New York during the month of July, 1909, as follows:

	Fare Passengers, July, 1909.	Total Rev. from St. Ry. Oper.
Interboro Rapid Transit	39,091,968	$2,015,025
B. R. T. System:		
Brooklyn Un. Elev	14,482,405	$ 757,240
Sea Beach	417,610	21,698
South Brooklyn	1,331,663	70,995
Total elev. train service	16,231,878	$ 849,935
Brooklyn Heights	12,565,828	638,444
Brooklyn, Q. Co. & Sub	2,197,172	114,266
Coney Island & Graves	245,807	12,548
Nassau Electric	7,838,870	402,926
Total B. R. T. System	39,079,555	$2,018,121
*Third Avenue System:		
Dry Dock, East Broadway	964,881	$ 55,760
42d St. M. & St. Nic	2,372,064	120,946
Third Avenue, Kingsboro	4,615,313	281,632
Southern Boulevard	195,546	9,777
Union Railway Co	3,906,206	198,934
Westchester Electric	1,051,665	53,291
Total	13,105,675	$ 720,342
Manhattan and Bronx surface roads:		
Metropolitan St. Ry	20,771,983	$1,062,673
Central Park, N. & E. R	1,032,038	54,155
Second Avenue	1,562,362	81,728
28th & 29th Sts. Cr	37,085	1,879
Total Manhattan	23,403,468	$1,200,440
City Island	23,046	1,101
Pelham Park	28,681	1,562
New York City Interboro	353,413	16,596
Total Man. and Bronx	23,808,608	$1,219,700
Brooklyn and Queens surface roads:		
Bush Terminal	.....	$ 3,549
Coney Island & Brooklyn	3,690,552	178,551
Long Island Electric	461,576	25,530
Marine	46,846	2,342
N. Y. & L. Island Traction	770,617	38,804
N. Y. & Queens Co	2,000,360	102,224
Ocean Electric	525,463	26,367
Van Brunt St. & E. B	141,462	4,022
Total, excluding B. R. T.	7,636,876	$ 381,391
Richmond electric roads:		
Richmond Lt. & R. R	834,489	$ 42,658
South Beach	52,402	2,720
Staten Island Midland	726,351	37,082
Total	1,613,242	$ 82,460
Gr'd total, all companies	124,335,924	$6,437,042

*Exclusive of the Tarrytown, White Plains & Mamaroneck and the Yonkers Railroad.

SAN FRANCISCO UNITED RAILROADS.

The report of the United Railroads of San Francisco for the month of August shows a gross income of $642,120, as compared with $587,733 for August, 1908, an increase of $54,387. The expenses for the month were $363,952, as compared with $356,028 for last year, showing an increase of $7,925. The net earnings for August were $278,168, as compared with $231,705 for the same month last year, showing an increase of $46,463. A.

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Annual Meeting and Report, Commonwealth Edison Company.

The annual meeting of the stockholders of the Commonwealth Edison Company, of Chicago, was held on November 8. The directors submitted their annual report for the fiscal year ended September 30, 1909, from which the following facts are taken:

During the past year the directors have issued and sold $11,250,000 of the company's bonds and have paid off the following obligations:

$ 500,000	Commonwealth Electric Company 5% debentures.
588,000	Chicago Edison Company 5% first-mortgage gold bonds.
1,483,000	Chicago Edison Company 6% debenture bonds.
5,000,000	Chicago Edison Company 5% three-year gold debentures.
269,000	Chicago Sectional Electric Underground Company first-mortgage bonds.
90,000	Real estate mortgages.

The directors recommended to the stockholders an increase in the company's authorized capital stock of $10,000,000, to be issued from time to time, as the directors may deem advisable.

The earnings and expenses for the fiscal year have been as follows:

Gross earnings (including merchandise sales)		$10,639,446.50
Expenses (including depreciation and cost of merchandise sales)		6,642,693.67
Earnings for the year		$ 3,996,752.83
Charges against earnings:		
Interest on bonds and debentures	$1,182,506.63	
Depreciation reserve	427,250.00	1,609,756.63
(Under the terms of the mortgages made by the Chicago Edison Company and the Commonwealth Electric Company.)		
Available for dividends		$ 2,386,996.20
Dividends paid		1,800,000.00
Balance carried to surplus		$ 586,996.20
Balance surplus, September 30, 1908.		1,442,820.50
Surplus September 30, 1909		$ 2,029,816.70

The condensed balance sheet for the year is as follows:

ASSETS.		
Plants, real estate, etc.		$57,105,744.41
Unfinished plant investment		99,377.92
Open accounts		180,183.71
CURRENT ASSETS.		
Material in storerooms	$ 793,777.05	
Coal in storage	92,107.50	
Accounts and bills receivable	1,287,464.02	
Cash	1,026,329.76	
		3,199,678.33
		$60,584,984.37
LIABILITIES.		
Capital stock		$30,000,000.00
Five per cent first-mortgage gold bonds of the Commonwealth Edison Company		11,250,000.00
Five per cent first-mortgage gold bonds of the Commonwealth Electric Company		8,000,000.00
Five per cent first-mortgage gold bonds of the Chicago Edison Company		5,412,000.00
Real estate mortgage		130,000.00
Depreciation reserve		2,221,750.00
(Under the terms of the mortgages made by the Chicago Edison Company and the Commonwealth Electric Company.)		
CURRENT LIABILITIES.		
Accounts payable	$783,519.47	
Municipal compensation	122,468.19	
Bond interest, accrued, matured and unpaid	224,042.46	
Taxes accrued	411,387.55	
		1,541,417.67
Balance surplus, September 30, 1909.		2,029,816.70
		$60,584,984.37

The company's connected business (exclusive of electrical energy supplied to other public service corporations) amounted to the equivalent of 4,920,800 standard sixteen-candlepower lamps on September 30, 1909.

At the regular annual meeting of the stockholders of the company held Monday, November 8, all of the members of the board of directors were re-elected and the capital stock was increased from thirty million to forty million dollars. The board of directors subsequently re-elected all of the officers.

Hudson Companies' Earnings in Excess of Fixed Charges.

With the present passenger traffic running at the rate of 40,900,000 a year, the Hudson & Manhattan Railroad Company is not only enabled to pay bond charges, but is earning approximately one per cent on its $10,000,000 five per cent non-cumulative preferred stock.

The gross revenue of 40,900,000 passengers at a five-cent fare is	$2,045,000
From previous estimates the operating cost, including taxes, will not exceed 40 per cent, or	818,000
Net passenger earnings	$1,227,000

The earning capacity of the terminal buildings at Church Street is $1,200,000, and $300,000 is the figure placed for the net income for advertising, news-stands and other privileges. These together with the present passenger earnings total $2,727,000; from this is to be deducted interest on bonds issued, $2,567,000.

The surplus is thus $160,000, which is equivalent to 1.6 per cent on the authorized preferred stock.

Passenger traffic has more than trebled since the first part of the system was opened. An idea of this increase, and the daily average for the different periods, may be seen from the following table:

	Days.	Passengers Per Period.	Average.
Feb. 26 to June 30, 1908	126	4,480,320	35,304
July 1 to Sept. 30, 1908	92	2,427,461	26,385
Oct. 1 to Dec. 31, 1908	92	3,794,585	41,245
Jan. 1 to March 31, 1909	90	4,049,319	44,992
June 1 to July 15, 1909	45	2,104,740	46,772
July 16 to Aug. 1, 1909	16	1,360,000	85,000
Aug. 2 to Aug. 30, 1909	29	2,755,000	95,000
Aug. 31 to Sept. 24, 1909	25	2,875,000	115,000
Sept. 25 to Oct. 2, 1909	8	1,128,000	141,000
Oct. 3 to Oct. 10, 1909	8	920,000	115,000
Totals	531	25,894,425	

From the above figures it is seen that the opening of the downtown section, on July 15 last, practically doubled traffic, and since that time it has increased the average from 46,772 to 115,000 passengers daily. The daily average of 141,000 for the week of September 25 was due, of course, to the Hudson-Fulton celebration. During the four parade days the company carried 604,000 passengers, an average of 151,000 daily, and 524,000 were transported during the remainder of the event. But the daily average has now settled down to 115,000 again. The decrease that is so evident during the month of July, August and September can probably be ascribed to the hot weather that prevailed during that period when the ferries offered attractions in the way of fresh air and cool breezes, though the traffic is naturally lighter during the summer months.

It is expected that the line, exclusive of the Forty-second Street extension, will be completed and in full operation by next summer.

On the New York side things are running without a hitch. Of the fifty per cent of the property owners' consents necessary for the extension to Grand Central Station forty have been received; the other ten are held up owing to the absence of the parties concerned. During the present month it is expected that the balance will be obtained, and the line will doubtless be in operation by 1912.

Salem Electric Company Sold.

Charles H. Tenney, of Boston, has purchased control of the Salem (Mass.) Electric Company at a price understood to be about $300 a share. Practically all of the 2,750 shares of the company were pooled last May at a minimum selling price of $225 per share, since which time several different interests have been in negotiations for control. The company has paid $18 per share in dividends for the present year.

Mr. Tenney and associates now control the following gas and electric companies: Concord (N. H.) Electric Company, Haverhill Electric Company, Malden Electric Company, Malden & Melrose Gas Light Company, Springfield Gas Light Company, Salem Electric Company, Suburban Gas and Electric Company, Fitchburg Gas and Electric Company, all of Massachusetts, and the People's Gas and Electric, Oswego, N. Y.

Rubber Companies Consolidate.

The Intercontinental Rubber Company, with a capital of $40,000,000, and the Continental Rubber Company, with a capital of $30,000,000, have recently merged in order to facilitate business management. The Intercontinental Rubber Company already owned a large part of the stock of the Continental Rubber Company.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Western Electric Arc-Lamp Displays at the Hudson-Fulton Celebration.

During the Hudson-Fulton celebration, particulars of which have already been given in these columns, business and commercial houses in and around New York city vied with each other to obtain the best illumination effects.

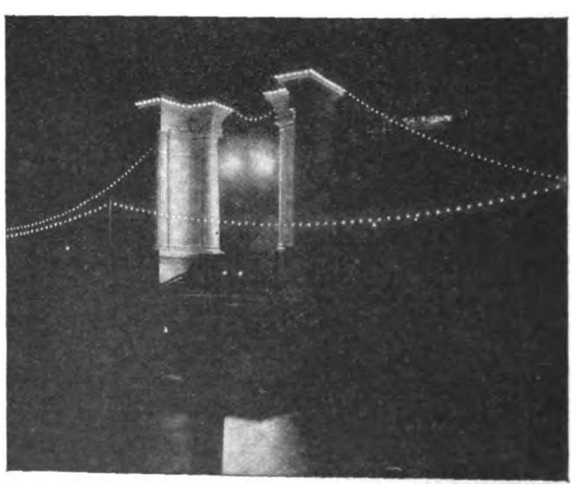
A noteworthy instance of the few arc-lamp installations was seen at the thirteen-story building of the Western Electric Company, which faces on West Street, directly overlooking the river from its front, north and south windows.

ILLUMINATION OF THE WESTERN ELECTRIC BUILDING.

The arc lamps used in the rooms and offices of the building were the Hawthorn enclosed carbon type, which are so extensively used at the present time for factory illumination. The distribution of the lamps was not specially arranged for a lighting display, but was that used for lighting the interior of the building under working conditions. The shades of approximately 200 windows facing directly west were simply lifted, with the effect as shown in the illustration. Unlike most of the buildings which had their outlines illuminated with festoons of incandescent bulbs, the effect at a distance was of an interior of considerable depth. On the roof of this building five immense flags floated from staffs, each under the rays of its own spot light.

Another feature of arc-lamp lighting is shown herewith in the other illustration, which is a photograph of the "Water Gate" which was erected at the foot of 110th Street. The intensity of the artificial light at this arch, which was produced by two Hawthorn flaming arcs, is readily seen from the distinct showing up of the design in the ornamentation on the column caps.

The flaming arcs were suspended as shown from the top of the arch and between the two great white supporting columns at the Water Gate, which are thrown into relief by the rays. Due to the lamps being suspended at a considerable height and to the soft yellow color of the rays, there was no blinding effect when standing at close range. The lamps, therefore, served a double purpose of decorative illumination and providing an intensity of light which was sufficient to light up the arch nearly as well as in daylight.



ARC ILLUMINATION AT "WATER GATE."

Inauguration of the Triumph Companies' New Plant.

On Saturday, October 23, an informal reception was given to the employes of the Triumph Electric Company and of the Triumph Ice Machine Company, to celebrate the opening of the new joint plant at Oakley, near Cincinnati, Ohio. Notwithstanding a steady downpour of rain, there was a large and enthusiastic gathering of employes with their families and friends.

An inspection of the plant, which is of the most modern construction, was made by the entire party. An excellent band, located on the third gallery, furnished music, while the younger members of the party danced. Ices and other refreshments were served.

During the intermission several excellent speeches were made. The deputy mayor of Oakley welcomed the Triumph Company to the community. He said that Oakley was proud to harbor such a

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progressive and up-to-date concern and felt sure that the community at large would benefit thereby. It was a matter of gratification that Oakley would now be known all over the American continent; in fact, wherever modern machinery was in use.

A delegate of the Triumph employes spoke feelingly of the good fellowship and good will that existed between the management and staff, and expressed a wish that such a feeling would long continue.

J. C. Hobart, the manager, in reply referred to the value of "team work." He said that it was team work that had built up the Triumph company and had made the present buildings possible. It was team work that would eventually enlarge the plant to double or treble the present proportions, and he felt sure that if all the employes continued to "pull together," as they had done in the past, it would be a matter of only a few years before the extensions planned would be erected.

An energetic call for the president of the company, brought W. H. Hobart quickly to his feet. He said that it afforded him considerable pleasure to see the employes, their wives and children, all gathered together, and he welcomed the opportunity to say a few words to them collectively. He pointed out in a very convincing manner that the interests of the company and of the employes were identical. The advancement of the company meant better conditions and advancement for the men and reflected naturally to their wives and families. He fully believed that each and every man had the interest of the company at heart and cited as a proof of this the remarkable celerity with which the old factory had been dismantled and the new plant fitted up. He had hardly believed that such a feat was possible, and it spoke volumes for the zest and energy of the men that it had been accomplished in such a short time.

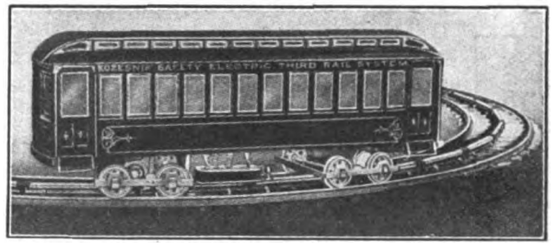
As described on pages 604 and 605 of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 25 last, the new factory is 300 feet long, three stories high and 140 feet wide, and provides some 125,000 square feet of floor space. The building represents a capital outlay of approximately $250,000, in addition to which over $50,000 worth of new equipment has been purchased. The increased facilities will enable both the Triumph Electric Company and the Triumph Ice Machine Company to turn out even better work than heretofore.

Kozesnik Safety Third-Rail System.

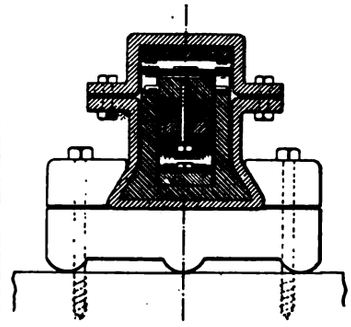
Numerous types of sectionalized third-rail systems and also the so-called surface-contact systems have been in evidence, the latter being used somewhat in Great Britain.

The Kozesnik Safety Electric Third-Rail Company, of New York, N. Y., however, has patented a harmless high-voltage, third-rail system for which is claimed the solution of what is still regarded by many as the dangerous third-rail problem.

The third rail in this system is mounted between the two main rails and comprises box and contact members made in sections. The contact members are constructed of a non-magnetic metal; the box members are made of a suitable material, and the third-rail sections are separated by block insulators. Each rail section is supported upon sleepers of insulated material which rest upon ties or other foundations in the roadbed, the same as the live third rail.

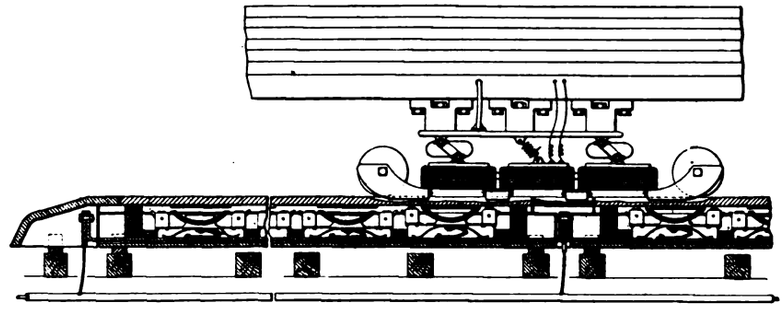


DEMONSTRATION OF KOZESNIK THIRD-RAIL SYSTEM.



CROSS-SECTION THROUGH THIRD RAIL.

Within the rail sections are a series of vertically movable armatures and contact members which are actuated by the movements of the armatures. Means are provided for electrically connecting the contact members to the conductor bar and returning them, together with the armatures, to their normal position. The accompanying illustrations show the principles of the system quite well.



CONTACT MEMBER AND LONGITUDINAL SECTION THROUGH THIRD RAIL.

All exposed parts of the third rail are out of the circuit, or "dead," and are only energized or "alive" when a magnetic contact shoe rests upon them; and by placing the rails in the middle of the car tracks the only live rails will be underneath the car, thus making the system devoid of the danger of the live third-rail system.

The most important feature claimed by the manufacturers is the possibility of very high voltage which would result in a large saving of copper and a considerable saving in substations. Other advantages claimed are the saving of wooden boxing of rails, fencing in of tracks as a protection against shocks, and, as there is no loss of current from the rails to the ground on account of dampness, the rails always being out of circuit except on contact, the cost of maintenance is reduced. Regarding the cost of installation, it is claimed by the company that it is no more than the covered live rail. It is also claimed that good contact is possible between shoe and rail even when covered with snow or sleet, because of the large surface that is covered by the shoe, and the magnetic action, which has a tendency to increase the friction.

Electrical engineers of prominence have thoroughly examined the actual size model, showing the electrical and mechanical action under power as it would be installed on a railroad, also a running car of fair size on a circular track, that has proved the practicability of the system.

The Kozesnik company contemplates manufacturing every part of this system in its own factory.

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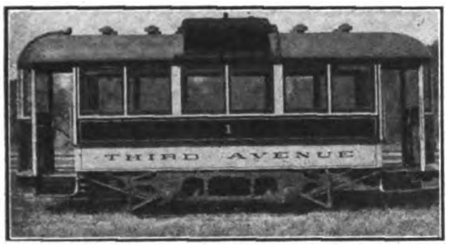
A Gas-Electric Motor Car for the Third Avenue Railway Company, New York City.

The General Electric Company has completed the construction of a single-truck car for the Third Avenue Railway Company, of New York, which is driven by a totally enclosed gas engine mounted between the axles. As shown in the photograph, the car resembles in many respects the short cars on many of our city railroads, and in operation can scarcely be distinguished from an ordinary electric car.

The gas engine has a four-cylinder, four-cycle engine direct-connected to a



GAS-ELECTRIC MOTOR CAR FOR NEW YORK.

generator and exciter, and the electrical energy thus developed is transmitted to two railway motors mounted on the axles. The car is operated from either end by an electrical controller, in the same manner as a trolley car. The controllers on each platform connect the motors progressively in series and in parallel, and regulate the voltage supplied to the generator, as required by the speed of the car. In this way all mechanical connections between the gas engine and the driving axles are eliminated. The gas

GENERAL ELECTRIC ENGINE DIRECT-CONNECTED TO GENERATOR.

engine, provided with automatic centrifugal throttle governor, runs at constant speed, regardless of the speed of the car, and thus operates at all times at high efficiency. The operator has no auxiliary levers for controlling the gas engine or the car.

The Bosch low-tension magneto supplies the ignition system, which is of the "make-and-break" magnet plug type. The engine is started by a crank direct from the magneto.

The exciter referred to above supplies current for the main generator field and for the lighting of the car.

The car has no monitor, its roof being dome-shaped with suction ventilators. Water-cooling radiators are placed on the roof, over the center of the car, and are connected to the water-jackets of the cylinders by pipes enclosed within the center posts of the car. The circulation is semi-siphon.

The following are some of the general dimensions of the car:

Length over all	28 feet
Length of body over end frames	19 feet
Wheel base	7 feet 6 inches
Height rail to top of roof	12 feet
Width over all	8 feet
Seating capacity	26
Weight complete, equipped	12 tons

The truck is of special light construction of riveted plate frame, equipped with Hess-Bright ball-bearing journal boxes. The truck frame is supported on coil springs and is steadied by half-elliptic springs at the ends of the truck frame.

Coal Dust as Fuel.

Among the difficulties encountered in designing a boiler to use dust as fuel, says the *London Times,* are those of securing a continuous and steady ignition, of employing a material to withstand the destructive temperature necessary in the furnace, of maintaining a homogeneous mixture of fuel dust and air during the full period required for complete combustion, and of handling the molten ash.

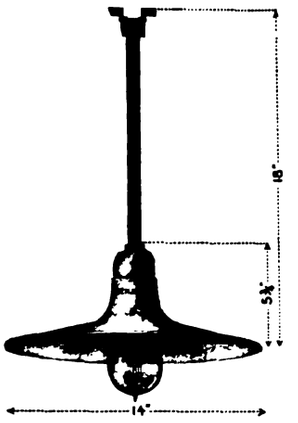
In the Bettington boiler made by Messrs. Fraser and Chalmers a vertical gas-jet inlet is employed, so constructed that a mushroom-shaped flame is produced within a line of water tubes which are part of the steam-producing plant. Otherwise only the ordinary firebrick and metalwork are employed as material. The combustible mixture enters the gas along the central axis of the furnace. The continuous ignition of the incoming stream of dust and air is effected primarily by the enveloping sheath of the products of combustion, and ignition is made independent of the incandescent brickwork. The furnace is stated to keep itself clear of slag at all rates of combustion.

At the Erith works of Messrs. Fraser and Chalmers a boiler of this kind has been in operation for some months. It has 2,200 square feet of heating surface, with a single twelve-and-three-fourth-inch tuyère fed with pulverized coal and air by a fan below a ball-mill pulverizer. Its calculated capacity was 7,000 pounds of steam per hour, but it has actually worked up to 15,000 pounds.

Benjamin Reflector Sockets.

The Benjamin Electric Manufacturing Company, of Chicago, is placing on the market a device known as the Benjamin Reflector Socket, which should eliminate much of the inconvenience caused by removing and installing lamp reflectors.

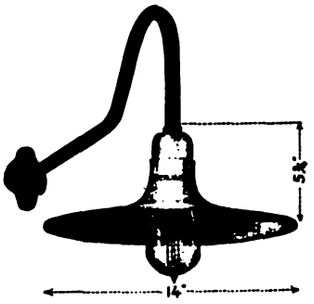
This socket consists primarily of a deeply hooded fourteen-inch enameled steel reflector fitted with a threaded brass



BENJAMIN REFLECTOR SOCKET COMPLETE WITH STEM.

bushing, tightly clamping the reflector between two leather washers, and a two-part porcelain receptacle of special design. The construction of the reflector and socket is such that connections can be easily made.

In the accompanying illustrations are shown two complete Benjamin outfits consisting of fixtures, sockets and reflectors. While the socket and reflector



BENJAMIN REFLECTOR SOCKET COMPLETE WITH GOOSENECK ARM.

sets are supplied separately, the outfits shown are particularly adapted for general service, namely, the thirty-inch gooseneck for outdoor service and the set with an iron pipe, brass casing, canopy and shock-absorber for indoor service.

A Chance for the Electric Furnace.

In a recent number of *American Industries* a photograph is given of an immense scrap heap of iron and steel at San Francisco., Cal., a relic of the recent earthquake and fire.

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Storage Battery for a Crane Load.

An electric crane equipment of peculiar interest, recently installed at Southampton, Eng., is described in a recent issue of *Electrical Engineering,* of London, Eng., to which publication we are indebted for the following description and illustrations:

The feature of the arrangement is that a storage battery is employed to take off the peaks in the load, and enable it to be dealt with by a comparatively small generating plant. The installation consists

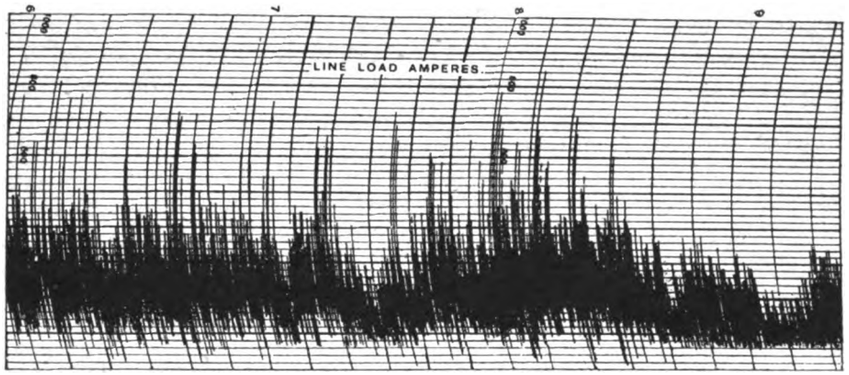

FIG. 1—CHART OF LINE LOAD, SHOWING FLUCTUATIONS BETWEEN 0 AND 800 AMPERES.

of a number of electric cranes, which have replaced the hydraulic cranes previously employed. They are equipped with grabs of a special type, with a capacity of one-and-one-half tons each, and are capable of loading and unloading at an average rate of one ton per minute. The cranes, when working simultaneously, take an average current of 250 amperes, at a pressure of 500 to 525 volts. The consumption per ton is said to be about 0.5 unit. The fluctuations in the load are necessarily severe, the current varying within short intervals from 0 to 800 amperes. With the aid, however, of a battery and reversible booster, this load is very successfully dealt with by one 150-horsepower producer-gas engine—another similar engine being in reserve. The engines are direct-coupled to generators capable of an output of 192 amperes at 520 volts, with a fifteen per cent overload for half an hour. It is stated that the coal consumption with the engines working at full load in one-and-five-tenths pounds per kilowatt-hour.

The battery consists of 245 cells of the "D.P." Battery Company's standard "L.S." fifteen-plate type, in wood lead-lined boxes, capable of discharging at 500 amperes for one hour, or at 1,000 amperes for short periods. The positive plates are about half an inch thick, and very solidly constructed to stand the heavy rates of charge and discharge. The formation of the plates is the "D.P." Battery Company's special Planté process, and consists of a thin hard skin, which is claimed to be practically proof against disintegration. The cells are burnt up throughout, and the inter-row and terminal connections consist of one-inch-diameter copper rod. The battery is erected on single-tier stands, mounted on concrete blocks. The booster, made by the Lancashire Dynamo and Motor Company, is so adjusted that the engines can be set at any desired load, and all variations above or below this load are taken care of by the battery and booster. Some records taken at this station are shown in the accompanying figures. From these it will be seen that with the line load fluctuating from zero to 800 amperes, the variation in the generator load was only about fifteen amperes above and below the mean. The generator was shut down for ten minutes, and during this time the battery supplied the whole load.

The connections of the switchboard are so arranged that the battery can be put on to the line by itself, or in parallel with a generator. As an alternative arrangement, the battery and booster can take the load without the generators, the booster being adjusted so as to give an over-compounding effect. The battery and booster can also be put on the line in parallel with both generators. In the unlikely event of both sets being temporarily disabled, the battery could, we are informed, keep all the cranes going for over three hours, so that the station is amply safeguarded against an interruption of supply. Besides the advantages in respect to reliability gained by installing storage batteries, a very considerable economy is said to be effected in the size and first cost of the whole generating plant, in addition to the saving in daily working expenses and wear and tear of the plant. The gas engines and generators were supplied by the British Westinghouse Company, Ltd. The battery, booster, switchboard, and cables were installed by the "D. P." Battery Company, Ltd., and the whole installation was designed by Lacey, Sillar & Leigh, consulting engineers, 78 King Street, Manchester, Eng.

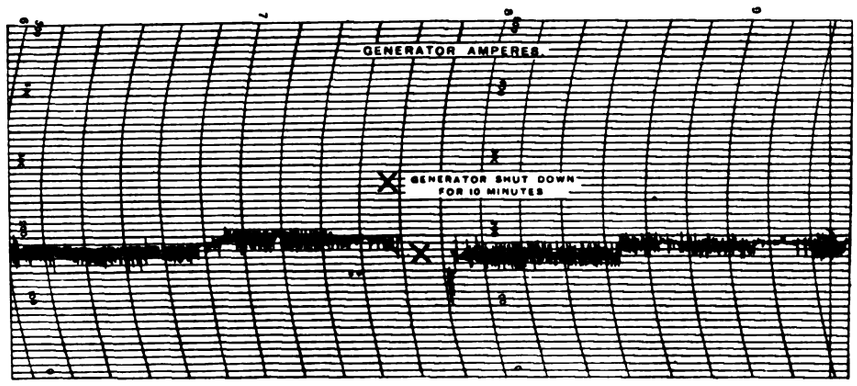

FIG. 2—CHART OF GENERATOR LOAD, SHOWING FLUCTUATIONS OF ONLY 15 AMPERES ON EITHER SIDE OF AVERAGE LOAD.

Telephone Train Dispatching on "Nickel Plate" Railroad.

The New York, Chicago & St. Louis Railroad Company is planning a telephone train-dispatching equipment for its line from Conneaut to Bellevue. This circuit will be the first one installed by the New York, Chicago & St. Louis, and if it proves satisfactory the railway company will in all probability equip its entire line with telephone train-dispatching apparatus.

The total length of the line is 132 miles, and there will be twenty-eight regular station equipments, with a number of special siding telephones so located that the train crews can get in direct communication with the dispatcher. The equipment used will consist of the standard Western Electric telephone train-

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dispatching apparatus and Gill selectors. The siding telephones will be mounted in telephone booths which will offer shelter for the train crews when reporting to the dispatcher, or receiving orders from him. Arrangements are made so that the telephone sets at these sidings are automatically cut free from the line when the telephone sets are not in use.

The telephone train-dispatching apparatus which has been installed on the large railroad systems throughout the country has been giving such satisfactory service that there is little doubt that the equipment installed by the "Nickel Plate" will result in the system being installed over the entire line of the New York, Chicago & St. Louis Railway.

Electrically Heated Oil Tempering Bath.

The coil tempering bath is very largely used by manufacturers for the purpose of tempering steel tools or dies. It has been common practice to heat the bath by gas; but as very close regulation of temperature is essential for a uniform quality of product, gas heating has not proved satisfactory. Added to this is the ever-present fire hazard, due to the excessive heat possible when gas is used.

As is often the case, the use of electricity has been advocated as a solution of the problem of proper oil tempering; and the General Electric Company has recently perfected an electrically heated oil bath which seems to meet all the requirements of such apparatus. The general appearance of this device is shown in the illustration.

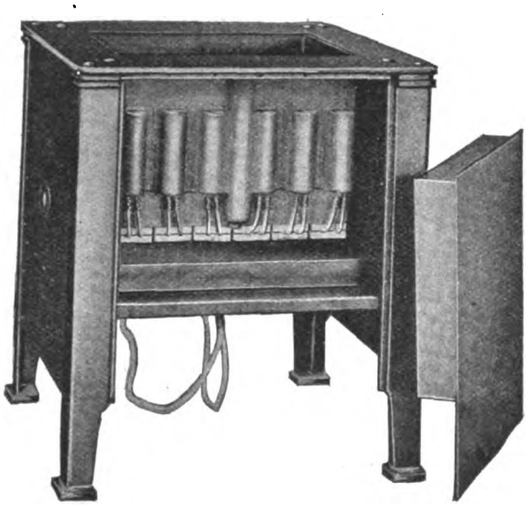
The bath proper consists of a cast-iron tank, or pot, having twelve lugs evenly spaced around the sides. These lugs are drilled to receive standard cartridge units, and it is found by thus distributing the units that an even temperature can be maintained in all parts of the oil. Around the pot is placed a heat-retaining jacket consisting of an inner and outer wall of sheet metal, the space of three inches between the walls being filled with mineral wool. The jacketing on each side of the pot is easily removable, thus allowing quick access to the internal connections of the units. Around the top of the pot there is a wide flange, to which are secured four cast-iron legs. A drain pipe, controlled by a globe valve, provides a means for drawing off the oil. There is a protected recess in one end of the pot, in which a thermometer can be placed to indicate the temperature of the oil.

There are two methods of using the oil bath. In the first method the temperature of the oil is raised to about 250 degrees Fahrenheit, the work placed in the bath, and full heat turned on. When the oil reaches the desired temperature, the work is removed and the current turned off. This method requires a single-heat bath. The second method is to turn on full heat, bring the oil to the desired temperature, then introduce the work, and by means of regulating switches maintain that temperature constant any length of time desired.

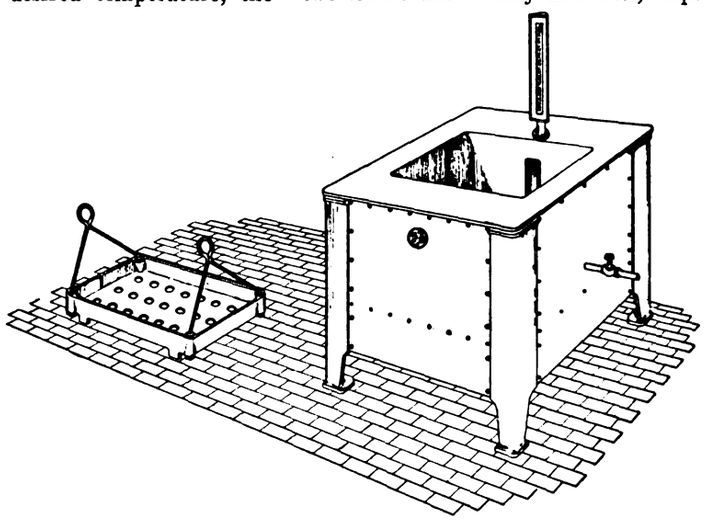
Where desired, a cast-iron basket or tray is supplied in which the work can be placed. The basket has eyebolts at each end to facilitate handling. The bottom of the basket is perforated with seven-eighth-inch holes, permitting free circulation of the oil. There are also legs on the bottom of the basket which keep the work an inch or more above the bottom of the bath.

The heating units are connected in groups according to the size of the bath, and the leads are brought out to the thermal block. In the single-heat devices, each group is protected by a fuse. In the multiple-heat device, the leads are carried to the switchboard, the latter being so arranged that the energy input can be varied in small steps from zero to maximum. A switchboard is not necessary for the single-heat bath, but is required where a multiple heat device is wanted.

Any desired temperature is obtained by throwing in the necessary number of units to give the approximate value. Close regulation is then secured by varying the voltage impressed on one of the units. This is accomplished by means of the rheostat mounted on the board. As a result of this method, there is a negligible loss of energy in the regulating device. The bath is made in three sizes of nine, eleven and thirty-seven gallons of oil capacity and consuming six, seven-and-two-two-tenths and twenty kilowatts, respectively. The energy consumption is sufficient to heat the oil to a temperature of 450 degrees Fahrenheit in less than one hour, starting cold.



GENERAL ELECTRIC OIL TEMPERING BATH.



OIL TEMPERING BATH WITH TRAY REMOVED.

May Use Barge Canal Reservoirs for Power.

While the barge-canal laws prohibit the use of water from its reservoirs for power purposes, there is a possibility of an amendment in the near future. It would be especially advantageous to use power from the Hinckley reservoir, as this will have at times a great surplus flow which must otherwise be allowed to waste back into the river.

The Hinckley reservoir is to cover an area of about four-and-one-half square miles and will have a capacity of approximately 7,445,000,000 gallons.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, OCTOBER 28.—The government has at last appointed a committee to consider the revision of the special rules framed six years ago relating to the use of electricity in mines, but it is doubtful whether the constitution of this will prove very acceptable to what may be termed the working portion of the mining community. The committee consists of the present chief inspector of mines and the present electrical inspector of mines, together with Mr. C. H. Merz, of London power scheme fame and also noted in connection with the progressive power companies on the Tyne. A good deal of power supply is given by the Tyne power companies for colliery working, but the point raised against the introduction of electrical men as officials is that they do not understand the working conditions in the mine, inasmuch as they have never studied the practical side of mining apart from the application of electrical apparatus to mining operations. Complaint has been publicly made that the present permanent electrical inspector of mines, who was only appointed a comparatively short time ago, had never been down a mine until after his appointment, and dissatisfaction is bound to be expressed in the same direction at the appointment of Mr. Merz, eminent electrical expert though he be. However, evidence is to be called from the working electrical engineers who have charge of the plant underground and their views will undoubtedly carry much weight with the committee.

The high courts have this week decided that the Kohler patents for the operation of printing presses by electric motors is not an infringement of the Clatworthy patents, for the reason that the latter were anticipated by an American patent published in 1882. Descriptions of plants erected under this latter patent were published in "The Western Electrician" and "The Electrical Engineer" at the time and the judge held that the principle embodied in the Clatworthy patent was covered by the American patent. Both patents employed a small motor to start the presses and this was overtaken and automatically cut out by a heavier motor which maintained the working of the press afterward. In the American patent the two machines were mechanically connected in parallel, but in the English patent they were connected in series. The judge held, however, that this did not constitute a fundamental difference and either system could be adopted merely as a means of saving floor space. There was no advantage, in other respects, of one over the other. The material clause in the English patent was held to have been already covered by the American patent, and the action for infringement was dismissed with costs. Printing presses on the Kohler system are in operation in the offices of the "Daily Mail" and the "Times," among others. Notice of appeal has been given.

Another electric power station has been added to London's already long list. The Stepney Borough Council, in 1907, found itself face to face with the question of extending its plant and at that time the London bulk supply schemes were before Parliament. The Council entered into an agreement with one of the proposed power companies for a bulk supply at a very low rate, but as the bill did not pass through Parliament the Council was forced to consider the erection of a new power station for the reason that their existing one was incapable of extension. The new structure has been built upon the River Thames at Limehouse, and was set working this week. A feature of it is that the buildings are the first steel and ferro-concrete structures to be sanctioned by the London County Council. This may sound somewhat astonishing to American engineers. Under the old Buildings Act the Council could not pass such a building, but last session an amending clause was added.

The General Electric Company is taking action in the police courts to restrain the Welsbach Incandescent Gas Light Company from calling the latter's new metal-filament lamps by the name of the "Aur" lamp. The reason for this is that the name "Aur" has been generally adopted for the metal-filament lamps made by the German "Aur" Company, with which Baron Welsbach was associated. The lamp now being offered to the public by the Welsbach company here, it is claimed, is neither the invention nor the manufacture of Baron Aur von Welsbach, and if this is proved it is an offense against the Merchandise and Trade Marks Act. The case is likely to proceed for some little time.

Railless electric traction is still very much to the fore. At present, any corporation or company desiring to adopt the system has to incur the expense and delay of promoting a special bill in Parliament. The suggestion has now been made that the Board of Trade should be authorized to grant licenses for the use of the system, a proposal which, if carried out, will greatly simplify matters.

The Electric Lighting Acts (Amendment) Bill has at length passed through Parliament, the process of amendment which has dogged its course from its birth, pursuing it unto the last stage. Generally, the industry is satisfied at having gained something after six years' struggle with the politicians, but there is by no means general satisfaction. In fact, the municipalities, who were deprived of their wiring powers owing to a difference between the House of Lords and the House of Commons, have proposed the promotion of a bill next session in order to get these powers. At present the law is very inconsistent upon this point, many municipalities having powers to undertake wiring work and many others not. As usual, however, it is the friction among themselves which kills all attempts at co-operation between the municipalities in Great Britain.

A curious deadlock has arisen in London with regard to linking up two stations belonging to one electric supply company. Under the London Electric Supply Act of 1908 powers were given to companies to link up their undertakings in order to get the full benefit of the many power houses which have been built. This may be regarded as one of the chief objects of the Act. The County of London Electric Supply Company has one power house in the south and another in the north of London without any interconnecting main. Previous to the act it had no power to lay such a main. It now desires to take advantage of the terms of the act and to lay a main between the two, but the City of London Comporation, through whose territory this has to pass, refuses to give its consent for the roads to be opened, the reason given being that it would cause too great an interference with traffic. Under the act, also, the London County Council, as the purchasing authority of the company, has to consent to any such works, but without any greater reason than that the city of London refuse to consent, the London County Council also refuses its consent. Thus the company is forced to appeal to the Board of Trade to send the matter to arbitration, and we have the spectacle of two public bodies obstructing the putting into force of an act which was proclaimed by everybody as containing the one essential to the success and cheapening of electric supply in London, viz., intercommunication between the scattered systems. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, OCTOBER 29.—In the southwestern region of France there is being developed an extensive electric traction project. The various lines which are to be built will connect Bayonne with the localities of Regrehorade and St. Jean Pied de Port, this latter point being situated in the Pyrenees region. In order to secure a supply of current for these lines, as well as for new tramway lines which it is also expected to install at various places, plans are being made to erect two electric plants, and these will be among the largest in this part of the country, as these plants will have a total of 10,000 horsepower capacity. About 2,000 horsepower will be needed for the different tramways.

A motor-operated cable incline was opened for service during the month of October in the town of Grasse. The electric outfit was installed by the Alcott Company, of Paris, while the mechanical part and structure was erected by the Berne Iron Works. The cable drum is operated by a seventy-five-horsepower motor, using current which is brought over a power line from a plant controlled by the Marseilles Enterprise Company.

During October there was also put in service an electric railroad line in Austro-Hungary which ranks among the large lines in that country. It has various sections and these make up about forty miles length. The whole system is known as the Trient-Malé railroad line. A part of this road, lying between Trient and Cles, had already been opened about the middle of September. It uses the trolley system, working on 800 volts direct current, and the electric outfit is supplied by the Austrian Siemens-Schuckert firm. The electric line was installed under the general direction of the Railroad Construction Bureau at Vienna. In connection with the electric road there is operated an electric plant known as the Sarca electric station, and it is situated about fifty miles distant. The alternators of the plant are operated on 20,000 volts and when fully installed it will have about 8,000 kilowatts capacity. This plant was opened last August and it furnishes current for the electric railroad, as well as for the town

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of Trient and other localities. At the same time, provision has been made for a supply for new electric railroads which are planned. As to the present line, it is fed from three substations, one of which is located at Pressano. Each of these has an output of transformers and two three-phase direct-current rotary converters, together with a storage battery. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., NOVEMBER 6.—The city of Guelph, Ont., gets a profit of over $5,000 this year from the municipally-owned street railway, after paying all expenses.

The gross earnings of the Toronto Street Railway for the ten months of the current year total $3,189,868, showing an increase of more than a quarter of a million dollars over the same period last year.

Financial institutions of the city of Hamilton, Ont., whose signatures are on the petition asking the Dominion government to disallow the Ontario hydroelectric act, say that they have received an intimation that the matter will be dealt with before the end of the month, and their request probably granted.

What is believed to look like the first move in the Niagara power fight, is the application just made to the Parliament of Canada for a charter for the London & Lake Erie Railway Company, capitalized at $2,000,000, to operate a line between Brantford and London, running through Paris, Ingersoll and Woodstock, and with running rights over the line already built from Brantford to Hamilton. This is understood to mean that electric energy will be taken from either the Electric Development Company or the Cataract Power Company, which will be in a position to compete with Niagara power.

The directors of the Electric Tramway Company, of Halifax, N. S., have increased the dividend of the company from a six per cent annual basis to seven per cent. The stock of the company is strong at 118 bid, with none, however, offering. Halifax electric is regarded as very attractive at this figure. It is a comparatively low price for a public utility paying seven per cent dividends.

The town of Port Arthur, Ont., has carried the hydroelectric power by-law. In the face of a strong fight put up by James Conmee, M. P., who claimed he would be able to deliver power from Nepigon at a lower rate than the hydroelectric commission, the ratepayers accepted the commission's contract, by a vote of three to one. The commission will at once award the contract for the erection of the transformer station and equipment at Port Arthur, at a cost of about $60,000.

The Canadian Pacific Railway Company has now completed the installation of the telephone, to replace the telegraph, in the despatching and operation of trains practically all the way from Sudbury, Ont., to Brantford, Man. This embraces about the whole of the Lake Superior division, and as this part of the system, particularly that which lies along the north shore of Lake Superior, is a hard one to operate in winter, the substitution of the telephone for the telegraph shows the confidence of the managers and engineers in the greater efficacy of the telephone in the operation of trains. It is now declared to be only a question of time that the telephone will be utilized all the way from coast to coast.

The new power house of J. R. Booth, at the Chaudiere Falls, Ottawa, will be completed in about a month. The electricians are now employed installing the two new generators supplied by Allis-Chalmers-Bullock, Limited. Each generator will develop 3,000 horsepower. The generators will be driven by new model turbine waterwheels made by an American firm.

The gross earnings of the Montreal street railway for the year ended September 30 amounted to $3,874,838. The net earnings were $1,229,676, or over twelve per cent on the common stock of the system. The surplus for the year is $253,344. In 1900, nine years ago, the gross earnings of the road were $1,769,904. During the year the road carried a total of 127,661,000 passengers as compared with a total of 121,089,000 passengers carried the year previous, and 56,557,000 in 1900. The earnings of the road during the past year per passenger were about three cents.

The company, composed of American and Canadian capitalists, which for two years past has been seeking authority from the Dominion government to develop the waterpower at Long Sault Rapids, in the St. Lawrence River, near Cornwall, has submitted to the government revised plans that, it is hoped, will obviate previous objections as to interference with navigation on the river. The company is an amalgamation of the St. Lawrence Power Company, Canada, which has a charter to develop power on the Canadian side of the river, and of the Long Sault Development Company, which has a charter from the New York Legislature to develop power on the American side.

The project contemplates the damming of the river at the foot of the rapids, thus raising the river and creating a new channel for boats, which now use the Canadian canal at Cornwall. A very large amount of power could thus be developed. The company claims that, under the plan as now proposed, navigation would be improved rather than injured. The new channel, which would be created in American waters, in the south side of the island, near Cornwall, would have sufficient depth for all boats on the river, and a new lock would be built by the company. The new proposals will be examined by engineers of the departments of canals, marine and public works here. Shipping men at Montreal, however, will oppose the scheme. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

GREAT CACAPON, W. VA.—The Hydroelectric Developing Company, recently incorporated with $100,000 capital stock, is planning a hydroelectric plant at Edes Fort, on the Great Cacapon River. The machinery will include four 4,000-horsepower vertical turbines direct-connected to high-voltage vertical type generators.

TRENTON, N. J.—Articles of incorporation have been filed at Trenton, N. J., for the Great Falls Power Company, with an authorized capital stock of $17,000,000. The object of the corporation is to acquire and deal in water, water rights and power and to generate electricity for all purposes by waterpower. The capital stock is divided into $10,000,000 preferred, bearing seven per cent cumulative dividends, and $7,000,000 common. The incorporators are W. C. Parker, L. J. Relyea and F. W. Griswald, and the registered office is at 76 Montgomery Avenue, Jersey City, the address of all the incorporators.

CHICO, CAL.—H. O. Lague, manager of the Feather River Power and Development Company, has recently filed papers appropriating 1,000 inches of water from Little Fall Creek and 2,500 inches from the Little North Fork. The water in each case is to be diverted by a dam 200 feet high and carried by ditches to the middle fork of the Feather River, where preparations are being made for the erection of three power plants. The proposed plants will, it is stated, produce a total of 86,000 horsepower, the drop secured being about 3,000 feet, and the volume of water ranging from 15,000 to 25,000 miner's inches.

AUGUSTA, ME.—Work is being pushed on one of the largest artificial reservoirs in the world, located two miles from Wilson's Mills, on Aziscoos Falls on the Magalolway River, a tributary of the Androscoggin. This work is being done by the Androscoggin Reservoir Company, which received charter rights from the Legislature of 1909. The president of the company is A. N. Burbank, of New York. When this work is finished in January, 1911, it will make a new lake about twelve miles in length, containing 8,000,000,000 cubic feet of water. At the present time a total of 125,523 horsepower is used along the river during the day hours.

MEXICO, MEX.—The Hydroelectric and Irrigation Company has obtained control of the Compañia Tranvias, Luz y Fuerza, of Guadalajara, and is building a great new plant on the Santiago River twenty-four kilometres from that city, where $2,000,000 worth of machinery is being installed. When this plant is completed it will be able to generate 120,000 electrical horsepower, with which the mining regions of Hostotipaquillo and Ezatlan will be supplied to operate their mills. Substations are now being built at these two places and half the line, a distance of over sixty-five kilometres, is now in operation, while the remainder is expected to be completed within the next two months.

OAXACA, MEXICO—It is planned by F. Zorrilla and associates, who own and operate the electric-light and power plant in Oaxaca, to erect a large hydroelectric plant in the mountains above Etla, one of the towns in this district, and to build transmission lines to the city of Oaxaca and the mining camps of Taviche, Ocotlan, Etla and and other places. The longest of these proposed transmission lines will be about sixty miles. The streams in the mountains where there is a water fall of 1,000 feet available will be harnessed for the purpose of generating the power. The initial capacity of the plant will be 10,000 horsepower, but this can be enlarged from time to time as the demands may require. The present plant of F. Zorrilla and associates in Oaxaca is operated by gas engines, with an auxiliary hydroelectric plant of 1,000 horsepower near Etla. It is expected that mining operations in this part of Mexico will be greatly cheapened by the introduction of this electric power.

LIGHTING AND POWER.

(Special Correspondence.)

ST. PETERSBURG, FLA.—An electric-light plant is to be installed here.

FESTUS, MO.—The city recently voted an issuance of $15,000 bonds for electric lights.

STANLEY, N. D.—The City Council will shortly install a complete street-lighting system. C.

RACINE, WIS.—The Standard Electrical Company is considering the enlargement of its factory. C.

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GLASGOW, MO.—This city has voted bonds for the purpose of buying the electric-light plant. P.

MARTINSVILLE, VA.—The city has voted $35,000 bonds for the enlargement of the electric-light plant here.

GRANITE FALLS, MINN.—Prices on a waterwheel for the power house are being secured by the village clerk. C.

SAVANNAH, MO.—The city has voted the issuance of $7,500 bonds for the construction of an electric-light plant.

BEEVILLE, TEX.—The Beeville Light Company has been granted a franchise to install an electric-light plant. P.

DALHART, TEX.—S. E. Killen, of the Dalhart Ice and Electric Company, is to double the capacity of the plant. P.

DAVENPORT, IOWA—The Davenport Water Power Company has applied for a franchise to transmit electric power. C.

CUTHBERT, GA.—The city has voted an issuance of $20,000 bonds for electric-light and water-works improvements.

KINGSVILLE, TEX.—H. Delno, manager of the Kingsville Ice Company, is about to install an electric-light plant. P.

COLUMBUS, OHIO—The Fremont Power and Light Company has increased its capital stock from $350,000 to $750,000.

WHITESTONE, GA.—A hydroelectric plant is to be installed to transmit 700 horsepower to a marble works near here.

TYLER, MINN.—The contract for the erection of the electric-light and water building was let to Andreas Sorensen. C.

ANSONVILLE, N. C.—It is reported that an 8,000-horsepower hydroelectric plant is to be constructed here at a cost of $750,000.

GRAND FORKS, N. D.—It is proposed to take a vote on issuing bonds for $25,000 with which to improve the lighting system. C.

ALTURAS, CAL.—The Alturas Light and Power Company has had surveys made of a number of possible power sites in this county.

KINGMAN, ARIZ.—The Frisno Mines Power Company, operating near this city, will install an electric-power plant on its property. A.

TWO HARBORS, MINN.—The Fort Wayne Electric Company secured the contract for the installation of electric meters for another year. C.

MANDAN, N. D.—A one-story building, sixty-four by ninety, will be erected by the Mandan Electric Company, on Main Street, at a cost of $30,000. C.

EUGENE, ORE.—A deal has been consummated whereby the Willamette Valley Company will take over the Howard Electric Company, of this city. A.

OAKLAND, CAL.—An ordinance has been adopted by the Council granting the Great Western Power Company a franchise to operate in this city. A.

ALBUQUERQUE, N. M.—The Highland Electric Railway has been granted a franchise for the construction of an electric-light and power plant. P.

FARGO, N. D.—J. S. Webster has sold the exclusive right to the North Dakota Heat and Power Company on a new electric meter which he has invented. C.

CARTHAGE, IND.—H. O. Henley has been appointed receiver for the electric light and power plant of this city. The property will likely be sold to the highest bidder. S.

MENOMINEE, MICH.—The Menominee and Marinette Light and Traction Company has commenced the construction of the concrete substation for the new power plant. C.

WAYZATA, MINN.—The Lake Minnetonka Public Service Company is having plans prepared for a power plant to cost $20,000, including two gas-generating engines. C.

NAPA, CAL.—The directors of the Veterans' Home at Yountsville, Cal., have awarded a contract to the Snow Mountain Power Company for supplying power to the institution.

GILBERT, MINN.—The Council has taken bids for wiring and equipment for electric lights. A wire has been ordered run at once from the high school to the Gilbert location. C.

EUREKA, CAL.—The Eureka Electrical Company has been awarded a contract to install a lighting plant on Willow Creek near China Flat, for a mining company of Los Angeles. A.

COLUMBIA, S. C.—The Eureka Cotton Mills, of Lancaster, will be fitted throughout with electric power as soon as the steam plant can be removed and the electric apparatus installed.

BROOK, IND.—The Commissioners of Newton County have granted a franchise to the Gragg Brothers to construct and operate an electric-light line between Brook, Morocco and Foresman. The Gragg Brothers are now in the market for wire, poles and other material to carry out the plan of constructing this transmission line. S.

FOLSOM, CAL.—The Great Western Power Company is constructing a power line along the Sacramento-Folsom road for the purpose of supplying power to the Natomas Consolidated Railway. A.

RENO, NEV.—The Reno Power, Light and Water Company will construct a $1,000,000 power plant west of Reno, on the Truckee River, in order to increase the power furnished by the company.

OROVILLE, CAL.—The plant of the Great Western Power Company at Big Bend is now producing 100,000 horsepower of electricity and the long power line is conveying it to San Francisco Bay. A.

ST. LOUIS, MO.—The Laclede Gas Light Company, in which John I. Beggs is interested, contemplates the erection of an electric-light plant of its own for supplying office buildings with light and power.

CHADRON, NEB.—The power plant of the Chadron Electric Light Company, together with all machinery, transmission lines, contracts and franchises, is to be sold at public auction on Tuesday, November 16.

FORT PIERRE, S. D.—If the City Council can obtain a satisfactory proposition from outside parties to install an electric light plant a franchise will be granted; otherwise it is proposed to install a municipal plant. C.

MARYSVILLE, CAL.—The work of construction on the new electric power line between this city and Meridian, in Sutter County, a distance of twenty miles, has been begun and will be completed as soon as possible.

SAPULPA, OKLA.—The Sapulpa Electric Light Company has been incorporated, with $150,000 capital stock, by George Willis, H. M. Adams, J. E. Kimball and Joseph Kergegan, all of Guthrie, Okla., and Charles F. Lane, Philadelphia, Pa.

SPOKANE, WASH.—The Washington Water Power Company, of Spokane, has completed arrangements with the Interstate Mining Company, controlled by Duluth parties, to furnish electric power for the Interstate property, west of the Hercules mine.

WALLA WALLA, WASH.—A big power plant is being erected by the Columbia & Walla Traction Company on the south fork of the Walla Walla River. The power will be used for the operation of the proposed Dayton-Wallula electric line. A.

SUTTER CITY, CAL.—The Pacific Gas and Electric Company has begun work on the construction of its power line from Terra Buena to this and neighboring towns. It is given out that power for lighting and other purposes will be available at this place by January 1. A.

TOLEDO, OHIO—The capital stock of the Fremont Power and Light Company has been increased from $350,000 to $750,000. This is the company which is constructing the mammoth dam and hydro-electric power plant, on the Sandusky River south of Fremont, Ohio. H.

COLONIAL BEACH, VA.—J. R. Benton, Philadelphia, Pa., and other capitalists will, it is reported, establish an electric-light plant at Classic Shore, one mile from Colonial Beach, in connection with the proposed electric railway from Quantico to Colonial Beach.

RONCEVERTE, W. VA.—It is reported that a 1,000-horsepower hydroelectric plant is to be built five miles from here, power to be furnished by Second Creek. B. F. Mann of Fort Springs, who has bought the site, expects to commence work on the dam early in the spring.

CITY OF MEXICO, MEXICO—The Mexican Light and Power Company is arranging to extend its power-transmission lines to the Pachuca mining district. The line is to be completed by July 1, 1910. It is one of the largest mining districts in Mexico and utilizes more than 25,000 horsepower.

ROANOKE, IND.—The Fort Wayne and Wabash Valley Traction Company has entered into a contract with the City Council to furnish current from the company's substation to light the city. The traction company is preparing to enter into similar contracts to light towns and cities along its entire system. S.

TOLEDO, OHIO—J. W. Harbaugh, special master in bankruptcy of the Consolidated Gas and Light Company, of Tiffin, Ohio, has reported to Judge Tayler, of the United States Court at Toledo, that the plant has been sold for $9,500 subject to a mortgage of 125,000. The sale has recently been confirmed by the court. H.

ZIHUATANEJO, STATE OF GUERRERO, MEXICO—The federal government has granted a concession to the Pacific Government and Concession Corporation, Ltd., of Victoria, British Columbia, to erect a hydroelectric plant near Zihuatanejo. This company owns a big tract of land near here, which it is develop-

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ing. It will build three large dams for the purpose of storing the water of the rivers which pass through its property. An important feature of the enterprise will be the irrigation of about 50,000 acres of land.

GLOVERSVILLE, N. Y.—The Caroga Water Power and Construction Company, of this city, has been incorporated with the secretary of state to furnish electricity for light, heat and power in Ephratah, Johnstown, Gloversville, Fonda and Fultonville. The capital is $50,000 and Gloversville, New York and New Jersey capitalists are financing the enterprise.

FT. WAYNE, IND.—The Board of Public Works has awarded a contract to the Ft. Wayne Electric Works for the furnishing and installation of two new switchboards, a new oil filter and other electric equipment, at the municipal electric plant, at a contract price of $1,225. The board will soon ask for bids for the furnishing of a new boiler and lamps for next year. S.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SCOTTSBURG, IND.—The Cincinnati, Madison & Western Traction Company has ordered the final survey for a traction road connecting the above-named cities and will soon ask for bids for constructing the road and for material and equipment. S.

LA CROSSE, WIS.—The La Crosse Water Power Company will apply for franchises to enter La Crosse with an interurban line to run from Winona to La Crosse and thence to Sparta, which will cost $3,000,000. Similar franchises will be asked at Winona and Sparta simultaneously.

FT. WAYNE, IND.—The Board of Public Works has notified the Ft. Wayne & Wabash Valley Traction Company that the Board has examined the new cement poles set in various parts of the city for test purposes, and find them satisfactory. The company will proceed with their manufacture for replacing the present poles in this city. S.

LOGANSPORT, IND.—The Commissioners of Cass County have granted a franchise to the Indiana & Northeastern Interurban Company to construct a road through the county. This company has secured similar franchises through White and Jasper counties and will eventually be built into Chicago. The company's legal office is in Logansport. S.

NEW YORK, N. Y.—The Public Service Commission has adopted an order requiring the New York & Queens County Railway Company to double-track its line between Flushing and College Point, Long Island, and also in Flushing. Between Flushing and Jamaica it is required to lengthen the turnouts, or switches, so as to maintain a headway of five minutes during the rush hours.

ABERDEEN, OHIO—The Pittsburg, Pomeroy, Portsmouth & Cincinnati Electric Railway Company has made application to Council for right-of-way through Aberdeen. The company, which is backed by Pittsburg and Cincinnati capitalists, has already obtained the right-of-way through the various counties and towns along the north bank of the Ohio River to the Brown County line. Agents are now obtaining the consent of property owners through Clermont and Hamilton counties. The promoters promise to have the road in operation between Pittsburg and Cincinnati within three years.

WICHITA, KAN.—Force that will give much impetus to the growth of this city is the building of the lines of the Arkansas Valley Interurban Company. When the system is completed all the more important cities in western Kansas will be connected by quick electric service with Wichita. The company is capitalized at $2,000,000 and has forces of men already at work surveying and buying right-of-way. As soon as the way can be secured active construction work will be begun. The first line to be constructed will be to the Northwest from Wichita, to a Hutchinson connection.

OAKLAND, CAL.—The Southern Pacific Railroad Company has withdrawn its application for a franchise for an extension to its double-track electric railway on Franklin Street, and the Peninsular Railroad Company, which is owned by the Southern Pacific interests, has asked for a single-track electric street-railway franchise over the same street. The move is supposed to be due to the opposition of the property holders to the franchise and to the fact that by asking for a street-railway franchise the necessity of securing the consent of a majority of the property holders affected is avoided.

OSHAWA, ONT.—It is announced that a syndicate of Oshawa manufacturers will give Oshawa, Bowmanville and Whitby the railway accommodation they sought in vain from the Canadian Northern. The road—an electric one—will be known as the Toronto and Eastern line, a Dominion charter being asked for. The village of Pickering will also be served, and entrance to Toronto made via Agincourt. An extension may ultimately be run north to Lindsay. A forty-five-minute service between Oshawa and Toronto is promised. Construction will be financed entirely by local capitalists.

PORTLAND, ORE.—Following the sale of the greater portion of the capital stock of the United Railways of Portland, Ore., the active control of the company and of the Ruth Trust Company, a subsidiary organization, passed largely into new hands. T. L. Greenough, president of the company, will continue in that position and will continue a member of the Board of Directors, but the remainder of the board is new. The new members are: Charles D. Fullen, of Iowa; J. H. Hulbert, of Iowa, and A. C. Emmons, L. B. Wickersham and F. E Bowman, of Portland. Charles D. Fullen succeeds Joseph E. Healy as vice-president. L. B. Wickersham continues as chief engineer and general manager. A.

SOUTH BEND, IND.—Plans for a limited electric service between this city and Indianapolis have been completed by the Chicago, South Bend & Northern Indiana, the Winona Traction Company and the Indiana Union Traction Company. Only a gap of five miles of road awaits completion to carry out the arrangements. Those who attended the meeting to make the arrangements and prepare a schedule were: C. E. & Alfred Deitrick, of New York; Samuel Murdock, of Lafayette; J. W. Smith and A. L. Kitselman, of Muncie, all of whom are interested in the lines over which the new service will be inaugurated. S.

MILWAUKEE, WIS.—To construct the proposed line of the Milwaukee Western Electric Railway Company between Milwaukee and Beaver Dam will cost about $1,500,000, according to testimony offered at the hearing last week before John H. Roemer, of the Wisconsin Rate Commission. The main line from Beaver Dam to the Milwaukee city limits will be a trifle over fifty-five miles in length. The proposed spur from Sussex through Pewaukee to Oconomowoc will be ten miles long. Traffic estimates for the new line include 355,000 cans of milk annually; 32,313 tons of mixed freight; 8,287 tons of stock and 1,600 tons of other farm products.

ALBANY, N. Y.—The public service commission has received an application from the Otsego & Herkimer Railroad Company, successors to the Oneonta & Mohawk Valley Railroad Company, which was previously the Oneonta, Cooperstown & Richfield Springs Railway Company, for authority to issue $1,500,000 in common capital stock, for consent to issue first, second and third mortgages and for authority to issue $500,000 first-mortgage bonds, $300,000 in second-mortgage bonds and $700,000 in third-mortgage bonds. The road in question runs from Oneonta, Otsego County, to Mohawk, Herkimer County, with a branch to Cooperstown.

VINELAND, N. Y.—The Northern New York Construction Company has been formed here for the purpose of building a trolley between here and Bridgeton, the county seat. The directors elected are: George E. Stevenson, proprietor of the Baker House; B. F. Patterson, a trolley magnate of New York; Dr. G. H. Burgess, of Philadelphia; Frank Parvin, owner of Parvin's Muddy Run Pond, on the proposed line; H. C. Bartlett, former solicitor of the borough of Vineland, and T. H. Coggey, retired capitalist, of New York. G. E. Stevenson was made president, B. F. Patterson and Frank Parvin vice-presidents, T. H. Coggey secretary and H. C. Bartlett treasurer.

MOUNT CLEMENS, MICH.—If the plans of the Illinois Valley Construction are carried out Macomb County will, in the near future, be traversed by a system of electric roads that will open up a considerable territory now only accessible by wagons and automobiles. For several months parties of engineers have been running lines up and down and across the county looking for the most feasible route for a trunk line to the Thumb district on which the prospectors have cast envious eyes for several years and through and to which many lines of roads have gotten as far as the blueprint stage. The Illinois Valley Construction Company has decided upon a route from Detroit along the Center Line road through Warren, Sterling, Shelby and Washington, taking in the villages of Warren, Utica, Disco, Washington and Romeo in this county and from the latter point to Lapeer and into the heart of the Thumb district.

CHAMPAIGN, ILL.—Articles of incorporation have been filed with Secretary of State Rose by the Edwardsville Belt Railway Company, the line to be constructed from a point approximately one-and-one-half miles south of the center of the city of Edwardsville to a point approximately one-and-one-fourth miles northwest of that city; the capital stock to be nominally $2,500 and the principal office to be located at Champaign. The incorporators and first board of directors are: George M. Mattis, W. H. Carnahan, Charles Zilly, B. E. Bramble and C. E. Cox, all of Champaign. Articles have also been filed by the Decatur Belt Railway Company, the line to be constructed from a point at or near the intersection of Jasper and Garfield streets in the city of Decatur to a point approximately two-and-one-half miles west of the center of said city; the capital stock also to be nominally $2,500, the principal office to be located at Champaign. The incorporators and first board of directors are: George M. Mattis, W. H. Carnahan, Charles Zilly, B. E. Bramble and C. E. Cox, all of Champaign.

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TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

GRAND MARAIS, MINN.—The United Wireless Telegraph Company will install a station here. C.

MARMADUKE, ARK.—The Independent Telephone Company has been incorporated, with a capital stock of $2,000. P.

CROSBYTON, TEX.—The Crosbyton Telephone Company has been incorporated, with a capital stock of $10,000. P.

MAMMOTH SPRINGS, ARK.—Lehman Kay, of Salem, Ark., and others have purchased the Montgomery Telephone System, and will extend the lines. P.

FT. WAYNE, IND.—The Home Telephone and Telegraph Company has distributed a three-and-a-half per cent semi-annual dividend to common stockholders. S.

BURLINGTON, VT.—The Independent Telephone Company, of Montgomery, has been granted by the village trustees the right to erect poles and string wires in the village streets.

HARLOWTOWN, MONT.—Lewis Penwell, of Helena, M. N. Stevens, of Harlowtown, and others have incorporated the Meagher-Fergus Telephone Company, with a capital of $40,000. C.

MONTPELIER, VT.—Incorporated under Massachusetts laws, with a capital of $7,000, the Heath Telephone Company has filed papers with the secretary of state to begin work in Windham County.

DES MOINES, IOWA—Judge McHenry in this district court has refused the restraining order to prevent the consolidation of the Bell and Mutual telephone companies. Minority stockholders of the Mutual asked for the order, claiming the consolidation was in restraint of trade.

WATERLOO, IND.—The City Council has ordered Home Telephone Company to remove all of the company's poles from the business streets to the alleys. It is reported that the company will install new wire on the poles planted in the alleys and make other improvements. Dr. E. Shoemaker is president. S.

SEYMOUR, IND.—The Seymour Mutual Telephone Company has just issued its first yearly dividend of eight per cent. This company was organized a year ago by the Merchants' Association, as a result of a bitter telephone fight waged against the Seymour Home Telephone Company, which persisted on raising rates. The directors of the Seymour Mutual Company have decided to install some new equipment and extend the lines. S.

FOND DU LAC, WIS.—Arrangements are being made by the Wisconsin Telephone Company to establish a rural telephone system in the eastern part of the town of Friendship, or that part of the county lying between the Northwestern and Soo line tracks and the shore of Lake Winnebago. There are a great many farmers residing in the territory and it is believed that from seventy-five to one hundred telephones would be installed in the first year.

TACOMA, WASH.—The Puyallup Home Telephone Company has changed hands and the stock is now owned principally by Puyallup citizens. The new company is capitalized at $40,000. The officers are: S. W. Greenwood, of Puyallup, president and manager; W. D. Cotter, of Puyallup, vice-president; J. S. Gregg, of Seattle, secretary; W. A. Miller, of Puyallup, treasurer; W. A. Zalm, of Tacoma, engineer. The trustees elected are W. D. Cotter, C. L. Zalm, E. P. Truedson, J. S. Gregg and S. W. Greenwood.

ALBANY, N. Y.—The Cattaraugus Union Telephone Company has been incorporated, with a capital of $50,000, to operate in the counties of Niagara, Erie, Chautauqua, Cattaraugus, Orleans, Genesee, Wyoming, Allegany, Livingston, Steuben and Monroe. The directors include: Charles M. Beattie, William T. Farrell and W. Roy McCanne. The Allegany Telephone Company, organized to operate in Allegany County, was also incorporated, with a capital of $10,000. The directors include: Robert E. Lang, George J. Fisk and John B. White, of Belfast.

AURORA, ILL.—A project to obtain funds with which to make extensive improvements to local and toll line service and other work has been approved of by the holders of bonds of the Inter-State Telephone Company and may be adopted soon. The scheme will do away with the issuing of any more bonds or floating of further outside loans, it is said. The $175,000 or more interest on bonds of the company, due annually, will be waived, by the scheme now being discussed, the bondholders taking notes for interest money, allowing the entire sum for use in improvements at once.

CLEVELAND, OHIO—In a signed statement here James S. Brailey, Jr., has denied positively the rumor that he had sold the controlling interest in the United States Telephone Company to the Bell interests. Mr. Brailey added that the United States company would do everything in its power in behalf of the independent telephone interests, and that his object in gaining control was for the sole purpose of giving the independents additional protection. In an interview he said that he was in no respect opposed to the plan previously arranged, to lease the property of the United States Telephone Company to the Ohio Home Telephone Company, the new company organized by the independents at Columbus last week for this purpose.

PERSONAL MENTION.

H. E. HANCE has taken the management of the Mankato Electric Traction Company, of Mankato, Minn.

HAROLD EDMUNDS, of Yankton, has assumed the control of the electric-light plant of the Ferris Brothers system at Watertown, S. D.

L. M. BOISEN, formerly with the Grand Rapids-Muskegon Power Company, has accepted a position with H. M. Byllesby & Company, Chicago, as power engineer.

HARRY C. KENDALL has severed his connection with the Westinghouse Electric and Manufacturing Company, to become instructor in railway electrical engineering at the University of Illinois.

EDGAR I. WENGER has resigned his position as associate in railway engineering, University of Illinois, to accept one as assistant professor of electrical engineering, McGill University, Montreal, Que.

ARTHUR BESSEY SMITH, assistant professor of telephone engineering, Purdue University, has become associated with the Automatic Electric Company, Chicago, in the sales and advertising department.

G. A. BURNHAM, recently connected with the General Electric Company, in the engineering department, has accepted a similar position with the Condit Electrical Manufacturing Company, Boston.

S. N. FARNSWORTH has accepted a position in the transformer division of the Westinghouse Electric and Manufacturing Company. Mr. Farnsworth was formerly with the Underwriters' Laboratories in Chicago.

E. P. KENNEY, for several years assistant superintendent of the Waltham Gas Light Company, has recently taken the position of sales manager with the Niagara and Erie Power Company, of Buffalo, N. Y.

H. B. KIRKLAND, of the National Metal Molding Company, Pittsburg, has been enjoying a well-earned rest of a few weeks in Milford, Pike County, Pa., a county which is the home of wild animals, game and fish.

L. C. FRITCH, consulting engineer of the Illinois Central Railroad and recently in charge of the electrification investigations carried on by that road, has accepted the position of chief engineer of the Chicago Great Western Railroad.

H. WESTBURY, well known in the electric-lamp manufacturing field, is now associated with the American Miniature and Decorative Lamp Company as manager, and hereafter will be located at 304 Hudson Street, New York city.

JOHN T. HUNTINGTON, of Topeka, Kan., has assumed his duties as general manager of the Green Bay Traction Company, the Northern Hydro-Electric Company and the Green Bay Gas and Electric Company, all of Green Bay, Wis.

PAUL SHEEHAN, one of the night chiefs in the Western Union Telegraph office, 195 Broadway, New York city, died suddenly on November 2, at his home, 19 Eldert Street, Brooklyn, after an illness lasting several months. He had been in the Western Union employ for nearly forty years. A widow and four children survive him.

CHARLES P. HIDDEN has joined the firm of Rosenbaum & Stockbridge, patent attorneys and solicitors, 41 Park Row, New York city. Mr. Hidden is a graduate mechanical and electrical engineer and has devoted several years to practical engineering work. He is an attorney at law and for several years has been in the examining corps of the United States Patent Office.

FOSTER MILLIKEN, of New York city, formerly president of Milliken Brothers, Inc., has severed his connection as assistant to the receivers of that firm. For the past twenty-seven years Mr. Milliken has been one of the foremost and best known structural steel men in this country, and his work has also extended to nearly every foreign country in the world. Many of the present improvements in shop practice and design of structural steel work are due to his ingenuity. He is also the inventor of a number of patented articles that are used extensively. In 1902 he built the large bridge and structural plant at Staten Island, and in 1906 he designed and built the large open-hearth structural steel plant and rolling mills which bear his name. Mr. Milliken has no idea of giving up the very active career that he has followed for so many years, but he has not definitely decided on just what line of work he will engage for the future.

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ELECTRICAL SECURITIES.

For the past week stocks have been very steady, with a continuation, in many cases, of the rise which has been the rule for some months past.

The recent rumors of telephone mergers and copper combinations seem to have had but little effect on the value of the telephone and copper securities. The steady resumption of activities on the part of the large manufacturing concerns is reflected in the better tone prevailing throughout the business market.

The traffic of the Metropolitan Elevated (Chicago) for October is estimated at 148,000 passengers daily, or an increase of 6,000.

The Northwestern Elevated's (Chicago) daily average traffic last month was 118,387 passengers, against 112,711 the previous month and 118,015 a year ago.

Directors and officers of the Chicago Railways Company, headed by President John M. Roach, have been re-elected for the ensuing year.

At the annual meeting of the Allis-Chalmers Company Stephen S. Palmer was elected a director, to succeed George Bullock, retired. Other directors were re-elected.

N. W. Harris & Company and the Harris Trust and Savings Bank have purchased $1,600,000 first-mortgage five per cent twenty-year gold bonds of the Oklahoma Gas and Electric Company, of Oklahoma City. The bonds will probably be offered in the near future.

An auction sale of $4,000 Chicago & Milwaukee Electric fives, due 1925, has been made at twenty-two. These bonds are on the Wisconsin division of the road. The 1919 bonds of the Illinois division are quoted on the curb at eighty-four bid.

Earnings of Boston Elevated for October made the best showing of any month since July. The increase in gross was approximately $52,000, or 4.2 per cent, compared with a September gain of $34,000, or three per cent, an increase in August of $46,000, or 4.1 per cent, and a July gain of $72,000, or six per cent.

The Northwestern Elevated, Chicago, will soon refund its four per cent bonds, maturing September, 1911, aggregating $22,482,000 outstanding, as the $3,000,000 block pledged against the loan was sold. Probably a four-and-one-half per cent issue will be substituted on the resumption of the elevated merger. Negotiations are expected at any time.

The 9,850 new shares of stock of the Old Colony Railroad authorized by the Railroad Commissioners, to be issued at $195 a share, is offered to the stock of record November 4, in the ratio of one new share for each twenty shares now owned. Subscriptions will be received until November 20, and payment in full is called for on or before December 18. Receipts will be given at time of payment which may be exchanged for new certificates at any time after January 10, 1910. Dividends on the new stock will accrue from January 1 next.

Brooklyn Rapid Transit continues to hold the remarkable gains in gross of the summer and fall months. For October gross increased $160,000, or $5,000 per day, which compares with daily gains of $5,000 in August and September. The percentage of increase is somewhat greater than in the summer months, as total gross receipts are naturally less at this season than earlier in the year. For the first four mnoths of the current fiscal year, which began July 1, Brooklyn Rapid Transit has gained $650,000 in gross passenger receipts, which compares with an increase of but $150,000 during all of the 1908-09 fiscal year, and $488,999 during the 1907-08 fiscal period.

DIVIDENDS.

Columbus Edison Company; quarterly dividend of one-quarter of one per cent, payable December 1.

Halifax Electric Tramway Company; dividend increased from a six per cent annual basis to seven per cent.

Pacific Gas and Electric Company; quarterly dividend of $1.50 per share on the preferred stock, payable November 10 to stockholders of record November 1. The first dividend on this stock, of one-and-one-half per cent, was paid April 15, 1906, and August 1, 1909, the dividends which had accumulated were refunded.

Tampa Electric Company, semi-annual dividend of $3.50 per share, payable November 15.

NEW YORK.

	Nov. 8.	Nov. 1.
Allis-Chalmers common	15¾	15⅜
Allis-Chalmers preferred	55⅛	53⅜
Amalgamated Copper	87¼	86⅛
American Tel. & Cable	*80	*80
American Tel. & Tel.	141	141¼
Brooklyn Rapid Transit	76½	75⅝
General Electric	163	163
Interborough-Metropolitan common	19¾	19⅝
Interborough-Metropolitan preferred	49¾	50⅛
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	93¾	91
Mackay Companies (Postal Telegraph and Cables) preferred	75½	75¼
Manhattan Elevated	141	141
Metropolitan Street Railway	23	20
New York & New Jersey Telephone	123½	123½
U. S. Steel common	91⅝	90
U. S. Steel preferred (ex. dividend)	126¾	127⅞
Western Union	78	76½
Westinghouse common	86⅝	86
Westinghouse preferred	140	140

*Last price quoted.

BOSTON.

	Nov. 8.	Nov. 1.
American Tel. & Tel.	141	141¼
Edison Elec. Illuminating	—	—
General Electric	163	163
Massachusetts Electric common	18½	18¼
Massachusetts Electric preferred	82¾	82
New England Telephone	134	134
Western Tel. & Tel. common	10½	10½
Western Tel. & Tel. preferred	88	88

PHILADELPHIA.

	Nov. 8.	Nov. 1.
American Railways	45¼	45½
Electric Company of America	12¼	12¼
Electric Storage Battery common	58½	58
Electric Storage Battery preferred	58½	58
Philadelphia Electric	13⅛	13⅛
Philadelphia Rapid Transit	27½	25¾
Philadelphia Traction	89	89½
Union Traction	53½	51¾

CHICAGO.

	Nov. 8.	Nov. 1.
Chicago Railways, Series 1	104	104
Chicago Railways, Series 2	34	35
Chicago Subway	7	7
Chicago Telephone	136	136
Commonwealth Edison	119	119
Metropolitan Elevated common	17	16
Metropolitan Elevated preferred	54	50
National Carbon common	95¾	95½
National Carbon preferred	118¼	118

NEW PUBLICATIONS.

STREET-RAILWAY LAMPS—The National Electric Lamp Association's Engineering Department, located at Cleveland, Ohio, is sending out copies of its new Bulletin 5-B, devoted to descriptions and data of modern street-railway lamps. The tantalum lamp, which has been well known to have a longer life on direct current than on alternating current, has been improved materially for both classes of service of late, with the result that it has been found peculiarly adapted for electric railway lighting. This bulletin shows at some length many of the desirable features of tantalum railway lamps, and also gives data on carbon lamps for alternating-current railway equipments. Copies of this bulletin should be of considerable value to electric railway companies in giving them the most recent information regarding incandescent lamps for their peculiar needs.

FOWLER'S MECHANICS' AND MACHINISTS' POCKET-BOOK AND DIARY FOR 1910—The second edition of this useful annual diary and pocketbook, published by the Scientific Publishing Company, of Manchester, England, at the nominal price (in England) of six pence (twelve cents) has just been published. The book is remarkable for its practical character and its convenience for reference purposes. Although chiefly typical of English practice there is much in its make-up of a universal nature. A number of tables relating to the proportions of bolts, nuts, spanners, pipe (Whitworth) and fine screw threads, as well as to tolerances and allowances for various qualities of running fits, are reproduced from the reports of the (British) Engineering Standards Committee. The work has been prepared under the direction of William H. Fowler, editor of "The Mechanical Engineer," of Manchester, England, who is a well-known authority on all matters pertaining to mechanical and electrical engineering.

NEW INDUSTRIAL COMPANIES.

EVANSVILLE, IND.—The National Electrical Advertising Company has incorporated to manufacture an electrical advertising device. J. A. McCoy and C. P. Schule are directors. S.

BOSTON, MASS.—The Burton Cloth Treating Company has been incorporated to deal in patent electrical machinery, with a capital of $100,000. G. D. Burton, Boston, president, and L. Harris, Jamaica Plain, are the incorporators.

NEW YORK, N. Y.—The Odin Dry Battery Company, of Manhattan, has been incorporated to do business as electricians, manufacturing electrical supplies, with a capital stock of $25,000. Incorporators: B. Colby, Bronx; H. C. Adams, H. R. Berlinicke, New York city.

ALBANY, N. Y.—The Hooker Electro-Chemical Company, of Niagara Falls, has been incorporated with the secretary of state, with a capital of $3,750,000. The directors are Michael Gavin, Jr., Franklin Remington, of New York city, and Albert H. Hooker, of Niagara Falls.

LIGONIER, IND.—The Interstate Contracting Company has filed articles of incorporation, capitalized at $50,000. The company proposes to make a specialty of building and equipping electric railroads. William T. Abbott is the president, and D. T. Mohabb, secretary. S.

WILMINGTON, DEL.—The Pre-Heating Appliance Company has been incorporated to manufacture electrical devices. The capital is $500,000, and the incorporators are: W. S. Potter, B. L. Beck, New York city; W. B. Hutchinson, Newark, N. J., and H. W. Davis, Wilmington, Del.

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INDUSTRIAL ITEMS.

WICKES BROTHERS, Saginaw, Mich., dealers and manufacturers of machinery, are distributing the November stock list of metal-working machinery.

THE BOGART GAS POWER ENGINEERING COMPANY, Buffalo, N. Y., is distributing a folder containing views of installations of Bogart single-cylinder gas engines.

THE WIRE AND TELEPHONE COMPANY, of Rome, N. Y., has issued an attractive calendar card for November. It shows a beautiful flower girl and is printed in a number of bright colors.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has installed 150 motors in the plant of the Moline Plough Company, at Moline, Ill. The entire plant is now operated by electricity.

JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., is distributing the October number of its publication entitled, "Graphite." In addition to some very interesting reading matter, this issue contains much useful data.

THE AJAX LINE MATERIAL WORKS, Milwaukee, Wis., manufacturers of outdoor lighting specialties, is distributing a folder devoted to arc-lamp insulators, insulating cross-arms, tungsten street fixtures and lamp-posts.

THE WAGNER ELECTRIC COMPANY has recently issued Bulletin No. 88, illustrative of motor applications. This bulletin contains a number of excellent illustrations of motors applied to machine tools, and industrial process machinery.

THE ARNOLD COMPANY, Chicago, Ill., engineers, is distributing a post card containing two views of the Burnside Foundry Plant of the Featherstone Foundry and Machine Company, Chicago, for which it acted as engineers and supervisors.

THE SPRAGUE ELECTRIC COMPANY, New York, N. Y., is sending out an attractive pamphlet, No. 233, which calls attention to its line of electric hoists, shovels, winches, etc. A copy will be sent upon request to anyone interested in such apparatus.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is distributing bulletins Nos. 3308, 3309 and 3137, descriptive of blowers for hot-air furnaces, electric forge blowers for direct and alternating currents, and single-phase induction motors, respectively.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., has recently distributed a catalogue devoted to "opalux" glassware and containing facts and figures relating to the same. This company is also distributing a list of revised reduced prices on Columbia tungsten lamps.

THE DUNCAN ELECTRIC MANUFACTURING COMPANY, of Lafayette, Ind., is issuing a little booklet calling attention to some of its products and incidentally containing an excellent story on the relations between a good old Irishman, a minister, and a lot of whisky bottles.

THE CHARLES L. KIEWERT COMPANY, Milwaukee, Wis., is distributing a booklet descriptive of Aurola flaming-arc lamps. In addition to the descriptive matter this little booklet contains a description of the general construction of this lamp, together with diagrams and useful data.

THE PENTON PUBLISHING COMPANY, of Chicago, Ill., and other cities, publishes on the tenth of each month "Penton's List," a miscellaneous advertising sheet of several pages, devoted mainly to machinery and the iron and steel trades. The October list has recently been received.

THE DUPLEX METALS COMPANY, 149 Broadway, New York city, is distributing a circular calling attention to one of the many advantages of copper-clad steel trolley wire. This firm has moved to the thirty-second floor of the Singer Building on account of being crowded for space in its former location.

THE GREGORY ELECTRIC COMPANY, Chicago, Ill., has recently distributed the November "bargain sheet," which contains a large number of electrical appliances and supplies at greatly reduced prices. This company is also distributing a circular devoted to a description of National Direct-Current Motors.

THE AMERICAN CONDUIT AND MANUFACTURING COMPANY, Pittsburg, Pa., reports an excellent demand for its American enameled rigid conduit. This conduit is entirely approved by the Underwriters' National Electrical Association, and is made in all the standard and several special sizes. Circulars describing it can be obtained upon request.

THE STANDARD ROLLER BEARING COMPANY, Philadelphia, Pa., announces that the following directors were elected for the ensuing year at the recent annual meeting: Lenox Smith, William D. Shane, I. H. Clothier, W. B. O. Field, Edwin Packard, Herbert DuPuy, Edward B. Smith, John C. Winston, G. H. Martin, James Boyd and R. S. Woodward, Jr. These directors formally elected the following officers: Lenox Smith, president; W. B. O. Field, vice-president; R. S. Woodward, Jr., vice-president and general manager; W. M. Baldwin, secretary and treasurer.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has issued the November number of its monthly publication, entitled "Trumbull Cheer." This issue is typical of the previous publications of the company in that it contains clever advertising intermingled with catchy stories and has a cheerful tone throughout.

THE LIBERTY ELECTRIC MANUFACTURING COMPANY, 543 Fourth Avenue, Pittsburg, Pa., the only manufacturers of all types of incandescent electric lamps in Pittsburg, was highly complimented in a reading notice appearing in a recent issue of "Commerce of Greater Pittsburg," a publication devoted to the interests of Pittsburg commerce.

E. J. BROOKS & COMPANY, 227-229 Fulton Street, New York, N. Y., is distributing a circular describing the Brooks' patent nailless box strap and seal with non-breakable metal straps in connection with the Brooks' patent strap-pulling device for sealing cases with straps. A sample of the strap and seal is sent out in connection with the circular.

THE LORD ELECTRIC COMPANY, of New York and Boston, has issued Bulletin M, which describes the new Heany multiple direct and alternating-current arc lamp. This lamp is of exceptionally simple and rugged construction, and should therefore prove particularly suited for places where hard service is apt to be imposed upon a lamp of this kind.

THE OHIO BRASS COMPANY, Mansfield, Ohio, has recently issued its October bulletin, which contains several interesting articles, among which may be named the "O-B Suspension Type Porcelain Insulator for 110,000 Volts," and a description of the Pomeroy Coal Company's haulage system. In addition this bulletin contains some interesting and useful data.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has issued a folder entitled, "Make Your Head Save Your Hands." In this are illustrated and briefly described a number of applications of Wagner motors to various industrial purposes, such as the dough kneader, coffee grinder, printing press, ventilating fan pump and ice cream freezer.

THE UNION SWITCH AND SIGNAL COMPANY, Swissvale, Pa., has just issued Bulletins Nos. 42 and 43. Bulletin No. 42 is devoted to union electric semaphores equipped with style "S" mechanism. Bulletin No. 43 is devoted to facing-point switches and passing siding protections. Both of these publications contain data and diagrams that should prove valuable.

THE J. P. DEVINE COMPANY, Buffalo, N. Y., manufacturers of the Passburg vacuum drying and impregnating apparatus, is distributing circulars explaining these equipments. One of them gives "the long and short of it" and another one contains an extract from the report of the committee on equipment of the American Street and Interurban Engineering Association.

THE BOGART GAS POWER ENGINEERING COMPANY, Buffalo, N. Y., has issued a folder describing various types of gas engines manufactured by it. These engines, from the small twenty-horsepower single cylinder to the large five-hundred-horsepower double-tandem engine, are fitted with a special magnetic-electric igniter, for which remarkable properties are claimed.

THE ALLIS-CHALMERS COMPANY, of Milwaukee, Wis., has recently closed a contract with the United States Naval Department for three 100-kilowatt (2,300-volt alternating current, 115-volt direct current) motor-generator sets; two twenty-five-kilowatt exciter sets and a twenty-seven-panel switchboard. This apparatus is to be used in connection with improvements now being made at the Philadelphia navy yards.

THE FERGUSON PUBLISHING COMPANY, 114 Liberty Street, New York city, announces that it has purchased from the Gage Publishing Company "Steam," the monthly publication devoted to the interests of the steam trade. It will be published under the latter name, beginning with the current issue. The Architects' and Automobile Editions of "The Buyers' Reference" have also been purchased by the Ferguson Publishing Company.

THE NEW YORK POLE COMPANY, 277 Broadway, New York city, has recently distributed an attractive booklet devoted to methods of reinforcing metal trolley poles. This booklet contains information which should prove particularly valuable to electric-railway managers who have iron poles that are showing signs of corrosion at the ground line. Several examples are given wherein old trolley poles almost entirely severed by corrosion were made practically as good as new.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a catalogue devoted to the description of miniature electric railways. This comprehensive catalogue of electrical toys will be found of interest especially to those looking for suitable electrical Christmas gifts. This company is also distributing a circular entitled, "Economical Meter Tests Made

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with P. M. Meter-Connection Blocks." This publication is a treatise on meter testing and gives full descriptions for testing all types of meters by means of the new P. M. system. It is claimed that the adoption of this system will reduce meter-testing expenses from fiftee nto forty per cent and will prevent theft of current.

THE NATIONAL X-RAY REFLECTOR COMPANY, 247 Jackson Boulevard, Chicago, Ill., has recently distributed Bulletin No. 2. This publication contains directions for planning installations using the "Eye-comfort" system of indirect illumination, and in addition tables, data and information which should prove of value to anyone contemplating lighting installations. The material presented in this bulletin was based on illumination tests made under various conditions, and consequently has a high practical value.

THE ALLIS-CHALMERS COMPANY has received a duplicate order from the Cleveland plant of the Cleveland Worsted Mills, Cleveland, Ohio, to be installed at their factory at Ravenna, Ohio. This will consist of a 1,500-kilowatt, sixty-cycle, three-phase alternator, direct-connected to a thirty-four and fifty-four by forty-eight of 100 revolutions per minute heavy-duty cross-compound Corliss engine. The necessary switchboard wiring and cables will also be furnished. The Geo. S. Rider Company are the consulting engineers in charge of the work.

THE AMERICAN STEEL AND WIRE COMPANY, Chicago, has recently issued a number of the W & M Telephone Wire News, containing several articles of considerable interest to telephone men. An account of some of the precaution taken to insure the manufacture of uniform wire, and an article on the "Preservation and Care of Poles" are well worth reading. A special feature of this number is a double page of engravings, showing more than twenty-five plants of the American Steel and Wire Company, from which the magnitude of this concern may be seen.

THE DARLEY ENGINEERING COMPANY, Singer Building, New York city, has prepared Bulletin No. 4, descriptive of its suction conveyor system. The bulletin explains the general principles and many of the details of this system, which is used principally for the removal of ashes from the pits of boiler furnaces. Illustrations are given of typical installations, showing both steam-driven and motor-driven exhausters, which provide the suction for drawing the ashes into the storage bin. There is also given a partial list of plants in which this suction system has been installed.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has issued two new publications. Handbook "L. V." relates to low-voltage lighting plants equipped with tungsten lamps and storage batteries. Handbook "I. P." relates to the use of the Chloride Accumulator in small isolated lighting plants. The former of these publications describes in some detail a comparatively new development in the isolated plant line, namely, that of using the more rugged and very highly efficient low-voltage tungsten lamp. This is peculiarly adapted to be used in connection with storage batteries and the pamphlet gives details of such installations with the switchboard and generator requirements as well as prices covering the complete equipment of the battery and switchboard.

THE TUNGSTOLIER COMPANY, Cleveland, Ohio, has prepared sample copies of its recommendations for improved illumination made by the engineering department of the company. Such recommendations are furnished free of charge, together with the service of the engineering department to those dealers and contractors who are co-operating with it in combining high-grade Tungstolier fixtures with artistic illumination. The company says that it is only necessary to send sketches with mentions of the areas it is proposed to illuminate and giving necessary information, and the engineering department will do the rest.

THE STAR EXPANSION BOLT COMPANY, of 147-149 Cedar Street, New York city, makers of the well-known Star expansion bolts, are adding a new safety device for hanging pictures, etc., securely, neatly and in an improved manner, to their products. This device is known as the Sebco Ready Fastener and consists of a wedge sharpened at one end, having a hole sunk, and threaded at the other. The wedge is driven in flush with the wall, the fixture placed, and a blunt-end screw is inserted into the threaded end of the wedge and fastened securely. Whenever it becomes desirable to remove the fastening, the screw is taken out, and the wedge being flush with the wall is not noticed. This product is being sold by picture-frame stores and by hardware dealers throughout the country.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, Ill., has recently issued a new bulletin (No. 49) on toll-test panels, which are a great convenience, as well as a necessity in the operation of an up-to-date toll equipment in connection with a city local exchange. In this bulletin the uses of the different types are fully explained and illustrated, and a detailed description of the construction is given. A still more recent bulletin (No. 51) covers the subject of arresters. The different uses for arresters are fully explained and illustrations, accompanied by detailed description, are plentifully scattered through the bulletin. Code numbers are arranged for the different types to facilitate ordering. Brief directions for installing and connecting the arresters, illustrated by diagrams, are also contained in this bulletin.

DATES AHEAD.

Alabama Light and Traction Association. Annual convention, Birmingham, Ala., November 15 and 16.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 to 18.

Boston Electrical Show. Mechanics' Building, Boston, November 15 to 25.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual meeting, Lima, O., November 19 and 20.

International Independent Telephone Association. Annual convention, Chicago, December 7, 8 and 9.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the second issue of each month.)

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary, Lloyd Lyon, secretary and auditor Mobile Light and Railway Company, 158 Government Street, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS.. Secretary, W. H. Tapley, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis Avenue, New York city.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York city.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West One Hundred and Sixteenth Street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York city.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, Flatiron Building, New York city.

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AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, secretary and treasurer Tri-City Railway Company, Davenport, Iowa.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

AMERICAN STREET AND INTERURBAN RAILWAY TRANSPORTATION AND TRAFFIC ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, superintendent of lighting Hot Springs Light and Railway Company, Hot Springs, Ark.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. Wilcox, Lowell, Mass.

ASSOCIATION OF EDISON PURCHASING AGENTS. Secretary, H. F. Frase, Edison Electric Illuminating Company, Brooklyn, N. Y.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, Perry-Payne Building, Cleveland, O.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Chicago, Ill.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Minnesota, St. Paul & Sault Ste. Marie Railroad, Chicago, Ill.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Pioda, Oak and Broderick streets, San Francisco.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Confederation Life Building, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 157 Bay Street, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Traction Terminal Building, Indianapolis.

CENTRAL ELECTRIC TRAFFIC ASSOCIATION. Secretary, J. T. Brittson, assistant claim agent Chicago, South Bend & Northern Indiana Railway Company, South Bend, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Colo.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Conn.

ELECTRIC CLUB OF CHICAGO. Secretary, Wm. S. Taussig, 115 Adams Street, Chicago, Ill.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CLUB OF CALIFORNIA. Secretary, Russell D. Holabird, Argonaut Hotel, San Francisco, Cal.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, George William Russell, Jr., 25 West Forty-second Street, New York city.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine Street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, San Francisco, Cal.

ELECTRICAL TRADES SOCIETY OF NEW YORK. (Member National Electrical Trades Association.) Secretary, Franz Neilson, 80 Wall Street, New York city.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West Thirty-ninth Street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt Street, New York city.

ENGINEERS' CLUB OF PHILADELPHIA. Secretary, H. G. Perring, 1317 Spruce Street, Philadelphia, Pa.

ENGINEERS' SOCIETY OF MILWAUKEE. Secretary, W. Fay Martin, Milwaukee, Wis.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, G. F. Doig, Gainesville, Fla.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Preston S. Millar, Engineering Societies Building, 33 West Thirty-ninth Street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

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INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Allen J. Paylow, Rockport, Ind.

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IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, Des Moines, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

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MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary and treasurer, A. P. Biggs, Detroit, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-treasurer, B. W. Copperthwait, Faribault, Minn.

MISSISSIPPI ELECTRICAL ASSOCIATION. Secretary, J. Abbott, manager Jackson Electric Railway, Light and Power Company, Jackson, Miss.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATERWORKS ASSOCIATION. Secretary, Claude L. Clary, Sikeston Electric Light and Power Company, Sikeston, Mo.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George W. Schwerer, Windsor, Mo.

MUNICIPAL LIGHTING ASSOCIATION OF MASSACHUSETTS. Secretary, J. C. Norcross, Reading, Mass.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, W. A. Wolls, Columbus, Ohio.

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NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago, Ill.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West Thirty-ninth Street, New York city.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State Street, Boston, Mass.

NEW ENGLAND SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, C. H. Hodskinson, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass. Meetings held on fourth Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth Street, New York city.

NEW YORK RAILROAD CLUB. Secretary, H. D. Vote, 95 Liberty Street, New York, N. Y.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD-TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, Frank J. Scherrer, 195 Broadway, New York city.

ORDER OF THE REJUVENATED SONS OF JOVE. Mercury, C. B. Roulet, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Van Dusen Rickert, Pottsville, Pa.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa.

SOCIETY OF AUTOMOBILE ENGINEERS. Secretary, Alexander Churchward, 30 Church Street, New York city.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, 96 Franklin Street, South Framingham, Mass.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. H. H. Norris, Cornell University, Ithaca, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York city.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. A. Gould, Ennis, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 141 Milk Street, Boston, Mass.

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RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) November 2, 1909.

938,471. GROUNDING DEVICE OR TERMINAL FOR LINE-WIRES. William R. Garton, Brooklyn, N. Y. Filed November 12, 1908. A longitudinal rod binds together units composed of hygroscopic material.

938,501. ADDING-MACHINE. Frank R. McBerty, Evanston, Ill., assignor to Burroughs Adding Machine Company, Detroit, Mich. Filed February 27, 1904. An electric motor operates the driving member and a magnetic switch can close the circuit and keep it closed independently of a manually-operated device for the same purpose.

938,516. APPARATUS FOR RECORDING BELL OR LIKE SIGNALS, ESPECIALLY APPLICABLE TO MINES. John Russell, Langlaagte, near Johannesburg, Transvaal, assignor of one-half to John Hugh Milligan, Langlaagte, Transvaal. Filed January 27, 1908. The device for marking the record strip is electrically operated.

938,525. ELECTRIC MOUTH-MIRROR. Burton E. Turney, Bridgeport, Conn. Filed July 6, 1908. An electric lamp is provided near one edge of the mirror.

938,541. TELEPHONE-EXCHANGE SYSTEM. Charles L. Zahm, Los Angeles, Cal., assignor of one-fourth to Edward E. Clement, Washington, D. C. Filed September 19, 1905. Means actuated in the first motion of the selector switch are provided to display a signal and indicate that a connection is desired on the manual switchboard.

938,553. PRIMING CHARGE FOR MINES. Louis Cahüc, Neumarkt, Germany. Filed June 15, 1908. Describes a form of electric fuse.

938,558. DYNAMO-ELECTRIC MACHINE. Abe L. Cushman, Concord, N. H. Filed May 27, 1907. The field magnet has a series of poles with windings in shunt, and commutating pole-pieces with windings in magnetic circuit independent of the field circuit, these pole-pieces being arranged in pairs connected by a magnetic yoke, one member of each pair being within and one member being without the plane of the armature periphery.

938,588. SELF-LOCKING RELAY. Jerome F. Keely, Chicago, Ill. Filed January 16, 1909. A magnet in electrical connection with a clock-control switch has an insulated arm secured thereto adapted to open and close a time-recorder circuit switch; a similar arrangement, with a pivoted armature, is also provided, and the armatures are connected by a link so that each armature is self-locking and adapted to be unlocked by the other armature.

938,604. BRUSH FOR DYNAMO-ELECTRIC MACHINES. Herbert S. Miller, Elizabeth, N. J., assignor to Diehl Manufacturing Company. Filed April 22, 1907. Describes a method of locking a flexible conducting lead in a recess in a carbon brush.

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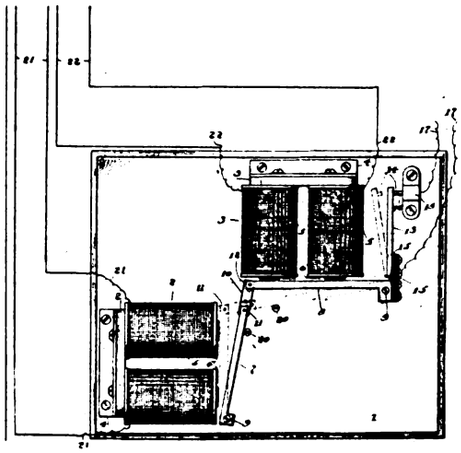
938,631. WIRELESS CLUSTER. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. Filed June 10, 1907. A plate carried by an insulating block engages a variable number of the threaded contacts.

938,632. CLUSTER-LAMP SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. Filed October 28, 1907. Similar to the preceding.

938,635. PANEL-BOARD. Albert E. Blackman, Mount Vernon, N. Y. Filed October 15, 1908. The body portion forms a compartment which is provided with a metallic trim serving as a cover, the trim serving as a metallic faceplate for the operating members of the switches.

938,649. CONTROLLER FOR ELECTRIC MOTORS. Frederick Diehl, Elizabeth, N. J., assignor to Diehl Manufacturing Company. Filed May 11, 1908. An electric switch connected with the motor is provided with an actuating lever extended into the path of movement of the motor clutch-operating member, and a spring completes the throw of the switch lever initiated by its engagement with this member.



938,588.—SELF-LOCKING RELAY.

938,752. METHOD OF WORKING METALS, ORES, AND THE LIKE. Otto Frick, Saltsjöbaden, Sweden. Filed August 31, 1905. The principal part of the charge is melted in one transformer furnace from which the melted material is conveyed into another transformer furnace, larger than the other, for the purpose of refining and storing it.

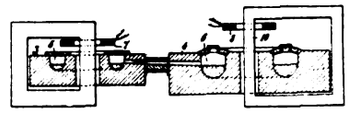
938,801. CARRIAGE-RETURN AND LINE-SPACING MECHANISM FOR TYPEWRITERS. Guillermo Trejo, Mexico, Mexico. Filed November 30, 1908. Is operated by an electric motor.

938,802. ADJUSTABLE SUSPENSION-CORD FOR ELECTRIC LAMPS. Thomas W. Trotter, Sault Ste. Marie, Ontario, Canada. Filed April 13, 1908. Describes a spool arrangement for the cord, in which electrical contacts engage spring arms.

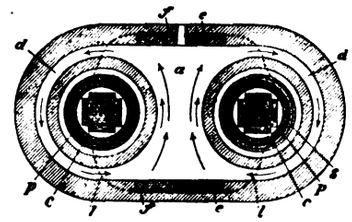
938,805. GEARING. Alfred D. Williamson, Sheffield, England, assignor to Vickers Sons & Maxim, Limited, Sheffield, England. Filed May 18, 1908. Describes a change-speed gear connected with a reversible electric motor.

938,830. ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS. Arthur T. Dawson and George T. Buckham, London, England, assignors to Vickers Sons & Maxim, Limited, Westminster, England. Filed November 27, 1905. A dynamo-electric sending device, connected to a counting device, actuates similar dynamo-electric devices step by step at the several receiving stations.

938,859. AUTOMATIC FIRE-EXTINGUISHER AND SIGNALING SYSTEM. Richard B. Hewitt and James G. Nolen, Chicago, Ill.; said Nolen assignor of one-half of his right to Frank B. Cook, Chicago, Ill. Filed May 29, 1903. Valves are electrically controlled.



938,752.—METHOD OF WORKING METALS, ORES, AND THE LIKE.



939,095.—ELECTRIC FURNACE.

938,663. BATTERY-CONTACT. Julius H. Gugler, Minneapolis, Minn., assignor to the Battery Company. Filed February 21, 1908. The lead wire contacts with a mercury pocket in the base of the jar.

938,664. ELECTRIC SWITCH. Gerald W. Hart, West Hartford, Conn., assignor to the Hart Manufacturing Company, Hartford, Conn. Filed May 5, 1909. Describes a form of push-button cam switch.

938,671. RESISTANCE UNIT. Harry W. Leonard, Bronxville, N. Y. Filed November 13, 1905. A reflexed ribbon conductor is supported edgewise between two protective sheet-metal supports.

938,672. BINDING-POST. Henry E. Leppert, New Britain, Conn., assignor to the Hart Manufacturing Company, Hartford, Conn. Filed April 2, 1908. A screw which engages a stationary member having connected opposing walls has an enlarged shoulder passing through one wall and adapted to clamp a conductor between it and the inside of the other wall.

938,682. OUTLET-BOX. James T. Meleady, Newark, N. J. Filed May 20, 1908. The conduit is received and secured by a sleeve passing through the side of the box and secured by a screw.

938,708. ELECTROMECHANICAL DEVICE. George H. Rowe, Riverside, Ill., assignor to Electro-Magnetic Tool Company, Chicago, Ill. Filed June 9, 1908. A number of electromechanically cushioned percussion devices, in balanced relation with respect to each other, are driven by a shaft to which they are connected.

938,709. ELECTROMECHANICAL DEVICE. George H. Rowe, Berwyn, Ill., assignor to Electro-Magnetic Tool Company, Chicago, Ill. Filed June 11, 1909. A magnet is provided with a hollow reciprocable core having an armature arranged to slide within it.

938,740. ELECTROMAGNETIC DEVICE. Einar A. Brofos, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Filed May 23, 1908. A fluctuating-current electromagnetic device has two electromagnets having separate cores forming portions of two distinct magnetic circuits; one is adapted to receive its current from a fluctuating-current source and the other to receive its current inductively from the former.

938,865. ELECTRICAL SYSTEM OF DISTRIBUTION. Albert S. Hubbard, Belleville, N. J., assignor to Gould Storage Battery Company. Filed March 18, 1908. A main distributive circuit is connected in operative relation with a storage apparatus and booster, means being provided for producing a variable flux in the booster and other means for applying to the booster a rapidly reversing magnetomotive force.

938,936. ELECTRIC CONTROL FOR PANTOGRAPHS. Alfred T. Ziegler, Pittsburg, Pa. Filed January 22, 1909. The tracing point comprises an electromagnet having a movable core and a point detachably held by the core. A circuit-closer located on the frame has movable contacts adapted to establish a circuit through the electromagnet.

938,943. TELEPHONE EXCHANGE. Clarence A. Anderson, Salina, and William Hagstrom, Lindsborg, Kan., assignors of two-thirds to the Anderson Electric and Manufacturing Company, McPherson, Kan., and one-third to Hagstrom Brothers Manufacturing Company, Lindsborg, Kan. Filed August 29, 1904. Describes an electromagnetic switching mechanism for a party-line exchange.

938,944. CALLING DEVICE FOR TELEPHONE-EXCHANGE. Clarence A. Anderson, Salina, and William Hagstrom, Lindsborg, Kan., assignors to the Anderson Electric and Manufacturing Company, McPherson, Kan., and Hagstrom Brothers Manufacturing Company, Lindsborg, Kan. Filed April 19, 1906. Comprises a series of contact points, a pair of contact makers, a drive shaft normally disconnected from the contact makers, a clutch mechanism arranged to connect the contact makers to the shaft, and means by which upon operating the clutch mechanism the contact makers will make one complete cycle of operations and come to rest in their normal position.

938,949. AUTOMATIC TELEPHONE PAY-STATION. Francis X. Bee, Philadelphia, Pa. Filed April 10, 1908. Describes a coin-actuated telephone device in detail.

938,974. TELEPHONE-LINE-TESTING SYSTEM. Arthur N. Chenoweth, Waterbury, Conn. Filed August 6, 1908. Comprises terminal stations and connecting telephone lines, an intermediate testing-station or stations, means located at the

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testing station or stations controlling the continuity of the telephone lines, and means located at the terminal station or stations operating the line controlling means automatically to open or bridge, at the testing station or stations, the desired telephone lines.

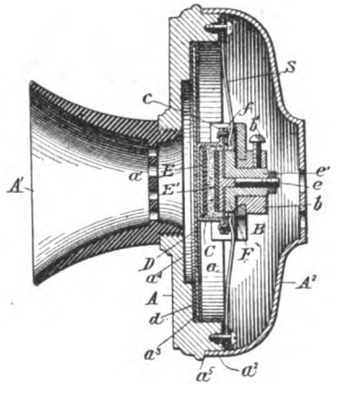
938,992. TELEPHONE-TRANSMITTER. Carl E. Egnér, Stockholm, and Johan G. Holmström, Saltsjö Storängen, Sweden. Filed February 18, 1909. The diaphragm, which is strained uniformly from center to periphery, is fixed at its center to a disk which vibrates in unison with that part of the diaphragm to which it is secured. The disk forms one of the electrodes of the transmitter.

939,006. STORAGE BATTERY. Gerhard M. W. Goettling, Brookline, Mass. Filed January 4, 1909. Describes special means for suspending the plates.

939,054. ELECTRIC WATER-HEATER. Paul P. Meyers, Grinnell, Iowa, assignor of one-half to Okey K. Cole, Grinnell, Iowa. Filed January 2, 1909. A body portion having an inlet and discharge opening contains two electrodes to each of which are detachably connected several electrode members, those on one electrode being interposed between, and spaced apart from, the members on the other electrode.

939,095. ELECTRIC FURNACE. Hermann Röchling and Wilhelm Rodenhauser, Völklingen, Germany, assignors to the Gröndal Kjellin Company, Limited, London, England. Filed September 7, 1906. Comprises a magnet core (c in illustration), piercing the furnace and having a primary (p) and a secondary (s) winding, the smelting room in the furnace being formed by an annular channel (d) surrounding the magnet core.

939,106. HAIR-DRYING APPARATUS. William A. Soles, New York, N. Y. Filed December 14, 1908. Air circulated by an electric fan is driven past electric lamps to heat it, the light from the lamps serving to illuminate the hair.



13,035.—TELEPHONE TRANSMITTER.

939,110. CONTROLLING-SWITCH FOR MOVING-PICTURE MACHINES AND STEREOPTICONS. Tomotaka Taira, Fresno, Cal. Filed April 6, 1909. Separated switch terminals are directly included in an electric-lamp circuit, and two independently operated bridging contact plates are adapted independently to close the circuit through the switch terminals.

939,128. FIRE-ALARM. Walter Goodchild, New York, N. Y., assignor to John Goodchild, New York, N. Y. Filed March 18, 1909. A circuit-closing means for fire-alarm devices and the like has a mercurial thermometer tube provided with a pendent, laterally-bent upper portion sealed at its lower extremity and adapted to receive the mercurial column upon elevation of temperature, spaced terminals embedded in the pendent, laterally-bent portion of the tube and adapted for communication through the mercurial column upon the rise of temperature, and a metallic casing arranged to enclose the sealed extremity of the pendent portion of the tube to prevent fracture thereof.

939,154. ELECTRIC CONTROLLING AND SIGNALING SYSTEM FOR RAILWAYS. Herbert E. McDonnell, Leominster, Mass. Original application filed August 7, 1906. Divided and this application filed January 26, 1907. A tram or car approaching an open switch closes an electric circuit causing a motor and brakes to operate.

939,155. ELECTRIC TIME-FUSE. Claud D. McPhee, Arnprior, and John Gillies, Braeside, Ontario, Canada. Filed January 14, 1909. A detonating cap is located in contact with a powder cartridge, the latter being explodable by an electric means inserted therein.

939,165. HOOD FOR ELECTRICAL WIRING ON STANDPIPES. John Potterton, Lynn, Mass. Filed January 21, 1908. A hood, covering the top of the pipe cap and embracing the rear of a standpipe, is cleft from front to rear so as to constitute a tongue-and-groove joint between the two portions so separated, and a separable piece embraces the front of the pipe under the hood, fastening the two portions together.

939,183. PROCESS OF GENERATING ELECTRICITY. Henry S. Blackmore, Mount Vernon, N. Y. Original application filed April 18, 1903. Divided and this application filed April 29, 1907. A molten electrolyte has in communication with, but separated from it, electrodes, the electropositive one of which contains metal carbide decomposable by the electrolyte.

939,186. SELECTIVE APPARATUS FOR SYSTEMS OF COMMUNICATION. Edward E. Clement, Washington, D. C., assignor to the North Electric Company, Cleveland, Ohio. Filed October 11, 1906. A cable or set of trunk wires is connected in multiple to corresponding terminals in all of a set of relays, each of which relays contains terminals of a number of electrical circuits, and each of a supplementary set of relays controls a branch from one only of the cable wires.

939,187 and 939,188. METHOD OF SELECTION IN SYSTEMS OF COMMUNICATION. Edward E. Clement, Washington, D. C., assignor to the North Electric Company, Cleveland, Ohio. Filed October 11, 1906. Describe methods of interconnection of the electrical circuits in the apparatus described in the previous number.

REISSUE.

13,035. TELEPHONE-TRANSMITTER. William W. Dean, Elyria, Ohio, assignor to the Dean Electric Company. Filed May 17, 1909. Original No. 823,768, dated June 19, 1906. Comprises a vibrating diaphragm, an independently-supported cup resting with its bottom against the diaphragm, the other parts of the cup being free from the diaphragm, an electrode supported by the cup, springs pressing the cup against said diaphragm, a second electrode independently and rigidly fixed with respect to the first, and granular conducting material between the electrodes in the cup.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 8, 1909:

485,618. APPARATUS FOR, AND PROCESS OF, REFINING COPPER BY ELECTRICITY. Franklin Farrel, Ansonia, Conn.

485,619. RHEOSTATIC CONTROLLER FOR ELECTRIC MOTORS. Jonathan P. B. Fiske, Lynn, Mass.

485,620. ELECTRIC MOTOR CONTROLLER. Jonathan P. B. Fiske, Lynn, Mass.

485,643. SWITCHBOARD FOR ELECTRIC-LIGHT CIRCUITS. John J. Moore and Catharine M. Henry, New York, N. Y.

485,645. ELECTRIC CLOCK. James D. McAnlis and Harvey E. Fleming, Beaver Falls, Pa.

485,658 and 485,659. ELECTRIC TRANSMISSION OF POWER. Edwin W. Rice, Jr., Lynn, Mass.

485,668. ELECTRIC RAILWAY SWITCH. Charles A. Stone and Edwin S. Webster, Boston, Mass.

485,669. CONTINUOUS-CURRENT TRANSFORMER. Elihu Thomson, Swampscott, Mass.

485,682. INCANDESCENT ELECTRIC LAMP. Augustus C. Carey, Lake Pleasant, Mass.

485,728. ELECTRIC RAILWAY SIGNAL. Adoniram J. Wilson, Port Chester, N. Y.

485,744. ELECTRIC ARC LAMP. George Kirkegaard, Brooklyn, N. Y.

485,754. ELECTRIC BELT. Emory N. X. Tefft, Iola, Kan.

485,767. ELECTRIC PERFORATING PEN. Aaron D. Lewis, Canton, Mo.

485,859. TELEPHONY. William Bruening, East Orange, N. J.

485,876. TELEPHONE. James W. McDonough, New York, N. Y.

485,895. ELECTRIC ARC LAMP. James R. Steers, New York, N. Y.

485,950. AUTOMATIC ELECTRIC SCALE. Paul J. Kuhbacher, Ashland, Ky.

486,029. ELECTRIC FORGE. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

486,051. TELEGRAPH SOUNDER. James Maret, Mount Vernon, Ky., and William L. De Graff, Homer, Mich.

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CONTENTS.

EDITORIAL:
A Tungsten Lamp for a Street Arc..... 971
Decision of the Worcester Appeal..... 972
Gyroscopic Balancing and the Brennan Monorailway..... 973
Boston Electrical Show..... 974
National District Heating Association..... 974
Dr. Steinmetz Lectures in Chicago..... 975
Annual Meeting of the Electrical Trades Association of Chicago..... 976
Electric Cooking—An Englishwoman's Experience..... 976
Independent Telephone Convention at Decatur..... 977
Navy Department Supplies..... 977
Power Sites Withdrawn..... 977
Control of Western Union Secured by American Telephone and Telegraph Company..... 978
Electrical Exhibition for San Francisco..... 978
The Brennan Monorail System..... 979
Electric Locomotives with Edison Accumulators..... 980
Chicago Electric Club..... 980
American Institute of Electrical Engineers, Meeting of November 12... 981
Newly Elected Associates, American Institute of Electrical Engineers. 985
A Vibrating Speed Indicator..... 985
CENTRAL-STATION PRACTICE:
Income From Cotton Mills..... 986
Grounding of Secondaries..... 987
Poor Municipal Wiring..... 988
Electricity From Peat..... 988
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
Street Lighting in Newark, N. J..... 989
New York Section, Illuminating Engineering Society..... 990
Chicago Section, Illuminating Engineering Society..... 991
Lamps for Residence Illumination..... 992
ELECTRO-CHEMISTRY AND METALLURGY:
Laws of Electrode Losses in Electric Furnaces..... 993
Electrolytic Bleaching..... 994
Gold Recovery by Electrolytic Amalgamation..... 995
INDUSTRIAL POWER:
Causes of Breakdowns in Electrical Machinery..... 996
Turbo-Electric Propulsion for Ships..... 997
Electrical Kitchen Machinery on Shipboard..... 997
The English Mining Situation..... 998
QUESTIONS AND ANSWERS.....999
ELECTRICAL ADVERTISING AND SELLING:
New Business Methods of the Electric Light and Power Company at Hamilton, Ont.....1000
FINANCIAL REPORTS OF ELECTRICAL COMPANIES.....1002
INDUSTRIAL SECTION:
New Single-Phase Motors.....1004
An Intercommunicating Telephone and Train Despatching System at the Erie Terminal, Jersey City.....1006
Gas Electric Motor Cars for Southern Railway.....1007
New Types of Holophane Reflectors.....1007
Largest Self-Cooling Transformer Ever Built.....1007
Special Motor-Generator Set.....1008
Large Railroads Adopt the Telephone for Train Despatching.....1008
CURRENT ELECTRICAL NEWS.....1009
RECORD OF ELECTRICAL PATENTS.....1016

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A TUNGSTEN LAMP FOR A STREET ARC.

Series tungsten lamps rated at 250 watts each are now on the market, and central stations can save money by substituting them for many of the street arc lamps now in use. For the old direct-current arc of 1,200 nominal candlepower and 300 to 330 watts, and for the common, enclosed alternating-current arc of 400 watts, the 250-watt tungsten may be substituted, lamp for lamp, with good effect. If the open arc of 2,000 nominal candlepower, or the 7.5-ampere alternating enclosed arc is to be replaced, equal illumination may be obtained by the substitution of a somewhat greater number of the 250-watt tungsten lamps.

Compared with the 400-watt alternating arc, the 250-watt tungsten is fully equal in the matter of mean hemispherical candlepower, but lacks perhaps twenty per cent of intensity in directions thirty to forty degrees below the horizontal.

If the substitution is made lamp for lamp, the power required of the central station is reduced from 330 to 250 watts where the open arc of 1,200 nominal candlepower is displaced, and from 400 to 250 watts where the alternating arc is abandoned. This latter reduction of power amounts to thirty-seven per cent for series transformers, generators and engines. More than this, the higher power-factor with the tungsten lamps makes a further gain in the capacity of apparatus. Assuming that the constant-current transformers are about nine-tenths loaded in each instance, the power-factor should be about seventy per cent with the arcs, and about ninety per cent with the tungsten lamps. With these power-factors, the demand on the generators is 571 volt-amperes per 400-watt arc lamp, and 277 volt-amperes per 250-watt tungsten lamp, neglecting line and transformer losses. In other words, each tungsten lamp requires forty-eight per cent of the generator capacity necessary for a 400-watt alternating-current arc.

At the station no change is necessary in the equipment when 250-watt tungsten lamps are put up in place of the street arcs, except that a part of the capacity in arc dynamos, rectifiers or constant-current transformers will be no longer required. The 250-watt tungsten lamps are made to operate with 6.6 amperes, like the 400-watt alternating arc and the old open arc of 1,200 nominal candlepower, so that the required ampere capacity of apparatus and lines remains the same. With 6.6 amperes the 250-watt tungsten lamp requires thirty-eight volts at its terminals, so that the number of these lamps may be twenty per cent greater than the number of open arcs on a direct-cur-

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rent dynamo, and fully double the number of 400-watt arcs on a transformer, because of the lower power-factor of the arcs.

The list price of the 250-watt tungsten lamp is $3.50 less discounts of ten and ten per cent in standard packages of one dozen each, giving a net price of $2.84 per lamp. As the manufacturers put the life of the tungsten lamps at 1,200 to 1,500 hours of use, it is conservative to estimate the cost of renewals on the basis of 1,000 hours life, which requires four lamps for a lighting year of 4,000 hours. On this basis the annual cost of renewals per 250-watt tungsten lamp is $11.36.

Against this cost of tungsten renewals should be set the annual expense of trimming and repairs on arc lamps, and a part of the expense of their inspection. Such costs must, of course, vary with wages, the location of lamps, and other local conditions, but the items of labor and supplies for trimming and repairs during 4,000 hours of lighting annually will be covered in many instances by $17.00 for each open arc of 1,200 nominal candlepower, and $7.00 for each 400-watt alternating arc. Where these figures apply, it appears that the renewal costs of the 250-watt tungsten lamp will exceed the trimming and repairs on the 400-watt alternating-current arc by about $4.36 per year, and will be less than the trimming and repairs on an open arc of 1,200 nominal candlepower by $10 yearly.

DECISION OF THE WORCESTER APPEAL.

In its decision, just announced, on the Worcester appeal the Gas and Electric Light Commissioners of Massachusetts affirm their previous conclusions in the case of the Fitchburg appeal. This Worcester appeal is the second to come before the commissioners from franchise grants to the Connecticut River Transmission Company for the sale of electric power in Massachusetts cities and towns.

As has previously been narrated, the Connecticut River company is engaged in the transmission and sale of electric power generated by the Connecticut River at a dam and hydroelectric plant in Vernon, Vt., several miles north of the Massachusetts line. The Connecticut River company is organized under the general laws of Massachusetts, and, as appeared at the Fitchburg and Worcester hearings, prefers to supply power only to large consumers, that is, in units of not less than several hundred horsepower.

In their grant of a franchise to the Connecticut River company, however, the Worcester aldermen provided that this company might supply any consumer whose motors and other apparatus connected for use had a rated capacity of not less than fifteen horsepower, and whose annual consumption should be not less than 22,500 horsepower-hours. As a fifteen-horsepower motor working at one-half load would deliver 22,500 horsepower-hours of mechanical work during 3,000 hours, the motor under these conditions would absorb 22,500 electric horsepower hours during a somewhat shorter period.

This provision of the franchise just stated was the one to which the Worcester Electric Light Company particularly objected in its appeal to the commissioners, the contention being that the Connecticut River company ought to supply no consumer with less than several hundred horsepower. It appeared at the hearing that the Worcester company had a connected load of about 2,000 rated horsepower in motors, and that the annual income from this source was about $54,000. It was also shown that the Worcester company has an extensive system of underground conduits in the city, and that the desire of the Connecticut River company was to make use of these conduits for the distribution of its power.

Since 1904, the motor load of the Worcester company had increased about eighty per cent, but its power income had increased only about forty-five per cent, because of reductions in rates. After the appeal was taken the Worcester company further reduced its power rates by about twenty-five per cent to the smaller consumers.

On these facts the commissioners concluded that the Worcester situation presented no sufficient reason to depart from the rule adopted in the Fitchburg decision, that the Connecticut River company may supply any consumer whose motors and other apparatus connected for use have an aggregate rated capacity of not less than 300 electric horsepower, and whose annual consumption shall not be less than 450,000 horsepower-hours. It may be noted that the operation of motors that consume 150 horsepower during 3,000 hours per year will give the required consumption of 450,000 horsepower hours.

In the course of its opinion the Board of Commissioners points out that if the Connecticut River company were to serve all classes of consumers its investment in a distributing system would increase the rates that it must charge for power, but if this company is to supply large consumers it cannot expect to receive much more than the cost to them of generating power. For the benefit of its consumers, the Worcester company should purchase such power as it requires that the Connecticut River company will sell at less than the cost of production to the Worcester company.

The grant of the Worcester aldermen limited the franchise of the Connecticut River company to twenty-eight years, but the commissioners remove the limitation, and say on this point:

"The provision in the order of the aldermen, limiting the exercise of privileges granted to a fixed term of only twenty-eight years, suggests, we believe, an entirely new departure in the treatment of similar companies in this state. Other states and municipalities have had experience in the granting of franchises for a definite limited term. Without attempting to fully discuss the important questions involved, we believe it is safe to say that such arrangements neither encourage the highest development of the properties involved, nor the lowest charges for service, and that they often discourage extensions and improvements, especially in the latter portion of the term. Where the privileges granted the company are not limited as to time, its relations to the public may, in the opinion of the board, be more effectively regulated and determined as the public interest may seem to demand by-laws and other requirements equally applicable to all companies of that class."

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The decision of the commissioners further provides that no purchaser of power from the Connecticut River company, except the Worcester Electric Light Company, shall, directly or indirectly, resell the same or any part thereof. Electric railways and railroads as well as the Worcester Electric Light Company are not limited in their purchases from the Connecticut River company by the provision as to 300 horsepower of motors and apparatus and a consumption of 450,000 horsepower-hours per year. These provisions, and also as to the resale of power purchased of the Connecticut River company, may be altered from time to time, on the written request of this company to the commissioners, or on the written complaint of at least twenty users of power in Worcester.

GYROSCOPIC BALANCING AND THE BRENNAN MONORAILWAY.

What may prove eventually to have been an epoch-making event was the recent demonstration in England of a full-sized, gyroscopically balanced, monorail car invented by Louis Brennan, and referred to in another part of this issue.

The gyroscope, the correct application of which is the feature of Brennan's invention, has up to comparatively recent times been regarded merely as an ingenious toy. Many people are acquainted with a few of its mystifying properties. With a form of the device which can be purchased at toy counters for a small price, many of these properties can be demonstrated. When the flywheel is caused to rotate at high speed, as by means of a string, it is difficult to hold the instrument in the hand, for a gyroscope of even a few ounces in weight will exert a surprising pull in resisting a force opposing its apparent inclinations. It will support itself, when the wheel is rotating at high speed, suspended in space at right angles to a string in apparent contradiction of all the laws of gravitation. If placed in a box while still spinning, the box will stand up on an edge or on one of its corners, nor will it fall down until the speed of the flywheel has become reduced beyond a certain (mathematically determinable) point!

The action of the gyroscope may be explained perfectly by the laws of rotating bodies, although the mathematics of the demonstration are not too elementary. The principle involved is, that if a mass is set in rotation about a principal axis of inertia of greatest or least momentum of the body, it will continue to revolve about this axis, and the direction of the axis will remain unchanged unless extraneous force is applied. The most wonderful property of the gyroscope is that when an effort is made to change the direction of the axis of rotation of the flywheel, the axis very forcibly resists such action and moves off in a direction at *right angles* to the direction of the applied force.

In Dr. Otto Schlick's invention for preventing the rolling of ships at sea, and which was very successfully demonstrated on the old German torpedo boat *Sea-bar,* the flywheel employed was one metre in diameter and weighed over 1,100 pounds. This was mounted amidships on a vertical axis. When it was caused to rotate at a velocity of about 1,600 revolutions a minute, by means of a specially designed turbine, and the secondary bearings of the gyroscope were released, the rolling of the ship was reduced from an oscillation of thirty degrees of arc to one of about one degree. The test was carried out in very rough weather, and the action of the Schlick gyroscope caused the ship's deck to remain almost exactly level, while the vessel as a whole heaved up and down with the waves. The *Sea-bar,* it may be noted, is 116 feet in length and has a displacement of about fifty-six long tons.

There is thus no doubt that the gyroscope as a balancing agent has been proved to be practical and powerful. The chance of its failure is infinitesimal, for a heavy gyroscope operating at high speed in a vacuum will run several days, and is effective as a balancer for many hours at least, before stopping, should the driving power be cut off from some cause or another. In the Brennan invention, the train, whether moving or stationary, is poised quite safely on the monorail as long as the gyroscopes are working safely. The speed of the latter, 3,000 revolutions a minute, or fifty revolutions a second, may be considered by some as extremely high, but this is not as great as the speed of many forms of turbines which have been safely operated for years. The mechanical difficulties have evidently been solved, as the reports of the recent trial in England of a car of commercial size do not tell of any hitch happening, and although troubles might develop in an extended trial under working conditions there would seem at this time to be no problem involved which could not eventually be successfully solved.

As with all inventions involving radically new ideas and upsetting all former traditions in their respective lines, it is difficult to predict the effect Mr. Brennan's invention will have on the traffic problem. Monorailways so far projected have met with little public favor. Apart from the toy line at Port Rush, in Ireland, the British monorail schemes so far promoted, namely, a high-speed line between Liverpool and Manchester, and another between London and Brighton, seem to have been abandoned for the time being, for nothing has been heard of them in reports from the other side for some time. If public confidence can be established in the gyroscopic monorailway and sufficient funds can be found to establish the venture commercially, it can safely be prophesied that passengers will be found to patronize the new idea, and this being done it only remains for the managers of the new undertaking to avoid accidents involving the destruction of human life to make the innovation permanent. It seems doubtful, however, that the gyroscopically balanced monorail system of Brennan will eventually supplant nearly all existing means of transportation, as has been claimed in some quarters, and it is probable that the new system, if commercially successful, will be restricted to a few high-speed lines, at least for many years to come. It will be interesting to note the operating cost of the gyroscope car, if and when the new invention can be commercially exploited.

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Boston Electrical Show.

The first Electrical Show to be held in Boston, and, in fact, New England, was opened auspiciously on the evening of November 15. For about six evenings preceding the opening night the show was excellently advertised throughout the city by means of three gorgeous electrically illuminated floats which were operated over the elevated and surface lines throughout Boston.

On approaching the Mechanics' Building, where the show is held, for some distance on Huntington Avenue on either side of the exhibition hall, the street was brilliantly illuminated by flaming arc lamps furnished by the Edison Electric Illuminating Company of Boston. The effect was so startling that the avenue has been called the "Great Yellow Way." From Copley Square to Massachusetts Avenue it is a blaze of light.

On entering the exhibition hall one was impressed with the magnificence of the ensemble. The entire scheme of decoration portrays an Italian garden which covers practically the entire main floor with sculptured columns of exquisite modeling and sunken electric water gardens on the surfaces of which there are lilies and other aqueous plants illuminated by small electric bulbs. There is a profusion of low balustrades which are a good imitation of Carrara marble, exquisite pergolas interwoven with carvings and clusters of grapes lighted in an apparently mysterious way from within, and interspersed among these are the typical plants of Italy.

There are thousands of lights in the ceiling of the structure. The balcony was treated in harmony with the general scheme, and along the front of it are bright colored awnings divided by elaborately trimmed cedars and directly below these are beautifully carved gargoyles holding festoons of incandescent lamps. There is an abundance of light on all sides, chiefly from tungsten lamps. Along the main floor there is a series of eight columns of honor which form a very striking feature. Each is surmounted by five large globes. About 100 small fluted columns mark the various passages and separate the exhibit booths from each other.

The largest, and by far the most elaborate exhibit, is that made by the Edison Electric Illuminating Company of Boston. This exhibit occupies the stage of the exhibition hall and is replete with artistic features. A striking one of these is an Italian perspective about forty feet high and 100 feet long. Thirty young ladies in Italian costume are in attendance at this exhibit. Among other prominent exhibitors on the main floor are the Westinghouse Electric and Manufacturing Company, the General Electric Company, Allis-Chalmers Company and the National Electric Lamp Association.

There is the usual display of electrical vacuum cleaning and washing machines on exhibition. In the basement of the building there is a comprehensive exhibit of electric vehicles, electrically operated printing presses and other industrial electrical applications, besides the exhibit of the Boston Elevated Railway Company.

There are quite a number of electrical novelties in addition to those commonly seen at similar exhibitions, such as electric incubators and cow-milking equipments. Among these new features is a submarine electric launch and Ovington's 1,000,000-volt oscilator and high-frequency machines.

A series of lectures has been arranged for in the lecture hall. The topics are of a popular character and comprise among others the following subjects: "Electricity in the Home," "Past, Present and Future of Electricity," "Store, Window and Sign Lighting," "Electric Power," "Possibilities of Electricity," "Commercial Electrical Vehicles." Besides these and other interesting talks, there is being given a series of demonstrations of wireless telegraphy and telephony, as well as a number of experiments with high-frequency apparatus.

All the prospects of the first few days of the show pointed to its marked success in every detail. The exhibits are made by the most representative companies and are displayed in an attractive manner. The attendance has been very good, and there is plenty to interest for all classes of the public. The Empire Woman's Orchestra discourses an interesting programme both afternoons and evenings, and from all points of view the indications are that this is the first of a very successful series of Boston Electrical Shows. The show closes on the evening of November 25.

The list of exhibitors is as follows:

DEPARTMENT A (Main Floor.)

Allis-Chalmers Company.
American Flaming Arc Lamp Company.
Anderson, Albert & J. M.
Bay State Electric Company.
Blake Signal and Manufacturing Company.
Burlingame Telegraphing Typewriter Company.
Condit Electrical Manufacturing Company.
Condit, S. B., Jr., & Company.
Campbell Electric Company.
Clapp-Eastham Company.
Day, The J. H., Company.
Di hl Manufacturing Company.
Duntley Manufacturing Company.
Duren & Kendall.
Dow Surgical Battery Company.
Edison Electric Illuminating Company.
Edison Manufacturing Company.
Electrical Review and Western Electrician.
Electric Cleaner Company.
Electric Storage Battery Company.
Electrical Contractors Association of Boston.
General Electric Company.
Gage Publishing Company.
Gest, G. M.
Holtzer-Cabot Electric Company.
Hurley Machine Company.
International Correspondence School.
Invincible Electrical Sales Renovating Company.
Ley, Fred T., & Company.
"1900" Washer Company.
National Acme Manufacturing Company.
National Electric Lamp Association.
New York Electrical School.
New York Pole Company.
Quimby, The W. S., Company.
Radio Reflector Company.
Singer Sewing Machine Company.
Simplex Electrical Heating Company.
Stuart-Howland Company.
Shelton Electric Company.
Snow, Franklin A.
Snow Iron Works, W. A.
Westinghouse Electric and Manufacturing Company.
Whiting, D., & Company.
Westchester Appliance Company.

DEPARTMENT B (Basement).

Adams, J. Q., & Company.
American Technical Society.
Baker, R. G.
Bailey, S. R., & Company, Inc.
Boston Electric Garage Company.
Boston Elevated Railroad Company.
Baker Electric Company.
Boston Lightning Rod Company.
Cross Paper Feeder Company.
Dodge Motor Vehicle Company.
Dearborn Drug and Chemical Company.
Electrical Testing Laboratories.
Electric Vehicle Company.
Knowles, C. S.
MacAlman, J. H.
Massachusetts Fan Company.
Mergenthaler Linotype Company.
Murdock, W. J., Company.
Neale, A. F.
Nugget Polish Company.
Rae Electric Vehicle Company.
Studebaker Brothers Company.
The Waverly Company.
Ziegler, P. R., & Company.

National District Heating Association.

The first annual convention of the National District Heating Association was held at Columbus, Ohio, on November 10 and 11. The convention was well attended, considering the youth of the association, which was formed at Toledo last July. The organization was perfected, and a short but good programme of papers was presented. Much interest was taken in the discussions. It was decided to hold the next convention at Toledo, Ohio, some time next May, the exact days to be decided by the executive committee. The prospects before the association are excellent, and the good it will do to central stations in pointing out another source of income and other means of getting new customers are already evident.

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Dr. Steinmetz Lectures in Chicago.

The second of the present series of joint meetings of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers was held on the evening of November 16 in Fullerton Hall of the Art Institute of Chicago. The speaker of the evening was Dr. Charles P. Steinmetz, who lectured on "The Conservation of Energy." The hall was thronged when Chairman W. L. Abbott of the Chicago Section opened the meeting by stating that the occasion was a memorable one since there were present three past presidents of the Institute, two past prsidents of the Western Society of Engineers and Secretary Ralph W. Pope, of the Institute. He introduced Bion J. Arnold, who acted as chairman of the meeting. Secretary Pope was called on for some remarks, and stated that the Institute is now well toward the lead of the engineering societies of the country. Continual efforts are being made to extend the influence of the Institute still further so that it may be represented in every section of the country. He referred briefly to his recent western tour and stated that he is now starting on another but shorter trip to the sections located in the cities of the Central West.

Doctor Steinmetz opened his lecture by calling attention to the fact that all matter is subject to the two laws of conservation of matter and the conservation of energy. The first of these laws is the older one, having been formulated some 200 years ago with the beginning of modern chemistry. The law of conservation of energy is about a century old. Both these laws are the foundation of modern science. The first one is very generally known. The law of the conservation of energy, however, is not so well known, for we still occasionally hear of attempts at perpetual motion. In brief, this law says that energy, like matter, cannot be created nor destroyed, it can only be changed in form. A corrollary of this law is that in every energy transformation some energy is apparently lost but really dissipated as low temperature heat. This is similar to our waste of matter and is known as the second law of thermodynamics. This degradation of energy requires a continual supply of additional energy.

Human beings are energy transformation machines. All the energy we obtain as food ultimately comes from the chemical energy of plants. These received their energy as radiant energy from the sun. Sunlight is the real source of all energy used to sustain animal life. This, however, is insufficient for our industrial needs. We must also use the energy of fuel, water power, etc. Coal is the chief source of this additional energy supply; it represents the chemical energy obtained from the sun in the carboniferous age. Water power represents energy obtained more directly from the sun. All sources of energy that we utilize revert ultimately back to the sun, except the tides, whose power is obtained from the rotational energy of the earth and the gravitational force of the moon; this is not very great, however, as a source of industrial energy.

Practically all our efficiency calculations are based on the law of the conservation of energy. For instance, we determine the electrical output of a generator and add the calculated losses to this to find the mechanical input. The calculation of problems dealing with only one form of energy is comparatively simple and accurate, but our calculations become more complex when different forms of energy are concerned. Here it is extremely valuable to make use of the law of the conservation of energy. This point was illustrated by considering the problem of calculating the force exerted between a horseshoe magnet and its armature. This is greatly simplified by equating the force times an assumed distance the armature has moved with the electrical work done by such an assumed movement. This method was also applied by the speaker to the problem of finding the force exerted between the primary and secondary coils of a transformer when the latter coil is short-circuited.

Even when treating a problem involving only one form of energy, it is often advantageous to make use of the law of the conservation of energy to bridge over some intricate portion of the problem. This was illustrated by considering what happens when a circuit is opened that contains inductance or capacity by showing the relation of the electromagnetic and electrostatic energy. The speaker emphasized the great value of the law of the conservation of energy as the convenient means of establishing relations between different forms of energy.

At the conclusion of the lecture the old question of what becomes of the mechanical energy of a tightly coiled spring that is placed in dilute sulphuric acid to dissolve was propounded to Doctor Steinmetz. The lecturer had a ready reply to this. He stated that the chemical action will be slightly more rapid than it would have been if the spring had not been under tension. Probably greater heat would also be developed during the solution. It would be difficult to determine this exactly, however, because the slightly increased heat evolved would be difficult to measure in comparison with the enormous heat set up by the solution. Doctor Steinmetz referred to the known fact that parts of an iron object under stress corroded more rapidly then those which are not subjected to stress as further illustrations of his conclusions.

Coercion Decision in Germany.

Deputy Consul-General Simon W. Hanauer writes from Frankfort that trusts and commercial combines in Germany have recently been the objects of an important legal decision, one of which he cites:

The director of one of the works of a syndicate addressed several letters to a firm purchasing goods from the syndicate works, threatening the firm that it would receive no more goods from the combine if the firm continued to purchase any goods from any concern not belonging to the syndicate. As the customer firm was dependent upon the combine for certain lines of manufactures it complied with the demand. Suit was then brought in the court at Schweinfurth against the director for having by his letters committed an act of coercion. The court acquitted the defendant, but the state's attorney brought the case on appeal before the Supreme Court of the Empire, which set aside the judgment rendered below, and remanded the case for retrial to the Criminal Court at Nuremburg, by which tribunal the director was found guilty of an attempt at coercion and sentenced to undergo thirty days' imprisonment.

Toledo Electrical Show.

The members of the Toledo Electrical Dealers' Association have planned a big electrical show and exposition to be held at the Toledo Coliseum during the week commencing January 31, 1910. This is designed to be the first of a series of annual shows which it is hoped to make a permanent winter feature for the city. An exhibit of electrical devices for cooking, heating, ironing and washing machines will be an attractive feature of the exposition. A series of lectures on electrical subjects and a program of amusements are also contemplated in connection with the show. H.

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Annual Meeting of the Electrical Trades Association of Chicago.

The fourteenth annual meeting of the Electrical Trades Association of Chicago was held at the University Club Friday evening, November 12. In every respect the meeting was an unquestionable success. The banquet room was tastefully decorated, a sumptuous repast was served, and the singing of old familiar songs, which was intermingled with the courses of the dinner, did much toward creating the spirit of goodfellowship which prevailed among the large assembly.

Following the dinner the report of the secretary and treasurer was read and adopted. Probably the most important feature of the necessarily brief business session was a motion made by James Wolff regarding changing the name of the association. The National Association is considering changing its name so as to substitute the word "Credit" for "Trades," and the motion made by Mr. Wolff was that the Chicago branch commend any action regarding this change taken by the National organization.

Toastmaster Charles E. Brown assumed charge of the meeting immediately following the completion of the business session and introduced the first speaker, Samuel Insull, president of the Commonwealth Edison Company, who delivered an entertaining and highly interesting address on "Thirty Years of Electrical Development."

Mr. Insull first explained how he became interested in electricity. While a young man and living in London he was attracted one morning by an American magazine, and in this publication read a story about Thomas A. Edison and his inventions. A few months later Mr. Insull was employed as the private secretary of Mr. Edison's European agent. Later he came to America and then actually saw an exhibition of the direct-driven unit, about which he had read in the magazine already mentioned. This unit consisted of a dynamo of Edison make and a Porter-Allen engine and was installed at Melrose Park.

Following this introduction Mr. Insull in chronological order mentioned various electrical developments and the rapid advancement of the industry up to the present time. The Central West can claim the first central station, as Appleton, Wis., was the first town to have such a distribution system. Shortly after this, however, a central station was put in operation in New York city. The first miniature railway was placed on exhibition in Berlin, Germany, in 1879. Two years later an electric road was put in operation. The electrical congress which met at the exposition held in 1881 made standard the electrical units now in common use, namely, the volt, ohm and ampere. It was also at this exposition that the first public demonstration was made of the direct-driven unit. In the years between 1882 and 1886 alternating current and the three-wire system came into general use and did much toward advancing electricity to the place it now holds. In 1886 Elihu Thomson made electric welding commercially practicable. Two years later Sprague's electric railroad was put in operation at Richmond, Va., and was successfully operated. This, Mr. Insull claimed, was the first commercial electric traction system. In this same year the first central station was established in the city of Chicago, although there were a number of isolated plants throughout the city at that time. The polyphase current patents, which formed a basis of the now well-known alternating-current machines, were also taken out during this year. The Paris Exposition, held in 1889, marked a milestone in the electrical industry. It was at this exposition that the now much-used watt and kilowatt were defined by the electrical congress held at that time. In the following year electric power transmission was successfully accomplished. The Chicago World's Fair, held in 1893, marked another milestone in electrical development. This fair was decidedly an electrical one, and many electrical developments which are now important features in the industry owe their origin to this fair. The year 1895 is noted electrically for the invention of the X-ray machine and Marconi's invention of wireless telegraphy in Italy. The developments during the succeeding years up to 1909 were briefly outlined, and in conclusion, Mr. Insull presented figures which are overwhelming in view of the fact that only thirty years have elapsed since electricity was first used commercially to any appreciable extent. In the city of Chicago alone the electrical industry represents a capital of $500,000,000. Other figures presented by the speaker showed that there are at present 5,000,500 telephones in use; 40,004,072 miles of electric traction representing an investment of approximately $4,000,000,000, 6,000 central stations in the United States, of which number over 3,000 are engaged in the electrical supply business. These central stations develop approximately 2,000,000 horsepower and have a gross yearly income of $250,000,000.

Following the address of Mr. Insull, James Wolff, the national representative of the Chicago branch, delivered a brief address, reviewing business transacted at the National Association's meetings.

Judge Frederick L. Fake delivered a brief but interesting address entitled, "Observed from the Bench." Judge Fake compared the different courts throughout the United States, showing the different classes of cases, attorneys and people who appeared before the various courts, also the difference in time between deciding cases in the lower courts with the time allowed in the higher ones.

H. E. Hackenburg, of the National Carbon Company, Cleveland, Ohio, read a paper entitled, "Our Association." After reviewing the association's history and outlining a number of benefits to be derived from being a member, Mr. Hackenburg confined his paper to examples of the benefits the company he represented derived from its membership. He outlined briefly the credit system being used by his company and explained the methods used when prospective customers applied for credit, thus showing the value of the membership in the Electrical Trades Association.

Toastmaster Brown next introduced C. E. Kremer, who amused the assembly by his recitation of amusing poems and comic stories.

For the ensuing year the following officers were elected or re-elected:

Frank M. Pierce, of the Manhattan Electric Supply Company, president.

Frank Horton, of the Moran & Hastings Manufacturing Company, vice-president.

James Wolff, New York Insulated Wire Company, national representative.

Frederic P. Vose, secretary-treasurer.

The executive committee is composed of the following members: A. B. Conover, John A. Roebling's Sons Company; E. Kennedy, Central Electric Company; Wm. A. Browne, M. B. Austin & Co.; Frank Horton, Moran & Hastings Manufacturing Company; Thos. I. Stacey, Electric Appliance Company, and A. O. Kuehmsted, Gregory Electric Company.

Electric Cooking—An Englishwoman's Experience.

Some time ago an abstract was given in these columns of an article by a correspondent of *The Electrical Review*, of London, Eng., signing herself "Maud," which was interesting as showing the views of the one ultimately most concerned, of the housewife, in other words, on elec-

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trical appliances for the household. The following item is a further contribution from the same litterateur, which appeared in a recent issue of our London contemporary:

After a somewhat chequered and interesting experience with regard to electric lighting and the simpler forms of electric heating and cooking, I decided to try an electric oven. The majority of housewives shrink from this mode of cooking chiefly on account of cost, but the information which I have at hand, based on my own experience, contradicts this commonly asserted notion, that electricity is very dear for cooking purposes.

Let us take first the simplest and most commonplace method of cooking—that of a coal fire—and suppose we have to deal with an average-sized cooking range; this, I find, costs, on an average, to cook a dinner consisting of a joint (about five pounds), pudding, pastry and vegetables, about five cents in coal, allowing for coal at $4.00 per ton; you may say that for this price you also have a constant supply of hot water, but this is not always the case, as usually the boiler damper must be closed to allow sufficient draft to heat up the oven, and therefore the cost of heating water for the house is an entirely separate charge.

Passing on to gas cooking, it is found that this costs for the same dinner six cents; this price does not include the time and gas taken to heat up the oven or the greater time taken to rid the oven of the objectionable smells (if the latter precaution is not taken the smell permeates the food).

Thirdly, we come to electric cooking, as regards the cost of which the majority have such hazy notions. This costs for the same dinner five cents, with electricity at two cents per kilowatt-hour. On the top of the oven stands a boiler for vegetables, etc., all the rest of the cooking being done in the oven. This oven is controlled by a switch, which allows for three heats; the first of these is low, costing two-thirds of a cent per hour; the second, which is medium, costs a little under one and one-half cents per hour; the third is high heat, with all the heaters in use, the cost being a little less than three cents per hour,—with electricity, as previously mentioned, at two cents per kilowatt-hour.

The electric oven takes a very short time to heat up to its maximum temperature, and when so heated can be easily regulated by the aforementioned switches, with the result that meat can be cooked to perfection, and cakes and pastry browned, in a way almost impossible with the ordinary cooking range. It will also be found that the lighter forms of confectionery can be cooked after the current has been switched off, by means of the heat contained in the oven.

As will be seen by this article I am enthusiastically in favor of electric cooking, though I must confess that previous to my experience with this most useful form of cooking, I was rather skeptical both as regards the cost of electricity for cooking purposes, and as regards the reliability of cooking utensils, but I have now nothing but praise for the same, after having given this oven a good and fair trial.

It would probably be interesting to many readers to know whether electric cooking is as satisfactory as cooking by coal or gas. My experience has taught me that electric cooking is far ahead of its competitors for cooking purposes, owing to the very even temperature obtained, which, as every lady knows, is essential to produce satisfactory results. The only fault I have to find is the entire absence of a ventilator on the oven. The want of this ventilator means that there is always, when cooking, a fair amount of steam in the oven, and this tends to take up some of the heat which should be given to the contents of the oven. I am sure this small thing has only to be appreciated by the makers to be remedied.

On the score of cleanliness the oven has no equal; all that is required after cooking is wiping out with a damp flannel, as there is no possibility of dust and dirt as with fires, and absolutely no smell is left in the oven after cooking is done. When the oven is switched on, that is all that is necessary for the heating of it, and there is not the continual poking and building up as with the coal fire, which must be done to keep the oven to a maximum even heat, the result of all this poking being that the heat of the ordinary oven is continually varying.

From the numerous questions I have been asked with regard to electric cooking, it is clear that ladies are extremely interested in the subject, and I feel confident now that the bogy of cost is rapidly disappearing that the electric oven will soon become a household article.

Independent Telephone Convention at Decatur.

At the meeting of the Independent Telephone Association at Decatur, Ill., steps were taken toward the formation of a more permanent organization for the protection of the independent telephone interests of the state. The final words of the retiring president, Manford B. Savage, made an urgent plea for a campaign against the telephone monopolies. A committee of five was elected to work out a plan for closer union of the independent companies and to take the necessary steps toward incorporation.

As the result of an election held at this meeting, C. B. Cheadle, president of the Decatur Home Telephone Company, was elected president. Other officers were elected as follows: F. C. Woods, Galesburg, vice-president; W. W. Holiday, Jacksonville, treasurer; M. B. Farwell, Bloomington, secretary.

Navy Department Supplies.

The Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., will open bids on the dates given below for the following electrical equipment and supplies. Bidders should without delay make application to the Bureau for copies of the schedules they are interested in, being careful to give the number of each schedule. Copies can be obtained on application to the Navy Pay Office nearest each navy yard.

NAVAL SUPPLIES.

Date of Opening.	Material.	Quantity.	Delivery at Navy Yard.	Schedule No.
November 30, 1909	Appliances, wiring	Miscellaneous	Annapolis, Md.	1938
	Fittings, conduit	Miscellaneous	Brooklyn, N. Y.	1940
	Mica, India, uncut	100 pounds	Washington, D. C.	1944
	Mirrors, parabolic	6	Brooklyn, N. Y.	1940
	Motor starters and circuit-breakers	Miscellaneous	Norfolk, Va.	1948
	Rosettes	3,000	Brooklyn, N. Y.	1940
	Receptacles	1,000	Brooklyn, N. Y.	1940
	Sockets, fiber-lined	3,000	Brooklyn, N. Y.	1940
	Wire, magnet, etc.	520 pounds	Washington, D. C.	1944
December 7, 1909	Machines, planing, motor-driven	2	Washington, D. C.	1962
	Planer, automatic bevel-gear, 36-inch, motor-driven	1	Norfolk, Va.	1964

Power Sites Withdrawn.

Secretary Ballinger has issued an order for the conservation of the waterpower rights on public lands. Without waiting for decisive legislation to learn what will eventually be done with many lands valuable for waterpower, the Secretary withdrew from disposition over 8,000 acres of such land located in the states of Montana, Idaho, Colorado, Washington and Wyoming and New Mexico.

This land now being in the public domain will probably be affected by legislation to be enacted during the next Congress. Until Congress decides just what is to be done with the land and the terms upon which it is to be utilized, the Secretary will keep a tight hold upon it. The land is located as follows: Six hundred and eighty-four acres on Red Rock Creek, Montana; 1,627 acres on Clark Fork in Montana and Idaho, 3,584 acres on the Gunnison River and tributaries in Colorado and New Mexico, 1,498 acres on the Klicitat River in Washington, 200 acres along the Judith River in Montana and 712 acres along the Green River and tributaries in Wyoming.

Electrical Sales Possibilities in India.

The following information concerning electrical equipments and supplies in India is furnished by Vice-Consul-General Charles B. Perry, of Calcutta: There seems to be an excellent opening in India for small electrical installations for furnishing light and running fans in country places and in places away from power stations. A number of successful installations have recently been made for twenty-five-volt lamps, one for which details are available, being arranged for thirty lights, and eight electric fans. The battery is easily contained in an unused corner, and occupies floor space of seven by four-and-one-half feet. The power house containing the dynamo, which is driven by a small oil engine, is placed some distance away. There is a large field for similar installations, and American electrical companies are urged to investigate this opening.

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Control of Western Union Secured by American Telephone and Telegraph Company.

In the issue of July 3 the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN referred at some length to the preliminary reports that were then current, stating that the American Telephone and Telegraph Company had secured control of the Western Union Telegraph Company. That there was substantial basis for these reports is borne out by the announcement made on November 16 that the deal has been completed, and a controlling interest in the Western Union Telegraph Company secured by the American Telephone and Telegraph Company.

This is an important move tending toward the complete merging, or friendly alliance at any rate, of the large telephone and telegraph interests of the country. The stock of the American Telephone and Telegraph Company is largely owned by the Mackay Companies, which own the Postal Telegraph and Cable Company. Persistent rumors within the last few weeks in relation to certain deals made by James S. Brailey, Jr., tending toward the merging of certain independent telephone companies of Ohio, have asserted that there were larger interests back of these moves, and the latest reports in this connection connect the Postal Telegraph and Cable Company with these deals. Although the matter is largely conjecture there is a persistent rumor that a complete affiliation of all the telegraph and telephone companies is to be carried out.

The growth of the friendly feeling between the Western Union Telegraph Company and the American Telephone and Telegraph Company was indicated in the last annual report of the former, in which the statement was made that the holdings of stock of the Western Union in the New York Telephone Company were disposed of to the American Telephone and Telegraph Company. An outline of the Western Union's annual report was given in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of October 30.

The authorized capital of the American Telephone and Telegraph Company is $300,000,000 stock, of which about $250,000,000 is outstanding. There are also outstanding about $50,000,000 bonds convertible into stock, and in addition $53,000,000 collateral trust bonds, and about $25,000,000 of notes. The Western Union Telegraph Company has an authorized issue of about $100,000,000 stock, and outstanding bonds of about $38,700,000.

President T. N. Vail made the following statement in regard to the latest developments in the merging of the two companies.

"From the very commencement of the telephone business it has been thought that a close co-operation—the making of one business the auxiliary to the other business—would give additional public service, as well as result in large economies both to the public and to the companies.

"There is much to be gained by the joint construction and maintenance of plant, and by its common use to the greatest possible extent, but the greatest advantage would follow the placing of millions of telephone subscribers in close and reliable connection with the receiving and dispatching offices of the telegraph companies.

"While some provision for this after a manner exists to-day, a lack of harmony and co-operation between the companies and an inability to agree on methods of fixing responsibility has limited its utilization to cases of absolute necessity.

"The harmony and co-operation necessary, it is believed, can now be established and the resulting advantage made available for the public.

"The telegraph service is analogous to the mail service in that it is the collection, transmission or transportation and delivery of correspondence, the difference being that the mails transport the actual communications, while the telegraph transmits the contents of the communication from office of origin to office of destination. From the collection to the delivery of the correspondence the entire work is done by the staff of the telegraph company.

"The telephone, on the other hand, enables persons too distant from each other for ordinary conversation to engage in personal communication with each other by placing at their disposition for a time a telephone circuit.

"While there is a common feature in the use of wires strung on poles or in cables, the similarity ends there; the circuits and methods used for the telegraph and the telephone are entirely distinct and different, and each business requires its special equipment, operating force and general business organization.

"It seems not only to be good policy but a duty to increase the service and advantages to the public by utilizing present unutilized possibilities, and at the same time benefit property and increase revenue."

It is expected that changes in the personnel of the organization will be made, and it is rumored that W. H. Baker, formerly vice-president and general manager of the Postal Telegraph Cable Company, will become general manager of the Western Union Telegraph system.

Electrical Exhibition for San Francisco.

At a convention of electrical firms recently held at San Francisco the proposition of having an electrical exhibition during the coming winter was decided on. Representatives from supply houses and manufacturers throughout the United States gave this exposition their approval and promised their support.

The exposition, which is to take place at the Coliseum, from January 29 to February 5, will be one of the best in this country. It is said that out of 40,000 feet of floor space, 26,000 has already been subscribed for, and there will be no difficulty in disposing of the remainder. It is the intention of the projectors to exhibit all the electrical inventions of the past twenty years, and arrangements are being made to secure the principal features of the Madison Square Garden show.

The committee in charge of the project is: E. M. Scribner, chairman; W. W. Briggs, vice-chairman; R. B. Elder, John R. Cole and W. S. Goodwin.

Subway Extension Approved.

The New York city Board of Estimate has unanimously approved the plan of the White Plains Avenue extension to the Westchester Avenue subway route. This section runs from Bear Swamp Road to Westchester Avenue, and apparently gives the Public Service Commission a lever with which to compel the Interborough company to build an extension from West Farms to connect with the Westchester Avenue route, as the new route just approved makes it possible to connect the Westchester extension with the proposed Broadway-Lexington Avenue line.

A Texas Decision.

In a decision handed down by the Court of Civil Appeals in session at San Antonio, Texas, in the case of the Galveston, Harrisburg & San Antonio Railroad Company versus the Houston Electric Company, on appeal from Harris County, it is held that the traction company cannot be restrained from building a suburban electric line across the tracks of the appellant company. In the lower court a writ of injunction was secured, but it was later set aside.

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THE BRENNAN MONORAIL SYSTEM.

SUCCESSFUL DEMONSTRATION IN ENGLAND OF A FULL-SIZED CAR.

Webster's New International Dictionary, recently published by the G. & C. Merriam Company, of Springfield, Mass., defines the term "gyroscope" in the following words: "An apparatus consisting essentially of a heavy-rimmed flywheel capable of rotation at great speed on a pair of bearings contained in or fastened to a piece, usually a ring or gimbals, so as to have additional freedom of movement in one or more directions." An encyclopedic note after the definition mentions among other uses of the gyroscope its applicability in a proposed type of monorailway. The monorailway herein indicated is the invention of Louis Brennan, the well-known inventor of the torpedo that bears his name.

A recent dispatch from London states that Mr. Brennan has at last constructed a full-sized car on his system, and a demonstration which was given last week at Chatham, England, was very successful.

Mr. Brennan's invention consists of a railway system in which the cars run without any external methods of support on a single line, or monorail, as it is called. Balancing is accomplished by means of two gyroscopes three feet six inches in diameter, weighing together one-and-one-half long tons, and rotating at the enormous speed of 3,000 revolutions a minute. The car itself is forty feet in length, ten feet wide, and thirteen feet in height to the top of the cab in which the machinery is contained. It weighs twenty-two long tons empty and has a carrying capacity of upwards of ten tons. A gasoline engine carried by the car generates the electric power by which the gyroscopes, and also the car itself, are driven.

In the demonstration at Chatham, forty persons were carried in the car which ran backward and forward along a straight monorail track and negotiated with perfect ease a sharp curve of one-eighth of a mile circle. The gyroscopes, which rotate in a vacuum and are automatically controlled as to procession by a pneumatic device, worked so perfectly that stability was maintained even when all the passengers moved over from one side of the car to the other. In every case the car automatically adjusted itself to a new balance.

The inventor claims that his new system of gyroscopic balancing will eventually revolutionize the railway system of the world. It is an admitted fact that with Mr. Brennan's system the maximum speed of railway traffic can be very largely increased, and it is asserted that the new invention makes possible a safe speed of over 100 miles an hour, a rate of traveling which is impossible under the conditions which now obtain with the present methods of railroad construction and operation. It seems hard for the average person to realize that the gyroscopically balanced car will not topple over. The action of the gyroscope, however, although in apparent contradiction of the laws of gravity, is capable of perfect explanation on mechanical principles.

Regarding his invention, Mr. Brennan is quoted by the Chicago *Tribune* in part as follows:

"When my new invention is brought down to a commercial basis, which time is not far distant, men will travel in railways with the same comfort now found on the biggest ocean liners in a perfectly smooth sea. Each train will then have its concert room with its orchestra, its promenade, its smoking rooms, its bathrooms, sitting rooms—in fact, every comfort and convenience we now find at home—for I look for the construction, as a complement to the introduction of my invention, of much larger cars than are now the rule on our railroads.

"For instance, I have drawn plans for a passenger car 100 feet in length and twenty feet wide, and I do not consider that an excessive estimate of the size of the railway coach of the near future. I predict a speed of at least 200 miles an hour, a saving in the wear and tear of rolling stock, economy in the cost of construction and maintenance.

"The principle of the invention is, of course, applicable to motor cars as well and is bound to result in the revolution of automobile construction in the next few years. As some of the advantages of the gyroscopic automobile over the present style I will say that it cannot tip over, there is much less danger of skidding, and it will take a much greater incline and there is an absence of side motion.

"The characteristic feature of this system of transport is that each vehicle is capable of maintaining its balance upon an ordinary rail laid upon sleepers on the ground, whether it is standing still or moving in either direction at any rate of speed, notwithstanding that the center of gravity is several feet above the rail and that wind pressure, shifting of load, centrifugal action, or any combination of these forces may tend to upset it.

"Automatic stability mechanism of extreme simplicity carried by the vehicle itself endows it with this power. The mechanism consists essentially of two flywheels rotated directly by electric motors in opposite directions at a high velocity and mounted so that their gyrostatic action and stored-up energy can be utilized. These flywheels are mounted on high-class bearings and are placed in exhausted cases, so that both air and journal friction are reduced to a minimum, and consequently the power required to keep them in rapid motion is small.

"The stability mechanism occupies but little space and is conveniently placed in the cab at one end of the vehicle. Its weight is also small, about five per cent of the total load being considered an ample allowance for the first vehicle.

"The road wheels are placed in a single row beneath the center of the vehicles instead of in two rows near the sides as usual and are carried on bogies or compound bogies, which are not only pivoted to provide for horizontal curves on the track but for vertical ones also. By this means the vehicles can run upon curves of even less radius than the length of the vehicle itself or on crooked rails without danger of derailment.

"Everything points to great economy resulting from making the vehicles wider in proportion to their length than on ordinary railways.

"Flying lines of railway can be laid with great rapidity over uneven ground with slight expenditure of labor. Specially designed building vehicles are also planned on the monorail principle and equipped with electric gear for handling the rails, being kept at the rail head for the purpose. It is confidently anticipated that working in this manner it will be possible to keep up with an army on the march and supply it with all its requirements.

"Bridges are of the simplest possible construction, a simple wire hawser stretched across a ravine or river being all that is necessary for temporary work. These hawsers can be built up on the spot from separate wire rope strands, so that the transportation of them becomes an easy matter. Strange to say, the lateral swaying of the hawser does not disturb the balance of the vehicles and the strongest winds will fail to blow them off. In other cases of bridge building a single row of piles with a rail on top suffices or a single girder carrying the rail may be conveniently used."

Other uses of the gyroscope have already been exploited commercially, in the

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Obry gear, which is used for automatically steering the well-known Whitehead torpedo, in a device recently invented by Dr. H. Anschütz-Kämpfe, designed to replace the mariner's compass or to serve as a check on its accuracy, in a contrivance invented by Dr. Otto Schlick to prevent rolling of ships at sea (see editorial pages), and in various proposed methods for automatically balancing aeroplanes and dirigible balloons.

Mr. Brennan has apparently demonstrated that his invention is practical, and it will be interesting to note how far it will be adopted, and whether the traveling public will avail itself of the opportunity to travel at a rate of speed which is even more revolutionary than was the steam locomotive over the earlier and more primitive methods of transportation.

Electric Locomotive with Edison Accumulators.

In order to avoid the disadvantages of lead accumulators, their weight, and the development of odors and fumes, the firm of F. Schichau has chosen the Edison accumulator as a source of power for the electric locomotive built by it. A small, normal-gauge locomotive, 7.8 metres in length, including buffers, was built for experimental purposes. The accumulators are installed in the front and rear in the usual way in spaces protected from outside influences by tight covers.

The battery consists of 408 Edison cells, type H45, of 280 ampere-hour capacity, so that the average discharge tension is 501.8 volts. Groups of four cells are contained in wooden frames, the individual cells being joined by rigid connections. The dimensions of the cells are: Length, 170 millimetres; width, 128 millimetres; height, 310 millimetres, without binding posts. The entire weight of the battery, including wooden frames, is about 5,900 kilogrammes; that is, only 14.5 kilogrammes per cell. Each cell consists of a thin-walled, heavily nickeled iron vessel, with projecting binding posts; an opening for filling; and a valve for letting out the entirely odorless gases. The vessel encloses a number of nickel-plated iron plates with perforated pockets of sheet steel. These pockets contain the active substance, which in the positive plates consists of nickel oxide and in the negative plates of iron oxide pressed into them under very high pressure. There is one negative for every two positive plates. The distance between the individual plates is only 1.5 millimetres, and they are insulated from each other by thin hard-rubber rods. From the bottom and walls the plates are insulated by hard-rubber disks. The electrolyte is a twenty-one per cent solution of caustic potash. According to experience, the life of the plates is equal to over 150,000 car-kilometres.

The further equipment of the locomotive consists of two series motors of thirty-five horsepower each, which drive the axles by means of simple gear transmission, a controller, measuring instruments, automatic cut-out, and hand brake. The total weight of the locomotive is 19.5 tons; that of the wagon frame being 9.8 tons; of the motors and controlling apparatus 3.8 tons, and of the battery 5.9 tons.

The locomotive, drawing a car of 30,000 kilogrammes, traveled 212.5 kilometres on a single battery charge. At the conclusion of the trip the battery still had a tension of about 468 volts, which showed that it could have traveled another fifty kilometres. The tests with this experimental locomotive were so favorable that the above-named firm has concluded to build and introduce locomotives of this type.—*Abstracted from Elektrotechnische Zeitschrift (Berlin), October 21.*

Chicago Electric Club.

The speaker on the occasion of the regular weekly midday meeting of the Chicago Electric Club on Wednesday, November 10, was Millard B. Hereley, traction expert of the city of Chicago, who gave an interesting talk on the traction situation in Chicago.

After duly apologizing for his title, Mr. Hereley started with the time when the only means of transportation were the horse car and other horse-drawn vehicles, and briefly reviewed the traction situation up to the preesnt time. For many years the people of Chicago tolerated a system which was far behind the times, and it was not until 1907 that the now well-known ordinances were passed by the City Council which meant a new traction system for Chicago.

Although a great deal has been accomplished so far, as is evidenced by the many miles of new track representing an expenditure of millions of dollars and the large number of modern cars, Mr. Hereley made many suggestions for the betterment of the entire system. For a remedy of the surface traction problem, he suggested that the north and south lines be through-routed. As an example, that the Kedzie Avenue, Western Avenue, Halsted Street and similar lines be operated from the extreme southern boundaries to the northern boundaries of the city. Also that lines operating east and west be terminated before crossing the downtown north and south lines.

Regarding the elevated situation, the speaker referred to the recent controversy regarding the loop problem, and said emphatically that the loop should be abolished. Another question of vital importance which is pressing upon the community and which must be answered in the near future is the proposed subway. However, Mr. Hereley refrained from giving any information on that subject.

The points emphasized in the address as tending toward the betterment of the traction situation were: A three-level system consisting of subways, elevated lines and surface lines, the elevated system to handle the long-haul traffic, the surface lines to handle the short-haul traffic, and the subway to accommodate the overflow traffic from the other lines; a single ownership for all lines; universal transfers; through routing, and abolishment of the present elevated loop in the business district.

In a conclusion bordering on the dramatic, Mr. Hereley said the present condition of the surface and elevated lines is holding Chicago as in the coils of an anaconda. A great steel corset encircles her waist and cuts off her respiration and circulation and impedes her progress. This great corset must be torn from her cramped and deformed body, so that healthy development, north, south and west, may be made possible. When this is done Chicago's business center will spread like a green bay tree. Her urban circulation will become normal and her rich commercial blood will flow through her veins like the torrent of a Niagara, and Chicago, the jeweled queen of the mighty West, with her motto "I Will" emblazoned on her crown, will stand erect, refulgent in the view of the world, full of hope and promise and commercial power.

New Bridge Franchise.

The Public Service Commission has approved the franchise granted by the New York city Board of Estimate to the South Shore Traction Company to construct a trolley line in Queens and run cars across the new Queensboro Bridge.

After the Commission had granted the certificate of necessity and convenience to the company, the Board issued the franchise. The Commission then refused to approve it, objecting to the terms.

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AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

THE ELECTRIC SYSTEM OF THE GREAT NORTHERN RAILWAY COMPANY AT CASCADE TUNNEL.

The two-hundred-and-fortieth meeting of the American Institute of Electrical Engineers was held on Friday evening, November 12, at the Engineering Societies Building, New York city, with President Stillwell in the chair. After the meeting was called to order Secretary Pope announced that at the meeting of the board of directors held in the afternoon, twenty-eight associates were elected and one associate transferred to grade of member.

The president then made a few introductory remarks prior to introducing the speaker of the evening, Dr. Cary T. Hutchinson, of the Great Northern Railway, who was to read a paper on "The Electric System of the Great Northern Railway Company at Cascade Tunnel." He said that it is certainly a fact of great interest that in this year 1909 a three-phase railway installation of magnitude had been completed and put into commercial operation in the United States. Polyphase motors were brought to this country in 1888. Those which arrived in that year were at about one-quarter horsepower, but none of them ever succeeded in producing that amount of power. Serious efforts were made at that time by American engineers, connected with one of our manufacturing companies, to adapt this motor to railway purposes, but the conclusion reached was that the constant-speed characteristic of the motor rendered it unsuitable for that purpose. He reviewed the development of the electric traction problems in Europe, and continuing, said that in the United States but little attention was paid from 1890 until recently to the practical application of the polyphase motor to railway purposes. It received during that period, it is true, very serious and careful study, but the conclusions reached were negative, and it was not introduced in commercial service in this country. In the United States today, there are three different electric systems operating electric traction of the heaviest kind, direct-current system, the single-phase alternating, and the three-phase alternating-current systems. All of these are doing their work not only successfully, but in a manner that shows a marked improvement, as compared with the steam locomotives which they superseded. The railroad managements of the country are beginning to awake, and are asking the question—which is the best system for general railway work? and that question, Mr. Stillwell said, is going to be answered by the electrical engineers. He then introduced Doctor Hutchinson, who made a few introductory remarks before beginning the reading of his paper, an abstract of which follows:

The first three-phase installation on a trunk line railway in the United States was put into operation early in June of this year at the Cascade Mountain Tunnel on the Great Northern Railway in Washington, about one hundred miles east of Seattle. In general the plant supplying current for this system comprises a hydroelectic generating station operating under a head of one hundred feet, having a capacity of approximately 5,000 kilowatts in generators at 6,600 volts and twenty-five cycles; a transmission system at 33,000 volts delivering energy to the substation, where it is transformed to 6,000 volts, at which pressure it is supplied to the overhead conductors and to the locomotive by way of an overhead trolley; on the locomotive the pressure is reduced by three-phase transformers to 500 volts for the supply of the four three-phase motors with which each locomotive is equipped.

The Great Northern Railway crosses the Cascade Mountains through a tunnel 13,873 feet long. The operation of this tunnel with steam locomotives was at all times difficult and frequently very dangerous on account of the heat and smoke from the locomotives. The temperature in the locomotive cab was almost unbearable. The tunnel is lined with concrete throughout its length and is in good condition. The entire tunnel drips more or less from condensed steam just after the passage of a train, but is comparatively dry at other times. The temperature changes at the top of the tunnel are very rapid, varying the atmospheric temperature several hundred degrees from the heat of the locomotive exhaust. For many reasons this tunnel is a limiting feature to the capacity of the Great Northern Railway for hauling freight across the mountains. The plant described is designed for use over the entire mountain division by extending the system of conductors and building additional stations.

The principal data of the locomotives are as follows: Total weight, 230,000 pounds, all on drivers; two trucks connected by a coupling, each truck having two driving axles; a three-phase motor connected by twin gears to each axle; synchronous speed of motor 375 revolutions per minute, giving a speed of 15.7 miles per hour at no load and dropping to fifteen miles per hour for a load corresponding to a one-hour rating. The motors are wound for 500 volts and are completely enclosed and air cooled. The specifications of the motor required an output of 250 horsepower continuously for three hours, with seventy-five degrees Centigrade temperature elevation when supplied with not more than 2,000 cubic feet of air per minute. Each locomotive is equipped with four three-phase induction motors wound for 500 volts at the primary or stator; the motors are completely enclosed and air cooled by forced air circulation from a large blower. They are suspended from the axles in the standard manner, except that they are geared at both ends of the armature shafts, this being made necessary by the low speed and high torque required, as it was not considered safe to use a single pair of gears. The locomotive carries two three-phase air blast transformers, having a nominal rating of 400 kilowatts each, transforming from 6,000 volts to 500 volts normal, or to 625 volts by the use of taps. The continuous capacity of the transformer is not as great as that of the motors, although it is fully up to the specifications, and it may be that the quantity of air to the transformer will have to be increased when the locomotives are put in continuous service. The control system of each motor is separate; the circuits branch from the transformer and are independent from the resistances. There are fourteen conductors in each motor circuit, fifty-six in all. The pilot control is in duplicate and there is one switch at each end of the locomotive. There is a clear aisle on each side of the locomotive from end to end, all of the apparatus being assembled in the center of the cab.

The locomotive is of the articulated or hinged type, having four driving wheels on each half of the running gear, and is without guiding wheels. The running gear is comparable to the Mallet type of steam locomotive, in that the hinge sections are so connected that they tend to support each other vertically and guide each other in taking the curves. The cab is carried on the trucks through center pins on each bolster, the center pin on one end having a slight longitudinal sliding motion to allow for variation in the distance between truck center pins in taking curves. The cab extends the entire length of the platform.

The energy supply for the locomotive is derived from the Wenatchie River, which flows along the line of the railway for a distance of some twenty miles. The power house is designed for three main units and two exciter units. There are now installed in the power house two main units, each being a turbine rated at 4,000 horsepower directly connected to a three-phase generator of a capacity of 2,500 kilo-volt-amperes, at 6,600 volts and twenty-five cycles. These machines are designed to have very large overload capacity and operate at a low flux density. There are two exciter units, each having a nominal capacity of 125 kilowatts. These units also have a large overload capacity. The power house contains four transformers for raising the pressure to 33,000 volts, each of nominal capacity of 833 kilowatts and guaranteed to operate 100 per cent overload for one hour with a low rise in the temperature. The switching apparatus is of the usual type.

The transmission line extends to the substation, approximately thirty miles away, following the railroad all the way. In the design of the line, as in other features of the work, the aim was to secure apparatus and types of construction giving promise of the greatest reliability, in order that there should be as few links as possible in the chain from the power house to the locomotive that would be liable to derangement. The overhead construction in the yards consists of wires supported at intervals of one hundred feet. Multiple track supports consist, for each phase, of a steady span supported by and insulated from the cross catenary span, both spans being secured to cross arms on the poles by means of porcelain petticoat strain insulators. The wires for the two respective phases are three feet apart. The wires of the same phase for the different tracks are insulated from each other by means of a wood breaks and porcelain link insulators in series. The lighting system installed in the tunnel consists of five transformers of four kilowatts capacity, each placed in refuge chambers. Incandescent lights are spaced at intervals of fifty feet and are connected in sets of five in series across the 500-volt system.

The electric service was started on July 10 last, although one or two trains had been handled previously. From that time to August 11 practically the entire east-bound service of the company had been handled by electric locomotives. During this period there were 221 train movements, of which eighty-two were freight, ninety-eight passenger and thirty-two special. In each case the steam locomotive was hauled through

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with the train. The total tonnage hauled was 275,000 tons.

In conclusion, the following advantages and disadvantages of the three-phase system for traction use are given: (1) Maximum electrical and mechanical simplicity. This point is of great importance and was one of a number of reasons for using three-phase system. The motors will stand any amount of abuse and rough use. (2) Greater continuous output within a given space than can be obtained from any other form of motor. This is shown by comparison with other electric locomotives, which is due to the fact that the losses can be kept lower in the three-phase motor than in any other type. (3) Uniform torque. This is important, particularly at starting. The three-phase motor will work to a three or four per cent greater coefficience of adhesion than a single-phase motor of fifteen cycles. (4) The possibility of using twenty-five cycles. This is important, as it leads to a less cost and a better transformation of power-station apparatus; moreover, it is standard and the power supply can readily be used for other purposes as well as for traction; a commercial supply can be provided. (5) Constant speed. This is ordinarily stated as a disadvantage of the three-phase motor, but it is a distinct advantage in mountain service, particularly the limitation of the speed on down grades. It has also an advantage on up grades—meeting points can be arranged with greater definiteness. It is generally believed that the impossibility of making up lost time with a three-phase motor will be a decided drawback to its use. This would be true if there were the same liability to lose time with three-phase motors, but when a train can be counted on to make a distinct speed without regard to conditions of track or of its load, there is less liability to lose time. (6) Regeneration on down grades. This matter has been discussed since the earliest days of electric traction, but has not been, up to the present time, put into practice. Although this result can be attained with other forms of motors, yet it is most perfectly attained by three-phase motors, there being no complications involved. This is of importance in reducing the power-house capacity required for a given space, although no doubt the saving in power-house capacity will not be as great as indicated by theory, owing to the various emergencies that must be provided for; nevertheless, there will be a material saving. (7) Excessive short-circuit current is impossible, and consequently destructive torque on the gears and driving rigging is eliminated. There will be no necessity for the complication of the friction connection between the armature and driving wheels, as in the recent large direct-current locomotives. (8) Impossibility of excessive speed. Even when the wheel slips the speed remains constant. Therefore, the maximum stresses put on the motor are less and are more accurately known than with any other form of motor.

On the other hand, the principal disadvantages of three-phase motors for traction use are commonly stated to be: (1) The constant speed. This is rather an advantage for this class of service. (2) Constant power. The fact is that the motor is a constant power motor, and, therefore, requires the same power at starting and accelerating as at full speed. (3) Small mechanical clearance. In this particular motor the clearance is one-eighth of an inch, which is ample for all practical purposes. (4) Inequality of load on several motors of a locomotive due to differences in diameter of driving-wheels. To meet this an adjustable resistance is included in the rotor of each motor. The motors are then balanced up and no further attention is required as long as the wear on the driving-wheels is approximately the same. (5) Low-power factor of the system. This does not seem to be borne out by practice. The power factor, as shown by the switchboard instruments in the power house, is eighty-five per cent. (6) Two overhead wires. There is no doubt that two wires will cause more trouble than one, and in case of complicated yard structure, it might not be practicable to use two overhead wires.

The president then called upon W. S. Murray to open the discussion.

Mr. Murray said that he was a "single-phase man;" but as far as the Cascade tunnel is concerned, he was hearitly in agreement with Doctor Hutchinson, because the physical conditions of the road required a three-phase system. The reasons for the application of three-phase are exceedingly simple. Any piece of trackage, be it one mile or three hundred miles, be it zero grade, up to a percentage of grade that admits of adhesion of the locomotive, only with trains upon it, with no stops, and even with conditions of stops where the acceleration is exceedingly low, under such conditions most of the engineers in this country would adopt three-phase. The single-phase motor is admittedly heavier than the three-phase motor for the same output. Therefore, three or four per cent greater adhesion is not important. Now, the single-phase motor is admittedly heavier than the three-phase, for a certain amount of capacity, and therefore this lack of adhesion, if that fact exists, is taken care of by its excess weight. It is unfortunate that the single-phase motor weighs more, but it does, and takes care of that case. The twenty-five-cycle on single-phase can be used, but the three-phase secures less costly generators. This is offset, however, by less complicated switchboards. It is not greatly more expensive to use three-phase rather than single-phase generators for single-phase distribution, and the dampened field rather cuts down the rising voltage on the idle phase, making it perfectly possible to develop three-phase current for commercial requirements.

Bion J. Arnold said that his difficulty for the last five years had been, not in handling single-phase or three-phase, direct-current or alternating-current systems, but rather in handling men and other elements, which enter, not into the construction of railways or in the operation of them, but in the continuance of them in financial existence, or endeavoring to point out ways whereby they could remain in existence and prevent them from being financially eliminated. He said that last summer, while on a trip, he found he was only a few miles from the Cascade tunnel, so went over and rode through the tunnel several times on the locomotives. The system operated as successfully as any direct-current or single-phase installation he had ever seen. It had the objection of the double overhead conductor, and the yard was necessarily somewhat complicated on that account. That was one of the principal reasons why Mr. Arnold chose the single-phase for the tunnel between Detroit, Mich., and Sarnia, Ont. That element, and others, which seemed to show an economy in favor of the adoption of the single-phase system, together with the saving in investment which seemed to be made under the circumstances, caused him to adopt the single-phase installation for that system, and at a time when single-phase installation had not been tried on heavy traction work.

F. N. Waterman said that, as one who has advocated the consideration of three-phase motors for railway work, he is particularly gratified by the evidence of its advantageous application as set forth in the paper of the evening. He called attention to one property of induction motors not exhibited in the present instance, because only one train is operated, namely, the action of moving trains as flywheels to keep down the peaks or minimize the fluctuations on output of the central station. The present system operates only one train at a time, and therefore it is impossible to realize that unique feature of induction motors.

J. H. Davis, electrical engineer, Baltimore & Ohio Railroad, said that the plant described by the author makes an epoch in the history of heavy railroad electrifications in the United States. It is the first attempt in this country to use the three-phase induction motor for handling heavy passenger and freight trains on a trunk-line railroad. The paper is replete with interest, as it covers, in a general way, all of the principal features of the plant from the utilization of an available waterpower to the locomotives and their operation. We are especially impressed with the importance of the electrical engineer's decision in recommending the adoption of a certain system of electrification. His decision is second in importance only to that of the engineer locating the railroad. A decision to use this or that system of electrification for a certain purpose, as, for instance, handling heavy traffic over a mountain division, will, of necessity, have great weight in determining the system of electrification to be used when other divisions of the road are electrified. The system thus adopted may or may not be that which is best suited for the desired extension. If the entire road is

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eventually electrified, one system of electrification should be used throughout, although this system may not be best adapted to all of the various conditions to be met. Therefore, the system adopted should be that which is best adapted to the requirements of the road as a whole. The necessity for interchange of equipment from one division to another is well known, and in meeting this requirement the electrical engineer can best secure simplicity of equipment by confining himself to one system of electrification. The gain in this direction will be more than sufficient to offset the loss due to the adopted system not meeting in the best way some of the conditions.

L. R. Pomeroy, of the American Locomotive Company, in the discussion stated that he made an examination of the Cascade Tunnel situation to determine the possibilities of electrification, and subsequently has been furnished with road tests of locomotives over the road described, which were presented. From these figures Mr. Pomeroy presented the deduction that the percentage of difference in favor of electricity was fifty-eight per cent. Also that the total amount saved by using electricity over this section is $268,769, and this amount capitalized at five per cent, represents $5,375,380. This amount alone, and not figuring on other savings, such as train crews, reduction in train mileage with the same tonnage, the advantage of a great increase in capacity, would go to show that such a mountain section comes very near being a situation where we can accomplish by electricity what is now impossible under steam conditions.

F. S. Denneen, of the Ohio Brass Company, said that he had quite a little to do in laying out the detail of the overhead construction, and in that capacity was acting for the manufacturers who supplied the materials. The trolley construction is what is generally termed a direct suspension type, that is, the trolley wire is not supported by any auxiliary overhead wire, and the reason for selecting this direct suspension instead of going into the more elaborate catenary types now so popular, was that there is a necessity for providing two wires over each track, with a voltage of 6,600 between the wires, and the same voltage between either wire and ground, and therefore the installation of auxiliary supporting wires would greatly complicate the problem of insulation, not only that, but the danger of cutting down the road and interrupting service for any of a great many possible causes, would be greatly increased, and therefore he decided to go to this self-supporting type of trolley. The overhead structure on the single track yard consists of a bracket, each phase is supported by an independent span, and auxiliary insulation is provided in every case, that is, the major insulation may be said to consist of two heavy porcelain strain insulators. The porcelain strains are rated for 10,000 volts, while wood break strains might be rated at 3,200 volts, or more. In certain parts of the yard it was necessary to provide overhead construction for as many as six tracks. Wires of the same phase are carried upon one cross catenary, while those of the opposite phase are carried upon another one; there is insulation between the wires of the same phase over different tracks. This was done in order to maintain the tracks entirely independent, and make it possible to cut out any one track or any set of tracks. Dr. Hutchinson refers to the trouble experienced at the intersection of lines due to the trolley leaving the wire, this trouble occurring as the trolley wheel crosses the pan casting. At the time the layout was originally made a scheme was considered for turning a tongued portion in the pan so as to carry the wheel across in the proper direction, but this complicated the arrangement and was not followed. When the original tunnel was made the trolley wires were set five feet apart, but after the whole layout had been worked out and approved by the railway engineers, the officials of the road decided that they wanted the entire central part of the tunnel, or the entire overhead, in the center, clear, so it was necessary to set the trolley wires out to a separation of eight feet within the tunnel, which made it rather bad in a great many ways. The clearance between the side wall and the trolley on either side was only fourteen inches, and it was desirable to prevent the trolley from swinging, and it was necessary to provide double insulation throughout, so the problem was not an easy one.

W. I. Slichter, of the General Electric Company, contributes a written discussion wherein he stated that the principal characteristic which differentiates American from European railway installations is size. In the locomotives under consideration it was necessary that there should be developed a tractive effort about three times as great as that developed by the foreign locomotives and the practice of pushing a 2,000-ton train up a two per cent grade required that that tractive effort should be applied gradually, steadily and continuously, as any sudden variations in a tractive effort of this large value would almost certainly result in breaking a train in two and possibly in causing a wreck. Thus, the control system of such a locomotive is a very vital feature. There can be no reduction in the tractive effort after it is once applied, and there must be sufficient control steps so that successive increments of tractive effort are not so great as to slip the wheels or strain the draw-bars to a dangerous extent. In this particular case the character of the service and the low speed of the locomotive eliminated the necessity of having more than one running speed. The problem was then to provide a control system which would give a steady acceleration and yet provide for running at fractional speeds for short intervals of time such as fifteen minutes as contrasted with continuous running. This is accomplished by using plain rheostatic control in the secondaries of the motors, varying the resistance by contactors and providing sufficient capacity in the rheostats to permit of running for fifteen minutes at full load. The control system consists of fourteen contactors per motor, five of which are in the primary, there being one contactor on one phase and two on each of the other two phases to provide for reversing the motors. This leaves nine contactors in the secondary to give thirteen steps, which is accomplished by a scheme of dividing the resistances into two or three groups, each having its contactor, and these groups are brought into different combinations so that each group is used over and over again, some times in series, some times in multiple with the others, and not left idle after being used once. A separate and independent set of resistances is provided for the secondary of each motor to avoid the tendency of the motors to exchange current and "buck" when they are all connected in multiple to one set of resistances. The advantage of the induction motor, due to its peculiar adaptability to regeneration, is best illustrated by considering the amount of energy which is regenerated and which would have to be dissipated in rheostats otherwise. To hold a train having a gross weight of 600 tons on a 2.2 per cent grade would require a resistance capable of absorbing 650 kilowatts per locomotive for the time during which the braking occurred. This corresponds in size of rheostats, to the condition of running continuously at a speed of four miles per hour with an input of 460 amperes per

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motor and a tractive effort per locomotive of 37,500 pounds.

C. L. de Muralt, after commending Dr. Hutchinson's paper and the three-phase system in general, said that a point emphasized particularly in the paper of Dr. Hutchinson is that the efficiency of the three-phase system is extremely high. The second point is that the recuperative feature has also been rather underestimated. The paper shows conclusively that the regeneration of the train on a down grade is fully up to the calculated results. There is no reason why actual experience should disagree with calculations on this subject. The paper does not bring out the full value of the recuperation, it cannot, because it is too limited an application. When the road is extended and operates over a long distance it will bring out the full value of the recuperation.

Calvert Townley, in the discussion, stated that he wanted to mention one point which seems not to have had as much emphasis as it really should have had. The various advantages of electric traction over steam have been considered for a long time, and predictions made of possibilities when the water powers of the western mountains were used to supply power for the electrification of our mountain roads, but here is a case where the installation has actually been made, where a large steam railroad system, backed by abundant capital and officered by men standing high in their profession has gone to work and electrified a section of their line at a very heavy expense. He said that question of the type of apparatus, its performance, etc., in which electrical engineers are naturally very much interested, important though it may be, is really a secondary matter in this particular case. It seems that the greatest importance attaches to the making of this installation. It means more than any mere question of the design of the machinery, because this installation will be successful, it will be extended, the road putting it in will find that it has been to their advantage to substitute electricity for steam, that entirely aside from the questions of economy of operation on which we have had some interesting figures, on other and broader questions in operation that will be shown to be of such importance that this installation will mark a distinct advance towards the electrification of these important trunk lines.

C. P. Steinmetz said that it is now something over fifteen years since the first three-phase induction motors were applied to railway circuits. At that time the single-phase commutator motor had been designed for railway work, had been designed some years previously, but had not been carried through, because no frequency then existed low enough to make this type of motor suitable. Very much work was done on three-phase induction motors, a number of equipments filled, and very high hopes were entertained in those early days. At the same time, however, the rotary converter was successfully developed and introduced into the industry and gave the direct-current railway motor such an extension in the distance to which it could be used, that the direct-current railway motor was capable of taking care of all the railway work for practically unlimited distances, and in view of this the three-phase induction motor development in this country did not progress as we hoped it would. Ultimately the three-phase induction motor also has reappeared and found successful application. The advantage of the three-phase induction motor is the simplicity and resulting reliability, the uniformity of current and the greater output. These are the characteristics of polyphase machinery in the polyphase generator, motors, etc.—the main characteristic of the three-phase induction motor, however, is that it is a constant feed motor. All other characteristics result from the constant speed, and that follows that its efficiency of acceleration is relatively low, it consumes the same amount of power in turning around slowly as it consumes when running at full speed at the same given current. The result of the constant speed feature is also the regenerative feature, that above synchronism it goes into regeneration automatically. The constant speed feature limits to a certain extent the present application of the three-phase motor in railway work. It is well suited for mountain divisions, for running continuously with heavy torque, positive or negative. For general railway work, however, as it is at present carried out in our country, the three-phase induction motor locomotive is not as well suited as the direct-current locomotive or the single-phase commutating machine, for the reason that the direct-current series motor or the alternating current commutating motor can replace the steam locomotive in our present railway operation, while the three-phase induction motor locomotive can at best efficiency replace the steam locomotive and operate the railway system in the same manner as it is operated now, but it requires a rearrangement of the method of operating to a constant speed service. When considering the method of operation, we have to investigate whether this particular method is really inherent in the problem, is a necessary feature of the desired results, or whether it is an incidental feature of the particular apparatus we use. The steam locomotive is a constant power motor. It gives the same power irrespective of the speed—the power is limited by the steaming capacity of the boiler, and whether you climb a heavy grade or run on a level track, you have that particular power limit, and that has fixed the present method of railway operation. It was not the anticipation of making up for lost time, it was merely that the locomotive had to slow down on the up-grade, because it could not keep up steam and could run faster on a level track. As regards the shunt motor limitation, Mr. Steinmetz called attention to one particular curiosity—when speaking of the shunt motor, the induction motor, we always specifically exclude from its field of operation, the rapid transit service—rapid transit is that operation where the series characteristic is especially necessary and where the shunt motor is especially unsuited. The most extreme case of this constant acceleration of heavy torque and never doing anything else, the most extreme case of rapid transit, is the high-speed passenger elevator operated by the shunt motor and induction motor for the sake of reliability and capacity of operation.

Frank J. Sprague was present and entered into the discussion by saying that he is not the advocate of any particular system, or the disparager of any particular system. He mentioned the three main electric installations on trunk lines in this country, and said that at each of these places the steam locomotive was under the maximum disadvantage, under the vilest possible conditions of operation. Electricity offered a remedy, and according either to the beliefs of the designers or the ambitions of the various manufacturing companies, or the engineers of the railroad companies, the three distinct systems were adopted. In each of these operation continues successfully. There are higher speeds, higher capacity, greater safety and greater cleanliness, which are the characteristics of operation, and he thinks engineers have every reason to have hope, and feel gratified, because each system of these three particular installations has overcome many difficulties incident to steam operation, and are giving creditable results, but neither of these is

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a complete trunk line, the Cascade, not more than the others.

Dr. Hutchinson concluded the discussion by saying that most of the criticisms that have been made can be answered in the general statement that he was not describing this as a system applicable to any condition other than that to which it was applied. This system has been put in for a particular purpose, to meet a particular situation. It may or may not be good for other conditions. He said that he believed it would be good for the entire mountain, but that has not been tried. As to whether, generally speaking, it is better or worse than other systems, that is immaterial.

Newly Elected Associates, American Institute of Electrical Engineers.

At the directors' meeting, held in New York on Friday, November 12, twenty-eight applicants were elected to membership in the American Institute of Electrical Engineers, as Associates. The list of Associates so elected is as follows:

Anderson, Gustave Emil, assistant installer, Automatic Electric Company, Morgan and Van Buren streets, Chicago, Ill.

Bailey, Edgar Lawrence, electrical expert, General Electric Company; residence, 119 East Erie street, Chicago, Ill.

Beal, Henry M., superintendent, Citizens' Light, Heat and Power Company., Montgomery, Ala.

Bell, Robert James, electrical engineer, Chicago & Southern Traction Company, Chicago; residence, 91 154th street, Harvey, Ill.

Campbell, George, electrical superintendent, R. Simpson Department Store; residence, 108 Emerson avenue, Toronto, Ont.

Cline, William Hamlen, motor engineer, General Electric Company; residence, 101 North Common street, Lynn, Mass.

Condon, Casimir C., superintendent of construction, Condon Construction Company, 1531 Unity Building, Chicago, Ill.

Cox, John William, chief engineer, Columbus & Hocking Coal and Iron Company, Kachelmacher, Ohio.

Coxey, Albert Childs, electrician, Pittsburgh Plate Glass Company, Crystal City, Mo.

Frickey, Royal Evarol, electrical engineer, Northern California Power Company, Redding Cal.

Garnier, Edward Jacob, electric section foreman, Indiana Steel Company; residence, 767 Madison street, Gary, Ind.

Hillebrand, Phillip Henry, division foreman, Marysville Power Division, Pacific Gas and Electric Company, Marysville, Cal.

Karow, Edward, Jr., designing engineer, General Electric Company, Schnectady, N. Y.

Knapp, Martin Vale, superintendent of electrical department, The Union Utilities Company, Morgantown, W. Va.

Marcell, Lawrence Powell, electrical engineer, The National Railways of Mexico, Aguascalientes, Mexico.

Murray, William Wallace, superintendent, Dreamland, Coney Island; residence, 92 Montrose avenue, Brooklyn, N. Y.

Myers, Laurence Joseph, consulting electrical engineer, 228 West Borden avenue, Syracuse, N. Y.

Neel, Blanton, enginner, Chattanooga Electric Company; residence, 215½ Vine street, Chattanooga, Tenn.

Nichols, Charles Hart, consulting engineer, 11 East 24th street; residence, 63 West 127th street, New York city.

Nipper, Ainsworth M., superintendent electric light and power, Board of Public Works, Hannibal, Mo.

Orr, John, professor of engineering, Transvaal University College, Johannesburg, S. A.

Rice, Homer Coke, sales engineer, Westinghouse Electric and Manufacturing Company, 209 Central Building, Seattle, Wash.

Rutledge, Henry Benson, construction foreman, General Eelctric Company, Union Trust Building, San Francisco, Cal.

Tillson, Percy E., assistant engineering department, Bell Telephone Company of Pennsylvania, Philadelphia, Pa.

Wadsworth, George Reed, consulting engineer, 19 Congress Street, Boston; residence, Brington Road, Brookline, Mass.

Wall, Samuel Smith, superintendent, Town of Pulaski Light and Water Department, Pulaski, Va.

Warren, William Douglas, president and manager, Warren Electric Company; residence, 117 South Water Street, Trinidad, Colo.

Wyrick, Byron M., superintendent construction and equipment, Postal Telegraph and Cable Company, of Texas, 243 Main Street, Dallas, Tex.

At the same meeting Robert Dale McCarter, consulting engineer, London, England, was transferred to the grade of Member.

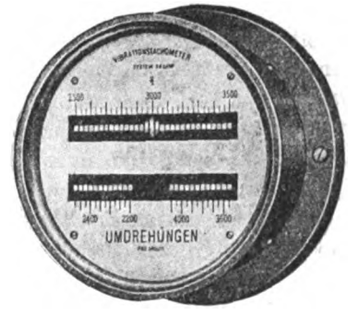
Inductance in Resistance Coils.

In an article by S. Leroy Brown in *The Physical Review* for October, on "The Residual of Inductance and Capacity in Residual Coils," the author arrives at the following conclusions: (1) A parallel wire standard of resistance can be constructed which is free from residual inductance when used with interrupted, steady current, or with alternating current of moderate frequency. (2) The outstanding difference between inductance and capacity in resistance coils can be measured by comparison with this parallel wire standard. (3) A standard coil, made by twisting the wires together and separating consecutive turns, is not completely compensated for inductance and capacity when capacities of a few hundred micro-microfarads are to be measured. (4) Capacities and inductances of small or large values can be measured with alternating current and an alternating-current galvanometer. The values are calculated from formulas which involve only the resistance, inductance and capacity of a single circuit and the frequency of the applied electromotive-force.

The new electric-railroad mileage built in 1908 in the United States, Canada and Mexico was 1,258 miles, computed as single-track road. New York state takes the lead in mileage, with 184 miles, closely followed by Ohio, with 171 miles.

A Vibrating Speed Indicator.

This device, which is manufactured by the Siemens & Halske Company, under the Frahm patents, is based on the resonance principle and utilizes the balancing defect existing in the rotating mass of all machines on account of the fact that the center of gravity of rotating systems can never be placed exactly in the center of the axis. The small, often scarcely perceptible, shocks are a direct function of the number of revolutions of the shaft and



VIBRATING SPEED INDICATOR.

are perfectly sufficient to set the apparatus in action. If a tuning fork is mounted on a machine, it will receive a small impulse at each revolution, but will respond to these impulses only when they coincide exactly with its natural period of vibration. If several tuning forks of different notes are mounted together it will be possible to make the number of revolutions correspond to their known notes. The construction of the practical apparatus is shown in Fig. 1. The tuning forks are replaced by thin, flat steel strips bent at right angle at their heads and painted

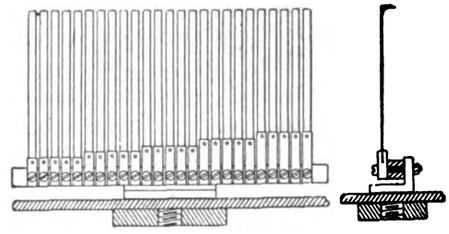


FIG. 1.—VIBRATING ELEMENTS OF SPEED INDICATOR.

white in order to render them more visible. These so-called resonance tongues are roughly tuned by varying their lengths, the finer adjustment being made by a quantity of tin solder under the bent heads. The apparatus receives a larger or smaller number of such resonant tongues according to the limits of speed which it is desired to measure. On the basis of practical experience a maximum vibrating scale is made about seventeen millimetres wide with tongues of a width of about three millimetres.

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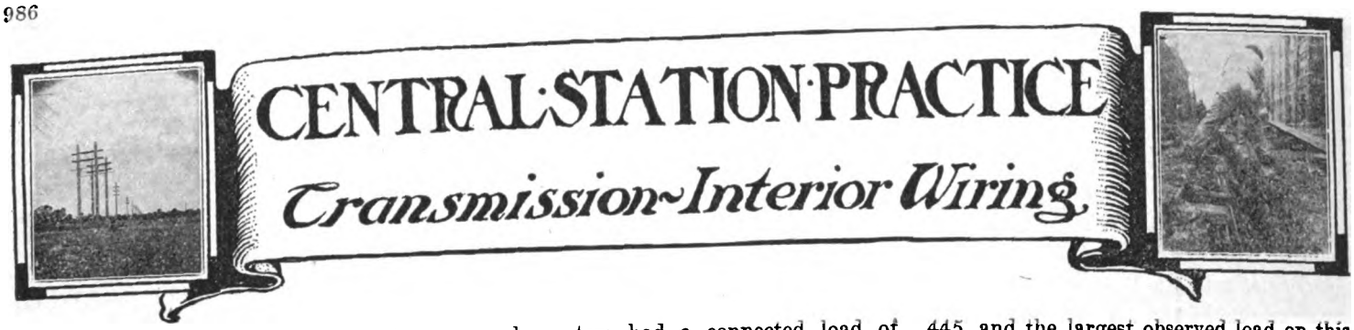
Vol. 55—No. 21



INCOME FROM COTTON MILLS.

BY ALTON D. ADAMS.

The cotton mill offers one of the largest loads that are available for electrical supply systems, and such loads are especially attractive beecause of their uniformity.

On the other hand, like most industrial power loads, the cotton mill ordinarily uses power during less than one-half of each twenty-four hours, not counting Sundays, even when in full operation. Cotton mills also require power in very large units in many instances, so that it is often a question whether anything can be saved by supply from a central steam-driven station.

To solve this question it is necessary to know the income that may be obtained from cotton-mill loads, and it is convenient to have this income reduced to dollars per horsepower of motors, per week, month or year.

In the North, comparatively little has thus far been done in the way of connecting cotton mills with electrical supply systems, though the construction of very large isolated electric plants for such mills is quite common. This situation appears to be due largely to the amount of power required by the ordinary cotton-mill plant in New York and New England, where the bulk of the northern mills are located, and to the fact that many of the most available waterpowers in this section were appropriated to cotton manufacture before the birth of electric power supply. Nevertheless, as the electrical supply systems grow larger and the more remote waterpowers are developed for transmission, cotton mills in various parts of the North are being connected to central stations.

Thus, the largest cotton-mill plant in Canada adopted electric drive with 3,412 horsepower of electric motors connected to the public supply system, some years ago. In a New England mill, electric motors of 746 aggregate horsepower began to operate with central-station power within the past decade, and in another mill of the same district the electrical supply system had a connected load of 817 horsepower in motors last year.

Cotton mills have connected much more readily with the electrical supply systems in the South, because the textile industry there has been developed mainly since the transmission of power on a large scale became common, and because there has been abundant unused waterpower. In fact, it is safe to say that but for the electric transmission of waterpower a large part of the present textile industry in the South would not have been created. Many of the more important waterpowers of the South are remote from the railways, which follow the ridges rather than the valleys, so that without electric transmission a mill must either use steam power or haul its product with teams, in many instances. Such circumstances as these helped to make it possible for a single electric transmission system in the South to connect with more than seventy cotton mills having an aggregate motor capacity above 30,000 horsepower, up to 1908.

It may be noted that the average horsepower at each of these southern mills was about 420, and this comparatively small power per mill makes it easier for the transmission system to secure the load, because the average cost of steam power to the mills must be high with these small units.

In the North, the regular running time of cotton mills is usually fifty-five to sixty hours per week, while in the South the figures are sixty to sixty-six hours per week. Where cotton mills are operated by a transmission system using waterpower the bearing of these hours of work is very important, as there must be sufficient storage capacity on the rivers to hold their night flow, if this is to be applied to the mill work.

Where the motors are well proportioned for cotton-mill work, it may be expected that the maximum load of a mill will approximate closely to its total motor capacity. Thus in a southern mill with 14,000 spindles and 800 looms the aggregate horsepower of driving motors was 445, and the largest observed load on this mill during twelve months was 320 kilowatts, or 426 electrical horsepower, amounting to 0.72 kilowatt per horsepower, of motors. On a day of eleven-and-one-fourth hours, when the total kilowatt-hours absorbed by these motors were 2,550, the observed power at four p. m. was 270 kilowatts, but this was a day of comparatively light load.

The uniform nature of cotton-mill loads is well illustrated by the two sets of curves presented herewith, each set showing the energy consumed by a mill during one month by ordinates for the number of kilowatt-hours used on each day of the month. In the mill with the larger consumption the figures are for the month of April, and in the other mill they are for the month of March. For the larger mill the regular time of operation is eleven-and-one-fourth hours per day except on Saturday, when the machinery stops at noon, and the time at the smaller mill approximates to these figures.

As the mills do not operate on Sunday, the curve for each is broken into parts corresponding to the several weeks and parts of weeks included in the month recorded. The consumption during three full weeks is shown for the greater mill, and the consumption in four full weeks for the lesser mill. In each set of curves the drop of consumption due to the short runs on Saturdays will be noted, and there is a break at each Sunday.

For the larger mill the three full weeks show consumption of 19,050, 20,700 and 19,650 kilowatt-hours, respectively. During the week when 20,700 kilowatt-hours were used there was one day with a consumption of 4,200 and one with a consumption of 4,500 kilowatt-hours, which last figures probably indicate some night work. On the basis of sixty-two hours per week, the average loads during these three weeks were 307, 333 and 316 kilowatts, respectively, but there was probably overtime in the week of largest consumption. Apart from the Saturdays and the two days that represent more than the usual hours of work, the consumption

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ranged from 2,550 to 3,750 kilowatt-hours per twenty-four hours.

At the lesser mill the four weeks show 12,650, 13,210, 13,360, and 13,890 kilowatt-hours, respectively, amounting to average loads of 204, 211, 215, and 224 kilowatts, on the basis of sixty-two hours, operating time per week. Apart from Saturdays and Sundays, the least consumption per day at this mill was 2,110 and the greatest was 2,530 kilowatt-hours.

The character of cotton-mill loads shown above has a very marked effect on the load curve of an electrical transmission or supply system that is largely devoted to this class of work. Results in this respect are well illustrated by the twenty-four-hour load curve of a great hydroelectric system that is presented herewith. This load curve has been constructed by taking the average of the total kilowatt-hours delivered by the generating stations from 6 a. m. to 6 p. m. as the day load, and the average of the total kilowatt-hours from 6 p. m. to 6 a. m. as the night load.

From 6 a. m. to 6 p. m. the total output of the generating stations in this hydroelectric system was close to 161,000 kilowatt-hours, and from 6 p. m. to 6 a. m. it was about 30,600 kilowatt-hours, on an April day. The average load on the system during the twelve hours of day was thus more than five times as great as the average load during the twelve hours of night.

On the day for which this load curve is constructed, the system in question had some sixty-two cotton mills connected to its lines, besides a number of other factories and nearly a score of town-lighting plants. It was doubtless these lighting plants that absorbed most of the 30,600 kilowatt-hours from 6 p. m. to 6 a. m., as very few of the cotton or other mills operated at night.

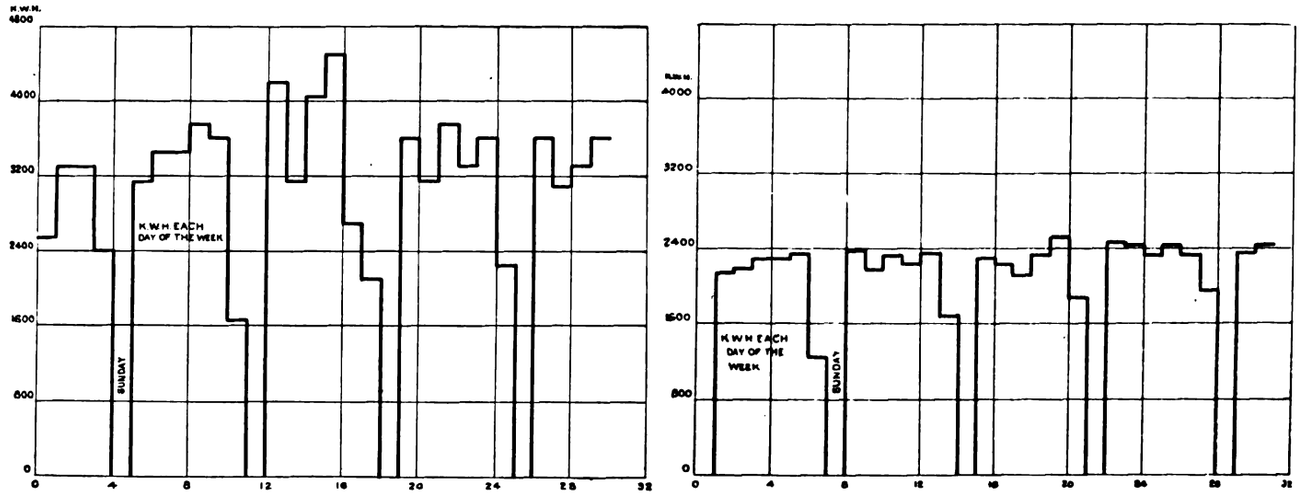
In a certain cotton-mill plant in the North the rated capacity of motors last year was 817 horsepower, and the electric energy purchased for the operation of the plant by means of these motors during the year was 1,452 kilowatt-hours per horsepower of motor capacity. For this energy the rate paid was 1.8 cents per kilowatt-hour, so that the income to the central station that supplied it was $26.14 per horsepower of the rated motor capacity in the plant, during the year.

Another northern cotton mill operated 221.5 hours with motors of 1,365 rated horsepower, and consumed 148 kilowatt-hours per horsepower. On the basis of 3,000 operating hours per year, the motors in this mill would use 2,000 kilowatt-hours per horsepower, if the rate of consumption corresponded to that just stated. With 2,000 kilowatt-hours and a rate of one cent per kilowatt-hour, the annual income per rated horsepower of motors would be twenty dollars.

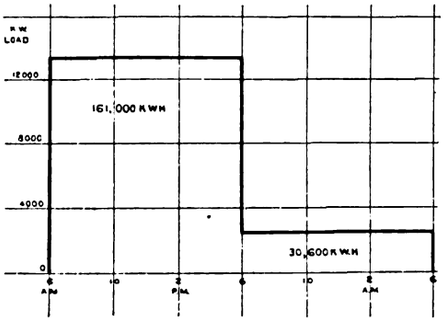
In one month of regular operation during six days per week a southern cotton mill with 445 horsepower of motor capacity used 187 kilowatt-hours per horsepower of motors. For the same rate of consumption during twelve months the kilowatt-hours per motor horsepower would reach 2,240, and the income to the central station from this energy would be $19.92 per year, at 0.8 cent per kilowatt-hour, a rate which commonly obtains in southern mills.

The Canadian cotton mills that had 3,412 horsepower of motors connected to a central-station supply paid 0.57 cents per kilowatt-hour, and if the consumption was 2,240 kilowatt-hours per motor horsepower per year, the resulting income was $12.77 per horsepower of motors.

While the above rates are low, the duration and uniformity of the load makes it economical to operate such mills from large supply systems.



KILOWATT-HOUR LOAD CURVES FOR TWO COTTON MILLS FOR EACH DAY OF A MONTH.



AVERAGE DAILY LOAD CURVE OF A SOUTHERN COTTON MILL.

Grounding of Secondaries.

At the recent Atlantic City convention of the International Association of Municipal Electricians, the following resolution, introduced by C. S. Downs, city electrician of Altoona, Pa., was adopted:

Whereas, One of the purposes of the International Association of Municipal Electricians is the protection of the lives and property of the people whom we represent from electrical hazards, and

Whereas, Alarming destruction of life and property has resulted from high voltages on alternating current secondary systems by reason of the failure of the insulation between the primary and secondary circuits of such systems, and

Whereas, The existence of the said high voltages may be prevented by properly grounding the alternating current secondary systems. Now therefore, be it

Resolved, That the International Association of Municipal Electricians, deliberating as an international body, urges and demands the enactment of proper legislation requiring the grounding of all alternating current secondary systems, when by so doing, the voltage between the earth and any part of the said secondary system will not exceed 250 volts, and this body pledges the support and advocacy by its members of all legislative measures to the end.

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Poor Municipal Wiring.[1]

Fire-alarm and police central-office wiring is far from being what is required by the National Electrical Code, suitable fireproof racks and cabinets being conspicuous by their absence, high-tension and sneak-current protectors not being provided, and often only bell wire being used to carry heavy-voltage circuits.

Battery stands and wiring thereto constitute a great source of danger when long circuits are to be provided for; also when storage batteries are used and stands are connected to lighting mains for charging.

When it is understood that the National Electrical Code contains a rule that requires all branch circuits connected to lighting circuits of 300 volts and less to be installed with rubber-covered, or slow-burning insulated wire, not less than No. 14 B. & S. and mounted on insulated supports that give at least half-inch separation between wire and surface wired over, to be at least two-and-one-half inches apart, and to be bushed through woodwork with approved tubes, it will be apparent that battery circuits, from charging board to battery stand at least, should comply with this rule.

Battery racks are sometimes ignored in providing protection against possible short-circuiting of battery wires between battery and switchboard. This is also a violation of the Code rule that requires proper fusing of all wires connected to a source of energy, whether dynamo or storage battery.

Current for charging purposes is often obtained from as high as 550-volt trolley circuits. This and most all lighting circuits being grounded on one side, always has a difference of potential between one side of circuit and ground equal to full voltage of line. This means heavy leaks to other circuits if not properly insulated, electrolysis of wires in damp places, and also a possible reversal of current in working circuits that may be run parallel.

Other requirements of the National Board of Fire Underwriters are: The proper distribution of circuits; not allowing more than twenty boxes to a circuit; avoiding placing both sides of the same circuit in one cable; fireproof buildings; records of tests and troubles; absolute non-interfering and successive movements in boxes; distances between boxes in congested business districts to be so arranged that there will be a box within 600 feet of all buildings.

[1] From an article by R. A. Smith of Norfolk, Va., in *Insurance Engineering*, October, 1909.

Maps are considered essential, and full records of lengths of circuits, tests of liquid of storage batteries and ample ventilation for battery rooms are advised.

These matters are of vital importance to fire-alarm and police superintendents. By observing them, they will be saved much embarrassment should a representative of the national or local board of fire underwriters pay them a visit and give them a write-up.

The proper observance and interpretation of other rules in code, relating to line work and lighting in general, are of vast importance to the city electrician. He will find constant study and application of the rules necessary, in order to keep abreast of the march of improvements, and necessary changes in rules.

There is much to be learned from attending the bi-annual meetings of the Underwriters' National Electric Association, held in New York. These meetings are open to all parties interested, and afford excellent means of finding out the true meaning of rules, as well as obtaining valuable information from inspectors from all parts of the country.

Electricity from Peat.

The department of Agriculture, Domains, and Forestry, in Germany, is engaged in opening up to culture the peat moor situated to the south of the Ems-Jade Canal, between Aurich and Wilhelmshaven. For this purpose a navigable canal is laid out through the moor, forming an extension of the Georg-Fehner Canal, and intended to terminate in the Ems-Jade Canal. Branch canals will eventually be dug for draining the moor.

The dredges used in forming the canals, as well as the presses intended for working the peat derived from the moor, were at first operated by steam engines. As, however, the heavy vibrations and considerable weight of these engines gave rise to earth slips, they were replaced by electric drive, a small power station with a 200-horsepower steam engine being erected in the middle of the moor on the Wittmund-Leer Highroad. The electric current generated at the station is used to feed the electric motors of the dredges and peat presses. Owing to the smooth working and small weight of these motors, any danger of earth-slips at the spot is now effectually eliminated.

The amounts of peat recovered in digging the canals are so important that they could not be marketed without serious prejudice to the minor moor owners. It was therefore decided to utilize this peat for the operation of a large electricity works intended to supply the whole of the neighboring district with electric light and power. The Siemens-Schuckert Company agreed to fit up the works on their own account. The construction of the new plant was begun in the autumn of 1908. Two steam turbines of 1,800 horsepower each with their respective boilers were provisionally installed, while a further set of 3,000 horsepower, which is in course of construction, will be taken into operation in the course of next year.

Part of the current generated by the dynamos, at a tension of 6,000 volts, is supplied direct to the neighboring working centers, for the operation of the peat presses, pumps, etc., while another part is raised in transformers to the tension of 20,000 volts, in order afterward to be supplied to more distant centers of consumption. The transmission lines are supported partly by wooden and partly by iron poles, the latter being used in solid ground and the former in soft ground. At present there are two large loop lines, one of which leads along the Ems-Jade Canal, eastward to Wilhelmshaven and back, via Zetel, to the central station, while the other runs alongside the same canal westward, beyond Aurich, touching Emden, Oldersum, Leer, and returning alongside the Georg-Fehner Canal to the central station. These lines are so substantial in construction as to allow anywhere of branch lines being installed, and thus the whole of Eastern Friesland may be supplied with current from this central station. Contracts for current supply have been concluded with the towns of Wilhelmshaven, Bant, Zetel, Leer, and the port of Emden, while negotiations are pending with a number of other communities. The construction of the plant is sufficiently advanced to allow the beginning of a regular service to be anticipated for next month.—*From The Times Engineering Supplement (London), October 27.*

The Smoke Problem in Illinois.

Considerable attention has been aroused in Chicago these last few days by the announcement of a new process for the coking of Illinois coal. The coke, used as a fuel, will go far, it is said, toward solving the smoke problem in the state, and the exploitation of the new industry is expected to give a new impetus to the coal-mining industry. Further developments are expected.

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ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

STREET LIGHTING IN NEWARK, N. J.

BY H. THURSTON OWENS.

Newark, N. J., long known as a great manufacturing center adjacent to New York city, is making great strides to overcome any thought of its being merely a suburb of the latter. In point of population it stands sixteenth in the country with approximately 300,000 inhabitants, and, as far as public buildings are concerned, its Court House and City Hall rank among the finest in the country.

About a year ago the subject of street lighting was agitated, as the enclosed arcs and open-flame gas lamps were neither attractive nor satisfactory. As the city did not act, the merchants on Broad Street south of Market Street decided to change the lamps to the flame type and pay the additional expense. When the lamps were first turned on strings of incandescents were placed across the street, and quite a gala week ensued. During the past summer the merchants of Market Street had their street-lighting equipment changed and now the same thing has occurred on North Broad Street.

The results have gone further than producing a spectacular effect on these main streets, however, for the city authorities have taken up the matter of changing over the old open-flame gas lamps to the mantle type, and the work is well under way.

POSTS AND FIXTURES.

The posts formerly in use on Broad and Market streets were of wood with a more or less ornamental iron hanger at the top, as shown in Fig. 1, the lamp being seventeen feet above the pavement. When the first installation was made on South Broad Street thirty-five of the lamps were changed to Scott flaming arcs. Owing to the fact that the lamps were so low, there was considerable criticism passed upon the installation.

The merchants on Market Street decided to do better, so the poles were replaced with longer ones, as shown in Fig. 2, and fifty-eight Toerring flame arcs were hung twenty-five feet above the pavement.

North Broad Street, which begins at Market Street, had always been a better business thoroughfare than South Broad Street until the latter was lighted up, so the merchants of the former decided to outdo the efforts of their rivals and ordered fixtures which would as well be an ornament by day. These posts, as shown in Fig. 3, are the same height as those on Market Street, twenty-five feet; they were designed and built by the Elmer P. Morris Company, of New York city. The installation consists of thirty-three lamps.

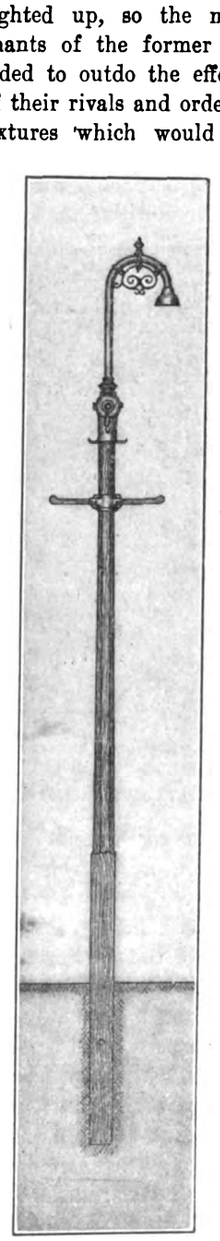

FIG. 1.—OLD POST USED IN NEWARK, N. J.

FIG. 2.—NEW POST USED TO REPLACE OLD ONE.

LAMPS.

As shown in Fig. 4, the Toerring flame arc lamp, which is used in both the latter installations, is somewhat of a novelty, inasmuch as it is constructed so that it can be connected directly across a 110-volt line, running two arcs in series within a single globe. Each arc is dependent on

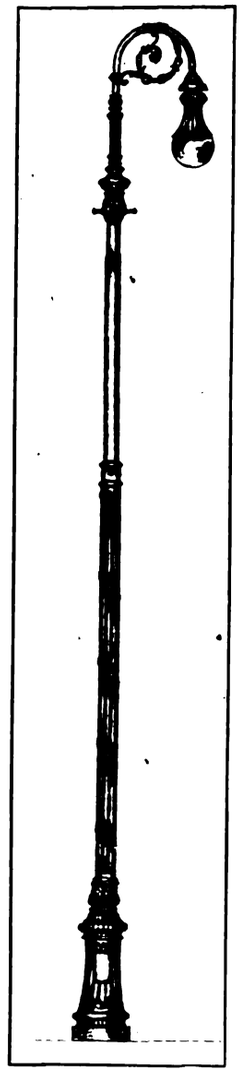

FIG. 3.—ORNAMENTAL POST USED IN NEWARK, N. J.

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its own regulating mechanism, which insures a perfect burning and regulation that would not be possible were the two arcs regulated by a common feeding device. The regulation of each arc for an alternating system is provided by a rotating aluminum disk actuated by a series and a shunt magnet, whereby a chain run on a pulley is unwound to feed the arc and rewound to lengthen the arc gap. The series coils, blow magnets, arcs and resistance are all in series, each shunt being connected directly across its own arc. The two sets of carbons are trimmed in a position inclining downward, the carbons being supported by chains from above, each of which in turn is regulated by its own aluminum-disk motor.

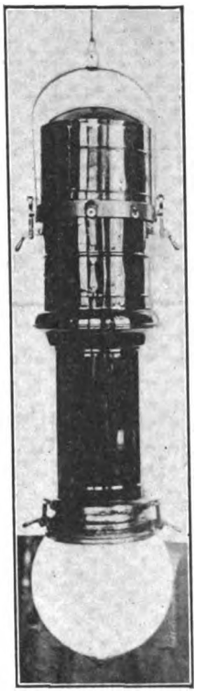

FIG. 4.—FLAME ARC USED IN NEWARK.

When the current is first thrown on, a current at a pressure of 110 volts actuates the shunts, causing a rapid rotation, tending to lower the two sets of carbons. Should one set get together before the other the shunts, of course, are short-circuited, and the downward rotation will stop on that side, the other pair of carbons still continuing down until contact is made at their tips. This closes the series circuit and throws current into the series coils, causing a rapid rotation, tending to pull the carbons upward and apart. As soon as these tips are pulled apart, however, a small shunt current immediately begins to flow, which, at a definite height of the carbons in the economizer, will cause a balance and the disk will become stationary. The arcs are now burning at their required voltage, and at a designated point in the economizer a definite distance from the blow-magnet pole tips, which stretch them and hold them rigidly on the carbon tips. As the carbon burns away, causing the arc gap to increase, the shunts predominate and slowly unwind the pulleys, lowering the carbons as they are consumed. The carbons by this method are always being fed a little and with a smooth, steady motion only as far as needed. Should an imperfection in the carbon cause an overfeed—that is, lowering the tips too low momentarily—the series magnet will immediately predominate and pull them back to the desired point once more.

The construction of the lamp is such that all moving parts are enclosed in a weather and dustproof cap, which never has to be removed by the trimmer.

The actual result of all this increase in street lighting at Newark has been to prove the truth of the saying that "Lights attract bugs and men."

New York Section, Illuminating Engineering Society.

The November meeting of the New York Section of the Illuminating Engineering Society was held on November 11 in the Engineering Societies Building. The following subjects were discussed:

"What Qualifications Should a Person Possess Before He Is Entitled to Assume the Title of Illuminating Engineer?" and "Should There Be a Division in Membership?"

The chairman, E. L. Elliott, called the meeting to order, and the secretary, A. J. Marshall, announced that the December meeting would be held in the Concert Hall of Madison Square Garden on the night of December 17, in connection with the Gas Show, which is to be held by the National Commercial Gas Association. At that time V. R. Lansingh will describe the model show room recently opened by the Consolidated Gas Company, of New York city, and H. Thurston Owens will deliver a lecture, illustrated with stereopticon views, on "Street Lighting Fixtures."

Although no set paper was to be delivered, there was a good attendance and many of those present discussed the questions presented. In opening the discussion Bassett Jones called attention to the fact that art and engineering have no common ground, and that persons of an artistic mind were rarely practical, and vice versa. The efficiency of illumination may not be judged by the flux of light upon a plane three feet from the floor or at any other height, as the real efficiency is the physiological effect upon the eye. Architects desire a certain lighting effect, and the work of the illuminating engineer is confined to the details of the lamps, reflectors, etc., which will produce that effect.

W. H. Gardner stated that a man should possess a thorough scientific knowledge of the laws of light and illumination and have a practical, responsible and extended experience before he should assume the title.

After further discussion between the two gentlemen mentioned regarding the relations between science and art, Dr. A. H. Elliott brought out the fact that engineering is the economical application of scientific laws, and inasmuch as that was true the question of art was not essential.

FIG. 5.—LIGHTING OF MARKET STREET, NEWARK, N. J., WITH FLAME ARCS AND TEMPORARY STREAMERS OF INCANDESCENTS.

After further discussion by T. I. Jones and N. Macbeth, the chairman closed the discussion and called attention to the fact that lighting overlaps, to a certain extent, the æsthetic side, and if this were not true architects would take more kindly to the subject. Engineering is applied science, and if illuminating engineers confine themselves to the engineering features alone there could be no clash with architects and decorators.

At the last annual meeting President W. H. Gartley nominated a committee to report on the division of membership, and E. L. Elliott, the chairman of that com-

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mittee, stated that they would report at the annual meeting in January in favor of having Fellows elected by the council upon the recommendation of a committee on fellowship. This subject was very warmly discussed by Doctor Elliott and Messrs. Marshall, Bassett Jones, T. I. Jones, C. W. Jones, Macbeth, Gardner, Forchette and Owens. It was brought out that practically all societies have classes of membership except this one, but many argued that the time was not ripe to bring this change about, and upon a motion by Mr. Marshall it was voted by those present that any action taken at the present time would be premature.

Chicago Section Illuminating Engineering Society.

The Chicago Section of the Illuminating Engineering Society held its first meeting this season in the Chicago room of the Great Northern Hotel at noon on November 11. The custom of holding the meeting directly after a luncheon will probably be carried out throughout the coming year. When the meeting was opened by Chairman Albert Scheible the topic announced for discussion was the paper by L. B. Marks on "Factory Lighting" that was read before the recent convention of the society. Mr. Scheible presented this paper in abstract form pointing out clearly and with great fidelity the most important points that had been made by its author.

The discussion was opened by J. E. Moore, of the Western Electric Company. This company is now carrying out a scheme of general illumination at its new Hawthorne shops which is planned to give sufficient general illumination for all average operations. This lighting is supplemented by individual lighting in certain cases where a more concentrated light is needed for special work. In the assembly department forty-watt tungsten lamps with prismatic reflectors are spaced about seven-and-one-half feet apart for general illumination. An average of about 2.8 foot-candles is found at a working plane thirty inches from the floor. The energy consumption averages about 0.68 watt per square foot. For the comparatively few individual lights needed sixteen-candlepower lamps with metal reflectors are used. In the coil-winding department where much small work is done four-light tungsten clusters at nineteen-and-one-half to twenty-nine feet centers and nine-and-one-half feet from the floor are used. The illumination on the working plane is found to vary from 2.1 to 1.3 foot-candles from points directly below to points midway between the lamps. This is found to be ample for practically all the general operations, although there are a few individual lights installed for special work. A similar installation equipped with Gem lamps instead of tungsten was found to give 2.2 to 1.0 foot-candles.

L. G. Shepard, of the Federal Electric Company, said that in that company's shop some very good results are obtained with sixty-watt tungsten lamps equipped with twenty-inch steel reflectors. These are installed in fourteen-foot bays and give good general illumination when aided by a few special lamps for close work.

Mr. Hubbard, of the Adams-Bagnall Company, said that his company now recommended very strongly the use of flame arc lamps for foundries and other shops. He described the regenerative flame lamp in some detail. Where traveling cranes are used the ordinary arc cannot be hung properly, but flaming arcs may be hung above the crane from twenty feet up to seventy-eight feet above the floor and approximately seventy-five feet apart with a resulting illumination of about two foot-candles.

George C. Keech, of the Cooper-Hewitt Lamp Company, said that Mr. Marks' paper is certainly a body-blow to localized lighting. He emphasized the great trouble from promiscuously hanging drop-cords and the severe eye trouble resulting from great contrast from bright to dark surfaces; also the trouble from oil, dust and finger-marks on the lamps. He believes that the placing of high candlepower lamps near the walls so as to have the light enter the room from the same general direction as during the day should produce nearly ideal results.

J. R. Cravath stated that we are new trying to get away from localized illumination and certainly are using general lighting much more extensively than heretofore. However, in some places it is physically impossible to rely exclusively upon general lighting. Where individual lighting is necessary it should be installed with better cords, shade holders, cord adjusters, shaded lamps, etc., so as to make the localized lighting installation as rugged and as effective from an illuminating engineering standpoint as possible.

The subject was also briefly discussed by Mr. Hoffman, of the Pullman Company, who spoke of some tests now being made for the proper lighting of the large car shops which are located at Pullman, Chicago.

Lamps for Residence Illumination.

To the Editors:

As I have noted from time to time a willingness on your part to devote space to the advancement of illuminating engineering, I therefore desire to add a contribution to the discussion to the paper on "Lamps for Residence Illumination," by Prof. Arthur Curtis Scott, as abstracted in your publication of August 7, 1909.

In the center of the first column, on page 246, where he advises the use of wall switches rather than socket switches, you neglected to give the reasons advanced:

"It is well known that there is a possibility of the high-tension current finding its way into a low-tension circuit to such an extent as to cause serious or fatal shock to a person, without any possible indication of such trouble being given to the operator at the power plant. The method commonly followed by people unfamiliar with electrical work, of grasping a socket of a lamp suspended by a flexible cord, with one hand, and turning the socket switch with the other, is a much more dangerous one than the opening or closing of a wall switch, where only one hand would be used."

In the second column the statements are made:

(1) Very efficient sources of light are likely to be of high candlepower and must be placed comparatively far apart, and the efficiency of distribution is decreased.

(2) Light produced at high luminous intensity is more rapidly absorbed by the atmosphere, and, therefore, less proportionately reaches the object to be illuminated.

This is certainly erroneous, and resembles in many respects the popular misconception regarding the application of the inverse-square law. The small tungsten lamps are quite as efficient as the larger ones and, in addition, they show much better life; in incandescent gas lighting with low pressure the small two-and-one-half-inch upright mantle has shown an efficiency considerably above the larger lamps, both upright and inverted. At any rate, whether a source be one of high or low candlepower, the actual intensity has no bearing on the "efficiency of distribution."

That "light produced at high luminous intensity is more rapidly absorbed by the atmosphere" should be a factor in "lamps

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for residence illumination" is certainly a point which illuminating engineers have grossly overlooked.

The tables given are those with which your readers should be quite familiar, that giving "the desirable amount of illumination for various classes of service" having been published by several accessory and lamp manufacturers. Little of this data has been based on actual measurements of existing installations. The table of coefficients of reflection from various colored surfaces is from Bell's "Art of Illumination," page 52, published in 1902; and that giving the relative intensities of light sources in candlepower per square inch, from "Art of Illumination," page 9, supplemented by Woodwell, "Illuminating Engineering Society Transactions," 1906, page 256, and bulletins issued by electric incandescent-lamp manufacturers.

The light-distribution curves of Welsbach lamps, also those showing the candlepower variation with variation in pressure, of which Professor Scott says, "This curve (Fig. 7, page 20) is drawn as the average of a number of tests, and evidences the fact that the candlepower increases rapidly with increase in pressure," were copied from "Practical Illumination" (Cravath and Lansingh, 1907, pages 76, 77 and 78), and were given by the authors to show the performance of one upright burner on New York city gas under various ordinary pressures when the burner was adjusted at each reading point for maximum incandescence.

A close reading of Professor Scott's paper does not show any reference to upright incandescent burners, excepting on two lines on page 6, where the distribution curve of an upright Welsbach lamp is compared to that of a tungsten lamp. We are therefore to assume that the pressure and candlepower characteristics of Welsbach Reflex lamps, with the gas supplied in Austin, give results exactly similar to those shown by one upright burner tested on New York city gas in 1906, on pressures from one to 3.5 inches, while the only pressures shown in Professor Scott's paper, page 25, run from 3.5 to 4.3 inches.

In "Data on Gas Lamps," page 35, with five Reflex Welsbach lamps on test, at 300 hours a "hole in mantle No. 3" is reported, and at 600 hours "mantle No. 3 burned out." The gas lamp, unfortunately for results in tests of this kind, does not open the circuit nor turn off the gas when the mantle "burns out," and consequently, for the purposes of a just and fair average, Messrs. Conrad and McCullough, who were directly in charge of the test, permitted the gas to continue to register for the "burned-out" mantle for the 400 hours remaining up to the 1,000-hour point. This latter is, of course, a bald assumption on my part, as it is possible that the other four lamps may have increased their consumption to just equal that taken by the five at the 600-hour point and continued the necessary average to the 1,000-hour point.

The mantles on this test showed erratic action, mantle No. 3 showing an increase of over sixty per cent in candlepower for the 100 hours' burning after the "hole" developed and but three per cent less for the next 100 hours, finally burning out at 600 hours with a Fourth-of-July rocket finish, the candlepower being forty per cent higher than at the 300-hour point.

Mantle No. 2 stood at 1,000 hours with a rating thirty-three-and-one-third per cent higher than at the 300-hour point and thirty-eight per cent higher than at the 700-hour point, and so on.

Professor Scott says the results showing costs per kilo-candlepower-hour for 1,000 hours' operation with electricity at ten cents per kilowatt-hour and gas at $1.70 (net) per 1,000 cubic feet "may be tabulated as follows," which really does not add particularly to their value. Even your typographical error could hardly take from the value of the conclusions reached. With the Nernst 0.6-ampere lamp on the "horizontal candlepower basis" of rating, the cost as given is over twice that of the rating "on basis of mean candlepower between vertical and horizontal values in lower hemisphere"—26.4 cents per 1,000 candlepower-hours as against 12.4 cents.

The table as given when reduced to familiar terms, is as follows:

Type of Lamp.	C.P. per cu. ft. per hr.
30-C.P. Reflex Welsbach[1] lamp (horizontal C.P. basis)	6.87
80-C.P. Reflex Welsbach lamp (on basis of mean C.P. between vertical and horizontal values in lower hemisphere)	5.85

	Watts per C.P.
60-watt tungsten lamp	1.489
40-watt tantalum lamp	2.642
50-watt "Gem" lamp	3.287
110-volt, 16-C.P. carbon-filament lamp	4.255
Nernst 0.6-amp. (horizontal C.P. basis)	2.644
Nernst 0.6-amp. (on basis of mean C.P. between vertical and horizontal values in lower hemiphere)	1.24

Considering the paper as a whole I fail to see wherein the tables and deductions can be other than misleading.

NORMAN MACBETH.

Philadelphia, Pa.

[1] The only Welsbach reflex lamp on the market has a nominal rating of sixty mean spherical candlepower or 750 lumens on a consumption of 3.3 cubic feet of gas per hour at 2.5-inch pressure.

New Electric Sign Rules.

The new rules promulgated at Dallas, Texas, regulating electric signs meet with the general approval of business men except the clause providing that any sign extending over the sidewalk or alley or public way to a length of more than eighteen inches from the property line shall have at least eight candlepower of lights to every square foot of surface and shall be maintained in full illumination until midnight every night. The objection to the clause is the expense. The commissioner's aim is merely to obtain safety from improper signs overhead and provide adequate street lighting.

The Illuminating Engineering Society of Great Britain.

The opening meeting of the British Illuminating Engineering Society was scheduled to take place on Thursday, November 18, at 8 p. m., at the premises of the Royal Society of Arts, Adelphi, London. A brief report of the progress of the society was to be presented by the honorary secretary, Leon Gaster, and the inaugural address was to be delivered by Prof. Silvanus P. Thompson, the first president of the society.

Central Park to be Properly Lighted.

Central and Prospect parks in New York city are to be more adequately lighted at night. The Board of Park Commissioners has not only decided on this action, but the conduit for laying the electric light wires have already been partly installed, and in Central Park many of the posts that will hold the new lights have been put up. While there are now 400 gasoline lights in Central Park there will soon be 1,477 electric lights.

The business men along Blue Island Avenue, from Sixteenth to Twenty-second streets, in Chicago, have decided to install special tungsten street lights on ornamental posts twenty-five feet apart along the curb line.

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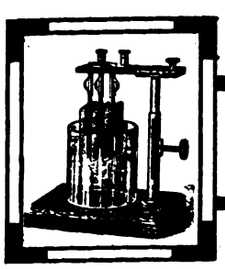

ELECTRO-CHEMISTRY and METALLURGY

LAWS OF ELECTRODE LOSSES IN ELECTRIC FURNACES.[1]—I.

BY CARL HERING.

At the last annual meeting of this society the writer showed how it is possible to obtain in practice the combined effects of perfect heat insulation and good electrical conductivity, two antagonistic qualities which it was heretofore generally supposed could not both exist in the same material.

The method is as follows: Let *e* (Fig. 1) be the electrode. If now it be so

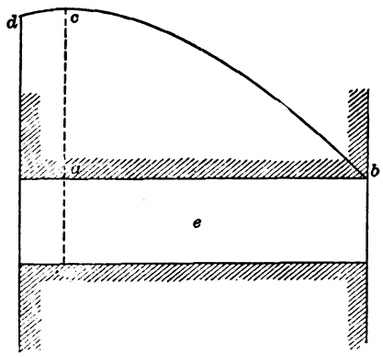

FIG. 1.

proportioned that the electric or C^2R loss heats the furnace end to a slightly higher temperature than that of the furnace, there will be a flow of heat from that end into the furnace. Let the section *a* very near the hot end be that at which the temperature is greatest; then the heat gradients *cb* and *cd* will evidently fall in both directions. This means that some heat flows from that hot section into the furnace; and as heat cannot flow in two opposite directions at the same time, it follows that no furnace heat will flow out of the furnace through such an electrode, which therefore becomes in effect a perfect heat insulator, more perfect even than the walls of the furnace, while at the same time it remains a good electrical conductor. In practice it is not necessary to make this temperature higher than that of the furnace, as it need merely not be lower, and the section *a* is best made to be the extreme end of the electrode. Hence the results will be accomplished if the C^2R loss heats the end of the electrode to the furnace temperature. It will be shown that these are the conditions for obtaining the minimum loss.

There are two kinds of losses which must be considered in electrodes: First, the loss due to the conduction of heat by the electrode from the material or gases in the furnace to the outside, which may be termed the heat-conduction loss, or simply the thermic loss; and, second, the loss due to the eelctrical resistance of the electrode, which may be termed the electrical loss, or th C^2R loss. Both losses originate electrically, and are therefore of equal commercial value in cents per kilowatt-hour. For a given length, if the cross-section increases, the heat loss increases, while the electrical loss diminishes; while for a given cross-section the reverse is the case when the length is increased. Moreover, the thermal and the electrical conductivities of the particular material enter into the determination of these losses; and the total loss may be partly thermal and partly electrical, or entirely electrical or thermal, or even only a part of the C^2R energy. As these physical properties of the electrode material are an important factor, a comparison between two materials, like graphite and carbon, is evidently not a fair one unless each of the electrodes has its best proportions. The problem of finding the best conditions is therefore not a simple one.

The author has thus found the following relations to exist, which, as they are absolute, may be termed the laws of electrode losses.

Laws of Electrode Losses.

a. The combined loss through the cold end of an electrode is equivalent to the sum of the loss by heat conduction alone (when there is no current) and half the C^2R loss.

b. This combined loss will be least when the loss by heat conduction alone is made equal to half the C^2R loss; the total loss will then be equal to the C^2R loss and no heat will be conducted from the interior of the furnace.

c. This minimum loss is dependent only on the material, current and temperature, but not on the absolute dimensions; it merely fixes the relation of the cross-section to the length, but leaves a choice of either; hence

d. For economy of electrode material the length should be made as short as practical considerations permit.

e. For each material there is a definite minimum loss of electrode voltage which depends only on the temperature and is independent of the dimensions or the normal current for which the furnace is designed; hence

f. The best possible electrode efficiency for any material may be determined from the total voltage of the furnace and this minimum voltage due to the material and the temperature, and is independent of the dimensions.

g. The heat gradient of the combined flow is equal to the sum of the heat gradients of the individual flows.

These laws are based on the following fundamental assumptions, any departures from which must be treated as correction factors: (1) That the electrodes have a uniform cross-section throughout their whole length. (2) That no heat leaves the electrode to the furnace walls or enters it from them; this is approximately true in most cases, because the heat gradients are approximately the same in both, and

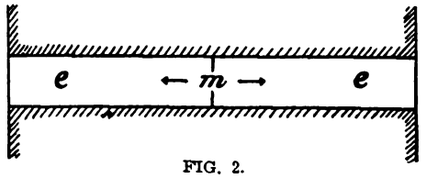

FIG. 2.

there is contact resistance between them which may be quite great. (3) That the temperature variation of the heat conductivity is approximately a straight line proportion.

Neither of the two latter conditions seem to be accurately true, but the differences are probably small in comparison with the best possible degree of accuracy with which the most desirable proportions of furnaces can be predetermined or realized in practice. Hence great accuracy is not essential. The matter of importance for us to know is in what direction to go to reduce the losses, and approximately what the minimum possible loss is, so that we can approach it as closely as practicable and do not waste efforts in trying to realize something which is impossible.

The conditions of minimum loss for a given normal current are illustrated in the following simple cases: Let *ee* (Fig. 2) be an electrode surrounded by a perfect heat insulator except at its ends,

[1] Abstract of a paper presented at the sixteenth annual meeting of the American Electrochemical Society at New York, October 30, 1909.

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which are kept cool, say, with a water jacket. Let a relatively large current be passed through it. This will heat it to a high temperature at the middle m. When the stable state is reached, all the C^2R heat will flow out at the two ends, and none will flow across the section m.

If now this embedded electrode be imagined to be cut into two parts at m, and if these two parts are made the two end walls of a furnace with these conductors as its electrodes, as in Fig. 3, the temperature of the interior of the furnace

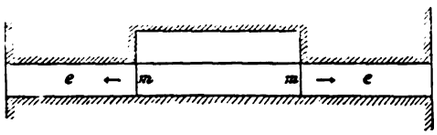

FIG. 3.

being the same as that at m was in Fig. 2, it is evident that the heat flow will not be altered while the same normal current is flowing, and that therefore there will be no loss of heat from the interior of the furnace through the electrodes. This is the condition of minimum electrode loss.

The writer has determined the following equation for the combined flow:

Let X be the total energy expressed in watts, which flows out at the cold end of a conductor; C the current in amperes; T the difference in temperature in centigrade degrees between the hot and cold ends; S the cross-section in square inches; L the length in inches; k the average heat conductivity (or specific heat conductance) in gramme calories per second per degree centigrade for one inch length and one square inch section for the given range of temperature; r the average electrical resistivity (or specific resistance) in ohms for one inch length and one square inch section for the given range of temperature; and let one calorie per second equal 4.186 watts.

Then

$$X = 4.186\,kT.\,S/L + C^2r/2.\,L/S \ldots (1)$$

It will at once be seen from this that the first term represents the heat (in watts) that would flow by heat conduction alone, that is, when no current is flowing (the constant 4.186 is merely the figure which reduces calories to watts). It will also be seen that the second term represents the C^2R loss and is equal to half of it. Hence this general law may be stated in words as follows: The total flow of energy out of the cold end is equivalent to the sum of that which would flow by heat conduction alone, and half of that due to the electrical resistance.

[To be continued.]

ELECTROLYTIC BLEACHING.

BY J. B. C. KERSHAW.

The comparative efficiencies of bleaching-powder solutions and electrolytic bleach liquor, for bleaching cellulose, have long been in dispute, and there are many chemists who still believe that the greater efficiency claimed for the product of the electric cell is chiefly due to the use of incorrect or unreliable methods of analysis and comparison. That the atom or molecule of chlorine liberated from a solution of bleaching powder should possess less bleaching (*i. e.*, oxidizing) effect than the atom or molecule of chlorine liberated from a solution of hypochlorite, prepared in the electrolytic cell, seems to them incredible.

The constitution of the two solutions, they urge, is chemically alike, and the only difference is in the base with which the hypochlorite acid is combined—calcium in the one case and sodium or magnesium in the other. The supporters of electrolytic bleaching methods contend against this view, that the combination between the chlorine and the base is looser and more easily broken down in the electrolytic solution, which is, in fact, partially ionized when ready for use.

The most recent contribution to the study of this subject is a paper by Doctor Fraas, published recently in two German periodicals. In opening the paper the author refers to the earlier investigations of German chemists, and states that Doctors Kind and Weindel had already by their researches proved the superior efficiency of electrolytic bleach liquor for bleaching cotton, but had not dealt especially with the settlement of the same question as regards cellulose. The great delay in deciding this question has been due to the difficulty that exists in obtaining reliable standards of comparison in bleaching work, and also in obtaining exactly similar conditions for the trials.

This difficulty has been much greater in the bleaching of cellulose than in that of cotton goods, and for this reason most of the attempts have been made on a laboratory scale of operations. These give figures of value for comparative purposes, but not for estimating the absolute amount required in bleaching on a large scale, since here the mass of materials dealt with has important bearing upon the results.

The following points were investigated by the author: (1) Which of the two bleaching agents gives the better color when using similar amounts of chlorine. (2) What saving in chlorine or bleaching agent is possible, when obtaining equal bleaching effects. (3) What influence have variations in the acidity of the souring liquors upon the results. (4) What influence has an excess of bleaching agent upon the results.

A total of forty-nine experiments were made during the investigations, and the results of these are set forth in four tables to be found in the original paper.

The results are summarized by the author as follows: (1) Using equal amounts of chlorine, and working under similar conditions, the electrolytic bleaching liquor gives the better bleaching effect. (2) If the bleaching effect be stopped at the same degree of whiteness, the use of electrolytic liquor enables a saving of five per cent of chlorine to be made, when working with alkaline solutions. (3) The presence of an excess of bleaching liquor does not alter these comparative results. (4) Increase of alkalinity diminishes the rate of bleaching, but increases the final effectiveness of the bleach, in the case of both electrolytic and bleaching-powder solutions.

The author finally remarks that although the economy due to the use of electrolytic bleaching solutions may be small, yet the results prove that in the bleaching sulphite wood-pulp and cellulost, the electrolytic liquor gives the better bleaching effect.

As practical commentary upon this investigation, it may be stated that the Haas and Oettel form of electrolytic cell for the preparation of bleaching solutions is finding extended use. It is stated that over 600 of these electrolyzers are in use today, in the textile industries, in laundries, and in public institutions.

Tension of Electrolytic Metallic Films.

In a paper by Gerald Stoney, read before the Royal Society of London (Eng.) last May, the author showed that metals are electrolytically deposited under tension, and hence tend to strain the cathode on which they are deposited. Steel rules on which he electrolytically deposited a thin coating of nickel were bent considerably by this tension, the author calculating from his observed data that the stress amounted to from about eight to twenty tons per square inch for thicknesses of films ranging from 0.046 to 0.056 of a millimetre. On heating to redness the annealing caused an appreciable straightening of the rules.

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Gold Recovery by Electrolytic Amalgamation.[1]

The electrochemical system of amalgamation is designed to extract from the sands or pulp, all gold values not encased. It is entirely a new system of amalgamation, designed to do the work of the ordinary mill plate. This includes the treatment of slimes, and the simultaneous extraction of values which cannot be saved by the usual mill practice. These latter would otherwise require cyanide treatment, and the new process does all this in one single, inexpensive and continuous operation, requiring practically no more outlay for installation and maintenance than the usual mill plate. The system also furnishes a method by which the black sands, desert deposits and many low-grade propositions can all be profitably worked. The broad claim made for the electrolytic system is that it will save all values not encased.

It will be observed that the one point most emphasized by the above statement, which is paraphrased from a recent expert article on the subject, is that the electrolytic system will save all values not encased. For the cyanide process, no such claim is made, as there are many minerals found in ores that prevent the use of cyanide, either by rendering the operation too costly, or by causing a low percentage of extraction, even when the gold has been set free by a proper pulverization.

What is stated to be the first carefully constructed electrolytic amalgamating sluice, is one now in use in the laboratory of the Noble Metals Recovery Company, at San Francisco, for demonstration purposes. It has a capacity of about six tons of ore per twenty-four hours, and is the smallest apparatus made for general work, a larger one of the capacity of 100 tons, being the standard size. But there has been introduced, for laboratory work, a very much smaller apparatus, having a range capacity of from one-fifth assay-ton, to ten assay-tons per unit of time.

This smaller apparatus is of a different form and construction, though operating under the same electrolytic conditions, and is used for assaying and other determinations. It has been found perfectly reliable, and has been very extensively used, not only to give the values of various ores and sands, but also to elucidate the conditions necessary to a perfect obtaining of values from these materials.

In one line of research by this means, the matter of fineness, or necessary pulverization has been taken up. It has been found that in beach sands and placers generally, no further pulverization is necessary, nature having attended to this important part of the work. In ores, however, a considerable pulverization is necessary to obtain perfect results, the range for this being from thirty up to 150 mesh. And not only does this apply to pyritic ores, but to those generally considered "free milling."

There appears to be no general law governing the degree of fineness of mechanical reduction necessary to a full obtaining of values, but that each ore is a law unto itself, and that this applies not only to recovery by electrolytic amalgamation, but equally so to extraction by cyanide.

The profound difference that lies between the two methods may be seen at a glance. In the one case, the fine comminution produces final results with added recovery and no additional cost; but in the other, it leads to a variety of further costly manipulations, each of which is a source of loss of gold, and still further lengthens out the time consumed in the operation of extraction.

Taking into comparison a unit capacity of 100 tons of ore per day; each ton passing through the cyanide process requires continuous attention and manipulation, for a period of from three to six days, according to the manner of working and the fineness of mechanical reduction. In the electrolytic system each ton of ore, of whatever fineness, is handled and finally disposed of, in less than fifteen minutes.

The electrolytic amalgamation system aims always at a full recovery of values, and it is considered bad work when even the slightest particle of gold escapes. The potent forces employed in the work and the simplicity with which these may be adjusted, makes this immediate extraction possible; and when the system is properly installed, and operated by those properly instructed, this result may be relied upon.

The limitations to the use of cyanide in no degree extend to electrolytic amalgamation; for, as far as is yet known, there is no element that enters into gold-bearing ores which hinders the efficiency of the method.

Ores of an alkaline reaction and of an acid character, have been both tested, with equally good results, and as well, those so deterrent to the ordinary cyanide treatment.

As before stated, the system is applicable to the universal field of gold recovery, from the meager tahona of the prospector, which it will double in capacity, to the mill of 1,000 stamps, to which it will afford a higher recovery and a lessened expense.

It has a future also on the million acres of black sands of the coast, and at the hydraulic mine and on the gold dredge.

[1] Abstract of an article by J. H. Jory in *The Mining World* for October 2, 1909.

A New Electrolytic Process.

At a recent meeting in London, Eng., of the Rhodesia Broken Hill Development Company, says the *Daily Telegraph,* of Sheffield, Eng., the question of ore treatment was discussed, and it was reported that preliminary trials, recently made at Sheffield, of an electrolytic process had been considered by the company's consulting engineers as sufficiently encouraging to warrant the erection of a plant with a view to treating a considerable quantity of ore on a working scale. Orders have been given for a complete plant, and this would be erected on a site which had been secured in London. About 180 tons of ore have been secured for the purpose of the experiment, and should the results be satisfactory it was proposed to form a process company to acquire the patent rights for the whole of Rhodesia.

Electricity in Mines.

The British Home Office has appointed a departmental committee to inquire into the working of the existing rules for the use of electricity in mines in Great Britain and to consider alterations which may appear desirable. The committee consists of R. A. S. Redmayne, his majesty's chief inspector of mines (chairman), Robert Nelson, his majesty's electrical inspector of mines (secretary), and Charles H. Merz.

Electric Steel Plant for Russia.

A British correspondent states that the Slatons Works, in the Ural district in Russia and forming part of the royal estate, have made arrangements with a German company to use its patent induction steel furnace. The electric plant will be furnished by the Siemens-Halske Company.

A New Electrode Factory for Scotland.

A London correspondent writes that an electrode factory has recently been constructed at Kinlochleven, Scot., by the British Aluminum Company.

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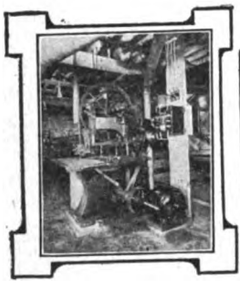

Industrial Power

CAUSES OF BREAKDOWNS IN ELECTRICAL MACHINERY.—II.

A BRITISH INSURANCE COMPANY'S REPORT.

The effect of corrosion from sulphur fumes and the importance of proper housing were instanced in the case of a three-phase, alternating-current, semi-enclosed motor taking current at 440 volts and developing fifteen horsepower at 800 revolutions a minute. The motor was located at the top of a tower in a chamber which was often full of dust and steam arising from the slacking of hot ashes with water. The cause of the breakdown in this case was that the insulation of the stator windings had become rotted by sulphurous steam and impregnated with dust and dirt, so that they became short-circuited. The fuse melted and four of the stator coils were burned, the top and bottom in one slot and the top in the two adjacent slots.

A short-circuit caused by an accumulation of dust under the string binders of a four-pole, enclosed, shunt-wound, direct-current motor was responsible for the breakdown in another case. This motor drove two drilling machines by gearing and was protected by a copper-wire fuse designed to melt at forty-eight amperes. The short-circuit occurred while the motor was driving the machines idle, and was caused partly by abrasion of the insulation, due to the jarring of the gearing and partly by accumulation of dust under a broad binder of string around the end winding. When the armature coils were lifted for repair the installation was found to be so deteriorated that the armature had to be entirely rewound.

Imperfect insulation of the armature troughs caused the breakdown of a four-pole, semi-enclosed, shunt-wound, direct-current motor taking current at 420 volts and giving two horsepower at 650 revolutions a minute. The armature conductors were laid in slots and insulated from the core plates by presspahn, varnished calico, and strips of mica. The armature winding was earthed, one of the coils was fused and the insulation burnt. As a consequence the coils had to be entirely rewound. The trouble was due to the fact that the insulated troughs in which the coils were carried reached only half way up the sides of the slots, so that every turn of each of the top coils had to rely on its own cotton covering to insulate it from the core.

Lack of proper precaution in turning up the commutator in the lathe caused three of the commutator segments of a shunt-wound motor to become short-circuited by copper dust and partly fused, the insulation being burnt off from three of the armature coils. The cause of the breakdown in this case was due to the fact that the owners of the machine, who had been turning the commutator in one of their own lathes, had neglected to clean out the copper dust from the mica between the bars or to see that there was no bridging from bar to bar before replacing the armature in its bearings.

An overworked driving rope was the cause of the downfall of a six-pole, direct-current dynamo giving 340 amperes at 220 volts when running at 650 revolutions a minute. The armature shaft was carried in three bearings and was driven by eight ropes with the driving spans uppermost. One of the ropes broke while the machine was running, a loose end fouled the outer bearing of the armature shaft, tore the machine bodily from the foundation rails, and caused a general smash-up. The design of the rope drive was greatly at fault, and the ropes were accordingly much overworked.

In discussing the case of a breakdown of a four-pole, shunt-wound, twenty-seven-horsepower, direct-current motor, due to a defective brush-holder, Mr. Longridge mentioned that his company has had the least trouble, perhaps, with brush-holders consisting of a plain box holding a rectangular block of carbon with a flexible conductor attached, and a spring to keep the carbon up to the commutator surface.

A defective armature nut was the cause of the failure in the case of a four-pole, semi-enclosed, shunt-wound, direct-current motor used for driving a pump in a coalpit by gearing. On examination several of the conductors were found to be broken just behind the commutator spokes, and the commutator and armature cores were loose on the shaft. This was due to the slacking back of the nut which held the core plates, so that all the plates were loose. Forty-six out of a total of eighty-eight were broken and the rest were considerably damaged. The nut had not been fastened by a lock nut or taper pin. The report makes the recommendation that core plates can be held endways more safely by a ring sunk in a circumferential groove on the spindle than by a nut, but that the bottoms of the grooves for such rings should be rounded instead of square-cornered.

Two cases, taken at random, from a large number, were instanced to show the danger of sharp corners in commutator cores and defective shaft connections. Mr. Longridge says in this connection: "Surely common sense should suggest that the edges of end plates and winding drums over which thinly covered conductors pass should be well rounded, and that the conductors should be still further protected by strong presspahn or other insulating material. It is not possible to entirely prevent relative movement between the conductors and the core of winding drum, and it is certain that any movement, however slight, will enable a sharp metal edge to cut through the thin covering of an armature conductor. This relative motion is also responsible for another large class of accidents, the fracture of armature conductors at their junctions with the commutator arms. The usual methods of preventing the rotation of armature spiders and commutator quills, and still more of armature core plates threaded upon the shafts, by feathers, projecting screw heads, and set-screws are not effective, either because the bearing surfaces are insufficient, or because the fitting is not good enough. The best plan when the diameter permits undoubtedly is to build both armature and commutator upon the same casting."

An overload on a punching-machine motor gave rise to an increase in temperature which melted the solder out of

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most of the joints of the rotor commutators. The melting solder ran to the two short-circuiting rings and was thrown on to the end windings of the stator and into the air gap, damaging the insulation. The breakdown was ascribed by the owners of the motor to overrating by the makers, but it was shown that it was really due to negligence in watching the ammeter and to inability in properly fixing a limit to the resistance of the machine tool driven by this motor.

The last case recorded was the curious breakdown of a semi-enclosed, three-phase, alternating-current motor with wound rotor, slip rings, and carbon brushes. The motor was belt-coupled to an ash elevator and controlled by a three-pole switch in the stator circuit and a regulating resistance starting switch in the rotor circuit. The electrician in charge reported that the motor refused to start even with the belt off, and that one of the carbon brushes got red hot. On examination it was found that a short-circuit was established between two conductors belonging to different windings, due apparently to an accumulation of dirt between the conductors and under the binders on the end connections at the driving end of the rotor. The rotor had also been in contact with the stator, the binders were taken off, the conductors lifted, and the dirt cleared out. On reassembling, the machine started without difficulty. It was supposed that the breakdown was due to springing of the shaft by unequal magnetic pull, caused by short-circuiting.

The general conclusions of Mr. Longridge were as follows: "The general impressions left upon the minds of those in charge of the electrical department are that a very large majority of the breakdowns are due to the deteriorating effect of oil, dust, and damp on the materials used for insulating. Of these, oil is the most injurious and most difficult to deal with. Better arrangements are needed to prevent oil throwing. If oil once gets out of a bearing it creeps along the shaft to the back of the commutator and on to the end windings, also on to the commutator insulation and brush gear, and mixing with copper, carbon, or other dust forms short-circuits, giving rise to carbonization and 'burning out.' The next most fruitful cause of damage is probably imperfect fitting, keying, and locking of spiders and core plate, commutator brushes, and even pole-pieces, leading to abrasion of insulation, and 'earthing.' Careless winding and fitting of magnet coils is also sufficiently common to be noted. Lastly, many of the users of electrical machinery do not give it the attention it requires. They locate motors in places which are dusty or dirty, or difficult of access, and leave them to work as best they may. If motor bearings were made like bicycle bearings, with balls running in vaseline, and if the armatures were regularly blown out, and the brushes attended to, the number of breakdowns would be far fewer than they are."

Turbo-Electric Propulsion for Ships.

At the opening meeting of the Glasgow (Scotland) Students' Section of the Institution of Electrical Engineers, Chairman H. A. Mavor, in his inaugural address, told of his proposed plant for electrical propulsion of ships by plant consisting of steam turbines, generators, and motor-driven propellers.

Mr. Mavor pointed out how skeptical marine engineers were of this type of gear, as its advantages were not apparent from general principles. A constant speed of the ships did not mean a constant power, as the power for any fixed speed altered with load, tide, wind, etc., so that an efficient change gear would result in great economy. With direct steam drives, subdivision of the plant was impossible, while electric driving lent itself to this.

Mr. Mavor's method would consist of high-pressure and low-pressure turbines driving generators having different frequencies, these generators being connected to a motor having a different stator winding for each generator, and each winding having a different number of poles. Thus a series of propeller speeds could be obtained with constant speed on the turbines. In this arrangement there would be no resistances or other wasteful devices used for obtaining speed variation, and the switch gear would be very simple, as no synchronizing would be required.

Electrical Kitchen Machinery on Shipboard.

The steamship *Orvieta,* the second of new Orient liners built by Workman, Clark & Company, Ltd., of Belfast, Ireland, to the order of the Orient Steam Navigation Company, Ltd., for the new Australian Government mail service (to go into force on February 1 next), will shortly be delivered. This steamer, which is thoroughly modern and up-to-date, contains many novel electrical appliances. The following descriptions of some of the kitchen devices are taken from a recent issue of *Engineering,* of London, Eng.:

In the bakery there is an electrically driven dough-mixer, which is capable of mixing flour into dough in fifteen minutes. This consists of a revolving drum, mounted on an electric motor shaft, and having internal bars or kneaders. The baker's oven is heated with steam pipes, which are much cleaner than the fire oven, while the temperature is maintained constant to any desired extent. The area of the oven is forty square feet. There are also special appliances for making pastry.

Another interesting machine is the potato peeler, a machine which consists of a bucket, in the bottom of which there rotates a disk with corrugations covered with corundum. The potatoes are put into the bucket, and the rotation of the disk by reason of its formation, peels all in the machine in five minutes. The disk is mounted on a spindle which is driven by belt from an electric motor. During the process a supply of water flows through the bucket to carry away the peelings.

The dish-washing machines are also an interesting feature. These are designed to deal with 3,000 dishes per hour. The dishes are placed in specially constructed "baskets" designed to suit particular dishes, and thus they do not again require to be touched by hand during the cleaning or drying process. These baskets are lowered into troughs, the water in which is agitated by electrcally driven propellers, and the heat maintained at about boiling point by steam jets.

Electric Drive in Italian Arsenals.

The most important arsenal in Italy for the manufacture of military small arms is located at Terni, near the falls of the same name. There are about 1,400 machine tools in use and electric drive is used throughout the shops. The power is obtained from the falls, where eight turbines generate about 1,000 electrical horsepower. The average number of men employed is less than 1,000, but this can be increased to 2,000 if necessary.

In another Italian arsenal, the "Laboratoria di Precisione," in Rome, which employs about 150 men and where artillery is manufactured, the shops have metal overhead framing for all pulleys and belting, and the drive is electrical throughout.

Experiments on the best methods of utilizing electric drive in machine shops are being undertaken at the present time by the Engineering Experiment Station at the University of Illinois, Urbana, Ill.

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The English Mining Situation.

In his monthly notes to the Northumberland (Eng.) miners, Thos. Burt, member of Parliament, discussing the question of electricity in mines, says: "To take the electrical plant and machinery out of the mines is a drastic proposal, and can hardly be regarded as practical. But there is certainly need for greater care and stricter supervision than in many cases have been exercised. What, then, is to be done? The answer is simple; first, stop cheese-paring, and accepting the lowest tender; secondly, put the installation in charge of 'certificated and qualified' engineers, and make them absolutely responsible to the law—not the colliery manager; and, thirdly, appoint competent mines electrical inspectors to see that they (the engineers) are fulfilling their duties, and see that the plant is safely installed and operated. But such inspectors will have to visit the colliery; go below ground; make insulation tests, and give instructions for alterations or recommendations, if necessary. A single inspector for the British Isles is absurdly inadequate. We have hundreds of miles of tramways and railways all worked by electricity, carrying hundreds of millions of passengers annually, yet how often do we hear of fatal accidents to the men operating these? They are very few indeed compared to accidents in coal mines. Yet it is the same electricity! But it is installed and operated by men who know what they are about. Every detail is carefully thought out and considered in all its phases by trained engineers who are alive to their responsibilities."—*From the Engineer and Iron Trades Advertiser* (*Glasgow, Scot.*), *October 19.*

Electric Power in a Scotch Shipyard.

There is at present being put into operation in the shipyard of Wm. Simons & Company, at Renfrew, says *The Engineer and Iron Trades Advertiser* (*Glasgow, Scot.*), a new electric power plant which is interesting as indicative of the very widely extended use of electric power nowadays from power-supply company's mains. This company has dispensed entirely with the use of steam plant, both for shop-driving purposes and generating electric energy, and has installed three-phase, twenty-five-period, alternating current from the Yoker station of the Clyde Valley Electric Power Company. The feeders, at a pressure of 11,000 volts, cross under the bed of the River Clyde at Yoker to Renfrew in duplicate for their ring main system. In the substation in the shipyard there are installed two 500-kilowatt, three-phase, static, step-down transformer units, reducing from 11,000 to 400 volts. The transformer units and all extra high-tension apparatus are completely insulated, but by means of remote-control gear either or both of the units can be put into commission as the leads should necessitate, so reducing the conversion losses to a minimum. Besides the substation with the plan above indicated, there has been installed in the new power house an alternating-current switchboard, a direct-current switchboard, two motor generators, and one rotary converter, as well as two powerful Ingersoll-Rand air compressors, motor- driven by belt for the pneumatic-tool plant throughout the shipyard and boiler works.

A Unique Vacuum-Cleaner Development.

A case in which the electric motor has displaced the cumbersome portable gasoline-engine vacuum-cleaner is reported from Des Moines, Iowa. The credit for the innovation belongs to the Auto Renovator Company in the Hawkeye-State city, which company is using a White steamer car, on the chassis of which is built a special body containing a dynamo and the several electrical regulating devices.

The car carrying the necessary attendants and apparatus is driven from its garage to the building to be cleaned. The dynamo is belted to the driving shaft and generates current which is conducted by means of wires into the room to be cleaned. Here the current operates an electric motor which drives the vacuum apparatus.

This method has been found to be more convenient and economical than the old system of having the vacuum apparatus carried in a vehicle, with cumbersome rubber piping running into the room to be cleaned.

An Electrical Floating Dock.

An electrical floating dock of 11,500 tons capacity is located at Hoboken, near Antwerp, in Germany, says *The Inventive Age,* of Washington, D. C.

The dock has seven centrifugal pumps directly coupled to electric motors, and these high-speed pumps are so powerful that they can raise the loaded dock in ninety minutes. It has a total weight of 4,300 tons, and is constructed in two sections, one having four, and one three pontoons, carrying the two side walls which measure thirty feet in height. The total lifting capacity is twenty-three million pounds.

One of the sections is 277 feet nine inches long and the other is 207 feet eight inches long, and the height of the pontoons is twelve feet ten inches, while the total width of this enormous floating dock is nearly 100 feet. It is owned by the Compagnie des Cales d'Anvers, and is equipped with a most complete electric installation, arc lamps as well as incandescent being utilized, with numerous motors for operating electric machine tools, hoisting apparatus and other labor-saving devices. The high-power arc lamps are fixed on arched poles mounted on the side walls.

Machinery Development in Austria.

The following information concerning the changes which occurred in Austria in motive-power machinery in 1908, as given in the report of the inspector of workshops and factories, is furnished by Consul Joseph I. Brittain, of Prague:

The greatest advance made during the year was in the use of electricity as a motive power. In the north Tyrol and Alpine districts waterpower has been widely utilized through the construction of electrical plants, furnishing many thousands of added horsepower, especially for numerous small enterprises. The inspector for the Voraelsburg district reports that out of 1,200 motor-driven factories 800 are exclusively, and seventy others partially, driven by electrical power. In the same district, where in the early spring there was a lack of waterpower for small factories which did not use electricity, there were many benzine motors used. The Diesel motor attained great popularity in these places. In one district thirteen benzine motors were installed and four Diesel motors. The Diesel motor is constantly increasing its horsepower, and one inspector reports that in his district several of these motors have over 100 horsepower each.

Where great power is required there seems to be a gradual displacement of the piston-action machine by the steam turbine. In the central electric station in one Vienna district four steam engines, each of 800 horsepower, have been replaced by two turbine steam engines of 5,000 horsepower each. In an electrical station in another district four turbine steam engines have been installed, giving 10,000 horsepower. From Reichenberg, Prerau and Troppau come reports of the increasing use of steam turbines.

The city of Bath, Eng., has reduced the price for electricity to photographers.

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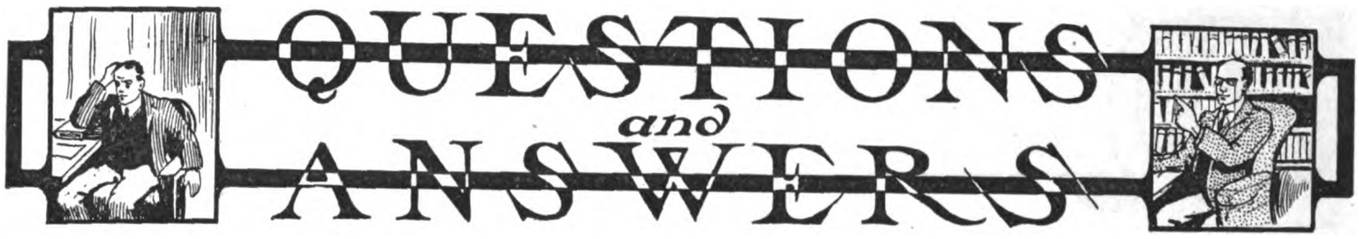

PECULIAR BEHAVIOR OF INCANDESCENT LAMPS.—While waiting for an elevated train at one of the Union Loop stations one evening last week I noticed a peculiar thing about a group of lamps lighting the platform. At first they were all lit uniformly like the rest of the lamps; suddenly one went out and the others next to it immediately became much brighter than the rest; as a train went by all were lighted equally again. These changes alternated for a long time till I tired of watching them and boarded my train. What could have caused this?—C. H. C., Chicago, Ill.

The incandescent lamps used in lighting the elevated railway platforms, like those used in the cars, barns, stations, etc., of all direct-current electric railways, are wired in sets of five lamps in series and the various sets in parallel across the 500 to 600-volt mains. If one lamp in such a set is burned out, the circuit of that set is broken and all its lamps extinguished. If one lamp in the set is short-circuited it goes out, but the other four lamps burn much brighter because the 500 or more volts is then impressed across only four lamps, so that each receives 125 volts. It is evident that one lamp was short-circuited temporarily, probably at the leading-in wires. The vibrations caused by passing trains opened the short-circuit so that all the lamps of the set again burned normally.

CURRENT RECTIFIER.—What is a current rectifier and what are its uses?—L. L. F., New York, N. Y.

The electrical term rectifier refers to an apparatus which changes an alternating current into a direct current, i. e., rectifies the current. The term rectifier is usually confined to the smaller apparatus used for this purpose, such as the mercury-arc rectifier, the electrolytic rectifier and mechanical rectifier, like the Murphy and Soulier types. Of these three classes the mercury-arc rectifier is the one most generally used, the electrolytic is the least efficient but simplest, and the mechanical types are the ones last developed. For changing alternating into direct current on a large scale machines called rotary converters and motor generators are used by central station and electric railway companies. Rectifiers are used chiefly for charging storage batteries and operating magnetite luminous arc lamps on alternating-current circuits. These batteries and lamps must be supplied with direct current, which, of course, has to be rectified, if it is to be furnished from an alternating-current source.

COLORING INCANDESCENT LAMPS.—What is the best way to color lamps that are exposed to all kinds of weather?—J. T. O., St. Louis, Mo.

There is probably no coloring compound made that can be fully guaranteed to survive the severe test of exposure to all kinds of weather. This property is claimed for several compounds on the market but cannot be entirely substantiated. However, there are some fairly reliable coloring compounds procurable which will give cheaper and more durable results than those obtained with home-made collodion mixtures. It seems to be impossible to get a transparent composition that will positively adhere to the glass under various conditions of moisture and temperature. If the film formed over the glass is thoroughly uniform and elastic it will stand normal weather changes for perhaps several weeks without cracking or flaking. Lack of homogeneity quickly results in chipping and cracking of the film, which is apt to be removed entirely on attempts at cleaning. For lamps that are installed in permanent signs it is much more satisfactory to use bulbs of actually colored glass instead of putting a film of color over ordinary glass bulbs. Such lamps can be obtained in the following natural colors: Green, blue, purple, opal, amber, ruby and canary. The price of such carbon lamps is fifty to 100 per cent greater than ordinary bulbs and they probably cut off a little more light than a collodion film, but they give a clear, uniform light and are indispensable for severe service.

WIRE FOR AN ELECTRIC HEATER.—How can I make an electric heater for 550 volts? What kind of wire, what size wire and how much wire shall I use?—J. T., Alton, Ill.

This problem is very indefinite. In order to advise definitely about the kind, size and amount of wire, as well as about the general construction of the heater, it is necessary to know for what purpose the heater is to be used and the amount of heat it will have to develop in a definite time. For instance, in the case of an electric radiator there should be specified the volume of air that is to be heated from a certain assumed temperature to a definite higher temperature every minute or other known period of time. For a water heater the amount of water and the temperature limits must likewise be known. Similarly for other electric heaters. With these conditions stated it is easy to determine exactly how many heat units must be developed and therefore the resistance and current capacity of the wire best suited for the purpose.

POWER-FACTOR INDICATOR.—Kindly describe a power-factor indicator and its uses.—P. A. B., Chicago, Ill.

A power-factor indicator, as its name suggests, is an instrument that shows what the exact value of the power-factor of an alternating-current circuit is. A description of the construction and principle of operation of such an instrument was given in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of May 15, 1909, page 888. Since the power-factor of an alternating-current circuit is the fraction by which the product of the volts and amperes must be multiplied to get the true power in watts and since this power-factor is numerically equal to the cosine of the angle of lead or lag between the current and electromotive-force, power-factor indicators are used when it is desired to find the exact power used or consumed from the product of the voltmeter and ammeter readings; also when it is desired to know the amount of inductive load and therefore the wattless component of the current; also to ascertain exactly when the inductive load on a circuit has been balanced by the field adjustment of a rotary converter, a synchronous motor, or other synchrous condenser. It is very desirable in alternating-current transmission and distributing systems to keep the current in phase with the electro-motive force. When this is the case the generators, transformers and lines are not burdened with wattless current and therefore are capable of carrying the maximum possible output.

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ELECTRICAL Advertising and Selling

NEW BUSINESS METHODS OF THE ELECTRIC LIGHT AND POWER COMPANY AT HAMILTON, ONT.

BY G. E. L. CARPENTER.

The Electric City of Canada, is what Hamilton, Ontario, is popularly called. It has won this enviable name by virtue of its cheap electric power and the extended uses to which it has been put in lighting and operating factories and railways. Hamilton is primarily a manufacturing city, with a population of some 75,000 inhabitants. Most of the citizens, and especially the moneyed ones, are of Scotch blood, and in all the business enterprises in the city their shrewdness is apparent.

The Hamilton Electric Light and Power Company, Ltd., which operates the electric-light and power business in Hamilton, gets the current from the Dominion Power and Transmission Company, Ltd. This is generated at its large station about thirty-five miles from Hamilton. The waterpower is derived from the precipitous change of level between Lake Erie and Lake Ontario, formed by the Niagara escarpment. The water is diverted from the Welland Canal at the Lake Erie level, carried through a canal five miles in length, discharged into a forebay, and plunged through steel penstocks 940 feet long against the turbine wheels in the hydraulic station. The impulse wheels are approximately twenty feet above the level of Lake Ontario, the water charges against them under a static head of 269 feet, or 120 feet greater than that at Niagara Falls, and is then returned to the Welland Canal at the Lake Ontario level. The current generated here is sold to the various light and power companies in a territory which is about fifty-seven miles long by twenty miles wide. These companies, in the various towns and cities, are all controlled by the generating company.

In the city of Hamilton, practically all power users are using current bought from the Hamilton Electric Light and Power Company, Ltd., and among the largest consumers of power are the Canadian Westinghouse Company, the International Harvester Company, the Canadian Colored Cotton Mills, the Hamilton Steel and Iron Company, and the Canada Screw Company, besides many other companies manufacturing wire, wire fencing, patent roofing, elevators, meters, patent foods, tools, shovels, carriages, incandescent lamps, etc. All the above manufacturers are securing electric power at a reduction in power cost under steam of from fifty to sixty per cent and a saving of thirty to sixty per cent in the investment that would be required for the installation of individual power plants.

The large use of central-station power in Hamilton has been obtained only after a strong campaign carried on by the company, and the very few users of steam still remaining are slowly but surely being won over. The many industries that have located in Hamilton since the beginning of this campaign are without exception using electric power. Some years ago a municipal industrial committee inaugurated a publicity campaign, advertising the advantages of Hamilton as a manufacturing center, which attracted the notice of and secured a large number of the Canadian branches of American industries. This industrial committee worked in conjunction with the company to advertise the city. This campaign is still being carried on, and new industries are steadily being started. Cheap electric power is not only obtainable, but lighting is also, which has now become quite general in the homes and stores, and when all the meters are set, replacing the flat rate, it is estimated that there will be a meter installed to every ten inhabitants.

In the year 1905 the Hamilton Electric Light and Power Company, Ltd., started its new-business work, and this work was pushed as hard as possible. The force consisted of a contract agent and two solicitors. The city was divided up into two districts, and the solicitors were held responsible for business in their respective territories. They were paid a salary and commission on the amount of business secured.

The advertising was done by newspapers, illustrated folders and pamphlets, and also a follow-up system of direct advertising was instituted. The space in the daily newspapers was used one week with a pointed-remark advertisement, which was changed every week. The folders are issued periodically, and generally advertise electrical appliances. A combined letter and pamphlet follow-up system was also inaugurated, and has worked smoothly, giving good results.

The solicitors make a weekly visit to the building inspector's office and information is obtained on all permits granted to erect or alter buildings. This information is kept at the office and closely followed up, making sure that the building is or will be wired and electric light used. Special attention is paid to see that a building once wired and connected contains a customer, and to help the solicitors in getting into close touch with the new tenant the following plan was carried out: Printed posters are placed in street windows of vacant buildings, advertising that the premises are wired, and post cards, suitably printed, are left in prominent places in the building, which the incoming tenant can send to the office, notifying the company that he has rented the place and would like to secure some information concerning electric light. This plan has worked out very satisfactorily, not only as an assistance to the solicitor, but as direct advertisements, for they can be read from the street. Just before this plan was put into operation a call was made on all the real-estate firms and their co-operation was sought. Their aid was readily granted, they working in thorough accord with the company, realizing that the building advertised as being wired for electric lights will rent much more easily than if it were not fitted for electric conveniences. Electric appliances are advertised, and when a customer appears interested the appliance is sent by one of the solicitors, who explains the advantages and its operation, leaving it for trial.

In November, 1907, the company started in to change over all flat-rate consumers to meter service. This was done as fast as the contracts expired. Some

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consumers were lost by the change, as they were getting the current very cheap. The flat rate was thirty-six cents per month per sixteen-candlepower lamp for business purposes and twenty-five cents per sixteen-candlepower lamp per month for residential service. The company had to contend with natural gas at thirty-five cents per thousand feet, and coal gas at $1 per thousand feet. As the new rate which went into effect was something entirely different from any method of charging for current the consumers had experienced before, the company spent considerable time explaining and demonstrating this rate. No new business was sought for specially, as all the time of the contract department was spent in getting the consumers changed over to meter rates and having everything thoroughly explained, so as to avoid any possible loss of consumers through misunderstandings. The company has, through the newspapers, made public all the little details in regard to the meter service. An advertisement was run in each of the three daily papers, using considerable space.

The rate for commercial electric-light service is as follows: Base rate, four-and-one-half cents per kilowatt-hour and, in addition thereto, the following fixed charges:

RATE PER LAMP PER MONTH.

4-candlepower incandescent carbon-filament lamps	$0.04
8-candlepower incandescent carbon-filament lamps	.07
16-candlepower incandescent carbon-filament lamps	.10
32-candlepower incandescent carbon-filament lamps	.20
4-ampere arc lamps	.80
6.5-ampere arc lamps	1.00
1-glower Nernst lamp	.20
2-glower Nernst lamps	.40
3-glower Nernst lamps	.60
4-glower Nernst lamps	.80
6-glower Nernst lamps	1.20

Fixed charges on other lamps, such as tungsten, etc., in proportion to their wattage consumption to the expenses here listed.

The consumer further agrees that the minimum monthly charge payable under this contract shall be seventy-five cents net, and also pays a monthly service charge of twenty-five cents net for the use of the meter and service connections. From these charges there is a ten per cent discount allowed, off current consumption only, upon bills paid within ten days. A practical example showing how this rate is operated follows: A consumer has a four four-candlepower lamp installation and his consumption for one month is ten kilowatt-hours, the account would be calculated thus:

Current consumption as per meter, ten kilowatts at a four-and-one-half-cent rate is forty-five cents, plus sixteen cents fixed charge for four four-candlepower lamps, plus fourteen cents minimum charge, plus twenty-five cents service charge, makes the bill one dollar. No fixed charges are made on any current-consuming appliances connected to this meter under this rate other than expenses.

For domestic or residential lighting there is a sliding-scale rate based on consumption. There is a monthly minimum charge of fifty cents per month and a service or rental charge of twenty-five cents per month per meter. The company allows ten per cent discount for prompt payment within ten days. The rate is as follows:

KILOWATT-HOURS CONSUMPTION PER MONTH.

Hours.	Gross Rate.	Hours.	Gross Rate.
10	$0.085	110	$0.075
20	.084	120	.074
30	.083	130	.073
40	.082	140	.072
50	.081	150	.071
60	.08	160	.07
70	.079	170	.069
80	.078	180	.068
90	.077	190	.067
100	.076	200 and over	.066

The company has also a wholesale or large consumers' special rate, which is open to anyone. This rate is as follows: The consumer agrees to pay for current at the rate of two-and-one-half cents per kilowatt-hour and guarantees that—

WATT CONSUMPTION PER LAMP PER HOUR.

4-candlepower incandescent lamps	20
8-candlepower incandescent lamps	35
16-candlepower incandescent lamps	60
32-candlepower incandescent lamps	115
4-ampere arc lamps	350
6.5-ampere arc lamps	550
1-glower Nernst lamp	90
2-glower Nernst lamps	180
3-glower Nernst lamps	270
4-glower Nernst lamps	360
6-glower Nernst lamps	540

The minimum monthly charge payable under this contract shall be based on $5 per kilowatt consumption per month on connected capacity. There is also a monthly meter-service charge of twenty-five cents net. The ten per cent discount for payment within ten days is also allowed. The lowest minimum possible under this rate is $2.50 (not including meter rent), equal to one-half kilowatt.

A practical example showing this rate in operation with a ten sixteen-candlepower lamp installation would show that the monthly minimum charge for the installation would be $3 per month. The minimum charge always applies unless the total installation is used more than eight hours per day thirty days per month. Should the minimum not apply, the customer is paying two cents net per kilowatt-hour for his lighting. The power rate is as follows, providing he pays his accounts promptly:

Base rate, three cents per horsepower-hour.

The minimum monthly charge is seventy-five cents per horsepower connected, in addition to a monthly meter rental, based on size of meter.

Horsepower per Month.	Per Cent Discount.	Net Rate.
100	0	$0.03
200	7	.0279
300	15	.0255
400	23	.0231
500	30	.021
600	35	.0195
700	39	.0183
800	41	.0177
900	43½	.01695
1,000	46	.0162
1,100	48	.0156
1,200	49½	.01515
1,300	51	.0147
1,400	52½	.01425
1,500	54	.0138
1,600	55	.0135
1,700	56	.0132
1,800	57	.0129
1,900	58	.0126
2,000	60	.0120
2,100	60¾	.011775
2,200	61½	.01155
2,300	62½	.01125
2,400	63	.0111
2,500	64	.0108
2,600	65	.0105
2,700	65½	.01035
2,800	66	.0102
2,900	66½	.01005

On an installation of fifty horsepower and upward the rate is one cent net per horsepower-hour.

On an installation of fifty horsepower and over the rate is three-fourths of one cent net per horsepower-hour, providing contract contains clause of restricted period (from October 1 to March 1, no current to be used between 5 and 6:10 p. m.).

The company renews all incandescent lamps and furnishes the first installation free. The electric-sign business has not been thoroughly developed and steps will be taken shortly to push this end of the business further. Flatirons have not received any special attention, such as a special campaign, but there are about 550 irons and heating appliances in use today. The Hamilton Electric Light and Power Company, Ltd., expects to register one of the largest years in point of new business secured, next year. The electric-lighting end will receive special attention. The City Council has not forgotten that to demonstrate that cheap electric power and light is obtained in Hamilton, as much use as possible should be made of the current to illuminate the city streets and parks. One result of this advertising was the illuminating of one of the city parks by about 1,600 eight-candlepower incandescent lamps colored red, white and blue. This particular illumination is lighted every night from dusk until midnight, for which the city pays a nominal charge. This has brought the merchants to believing that electric advertising out of doors is profitable publicity, with the result that the business streets are brilliantly lighted with arc lamps, electric signs and outline lighting.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

AMERICAN TELEPHONE AND TELEGRAPH.

The Associated Bell Operating Companies of the American Telephone and Telegraph Company, not including the long-distance lines of the American Telephone and Telegraph, report for the month of September and nine months ended September 30, as follows:

	1909.	1908.
September gross	$11,462,336	$10,565,053
Operating expenses and taxes	4,642,686	4,464,949
Balance	$ 6,769,650	$ 6,100,104
Maintenance and depreciation	3,405,276	2,907,231
Net	$ 3,364,374	$ 3,192,873
Interest	560,186	622,674
September surplus	$ 2,804,188	$ 2,570,199
Nine months gross	99,834,450	92,773,087
Operating expenses and taxes	41,115,143	40,106,841
Balance	$58,719,307	$52,666,246
Maintenance and depreciation	31,271,194	26,357,635
Nine months net	$27,448,113	$26,308,611
Interest	5,091,471	5,766,926
Nine months surplus	$22,356,642	$20,541,685

In 1909 all maintenance and depreciation is charged for by an extraordinary charge in December as heretofore. In order that a true comparison may be made between 1908 and 1909, the 1908 figures as above presented include in expenses for each month one-twelfth of the extraordinary provision for depreciation which was made in December, 1908. The unexpended portion of the provision made for depreciation for the first eight months of 1909 was $9,979,134, which is not counted as profits, but remains as a reserve for future replacements.

NEW YORK EDISON COMPANY.

The New York Public Service Commission has issued a report covering the operations of the New York Edison Company for the year ended December 31, 1908, as follows:

Operating revenue		$15,228,716
Operating expenses and taxes		9,087,680
Net operating income		$ 6,141,035
Non-operating income		1,014,436
Total income		$ 7,155,471
Interest, rentals, etc.		3,250,767
Net corporate income		$ 3,904,703
Previous surplus		12,849,628
Total surplus		$16,754,332
Deductions from surplus:		
Dividends	$2,703,060	
Adj. Bronx from taxes	1,505	
Total	$2,704,565	
Additions to surplus:		
Damage suits	12,600	
Miscellaneous items	220	
Electric Testing Laboratory, stock dividend	12,780	
Coupon interest and interest on unpaid coupons of Consol. Tel. & Elec. Sub. and Yonkers Electric Light & Power	760,178	
Total	$ 785,778	
		$ 1,918,785
Surplus December 31, 1908		$14,835,547

PUBLIC SERVICE CORPORATION OF NEW JERSEY.

President Thomas N. McCarter of the Public Service Corporation of New Jersey has given out a statement of the earnings of the corporation covering the twelve months ended September 30, 1909. This is the first report of the earnings of the entire system of the Public Service Corporation that has been made public:

Gross (including miscellaneous income)	$25,921,892
Operating expenses, taxes and rentals and fixed charges of leased and controlled companies	23,235,533
Net earnings	$ 2,686,359
*Interest on Public Service Corporation securities	1,681,132
Surplus	$ 1,005,227

*Includes interest on convertible and collateral notes which have since been retired, reducing the annual interest charges to $1,564,468.

The gross earnings of the Public Service Corporation for the nine months of 1909, and four calendar years preceding have been as follows:

1909 (nine months)	$19,286,261
1908	24,267,687
1907	23,628,044
1906	21,498,826
1905	19,949,842

LONG ACRE ELECTRIC LIGHT.

The New York Public Service Commission has issued a report covering the operations of the Long Acre Electric Light and Power Company for the year ended December 31, 1908, as follows:

Gross operating revenues	$ 3,804
Operating expenses, taxes, etc.	24,391
Total operating deficit	$20,586
Rentals, etc.	25,890
Deficit	$46,476
Previous deficit	28,798
Deficit December 31, 1908	$75,275

WESTERN ELECTRIC COMPANY.

October sales booked by Western Electric showed a material improvement, totaling nearly $4,500,000, or at the rate of $53,000,000 per annum.

In fact, October gross was the largest of any single month since May, 1907, and recorded the first distinct increase in orders for the last six or seven months. Business received was nearly $1,500,000, or fifty per cent greater than in October, 1908.

For the eleven months period Western Electric sales have been at the rate of slightly better than $47,000,000 per annum, an improvement of forty-three per cent over the same eleven months of last year.

For the 1907 and 1908 fiscal years Western Electric failed to show the eight per cent dividend on its $15,000,000 stock fully earned. It is very probable that this year, however, the company will be able to show the eight per cent dividend fully earned, with some surplus to the good.

Gross sales for the full year to end November 30 of rising $47,000,000, would compare with $33,000,000 last year, an increase of forty-five per cent, and coming, as much of the gain has, during the last six months, leads to the expectation that the company will book over $55,000,000 gross in the next fiscal period, or more than in 1907.

A factor helping Western Electric earning has been the steady advance in prices, not so much in telephone supplies as in general electrical apparatus, sales of which for the eleven months have been forty per cent greater than a year ago.

TWIN CITY RAPID TRANSIT.

W. W. Winter, president of the Brooklyn Rapid Transit Company, has returned from a two weeks' trip through the Middle West, during which he went over the lines of the Twin City system. He says of this property:

"It is an excellent system, well kept up and rightly managed. Conditions surrounding the operation of a street-railway line out there are much easier than in this part of the country, but that does not detract from the credit due the Twin City. It is not a criminal offense in Minnesota for capital to earn a fair rate of interest."

AMERICAN LIGHT AND TRACTION.

The American Light and Traction Company, for the convenience of its stockholders, is trying out the policy of dealing in its own warrants, which are issued to common stockholders for fractional parts of a share in payment of stock dividends, and of granting to holders the right to purchase full shares of stock by paying the fractional difference in cash. Both transactions are conducted at a certain definite rate per share, which rate is below the current market value of the stock.

It is interesting to note how this plan worked out in the case of the ten per cent stock dividend paid on the $8,279,000 common stock in August.

Certificates of stock for 8,033 shares were issued to stockholders who had ten or a multiple of ten shares, and warrants for fractions aggregating 246 shares were issued to those holding fractional parts of ten shares.

Holders of 214 warrants, aggregating seventy-three shares, sold their warrants to the American Light and Traction Company at the rate of $235 per share; 335 holders of fractional warrants, aggregating 151.7 shares, paid the fractional dif-

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ference at the same rate and each secured a full share, and forty-one fractions, aggregating eighteen shares, were exchanged even for that amount of stock. This makes a total of 353 shares issued in exchange for warrants aggregating 246 shares, or 107 shares more than were called for by the stock dividend. Warrants aggregating about fourteen shares were still outstanding when the November dividend was declared. These will now be treated the same as the November warrants.

The American Light and Traction Company has 987 common stockholders, 306 of whom hold over forty shares and 681 under that amount.

The Mackay Companies.

A report from New York states that the new cable of the Commercial Cable Company between New York and Newfoundland, laid to facilitate the transatlantic business, has proved a great success, according to officials of the Mackay Companies. It is not improbable that within a comparatively short time further cable connections will be made between the two points on the American continent, since both as time saver and a means of greater accuracy in transmission the Newfoundland route has more than justified the expenditures incurred.

While there has been a decided increase in business, there is, however, nothing to indicate that the dividends are to be raised beyond the four per cent rate, which has prevailed since 1904, for the preferred stock. Dividend payments on the common shares began in 1905 and were increased to four per cent in 1906. It has been semi-officially stated that the earnings would justify a larger dividend rate.

President Mackay was in the West, and it appears that since the Atlantic cable service received a great deal of attention during the earlier part of the year, the land lines are now to be favored similarly. The further building up of the Pacific Coast system is known to have for some time claimed the attention of the management.

Mr. Mackay's recent journey through the Western states has afforded an opportunity for the inspection of more than 10,000 miles of wires, and with the information he has gathered from this tour of inspection he will be in a position to make a detailed statement for the annual report, which is issued at the end of the fiscal year, January 30, 1910.

Associated Gas and Electric.

A controlling interest in the Associated Gas and Electric Company, of Ithaca, N. Y., has been acquired by W. S. Barstow & Company, of New York, with offices also in Portland, Ore. At the present time the Associated Gas and Electric Company has authorized $5,000,000 of collateral bonds, of which there are issued: $1,500,000 of debenture bonds, of which there are $225,000 issued; six per cent cumulative preferred stock authorized $1,000,000, of which there is $500,000 issued; common stock authorized $1,000,000, of which $600,000 is issued. The total securities of these companies to be taken over are $1,950,000 stocks and $1,717,000 bonds.

The officers of the Associated Gas and Electric Company, which will continue in existence and control the properties above mentioned are: W. S. Barstow, president; William T. Morris, vice-president; O. Clement Swanson, treasurer; Jos. B. Taylor, secretary; T. W. Summers, general manager.

Electric Road Mortgaged.

The Oregon Electric Railway Company of Oregon City recently filed a supplemental mortgage in behalf of the Columbia Trust Company of New York, as trustee, covering all of the property of the railway company that has been acquired since the original mortgage was given. The instrument was made to secure the payment of a bond issue of $10,000,000. Of this authorized issue of bonds only $2,000,000 have been sold. The supplemental mortgage embraces the Forest Grove division of the Oregon Electric Railway Company, covering 6.83 miles, and includes lands and franchises in Forest Grove, Hillsboro, Cornelius and Beaverton.

Michigan Telephone Companies Must Report Earnings.

Attorney-General Bird, of Michigan, has recently furnished the State Tax Commission with an opinion, in which he states that all telephone companies must make an annual report to the commission. Many small telephone companies have, in the past, refused to do this on the ground that their gross earnings do not exceed $500.

Mr. Bird said further, that, while the company might be in the best position to state its financial condition, it was the business of the commission and not of the company to determine the gross earnings officially.

Tramway Electrification in Russian Capital.

Consul James W. Ragsdale advises that an effort to sell the tramways of St. Petersburg to private parties caused the Municipal Board to take quick action to prevent it, and provide means for electrifying the extensions and those portions of the roads now operated by horsepower.

The second relay will include trackage of 64.6 versts (verst equals two-thirds of a mile), or a little more than the trackage now run by electricity. The cost of building the lines of the second relay will amount to 20,040,000 rubles (ruble equals 51.5 cents), against 18,600,000 rubles, the cost of the first relay for 54.3 versts. The revenues of the system, when extended, it is estimated, will aggregate 14,300,000 rubles, and the expenses 6,000,000 rubles. After deducting interest and cost of liquidation of loans, the net profit is estimated at 2,300,000 rubles, or 4.2 per cent on the capital invested. It is expected that the extension will require three years to complete, and when finished horsepower on any street-car line in St. Petersburg will be a matter of the past.

Denies Claim of $7,450,000.

The Interborough-Metropolitan Company denies that it owes the New York City Railway Company a balance of $7,450,000 on stock according to its answer to the suit of William W. Ladd, receiver for the New York City Railway. It asserts that the Metropolitan Securities Company, by which the New York City Railway stock was handled as a holding company, owes to the Interborough-Metropolitan $8,201,862.83 for money lent and advanced to the Metropolitan Securities Company for its corporate purposes.

Receiver Ladd already has obtained judgment against the Metropolitan Securities, and that company is trying to reverse the judgment.

King's County Electric Bonds.

At a special meeting of the stockholders of the Kings County Electric Light and Power Company, the proposition to issue $5,000,000 par value convertible six per cent debenture bonds was ratified. The bonds will be dated on or about January 1, 1910, and payable on or about January 1, 1922, and convertible into the stock of the company at par at the option of holders, or on and after January 1, 1913, and before January 1, 1922. The debentures will be offered to the stockholders at par in proportion to their holdings of stock.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

New Single-Phase Motors.

It has now become common practice for both central stations and isolated plants, employing polyphase generating units, to feed large portions of the lighting circuits as well as that part of the power load required for machinery of moderate capacity, through single-phase distribution lines.

Fully recognizing the permanent field for single-phase motors, the General Electric Company has paralleled its well-known polyphase design with two lines of single-phase motors. The KS type is well known, and thousands are now in successful operation. The RI motors of the repulsion induction type will be described here.

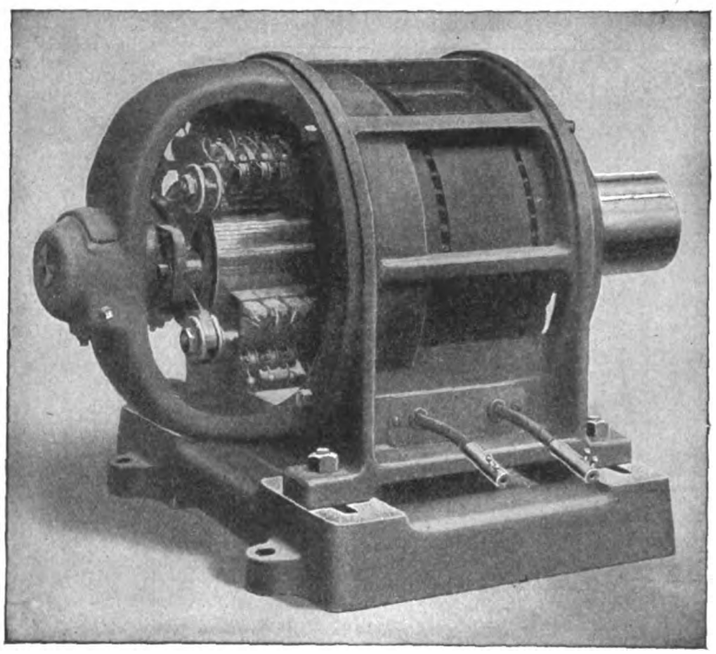

FIG. 1.—TYPE RI REPULSION MOTOR.

In general, the type RI motor is distinctly adapted to the operation, by belt, gears or rigid couplings, of all machines requiring constant or variable speed and moderate or heavy starting torque. They are entirely automatic, and may be thrown on the line without the interposition of any starting box, clutch cupling, or other external device.

RI motors are built in the unique and well-known open frame form, in which the laminations of the stator core are clamped between cast-iron flanges held in the frame to which the end heads are secured. This construction provides a most simple and effective method of natural heat radiation, since the laminated stator disks are exposed directly to the air. In addition, all inactive material is thus eliminated, weight is reduced, and without sacrificing rigidity, efficiency, or quality in any respect, the motor is made exceedingly compact and more readily accessible for cleaning than the older box-frame type. Also, pockets for the accumulation of dust are avoided.

The field of the RI motor is wound with a single-phase winding of the concentric type, each coil being taped and insulated separately. When completed, the stator coils receive a japan and baking treatment to render the insulation impervious to ordinary dampness or moisture.

To facilitate connection to circuits of either 110 or 220 volts four plainly tagged leads are brought out to the back of the removable terminal board.

The RI armature winding is of the series drum type connected to a commutator carrying two sets of brushes, each set being displaced electrically from the other by ninety degrees. The first set, known as the energy brushes, is permanently short-circuited and disposed at an angle to the lines of field or primary magnetization, as in an ordinary repulsion motor. The second set, or compensating brushes, is connected to a small portion of the primary winding included in the field circuit, so as to impress upon the armature an electromotive-force which serves both to raise the power-factor and at the same time maintain approximately synchronous speed at all loads.

The armature laminations are built up on a cast-iron sleeve having the same inside bore as the commutator. In case the shaft becomes damaged or worn, it can be readily pressed out and replaced without disturbing the commutator or windings.

The bearings are of the oil-ring type and of ample size to minimize wear and insure cool operation. Solid rings are used, which revolve loosely on the shaft and dip into reservoirs of proper capacity to provide constant lubrication of the journals and linings. The reservoirs are fitted with visible gauges to indicate the amount of oil, and with taps for drawing off the lubricant when required.

As will be noted, the double-arm construction of the bearing heads permits ready access to all parts of the commutator and brush-gear.

The standard method of interchangeably spacing the end-head retaining bolts is used, allowing the motor frame to be shifted ninety or 180 degrees for wall or ceiling suspension, as desired.

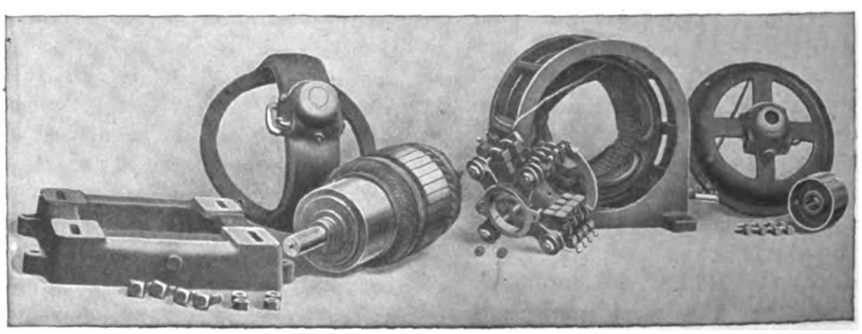

FIG. 2.—TYPE RI MOTOR DISASSEMBLED.

Standard RI motors are wound for sixty cycles and are interchangeable for

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110 or 120 volts, with capacities of one-half, one, two, three, and five horsepower. The full-load speed is as follows: One-half-horsepower, 1,625 revolutions per minute; one-horsepower, 1,720 revolutions per minute; two-horsepower, 1,725 revolutions per minute; five-horsepower, 1,625 revolutions per minute.

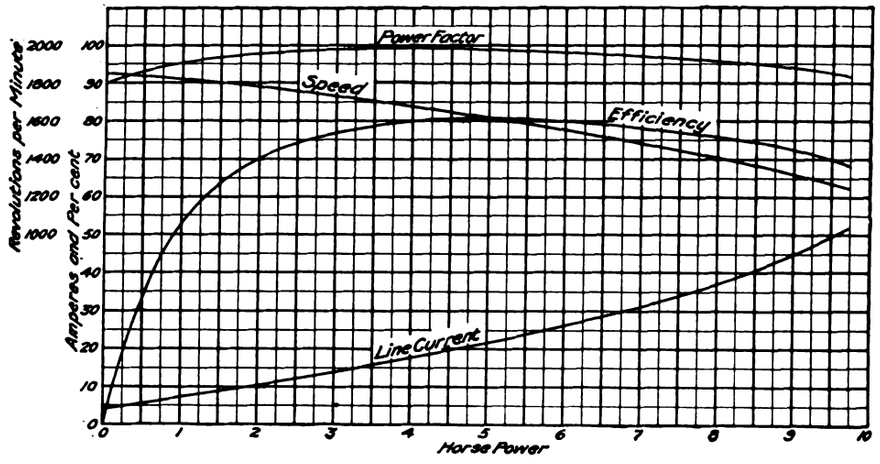

FIG. 3.—CHARACTERISTIC CURVE OF FIVE-HORSEPOWER TYPE RI MOTOR.

A study of the curve, Fig. 3, covering the performance of a standard five-horsepower RI motor will show at once the remarkably high and well-sustained power-factor and efficiency characteristics of the RI motors.

RI motors can be furnished with controllers to give a speed variation of fifty per cent below synchronous speed by inserting resistance or reactance in the energy and compensating circuits. With the exception of the leads brought out from these circuits, the constant-speed and variable-speed motors are identical. Reversible motors can be furnished at the slight additional cost of a special winding having terminals for connection to a four-pole double-throw switch.

The CR-118 rheostats are designed for starting duty only, and are recommended for operating these motors on circuits where it would be objectionable to throw the motor directly on the line. A no-voltage release coil allows the rheostat starting arm to automatically return to the "off" position in case of line-voltage interruption. The CR-172 controllers are designed to give speed reduction and speed increase, as resistance is inserted in the energy and compensating circuits.

Fig. 5 illustrates the controller for use with one and two-horsepower, 110 and 220-volt motors. The resistance for the compensating circuit is self-contained, while an external resistance is required for the energy circuit. The rheostat has renewable segments and is furnished with a cover which completely encloses the slate front.

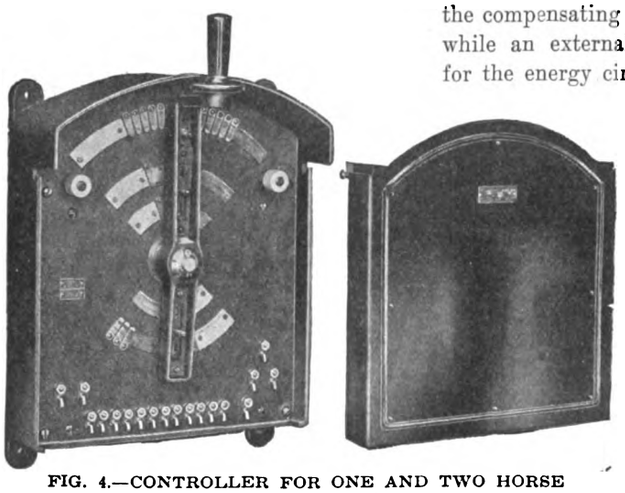

FIG. 4.—CONTROLLER FOR ONE AND TWO HORSE POWER RI MOTORS.

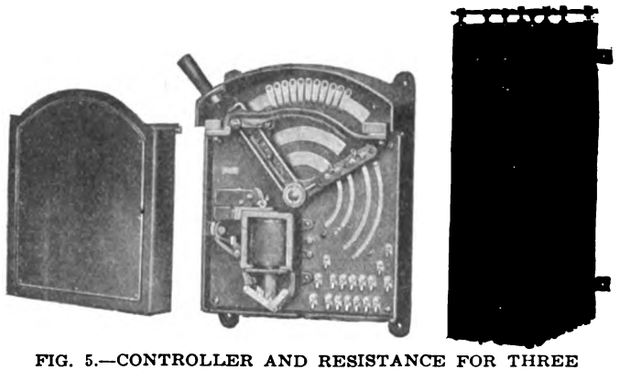

FIG. 5.—CONTROLLER AND RESISTANCE FOR THREE AND FIVE HORSEPOWER MOTORS.

The controllers for three and five-horsepower, 110 and 220-volt motors are shown in Fig. 6. The resistance for the compensating circuit is self-contained, while the resistance for the energy circuit is external, being assembled in a well-ventilated sheet-iron box suitable for mounting on the wall. These controllers have an enclosing cover, renewable segments and in addition are supplied with an alternating-current contactor. The contactor acts as a no-voltage release and also makes and breaks the motor circuit, thus preventing arcing on the switch contacts.

At present the RI motors are built in five sizes, one-half, one, two, three and five horsepower.

The advantages of this type of motor may be briefly stated as, noiseless operation, attractive design, improved ventilation, excellent heating and overload characteristics, compact and rigid construction, least weight consistent with proper mechanical strength and the sustaining of high electrical constants, self-starting with rapid acceleration, and wide speed control.

Westinghouse Business Increasing.

The first six months of the current fiscal year of the Westinghouse Machine Company, which ended last month, showed a business volume representing the second largest in the history of the company for a similar period. From present indications, it is confidently expected that the next six months will, however, show a much better result. This is due to the fact that business conditions generally are constantly improving, and also because the company has taken on several new lines of product within the last year, now fully developed, and the exploitation of which is greatly enhancing the volume of output. Indeed, forty per cent of the business done by the company in recent months is represented by these new lines. In addition, the revival of the electric-railway business from the financial depression is the source of many new orders which the company is now obtaining. One of the chief officials of the Machine company, speaking of the prospects, said recently: "There is every indication that the volume of our business will reach its normal figures again by the beginning of the new year."

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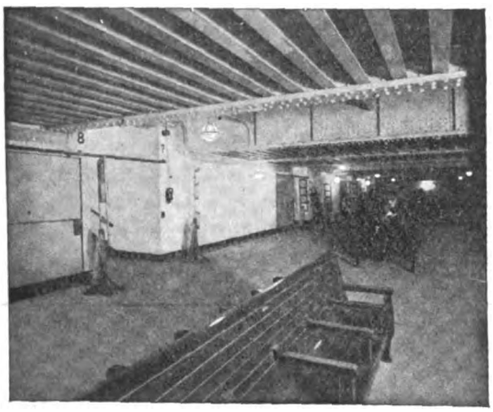
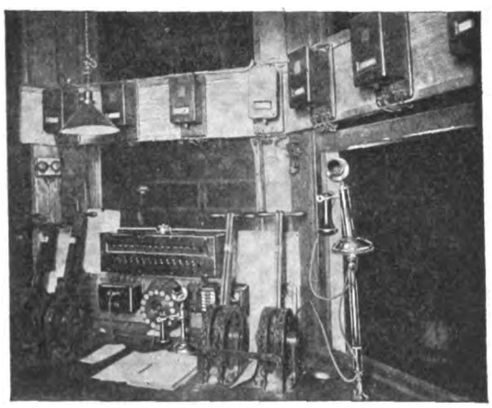
An Intercommunicating Telephone and Train Despatching System at the Erie Terminal, Jersey City.

It is a well-known fact that the telephone is rapidly replacing the telegraph instrument for railway train despatching. The intercommunicating telephone, on account of its economy of time and labor, is also recognized as the chief aid of the modern business man. A combination of the two, using an intercommunicating telephone system for train despatching, is, however, indeed a novel installation. Such is the use to which one is put at the Erie Railroad terminal, Jersey City, N. J. To make it more interesting, these telephones are also the connecting link between the Erie Railroad's suburban system, which terminates at Jersey City, and the Hudson & Manhattan Railroad Company's tunnel trains running from that point under the Hudson River to New York city.



VIEW OF GATES.

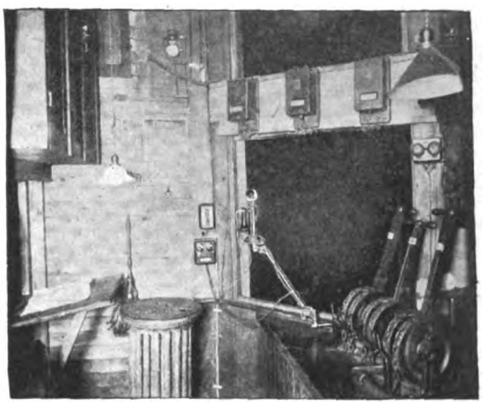


INTERIOR OF DESPATCHING TOWER, SHOWING GATE-CONTROL SYSTEM.

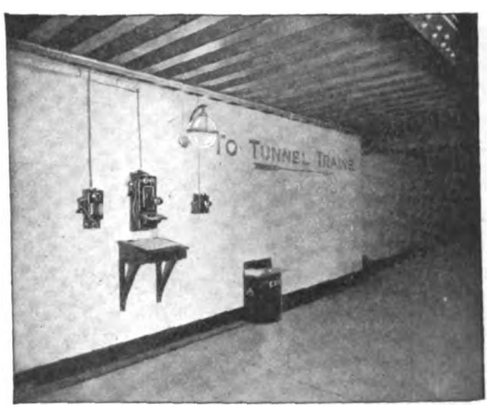
At the Erie station end of the train sheds, overlooking them, is built the despatching tower. The interior of this is shown in two photographs, the two views overlapping. At the right of the view of the northern end of the tower is seen mounted on an equipoise arm, the desk set of the gate-control system. The ringer and the key box connected with this set are shown side by side behind one of the levers mounted on the tower desk, and to the right of a second telephone seen in the center of the photograph. On the gate-control system are the tower telephone and five wall-type intercommunicating sets, one at each stairway leading from the concourse floor to the train shed. One of these is shown at the left of the group of three in the photograph of the end of the concourse. Others are seen in the general view of the concourse. All of these sets are built according to the latest designs of the Western Electric Company, which manufactures all of the telephones used in the "Bell" system. Each of the sets has an ultimate capacity of eleven connections. The conductors connecting each set with all of the others are carried throughout in cable, the conductors being insulated with double silk and single cotton, differently colored for identification. As much of the cable is laid where it is exposed to moisture, it has a lead cover.

The operation of this part of the system is as follows: The suburban passengers from the Hudson tunnels enter the concourse through the subway, but are kept from going into the trainsheds by the closed gates at the stairways. We will assume that the passengers live in Bloomfield and Montclair, and the train to these places is to leave track No. 8. The despatcher presses the button marked track No. 7 and No. 8 on his key box. This act automatically connects his set with the one at the gate for track 7 and 8 and rings the bell. When the guard answers the call he tells him that the train for Bloomfield will back into track 8. The guard puts up the sign on the rack to indicate this. A few minutes later the train is ready, and the despatcher rings the gong over the gate to notify the guard of the fact. The guard, after pressing one of the two buttons to be seen under each stairway telephone corresponding to the track number, opens the gate. Should the button pressed show the despatcher that the guard did not understand correctly which of the tracks is to be used, or if there is any misunderstanding, he can always easily reach the guard by use of the intercommunicating telephone.

The gongs referred to are controlled from the despatcher's office by means of the long box shown in front of the window in the interior view of the tower. The buttons at the bottom control the gongs for the ten tracks referred to and the four additional tracks in the train sheds. When the guard answers by pushing the bell button under his telephone, the bell on top of the control box rings and a corresponding numbered drop appears in the row of drops at the top of the box. This box is of special design and was built by the Western Electric Company.



INTERIOR OF DESPATCHING TOWER.



TELEPHONE INSTALLATION IN CONCOURSE.

In the view of the southern end of the despatcher's tower is the desk set, ringer and key box of a second intercommunicating system. Five sets are at present connected with the system, namely: Train Master, Division Master, Terminal Tower, Engine Yard and Passenger Yard. These have proven sufficient for the despatcher to keep in touch with all the details of train make-up and handling of special work.

In the center of the first referred to view of the tower is seen a desk tele-

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phone. This is connected to a three-plug magneto party system, which was in use before the volume of traffic demanded the installation of the new system. This is kept in place for emergency use.

Another photograph shows the desk of the chief attendant in the concourse. The set to the left is for tracks No. 1 and No. 2 on the gate-control intercommunicating system. The wall-type magneto set, in the center, is connected with a similar set on the platform of the Hudson tunnels, and is used to keep in touch with the arrival of the tunnel trains. The third set, farthest to the right in the illustration, is on another system maintained by the Hudson tunnels.

It is found that not only does this system do rapidly, and with a minimum effort on the part of the despatcher, the work for which it is intended, but, by keeping the men in conversational touch with each other, it forms practically a unit of them. No doubt similar equipments will be installed in other terminals in the near future.

Gas-Electric Motor Cars for Southern Railway.

The General Electric Company has sold to the Southern Railway Company two of its latest type of gas-electric motor cars. These cars are equipped with standard commutating-pole railway motors of 100 horsepower. Two of these motors are located on the forward truck, giving a motor capacity of 200 horsepower to each car.

The current is supplied from a 600-volt generator, which is direct-coupled to an eight-cylinder gas engine in the forward compartment. A controller similar to that used on an ordinary trolley car is located convenient to the operator, and through this the current passes from the generator to the motors. Combined straight and automatic air brakes are provided, with the usual valves and accessories. The car bodies are of steel, about fifty-five feet long, with seating room for fifty-two passengers. Both rear and center entrances are provided, thus furnishing a convenient means of dividing the two classes of passengers, as required in the South. The cars are illuminated by electric light throughout.

The order for these cars was placed with the General Electric Company after a thorough test of this type of car between Manassas and Strasburg, Virginia, last summer.

New Types of Holophane Reflectors.

The new extensive and intensive types of Holophane-D'Olier steel reflectors, manufactured by the Holophane Company, Newark, Ohio, and illustrated herewith, permit the use of standard-voltage tungsten lamps for industrial lighting. These reflectors, giving as they do the characteristic distributions of the Holophane "high-efficiency" glass reflectors, enable the illuminating engineer to undertake mill and factory lighting problems in the same way as he would handle a residence or commercial problem.

The new Holophane-D'Olier reflectors, being designed upon scientific lines, have created a demand for their use in factory lighting. It is definite, practical illuminating results at which the shrewd present-day factory manager looks. He has, in the past, bought lamps and "shades." Today he is demanding adequate and economical illumination.

Extensive Type.

Intensive Type.

NEW TYPES OF HOLOPHANE-D'OLIER STEEL REFLECTORS.

AN INSTALLATION OF HOLOPHANE-D'OLIER STEEL INTENSIVE REFLECTORS IN SHOE FACTORY.

Tungsten lamps have heretofore not been available to any considerable extent for industrial lighting because of the high percentage of breakages. Workmen could not be taught to handle the lamps carefully. The extensive and intensive Holophane-D'Olier steel reflectors, however, enable the lighting engineer to install tungsten lamps safely, as these reflectors give the best results when the units are hung high and out of the workmen's reach.

These new reflectors mark another step in the progress of Holophane illumination. While they are of such exact design as to commend themselves to the illuminating engineer, it requires no expert skill or deep engineering knowledge to use them with complete satisfaction wherever the "group-lighting" or "distributed-unit" system of lighting is desirable.

The Largest Self-Cooling Transformer Ever Built.

The maximum size for which a transformer can be built self-cooling is limited by the amount of heat-radiating capacity for which the case can be designed. Standard cases with corrugated sides are regularly supplied with transformers up to about 600 or 750 kilovolt-amperes, but beyond this size the weight and size of the case become so great that some method, other than mere increase in size, must be resorted to in order to get the necessary radiating surface.

A type of case recently developed by the Westinghouse Electric and Manufacturing Company overcomes this difficulty and is capable of being designed for a greater radiating capacity than has ever been attempted for a self-cooled transformer. It consists simply of a plain boiler-iron case to the outside of which are welded a number of radiating tubes. These tubes are in the vertical position

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and are given a ninety-degree bend at the top and bottom where they enter the case. The mechanical construction is very strong, so that there is practically no chance of ever springing a leak. Because of the ease with which the tubes can be widely separated from one another, the air circulates very freely among them, and the efficiency of the radiating surface is higher than for the corrugated case.

There is a growing demand for large self-cooled transformers in substations and other places where water for cooling purposes is either not available or else very

LARGEST SELF-COOLING TRANSFORMER EVER BUILT.

costly, or where weather conditions are so severe that water-cooled transformers may give trouble, or where it is desirable to have as little attendance as possible.

The Westinghouse Electric and Manufacturing Company has just built twelve 1,000-kilovolt-ampere, 100,000-volt transformers of this type, shown in the illustration, for the Southern Power Company; three of these transformers are for outdoor service and nine for indoor use.

Copper Exports.

Exports of copper for the week ended November 11 were 7,143 tons. Since November 1 they were 8,084 tons, compared with 6,423 tons the same period last year.

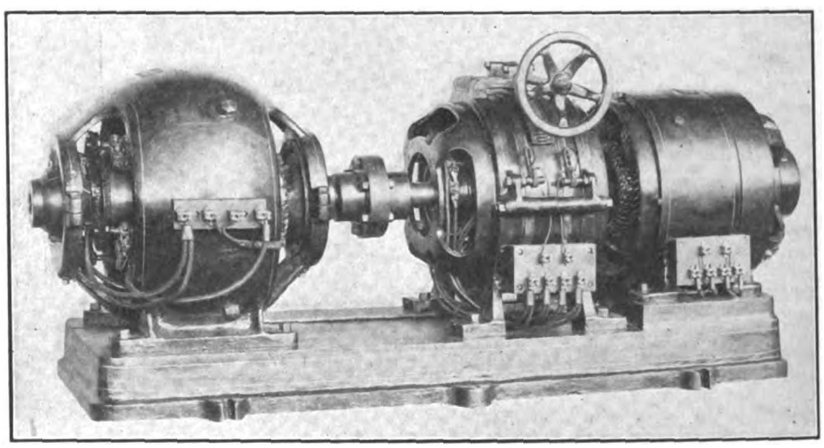
Special Motor-Generator Set.

A motor-generator set has recently been installed in the testing department of the Commonwealth Edison Company, Chicago, which on account of its special design and construction is worthy of consideration.

The motor-generator set under discussion is illustrated on this page. The motor is of the adjustable-speed type, capable of operating the two alternating-current generators at a speed of from 750 to 1,800 revolutions per minute, thus giving frequencies ranging from twenty-five to sixty cycles. The generators furnish alternating current of true sine wave, the one at the extreme right is wound for 110 volts and the other for fifty volts. The fifty-volt machine is arranged in such manner that the field rings supporting the pole-pieces may be rotated through 180 electrical degrees. The frame is supported on substantial bearings contained in the end brackets and is rotated by a worm-gear attachment operated by hand wheel. This outfit is used for calibrating alternating-current wattmeters.

The pressure coil of the wattmeter is connected to the high-voltage machine through suitable transformers. The current coil of the wattmeter is connected to the low-voltage machine through other suitable transformers. The power-factor of the load of the wattmeter may be varied from unity to zero by rotating the field ring and poles of the generator connected to the current coil. Thus artificial loads of all power-factors can be readily obtained without excessive consumption of energy and with the greatest exactness. The points of zero and unity power-factor may readily be found by means of electrical testing instruments. The field ring is provided with a graduated scale, which moves past the zero mark on the end rings and give an indication of the angle of lead or lag.

This outfit was designed and manufactured by Roth Brothers & Company.



ROTH BROTHERS & COMPANY SPECIAL MOTOR-GENERATOR SET.

Large Railroads Adopt the Telephone for Train Dispatching.

The New York, New Haven & Hartford Railroad Company has placed orders for telephone and selector apparatus for equipping the Northampton Division for telephone train dispatching. The equipment consists of Gill standard bridging selectors and Western Electric telephone apparatus. This will be the first circuit so equipped on the New Haven road and covers a total of seventy-seven miles with twenty-nine stations.

The Atlantic Coast Line also has in process of construction, and will shortly cut into service, a telephone train-dispatching circuit from Richmond, Va., to South Rocky Mount, N. C., a distance of 121 miles. The dispatcher for this circuit will be located at Richmond. There will be thirty-two selector way stations and two local telephone stations in the chief dispatcher's office and the superintendent's office at Richmond. These stations will be called by means of a buzzer. Western Electric telephone apparatus and Gill selectors are used.

The rapidity with which the telephone is being adopted for train dispatching in some parts of the South emphasizes the progressive spirit with which the railroads of that section are meeting their problems today. The Western Electric Company reports that within the past six weeks three other railroads have placed orders for telephone train-dispatching circuits leading out of Richmond. These are the Chesapeake & Ohio, Richmond, Fredericksburg & Potomac, and the Seaboard Air Line.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, NOVEMBER 6.—A new type of locomotive is being constructed for the Caledonian Railway Company, and the experiment will be watched with great interest by railway managers. In this locomotive steam is generated in a boiler of the usual locomotive type, and is supplied to a turbine which in turn drives a direct-current dynamo. The turbine is of the impulse type and runs at 3,000 revolutions per minute. Current is supplied from the dynamo to the four series-wound traction motors at 600 volts. The motor armatures are mounted directly on the four main or driving axles of the locomotive. Very few details of the new locomotive are available or will be given by the makers, but it is stated that a switchboard, by which the motors can be connected in series, series-parallel, or parallel (according to the drawbar pull to be exerted), forms part of the equipment. The engine is intended for express passenger service.

The annual statement of the British Postmaster-General contains, as usual, interesting statistics as to the various public departments coming under the control of the Post-Office administration. New trunk telephone exchanges have been opened during the year to the extent of forty-seven, bringing the total up to 551, and it is interesting to see that trunk telephone conversations have increased by some seven per cent. New telephone subscribers to the Post-Office system are being connected at the rate of 150 per week, and the attempt to adapt existing telegraph wires for telephone purposes locally has been very successful. Contrary to the expressed opinions of the Marconi Company when the Berlin radio-telegraph convention was under discussion, it is stated that the effect of this has been distinctly to the advantage of the company's business. One hundred British merchant vessels are now fitted with wireless telegraph apparatus.

An instance of the manner in which several of our electric power companies have allowed their Parliamentary powers to become derelict, is to be seen in the Somerset and District Electric Power Company. This was authorized some five years ago and some commotion was caused in municipal circles by the fact that this was the first power company to be given authority to supply in towns already possessing a municipal electricity undertaking. Great things were expected in this connection, but the company has never been able to get on its feet for some reason, and within the past few months the Board of Trade has issued certificates of cesser of powers in the municipal areas mentioned. This cuts away the company's best area, or at any rate a good portion of it, and it would not be at all surprising if the undertaking were never started at all. There are three or four other power companies in the United Kingdom which have so far made no attempt to put their Parliamentary powers in operation, although they have been incorporated for several years.

Efforts are to be made to induce the Board of Trade to grant licenses to tramway authorities to employ the trackless-trolley system, so that the work may be proceeded with rapidly, instead of having to wait about twelve months as would be the case if a bill has to be promoted in Parliament specially for this purpose.

The obstinacy which the London County Council has hitherto shown in regard to the question of intercommunication with other tramway systems is at last giving way. Arrangements have been made with three municipal tramway authorities on the eastern borders of London for a through service over certain lines, an arrangement which has been asked for by the latter for a long time past. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, NOVEMBER 5.—One of the largest electric mine plants in France has recently been installed at the Portes et Senechas mines. The installation includes a large steam-operated electric station which is erected at the surface and near the mouth of the shafts, together with a cable drum hoisting apparatus placed within the horizontal shaft of the mine, and an extensive motor-driven pumping plant for pumping out the water. In the boiler room of the station seven boiler units of the Babcock & Wilcox and other types have been installed to supply the three main engines and alternator groups of the station. The power equipment consists of Collman engines of French make, one alternator built by the Siemens & Halske firm and two by the Allgemeine company. For the cable drums and pumping outfit three-phase motors are used, working on 1,000 volts.

In Holland, the commune of Gonda is taking measures to erect an electric plant for the local supply. The concession for a light and power station has been awarded to a Rotterdam company by the commune of Ooststellingswerf.

Successful results have been secured in Luxemburg by the Roechling-Rodenhausen electric process for steel, and the new furnaces which were installed recently have yielded a very good quality of product. The inventors are much encouraged by these results, especially as there is a good field for the steel process in this county, where iron ore is abundant.

An extensive telephone system for Corea is to be installed by the Japanese government in Corea. It is estimated that the enterprise will require an outlay of 70,000 yen.

The Swedish government is taking measures towards using electric traction on the Ofoten railroad line, which runs from the mining region of Kiruno to the Norwegian frontier. It is at present considering the propositions which have been made by two of the leading German electrical firms, each of which has formed a syndicate with Swedish companies in order to promote their projects. A decision will likely be made in the near future. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., NOVEMBER 13.—The electrical pumps, eighteen in number of the city of Toronto, will cost less than one-third of what was estimated by the city engineer of the waterworks. He counted upon an expenditure of about $150,000, while the contracts awarded amount to only $45,210.

Sir J. P. Whitney, premier of Ontario, denies that his recent visit to Ottawa was for the purpose of conferring with the Dominion authorities upon the validity of the Ontario acts regarding the hydroelectric power projects of the Ontario government passed last session. There has been a formal application for the disallowance of the acts on the ground that they are ultra vires of the local legislature. The federal authorities have until April to disallow the acts.

The civic light and power department of the city of Brockville, Ont., closed its fiscal year on September 30, and from the report just published, it is found that after paying the operating expenses, depreciation, debenture and interest, the net gain amounts to $864. The plant was purchased nine years ago, and since then gas and electric light have been reduced from $2 to $1.12 net, per 1,000.

Negotiations have been concluded for the location, at Welland, Ont., of a large steel plant where smelting will be done by electricity. The men behind the enterprise have large interests in steel and iron in the Pittsburg, Pa., section. The officers are: President, Tyson S. Dynes, St. Louis, Mo.; vice-president, George G. Gooderich, Saratoga, N. Y.; secretary, A. S. Ramage, Philadelphia, Pa. The last named designed the plant. Work will be begun at once on the billet mill, and 1,000 horsepower for the operation of the mill have been contracted for with the Falls Power Company. The daily output will be 1,000 tons, which will require 2,000 tons of ore daily, or a shipload per day. It is intended to erect, next year, other mills for the making of finished products in iron and steel.

One of the biggest deals in the history of the province of Quebec has just been completed by the forwarding to Ottawa of an application for letters patent to incorporate the Quebec Railway, Light, Heat & Power Company. The capital of the new concern is $10,000,000, and the companies taken into the merger are the Quebec Railway & Power Company, the Jacques Cartier Power Company, the Quebec Gas Company, the Frontenac Gas Company, the Canadian Electric Company, the Seven Falls Company, and several smaller concerns. The principal executive officer will be C. E. A. Carr, who thus becomes the manager of one of the biggest corporations in Canada. He was not long ago the manager of the Helena Light & Railway Company, of Helena, Montana. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

BIG PLANT ON THE TRUCKEE RIVER—It is reported that the Reno Power, Light and Water Company of Reno, Nev., will in a short time commence work on a $1,000,000 hydroelectric plant on the Truckee River. Most of the power generated will be transmitted to mining districts.

BIG PLANT ON FRENCH BROAD RIVER—The North Carolina Electric Power Company, subsidiary to the W. T. Weaver Power Company, it is announced, will shortly begin the construction of a mammoth power plant across the French Broad River near Marshall, N. C., west of Asheville. The plant will maintain an average horsepower of 4,600, the dam being thirty feet high and 500 in length, with 18,000 yards of concrete work in the construction. There will be two 2,200 horsepower generators, the completed plant representing some $400,000. This is the plant from which

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it was stated power for the new electric line from Asheville to Galax, and tapping the new Carolina, Clinchfield & Ohio Railroad will be derived. Another site a few miles up the river offers further power if such shall be found to be required in the carrying cut of the company's plant. The electric road will be known as the Asheville and East Tennessee Railway, with Galax as the terminus. L.

POWER PLANT FOR SALT LAKE—Water right has been granted to C. H. Roby for 615-acre feet of water to be obtained from North Dry Creek, and work on the power plant will start very soon. Four dams in all are to be constructed and the maximum amount of water to be drawn from the river for storage purposes will be 50-second feet. The plant, which is to be located just south of Little Cottonwood canyon will operate under a head of 2,145 feet and will develop 3,000 horse power.

NEW PLANT ON BROAD MOUNTAIN—The Lehigh Coal and Navigation Company is planning to erect a power plant near Tamaqua, Pa., which will rank in size with the hydro-electric plant at Niagara Falls. While a great part of the power will be secured from the river known as James Run, there will be auxiliary boilers and special grates. These grates are to be especially constructed to burn culm from the nearby mines. It is the promoter's idea to furnish power to Philadelphia, Baltimore and Washington.

MAMMOTH CONDUIT IN WEBER CANYON — The J. P. O'Neill Construction Company is constructing near Ogden, Utah, what is one of the largest pipe lines of its kind in the world. This conduit, which is a little over a mile long, is six feet in circumference, part being constructed of solid concrete, and the remainder of wooden staves bound with steel hoops. Water is to be conducted through this pipe from the storage reservoir to a power plant at the foot of the canyon. The entire plant, including the pipe will cost about $350,000 and will develop approximately 5,000 horse-power.

TO DAM THE AU SABLE—Preliminary work has been begun on the first big dam to be built on the Au Sable River by the Eastern Michigan Power Company. When completed, the water backed up by this dam will form a lake about six miles long and capable of generating 3,000 horsepower. According to the plans of the power company the construction of twelve more dams on the river will follow. Several of the eventual dams will generate singly more than twice the power of the one now under way. The entire utilization of the river's power will produce in excess of 50,000 horsepower or its equivalent in electrical energy.

LIGHTING AND POWER.

(Special Correspondence.)

FREMONT, NEB.—This city has completed the installation of a municipal lighting plant.

GRAND FORKS, N. D.—It is proposed to vote bonds for $25,000 to improve the electric-lighting system. P.

PALERMO, N. D.—The Village Trustees are considering the installation of an electric-lighting plant.

POTOMAC, VA.—The Alexandria Electric Company has been awarded the contract for lighting this city.

LEON, IOWA—The Leon Electric Company is erecting a new brick power house and installing new machinery. C.

WINNECONNE, WIS.—Business men propose to raise $5,000 for the construction of an electric line to Oshkosh. P.

DECATUR CITY, IOWA—Johnson & Smith have petitioned for a franchise to put in an electric-light and power plant. C.

SEBEKA, MINN.—John Konkler and N. S. Barbour have the contract for the installation of an electric-light plant here. P.

CENTRAL CITY, NEB.—Work on the new municipal lighting plant is being pushed and the lights will be turned on at an early date.

WELLINGTON, TEX.—The Wellington Water, Light and Ice Company has been incorporated, with a capital stock of $10,000. P

OELWEIN, IOWA—The Oelwein Light, Heat and Power Company will build a brick power house and make extensive improvements to its plant. C.

ST. LOUIS, MO.—The Laclede Gas Light Company contemplates the erection of an electric plant to supply office buildings and industrial plants with power. P.

SALEM, MASS.—The light plant of this city has been purchased by the Tenney Lighting Combination. The Tenney company controlls a number of other plants in the state.

EL DORADO, KAN.—Sharp Brothers, of this city, are making an estimate of cost for a power dam at Augusta, where S. J. Safford is about to get a fifty-year light franchise. P.

GALENA, KAN.—The Empire District Electric Company has filed notice with the secretary of state that it had paid up twenty per cent of its $6,000,000 capital and is now ready to begin work on its plant near here. Power is to be supplied to mines, mills and interurban lines, and is also to be supplied to several towns for street lighting.

TACOMA, WASH.—The survey for the city's $2,000,000 hydro-electric plant at Nisqually has been completed and it is expected that the construction work will be begun in a short time.

TORONTO, ONT.—The power house for the city's power distribution system is now under construction on Exhibition road. It is of absolutely fireproof construction, and will cost $36,000.

ABERDEEN, S. D.—The Aberdeen Electric Light and Power Company has been sold to the Union Company, of Omaha, Neb., and $100,000 will be expended for the installation of additional equipment and machinery. C.

BRISTOL, TENN.—The Bristol Gas and Electric Company has closed a contract with Eastern capitalists for the erection of a large power plant near here for the purpose of generating electricity for power purposes.

EVANS CITY, PA.—The Evans City Light, Heat and Power Company has been organized for the purpose of supplying the city with electricity for light, heat and power. A plant is to be installed in the near future.

WHITE BEAR, MINN.—The electric-light plant has been acquired by the Washington County Light and Power Company, of Stillwater, Minn., which will abandon the steam power house and furnish power from the plant at Stillwater. C.

CYNTHIANA, KY.—J. S. Johnston, superintendent of the Cynthiana Electric Light Company, is in the market for an "alternator, compound wound, 140 cycles, 1,100 volts, 200 to 250 kilowatts with exciter, and rheostat, all in first-class condition, and guaranteed."

NAPA, CAL.—The power line of the Napa Valley Electric Company will soon be completed and ready to furnish power to the towns of Napa, St. Helena, and Calistoga. The directors of the company are: Henry Brown, Percy S. King, G. S. Bonnor, H. J. Lewelling and D. L. Beard.

SODUS, N. Y.—The electric light system between Sodus and Ontario has been completed. The two plants in the villages named are now connected and either village can give the other light or power and either plant can take care of Williamson or East Williamson, or, if necessary supply of the entire system.

GREEN BAY, WIS.—The L. E. Myers Construction Company, of Chicago, has commenced putting up poles and surveying the line to convey the current from High Falls on the Peshtigo, operated by the Northern Hydro-Electric Company. Later the power will be transmitted to Two Rivers, Manitowoc and Oshkosh. C.

PHILADELPHIA, PA.—An ordinance has been passed providing for the erection of 171 additional electric arc lamps between Second and Sixteenth streets and similar bills are to be passed for lighting in other parts of the city. The total cost will be about $55,000. About $30,000 of this amount will be expended in providing ornamental posts and installing underground work.

TRENTON, N. J.—The Great Falls Power Company of Jersey City has been chartered with an authorized capital stock of $17,000,000. The purpose of the company is to acquire and deal in water rights and power, and to generate electricity for all purposes by waterpower. The stock is divided into $10,000,000 preferred and $7,000,000 common. The incorporators are W. C. Parker, L. J. Relyea and F. E. Griswold.

FERGUS FALLS, MINN.—This city has awarded the lighting contract to the Otter Tail Power Company. The contract, covering a period of seven and a half years, specifies a rate of two and one-half cents for the first 200,000 kilowatts, two and one-quarter cents for the second 200,000, and a flat two-cent rate for all amounts exceeding that. Electricity is to be delivered to the city's switchboard and distributed by them.

JOPLIN, MO.—The merger of the properties controlled by the Spring River Power Company and the Consolidated Light, Power and Ice Company has been completed in the organization of the Empire District Electric Company, incorporated in both Missouri and Kansas. The headquarters of the new corporation will remain at 414 Joplin Street, which has heretofore been occupied by the Consolidated company. The officers of the new corporation are: President, Henry L. Doherty, New York city; first vice-president, Frank W. Frueauff, New York city; second vice-president, A. E. Spencer, Joplin; secretary, David D. Hoag, Joplin; treasurer and general manager, M. R. Bump, Joplin.

CHARLOTTE, N. C.—An industrial policy which promises much for the western portion of the states of North and South Carolina, is said to have been definitely adopted by the Southern Power Company, namely, that of attracting large cotton mill and manufacturing plants to build factories at or near the several hydroelectric plants of the electric power company along the Catawba River in North and South Carolina. In this way it is proposed to induce many manufacturers to build plants along the banks of the river, where it is pointed out power can be supplied with the loss by transmission cut out, and at a very reasonable rate. The first plant thus organized is a $600,000 cotton

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mill, which will be built near Great Falls, forty miles southwest from Charlotte, and in which Hal Mebane, Robert S. Mebane and others are interested. It is likewise understood that J. B. Duke, largely interested in the Southern Power Company, will be a stockholder in the new mill. This policy gives promise of numerous extensive developments along the Catawba River. L.

RICHMOND, VA.—It is reported that capitalists from Philadelphia contemplate building a double-track electric line, at least twenty-two miles in length, to connect Colonial Beach, a well-known resort, with the Richmond, Fredericksburg & Potomac Railroad. It is said that Quantico, being the nearest railway station to Colonial Beach, will likely be the terminus of the electric line. The estimated cost of the work is about $250,000. The power plant site will probably be at Classic Shore. A further report has it that the Widener-Elkins street-railway syndicate is behind this movement and that it is ultimately purposed to connect Richmond and Washington, D. C., by an electric line, several hundred miles in length. J. R. Benton, representing the parties interested, has already placed his petition for a franchise before the Town Council of Colonial Beach, and declared that the preliminary routes, costs, etc., had been considered and that the road would be built. L.

OROVILLE, CAL.—It is now given out that the Feather River Power and Development Company, which, under the name of H. O. Lague, recently filed an extensive water rights along the Middle Fork of the Feather River, is to erect three power plants, one on Fall River and two on Onion Creek. The first diversion of water from the Middle Fork of the Feather River will be at Nelson Point, where 15,000 inches will be diverted and carried eleven miles to the mouth of Onion Creek, where the water will be dropped 1,000 feet to the first power plant. From the first plant the water, increased to 20,000 inches, will be carried fourteen miles to a point near the mouth of the South Branch, where the water will be dropped 1,250 feet to the second power plant. From this point 25,000 inches of water will be ditched a distance of six miles to Fall River, where a fall of 720 feet to the third power plant will be available. It is claimed by the promoters that a total of 86,000 horsepower at low water can be developed at the three plants.

ELECTRIC RAILWAYS.

(Special Correspondence.)

IOWA CITY, IOWA—The Davenport and Iowa City Commercial clubs have pledged $400,000 toward the construction of an interurban line between the cities. C.

DAVENPORT, IOWA—The Davenport, Iowa City & Western Traction Company is planning the construction of an interurban line, fifty-three miles long, to Iowa City. C.

CHEHALIS, WASH.—The Twin City Light and Traction Company let the contract for grading on the electric line to Centralia to J. J. McCabe, of Portland, Ore. C.

POMONA, CAL.—The Trustees of Claremont have been asked to grant a franchise for the construction and maintenance of an electric street railway from Indian Hill through Claremont. A.

RENO, NEV.—Charles Burke and S. H. Wheeler have begun the work of building an electric line into the east end of the city. The line will run on South Virginia Street, Moran Street and Wheeler Avenue.

LA CROSSE, WIS.—The La Crosse Water Power Company has secured a franchise for the construction of an interurban line through Onalaska. The proposed route lies from there through Galesville and to Winona, Minn. C.

SEATTLE, WASH.—The Waterville Railway Company, of Waterville, Wash., has been organized and will build an electric railroad from Douglas Station on the new Great Northern extension to Waterville, a distance of five miles. The company is capitalized at $100,000. A.

IOWA CITY, IA.—The Davenport and Iowa City commercial clubs have pledged $400,000 preferred stock in a new company to use $1,500,000 in building an interurban line from Iowa City to Davenport. An effort is also being made to finance a line between Iowa City and Ottumwa.

CIUDAD PORFIRIO DIAZ, MEXICO—The proposition of building an electric railway from Ciudad Porfirio Diaz, state of Coahuila, to San Carlos, which is the headquarters of the 2,000,000-acre ranch and farm of General Lorenzo Trevino, is being promoted. It is claimed that the building of the road is practically assured. The Chamber of Commerce of Ciudad Porfirio Diaz is giving aid to the enterprise. The road will probably be largely financed by General Trevino.

ATLANTA, GA.—The Chattanooga Railway & Light Company, through its president, C. M. Clark, has filed a request for permission to issue $1,600,000 first mortgage and refunding bonds, and also to confirm an issue of $2,000,000 preferred and $3,000,000 common stock. The application is made in the state of Georgia because a part of the company's system is located in that state, and it is assumed that a general merger of those properties is contemplated. The application will be heard in Atlanta, November 9. L.

WASHINGTON, D. C.—Another step in the legal fight over street railways in New York City was recently taken when attorneys for the receivers for the Metropolitan Street Railway Company asked the Supreme Court of the United States to dismiss the appeal of the Guaranty Trust Company of New York. The decree, to which the appeal was made, ordered the foreclosure of a mortgage on the railway company. After the appeal had been denied by Judge Lacombe, it was allowed by Justice Peckham. The court has taken the subject under consideration.

TOLEDO, OHIO—The Detroit United Railway by the inauguration of a new fast limited train between Detroit and Saginaw has made it possible to go from Toledo to Saginaw Mich., a distance of 163 miles by trolley with only one change of cars. The change is made at Detroit. It is intimated that the D. U. R. will run limited cars through from Toledo to Saginaw next summer without change. From Detroit the route is by the way of the Flint division of the D. U. R. to Flint and over the Flint & Saginaw road to Saginaw. Port Huron and Jackson are among the Michigan cities reached by the new service. H.

SPOKANE, WASH.—Adolph F., Edward H. and Oswald N. Suksdorf, of Spokane, have incorporated the Columbia River & Mount Adams Railroad Company, with a capital of $2,000,000. The company has plans to build a railroad from a point on the Columbia River in Klickitat County, Wash., northerly through parts of Klickitat, Yakima and Skomania counties to a point in the vicinity of Mount Adams in the two latter counties. The company also plans to operate steamboats and ferries on the Columbia River and generate electric current for light and power purposes. Other enterprises contemplated will be to mine coal and handle timber.

ROCK HILL, S. C.—The Carolina Traction Company, of Rock Hill, has been chartered in South Carolina by W. S. Lee, Jr., manager of the Southern Power Company, Charlotte; George Stephens, president of the American Trust Company, Charlotte, and J. M. Cherry, real estate dealer, Rock Hill. The capitalization may be made $500,000. This company proposes to develop a system of rural trolley lines radiating from Rock Hill, and to build lines to Charlotte, twenty-five miles north, and to Lancaster, and to tap the Seaboard Air Line in Chester County. It is believed that power for the system will be obtained entirely from the Southern Power Company. L.

GUTHRIE, OKLA.—The St. Louis & Oklahoma Railway Company, with headquarters at Bromide, Coal County, and $50,000 capital stock, was chartered here today to build a line from Salisaw through Sequoyah, Haskell, Pittsburg, Coal, Johnson, Murray, Carter, Garvin, Stephens, Jackson and Greer counties to a point between the Red River and the Salt Fork of the Red River. The estimated length is 300 miles and the estimated cost of construction $15,000 per mile. The incorporators are: O. E. Snyder, Erie, Kan.; J. D. Cameron, Kansas City, Mo.; E. S. Brodie, St. Louis, Mo.; J. M. Sholl, Joplin, Mo.; E. T. Brown, Coalgate, Okla., and E. W. H. Jackson, Bromide, Okla.

SALT LAKE, UTAH—The San Francisco, Idaho & Montana Company, organized some time ago to build an electric line from Caldwell, Idaho, south to Jordan Valley, Ore., thence southwest via Duncan, and south to Winnemucca, Nev., is said to have been acquired by the Oregon Short Line. Grading has been finished on twenty miles, and track-laying will probably be finished this fall on this section, which carries the line to the Snake River, where a connection is to be made with the river extension of a new line to be built by the Oregon Short Line from Buhl, west to Nyssa. This new line avoids the two hills over which the operation of trains is difficult. It is probable that the new managers will build at an early date as far as Jordan Valley section, about sixty-six miles.

TOLEDO, OHIO—A strenuous effort is being made to finance the Findlay-Marion Railway and Light Company, so that the proposed road from Columbus to Toledo, planned before the financial depression, can be built. New York capitalists have been interested in the proposed line and it is said will send their engineer to Findlay, O., and if matters are found satisfactory it is declared that a construction company for carrying on the work will be immediately formed. The estimated cost of the work is $1,250,000 and the capital stock of the company stands at $250,000 but the claim is made that the capital stock will soon be increased to enough to cover the construction work. It is the intention to build the road over a private right of way. At a recent meeting interested capitalists and promoters were present from Findlay, Cleveland, Detroit, Marion and Columbus. H.

RICHMOND, VA.—On account of the near expiration of the time permitted within which to start work, and with the further report that the Virginia Railway & Power Company will not take over its franchise, the Richmond & Henrico Railway Company will be compelled to begin work immediately or to forfeit its franchise and the sum of $5,000 put up as a guarantee held

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by the city of Richmond. A further report says that the first-named company has made several attempts to open negotiations for the purchase of the Richmond & Henrico Railway Company's franchise, but without results, and that the representatives of the new company have also been approached in New York. In view of the status of affairs, the street committee of the aldermanic body of Richmond is calling for the contract. The Carnegie Trust Company is named as the trustee for the company. The company may, however, take steps to retain its franchise. L.

NEW YORK, N. Y.—The New York Public Service Commission adopted a resolution, by a vote of three to two, modifying the Broadway-Lexington Avenue subway plan, so as to include a branch up the White Plains Road, from its junction with Westchester Avenue to the West Farms Road, where the new line will join Route 18, previously laid out, running from West Farms Road up White Plains Road to East Two-Hundred-and-Forty-first Street, near the New York city line. This change will give the Broadway-Lexington Avenue system three branches in the Bronx, instead of two, and the new route will develop the portion of the Bronx lying between the Jerome Avenue section, served by the River and Jerome Avenue branch, and the Westchester Avenue section, which will be served by the Pelham Bay Park branch. The new line will be five miles long and add about $4,000,000 to the estimate of $60,000,000 for the Broadway-Lexington Avenue line. In addition, there is $7,000,000 cost for the Canal Street crosstown section.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

STANHOPE, IOWA—The Stanhope and Northwestern Telephone Company has been incorporated. P.

LYONS, NEB.—The Burt County Telephone Company has been incorporated with a capital stock of $100,000. P.

VERGAS, MINN.—The Vergas Telephone Company has been incorporated, with a capital stock of $10,000. P.

SEDAN, OKLA.—The Saddle Mountain Mutual Telephone Company has been incorporated with a capital stock of $875. P.

PAXTON, NEB.—The Paxton and Sutherland Telephone Company has been incorporated with a capital stock of $5,000. P.

BUCK CREEK, IND.—The Eckert Telephone Company is in the market for a new switchboard to replace the equipment recently destroyed by fire. J. C. Eckert is president of the company. S.

SOUTH BEND, IND.—The Central Union Telephone Company has been authorized to proceed with the installation of its conduit system. The company's new exchange building is almost completed. S.

FT. WAYNE, IND.—The officials of the Home Telephone and Telegraph Company announces that $4,000 worth of new equipment will be installed in the South Branch stations. The harmonic system will then be established. S.

GESSIE, IND.—The Citizens' Telephone Company has incorporated to build and equip an exchange and telephone system in Gessie and throughout the western portion of Vermilion County. The capital stock is $3,000. The directors are: A. R. Peterson, A. W. Banks, W. F. Clem and F. L. Vawter. S.

ROCKY MOUNT, N. C.—The Home Telephone Company has perfected plans for extensions through Nash and Wilson counties, reaching out to the exchange at Spring Hope, Bunn, and numerous other points. General Manager F. C. Toppleman, of Henderson, is superintending a large part of this work of extension. L.

TEAGARDEN, IND.—The St. Joseph County Mutual Telephone Company has filed articles of incorporation and is now in the market for material to build and equip a telephone system in Teagarden and extend the lines throughout St. Joseph County. W. C. Divine, C. F. Ruple, J. S. Davis and Frank Retter constitute the board of directors. S.

ALBANY, N. Y.—The Citizens' Home Telephone Company, of Walton, Delaware County, has been incorporated with a capital of $100,000. The company is to operate in the counties of Delaware, Broome, Otsego, Chenango, Green, Schoharie, Ulster and Sullivan. The directors include George O. Mead, of Walton; Theodore M. Brush and Irving H. Griswold, of Elyria, Ohio; Irving R. Coughley and George H. Rymers, of Albany.

ALBANY, N. Y.—The Cattaraugus Union Telephone Company has been incorporated, with a capital of $50,000, to operate in the counties of Niagara, Erie, Chautauqua, Cattaraugus, Orleans, Genesee, Wyoming, Allegany, Livingston, Steuben and Monroe. The directors are Charles M. Beattie, William T. Farrell, W. Roy McCanne, John W. Morrison, Jr., Fred C. Goodwin, Fletcher W. Peck and George R. Fuller, of Rochester.

BUTTE, MONT.—Incorporation articles of the Interstate Consolidated Telephone Company have been filed here. The company is capitalized at $5,000,000, and already has acquired the Home Telephone Company in Spokane. It will operate through the Northwest, taking over the Independent Telephone Company of Montana. The new corporation is backed by capitalists of San Francisco, Los Angeles, Spokane, Portland, Butte and Missoula.

CHICAGO, ILL.—The recent dispute between the city of Chicago and the Chicago Telephone Company has been ended by a payment of $17,282.57 to the city. According to the ordinance, the company was to pay the city three per cent of its gross earnings. The company held that revenue from real estate, construction work done for others, etc., should not be included. These amounts total $576,085.63 and are all covered by the company's payment.

FREDERICK, MD.—The Frederick County Telephone and Telegraph Company, operating a system covering Frederick County with 1,525 subscribers and having long-distance connections, will be absorbed by the Chesapeake and Potomac Telephone Company, of the Bell system, the deal for its purchase having just been closed. The purchasing company acquires the stock and bonds of the local concern at a price said to be in the neighborhood of $125,000.

PEORIA, ILL.—The telegraph companies have been given until the 12th of December to place their wires underground. This is in accordance with the ordinance passed by the Council, which calls for the completion of the work by that time. With the placing of these wires underground the streets in the downtown district will be cleared of all wires overhead, as the lighting company and the telephone companies have their wires underground now or will soon have them so. V.

TOLEDO, O.—Suit has been filed by Herman C. Stifel, a broker, of St. Louis, against the Toledo Home Telephone Company, to require the company to set a date upon which he may examine the books. The petition states that Stifel is a stockholder and that the company, upon proper demand, refused recently to permit him to make such an inspection. He also asks that the company be enjoined from removing the books from the jurisdiction of the court. A similar petition was filed by Mr. Stifel against the New Long-Distance Telephone Company of Indianapolis, Ind.

COVINGTON, KY.—United States District Judge Cochran handed down a decree which directs a special master to sell the plant of the Central Home Telephone Company, of Wilmington, Del., to foreclose a mortgage held by Judge John M. Lassing, of the Kentucky Court of Appeals. Judge Lassing claims that the company fraudulently delivered to its president $550,000 worth of bonds as collateral security on an indebtedness of less than $50,000. It is declared the president wrongfully converted the bonds to his own use, and has failed to account for them, which it is alleged has made the concern insolvent. Judge Lassing also alleged that the company was indebted to him $8,000, which he paid for it as security on notes, and for which he had a mortgage.

NEW YORK, N. Y.—Officers of the Continental Telephone Company, a recently incorporated independent concern, with an authorized capital of $50,000,000, announce the purchase of the property of the Independent Union Telephone and Telegraph Company, which operates telephone lines in a territory reaching from Newburgh, N. Y., on the east, to Erie, Pa., on the west. The new owners announce that they will put the property into shape to handle telegraph as well as telephone business. The Continental company announces that it expects to take in several other independent lines between New York and Omaha, and plans to handle telegraph as well as telephone business over all its long-distance wires. Capitalists from St. Louis, Wheeling, Pittsburg and New York are said to be backing the enterprise.

NEW INDUSTRIAL COMPANIES.

LORAINE, OHIO—The Marine Electrical Company has been incorporated with a capital of $25,000. Electrical steamship appliances and devices will be the principal articles manufactured.

NEWARK, N. J.—The Electric Economy Company, mechanical and electrical engineers, has incorporated with a capital of $25,000. The incorporators are Louis Froelich, James O. Sharp and Arthur S. Randolph, all of Newark.

CHICAGO, ILL.—The Charter Electric Company has been incorporated, with a capital of $250,000, to manufacture, sell and install electrical appliances. The incorporators are: G. C. Cummings, J. A. Kick and A. Wray.

PROVIDENCE, R. I.—The Barnes and Loud Electric Company of 57 Weybosset Street, has filed articles of incorporation with the Secretary of State. The incorporators are Bradbury L. Barnes, Harry M. Paine and Harry B. Loud. The capital stock is $5,000.

NEW YORK, N. Y.—The Acme Gas and Electric Fixture Company has been incorporated to manufacture electric fixtures, gas and electric appliances, etc., with a capital of $30,000. The incorporators are: S. Wallach, S. H. Shiminsky, New York city, and H. L. Adelman, Brooklyn.

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ELECTRICAL SECURITIES.

While the trend of the market has been, in general, good during the past week there has been a marked speculative tendency. The effect of this has been, in a number of cases, to produce a decrease in the value of securities and in others to cause a marked increase. Such a condition must occur from time to time, but does not in any way effect the gradual increase of values and the resumption of business.

On account of a special meeting of the stockholders of the Pacific Coast Power Company, to be held December 20, the transfer books will be closed from December 6 to December 20, inclusive.

The Chicago Blue Island & Joliet Traction Company has borrowed $500,000 from the American Trust & Savings of Chicago on forty-year, five-per-cent bonds.

Chicago Railways Company show an increase of gross-earnings in the first nine days November of $47,000, equal to seventeen per cent. It is safe to say that earnings for the fiscal year will be over $12,500,000, placing the Chicago Railways Company in the first rank of Chicago public utility corporations.

The Chicago Telephone Company has paid the city $17,282, representing three per cent due the city on $576,085, the gross receipts from odd sources. The matter was in dispute for two years.

Stockholders of the Commonwealth-Edison Company, Chicago, have authorized the $10,000,000 increase in the capital stock, from $30,000,000 to $40,000,000. Directors of the Commonwealth-Edison Company have re-elected officers.

At the annual meeting of the Manhattan Railway Company, Kingdon Gould was elected a director, to fill the place of General Thomas T. Eckert, resigned. Other directors and members of the executive committee were re-elected. The directors of the Manhattan Railway Company have re-elected the officers.

At the special meeting of the Electrical Securities Corporation it was voted that the number of directors be decreased from twenty-three to twenty-one. At the annual meeting of the stockholders S. L. Eldridge and G. M. Cumming were dropped from the directors and the other directors were re-elected.

For the current fiscal year, which began October 1, charges and dividends of Boston Elevated will be about $300,000 greater than for the twelve months just ended. This is made up of eight months' dividend at the rate of six per cent on $6,550,000, and three per cent. interest on seventy-five per cent. paid stock for about four months, or October to January 25.

In conformity with the new law passed last year authorizing public service corporations to fix a price at which they desire to issue additional shares, the directors of the Edison Electric Illuminating Company of Boston have fixed a price of $215 a share on the proposed issue of 19,452 new shares. The amount of shares to be issued and the price must receive the approval of the Gas Commission before the offer to stockholders for subscription.

Gross earnings of the American Telephone and Telegraph system for the year to end the last of next month, will total slightly more than $150,000,000, compared with $140,000,000 in 1908 and $125,000,000 in 1906, a gain of twenty per cent. in three years.

DIVIDENDS.

American Railways Company; quarterly dividend of one and one-half per cent, payable December 15.

Kings County Electric Light and Power Company; quarterly dividend of two per cent, payable December 1.

Mobile Electric Company; quarterly dividend of one and one-half per cent on preferred, payable November 16.

NEW YORK.

	Nov. 15.	Nov. 8.
Allis-Chalmers common	15	15¾
Allis-Chalmers preferred	53½	53½
Amalgamated Copper	90⅞	87¼
American Tel. & Cable	80*	80*
American Tel. & Tel.	141¾	141½
Brooklyn Rapid Transit	75¾	76
General Electric	162	163
Interborough-Meropolitan common	22⅞	19¾
Interborough-Metropolitan preferred	54¾	49⅝
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common.	92¼	93¾
Mackay Companies (Postal Telegraph and Cables) preferred	75⅞	75½
Manhattan Elevated	140	141
Metropolitan Street Railway	25	23
New York & New Jersey Telephone	123½	123½
U. S. Steel common	90⅜	91⅝
U. S. Steel preferred	126	126¾
Western Union	79	78
Westinghouse common	85	86⅝
Westinghouse preferred	135	140

*Last price quoted.

BOSTON.

	Nov. 15.	Nov. 8.
American Tel. & Tel.	141¾	141
Edison Elec. Illuminating	..	..
General Electric	162	163
Massachusetts Electric common	15¾	18½
Massachusetts Electric preferred	..	82⅜
New England Telephone	134	134
Western Tel. & Tel. common	11¼	10½
Western Tel. & Tel. preferred	88	88

PHILADELPHIA.

	Nov. 15.	Nov. 8.
American Railways	45¼	45¼
Electric Company of America	12⅛	12¼
Electric Storage Battery common	59	58½
Electric Storage Batterp preferred	59	58½
Philadelphia Electric	13⅛	13⅛
Philadelphia Rapid Transit	26¾	27½
Philadelphia Traction	89	89
Union Traction	52¾	53½

CHICAGO.

	Nov. 15.	Nov. 8.
Chicago Railways, Series 1	104	104
Chicago Railways, Series 2	33¼	34
Chicago Subway	6¾	7
Chicago Telephone	136	136
Commonwealth Edison	119	119
Metropolitan Elevated common	16½	17
Metropolitan Elevated preferred	52	54
National Carbon common	96½	95¾
National Carbon preferred	118½	118¼

PERSONAL MENTION.

H. C. RICE, vice-president of the General Incandescent Lamp Company, of Cleveland, Ohio, arrived in San Francisco from Los Angeles last week. A.

GEORGE W. WOOTEN, of Salt Lake City, has resigned his position as assistant secretary of the Rocky Mountain Bell Telephone Company, on account of the health of his family. Mr. Wooten has accepted a position in Chicago.

ERNST J. BERG, who has for the past seventeen years been associated with the General Electric Company of Schenectady, N. Y., has recently been appointed professor of electrical engineering in the University of Illinois at Urbana, Ill. Mr. Berg succeeds Professor Morgan Brooks, who is now absent on leave of absence.

EDWARD BENNETT, of Jeanette, Pa., has recently been appointed associate professor of electrical engineering at the University of Wisconsin. Professor Bennett is a graduate of Western University of Pennsylvania, now the University of Pittsburg. He was recently located at Telluride Institute in Utah, where he did research work for the Telluride Power Company and assisted in the instructional work of the institute. He has also been with the National Electrical Signal Company in wireless work, and the Nernst Lamp Company. M.

C. S. GLEED.

CHARLES S. GLEED of Kansas City, Mo., president of the Missouri and Kansas Telephone Company, has recently been elected president of the Bell Telephone Company of Missouri. Mr. Gleed has for a number of years been prominent in public life in both Missouri and Kansas, being director of several railroads and banking companies. Mr. Gleed has also been a trustee of Kansas University for a number of years and is the author of many legal and political articles.

B. F. O'MARA, general superintendent of the eastern division of the Michigan United Railway Company, has taken charge of the Kalamazoo city lines of that company.

W. E. SHARP was elected president of the Lincoln Traction Company at a recent meeting of the stockholders. A transfer of stock took place before this election, but the new stockholders intend to carry out the scheme of sharing profits with the city.

J. L. MILLSPAUGH, the general superintendent of the western division of the Michigan United Railway Company, has been put in charge of the Lansing-Jackson line. Mr. Millspaugh will also act as assistant to General Manager Clark in the work at Jackson.

GEORGE A. McKINLOCK, president of the Central Electric Company, and Mrs. McKinlock have been visitors in New York and Boston for the past week. They both attended the school football game, in which their son, Alexander McKinlock, won the highest honors.

MILLIDGE G. SWETT, Calais, Me., for several years a section manager for the New England Telephone Company, severed his connection with that company November 1. Joseph Broadbent, formerly, solicitor for the company has been appointed as manager for the present.

A. L. OAKES, of Newport, Me., who has been manager of the Bangor division of the New England Telephone and Telegraph Company, for the past three years, has been promoted to the position of special agent for District Manager Emerson and will enter upon his duties at once.

C. E. ALLEN has just joined the selling force of the Westinghouse Electric and Manufacturing Company in connection with the sales of transformers. Mr. Allen was formerly connected with

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the General Electric Company in a similar capacity, but resigned from that company during the past summer.

MARSHALL B. DOWNING, who has for some time been manager of several of the New York Telephone Company's exchanges in New York city, has recently been promoted to position of district superintendent. The district which Mr. Downing now has, includes Albany, Troy and several other up-state cities.

CHARLES L. EDGAR, of Boston, and W. C. L. EGLIN, of Philadelphia, both past-presidents of the National Electric Light Association, were recent visitors to New York, conferring on electric lighting problems. Both report the constant growth of their companies and an increased demand for electric current for illuminating and power purposes.

ARTHUR J. SWEET will leave the Westinghouse Lamp Company on December 1 to join the engineering department of the Holophane Company. In his new position, Mr. Sweet will have charge of important new development work which the Holophane Company has long planned to undertake along the line of special globes and reflectors for classes of service not heretofore covered by the Holophane products. Mr. Sweet is a graduate of Cornell University and satisfactorily completed three of the four years' course in electrical engineering at Massachusetts Institute of Technology. After a shop apprenticeship course, he spent three years with the Westinghouse Electric and Manufacturing Company, nine months with the Western Electric Company and about two years and a half with the Westinghouse Lamp Company. His work throughout has been along lines of practical and theoretical development. In the lamp works he gained an intimate knowledge of photometric methods and equipment, and did considerable work in illumination design. He has written several papers that were presented before engineering societies and a number of articles for technical journals.

A. J. SWEET.

W. P. CARSTARPHEN, of the Carstarphen Electrical Company, Denver, Colo., it is announced in a recent issue of The Denver Post, will about the beginning of January next, begin the erection of a four-story building for a new electrical plant to include departments for electrical manufacturing, chemical manufacturing, wiring and construction, merchandise, etc. The roof of the new building, it is stated, will have a specially constructed landing, of large proportions, for aerial craft. This will be the first of its kind constructed in the West and will be very similar to the aviation station designed for the roof of the twelve-story club building of the Automobile Club in New York city.

OBITUARY.

GEORGE WILLIAM HOFFMAN, of Indianapolis, Ind., manufacturer of United States metal polish and other similar specialties, died at his home on Friday, October 22, after a short illness. His departure is greatly regretted by his many friends. The business, it is understood, will be continued by his relict on the same lines as formerly.

GEORGE F. DURANT, who died suddenly at Boulder, Colo., a short time ago, was recognized everywhere as one who has not only been of great assistance to telephone development of late years, but was one of the first to see the possibilities of the exchange system and to attempt to install an exchange. In 1877, when Mr. Durant was local manager of the American District Telegraph Company, he conceived the idea of giving St. Louis a telephone system and interested his company in financing the scheme. It was his idea that after a hundred subscribers were secured the telephone business would begin to be profitable. Rates were then about $150 per year. Mr. Durant's activities were not confined to this country alone, but as the representative of the American District Telegraph Company he was the pioneer in the establishment of lines in Chili, Argentine Republic and Brazil. Mr. Durant was president of the Missouri Cremation Society, vice-president of the Lakeside Sugar Refinery Company and a director of the Lincoln Trust Company. He was a member of the Mercantile and Union clubs of St. Louis. At the time of his death he was general manager of the Bell Telephone Company of Missouri.

NEW PUBLICATIONS.

EDISON LIFE—The Edison Employees' Club, of the Edison Electric Illuminating Company, of Boston, has issued the first regular number of its new monthly, "Edison Life." This title was chosen as a result of a contest in which Harry B. Knights received the prize for the most appropriate name. This monthly will be devoted to both the business and social interests of the Boston Edison employes, and in this November issue contains a great many interesting facts relative to the generating department, as well as to the doings of the club.

THE GENERATOR—The October number of The Generator, a publication issued by the students of the New York Electrical School, has recently been distributed. It contains several articles of merit and also many interesting school notes.

COALING, DOCKING, AND REPAIRING FACILITIES OF THE PORTS OF THE WORLD—The fifth edition of this useful publication has recently been issued by the Office of Naval Intelligence (Washington, Government Printing Office, 1909).

YALE SCIENTIFIC MONTHLY—The October issue of this monthly magazine contains a very interesting account of the recent Aviation Week at Rheims. Among the other articles, one especially worthy of note is that by John T. Stevens, on "The Relation of Railways to Canals."

THE UTILIZATION OF FUEL IN LOCOMOTIVE PRACTICE.—This is the title of Bulletin No. 402, of the United States Geological Survey, edited by Prof. W. F. M. Goss, of the Technologic Branch of the Survey. The statement is made that locomotives in this country are responsible for more than one-fifth of the total coal production in the United States, and the tests detailed in the bulletin were made with a view to economy in this direction.

FUEL TESTS WITH ILLINOIS COAL.—This publication is issued as Circular No. 3 of the Engineering Experiment Station of the University of Illinois, Urbana, Ill., and presents the results of an elaborate series of tests conducted at the fuel testing plant of the United States Geological Survey. The circular is compiled by L. P. Breckenridge and Paul Diserens. It deals only with coals taken from mines within the state of Illinois. The investigations described include steaming tests under boilers, gas producer tests, washing tests, coking tests, briquetting tests, and tests to determine composition and heating value. From the results stated it appears (1) that the average calorific value of Illinois coal (ash and moisture free) is 14,319 British thermal units; (2) that its evaporative efficiency is but slightly affected by the moisture it contains; (3) that its evaporative efficiency decreases as the ash and sulphur content increases, and that when burned in a hand-fired furnace its evaporative efficiency decreases as the amount of fine coal contained in it increases; (4) the performance of Illinois coal in a gas producer compares favorably with that of any other bituminous coal tested at the United States Geological Survey laboratory; (5) one-fourth of all the samples tested may be used for the manufacture of coke; (6) briquetting improves the evaporative efficiency of Illinois coals only when the raw coal is in the form of slack or screenings. Complimentary copies of the circular may be obtained on application to W. F. M. Goss, director of the Engineering Experiment Station, at the University.

EDUCATIONAL NOTES.

CHICAGO TECHNICAL AND CONTINUATION HIGH SCHOOLS—The Board of Education, of the city of Chicago, has issued in pamphlet form its announcement of free evening courses in the technical and continuation high schools that have recently been established. The work comprises free English and commercial courses at the Hoyne School, and similar courses combined with technical studies at the Crane Technical High School, the Lake High School and the Lane Technical High School. These latter courses are of considerable interest, as they include, besides manual training and drawing, a fairly good introduction to the applied sciences, the principles of electrical and mechanical engineering, applied mathematics, English and modern languages.

NEW YORK UNIVERSITY, DEPARTMENT OF JOURNALISM—A very fitting recognition of the growing importance of trade papers has just been given by New York University in the inauguration of a department of journalism in the School of Commerce, Accounts and Finance. "Trade and financial journals," says the official announcement of the department, "have become within recent years a powerful force in business life. There still remain great opportunities for expansion and improvement, and a career in this field should appeal strongly to persons who possess ability and the right kind of training. It is believed that the School of Commerce, Accounts and Finance, in connection with the Department of Journalism, can now offer a remarkable comprehensive and efficient training for such work." There is hardly a business man who does not scan his trade journal more closely than he does his newspaper. This new department, established by one of the prominent educational institutions of the country, will undoubtedly help to their further development. Up to this present time adequate preparation for work on such publications has not been easily obtained. It is peculiarly fitting that New York University should be the first to give this deserved recognition, for its School of Commerce, Accounts and Finance has already established a reputation for giving practical education.

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PROPOSALS.

POST OFFICE AND COURT HOUSE, COUNCIL BLUFFS, IOWA—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 26 for a lighting and conduit system at the United States Post Office and Court House and extension thereto at Council Bluffs, Iowa, in accordance with drawings and specifications, copies of which may be had at this office, or at the Supervising Architect's office.

POST OFFICE, NEW LONDON, CONN.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 30 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, etc., to the United States Post Office at New London, Conn., in accordance with drawings and specification, copies of which may be obtained from the custodian at New London, Conn., or at the Supervising Architect's office.

NEW BRUNSWICK, N. J.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until December 2 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension and remodeling of the United States Post Office at New Brunswick, N. J., in accordance with the drawings and specifications, copies of which may be obtained from the custodian at New Brunswick, N. J., or at the Supervising Architect's office.

POST OFFICE, HOT SPRINGS, ARK.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until December 6, 1909, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the United States Post Office at Hot Springs, Ark., in accordance with the drawings and specification, copies of which may be obtained from the custodian at Hot Springs, Ark., or at the office of the Supervising Architect.

POST OFFICE AND COURT HOUSE, DAVENPORT, IOWA—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until December 15, 1909, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the United States Post Office and Court House, Davenport, Iowa, in accordance with drawings and specifications, copies of which may be obtained from the custodian at Davenport, Iowa, or at the Supervising Architect's office.

POST OFFICE AND COURT HOUSE, MONTGOMERY, ALA.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 24 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the United States Court House, Post Office, etc., at Montgomery, Ala., in accordance with drawings and specifications, copies of which may be obtained from the custodian at Montgomery, Ala., or at the Supervising Architect's office.

POWER PLANT FOR CUSTOM HOUSE, SAN FRANCISCO, CAL.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until December 18, 1909, for power plant, including boilers, engines, electric generators, switchboard, conduits, wiring, heating and ventilating apparatus, deep well, deep well pumps and vacuum cleaning system, for the United States Custom House and Appraisers' Stores buildings at San Francisco, Cal., in accordance with drawings and specification, copies of which may be obtained at the office of the Supervising Architect, or at the office of the architects, Messrs. Eames & Young, Wright Building, St. Louis, Mo. Applications must be accompanied by a certified check for $100, drawn to the order of the Treasurer of the United States, the proceeds of which will be held in this office until the return of the drawings and specifications.

LEGAL NOTES.

FAILURE TO COMPLY WITH ORDINANCE REQUIREMENTS NEGLIGENCE—Where the ordinances of a city require an electric-light company to maintain its electric-light wires in a taut condition to avoid swinging contacts, and to keep such wires properly insulated, and, wherever it is necessary for such electric-light wires to cross the line of a telegraph or telephone line, to string its said wires at a distance of not less than five feet from the wires of said telegraph or telephone line, the Supreme Court of Nebraska holds, Olson vs. Nebraska Telephone Company, that a failure on the part of said electric-light company to comply with all or any of such requirements is negligence which will render it liable to any person who, without fault on his part, is injured by reason thereof.

LIABILITY OF DISTRIBUTOR OF ELECTRICITY ON WIRES OWNED BY OTHERS—A distributor of such a deadly agency as electricity, the Court of Appeals of Kentucky says, in Lewis' Administrator vs. Bowling Green Gaslight Company, cannot escape liability for negligence in the manner of distribution by turning it onto private wires, or on the wires of another concern, which are not safely arranged to receive and transmit the current. Nor can it dispense with the duty of inspecting the wires, from time to time, to see that they are securely fastened and properly insulated, although the lines are not owned by it. When it uses the lines, it is its duty to see to their proper and safe condition. This duty is not discharged by the exercise of ordinary care, but requires the highest degree of care to keep them safe.

PUBLIC USE FOR ELECTRICITY—In a case where a corporation organized under the laws of the State of Washington for the purpose of generating and transmitting electrical current and electrical power for uses claimed to be public within the purview of the state constitution was seeking to condemn and appropriate certain waters, the Supreme Court of Washington holds, State vs. Superior Court, that so much of the electricity as was destined to be used for public and municipal lighting and in the operation of common carrying railroads, whether directly through the corporation or indirectly through its assignees or successors, was for a public use. The fact that the company would sell and deliver a portion of its electrical power to third persons and corporations, to be by them used for public and municipal lighting and in the operation of railroads, would not afford a sufficient reason for denying to it the right of eminent domain.

WHAT IS TAXABLE AS GROSS EARNINGS OF A TELEPHONE COMPANY—In State vs. Northwestern Telephone Exchange Company, the Supreme Court of Minnesota holds that a proportionate part of the earnings of the property of telephone companies within that state, resulting from its use in interstate commerce, constitute a part of its gross earnings, upon which it must pay the three-per-cent tax provided for by the general laws of 1897. Money received from messengers not regularly in the company's service, but employed specially to call non-subscribers to the telephone stations, and money collected from the company's patrons and subscribers as messenger charges actually paid to persons in whose buildings the company's booths are located, and as compensation for such location, are a part of the gross earnings. But money collected by a telephone company from its patrons and subscribers for other telephone companies, with which it has traffic arrangements, is not a part of its gross earnings. And the amounts which the regular rates would have produced, had the service, which was in fact rendered without charge, been charged for at the regular rates, is not a part of the gross earnings.

RIGHT OF ELECTRIC ROADS TO CROSS STEAM RAILROADS—In an opinion handed down in the Fourth Court of Civil Appeals at San Antonio, Tex., Associate Justice W. S. Fly handed a decisive blow to efforts of steam railroads to block competition from electric lines. The case in point was that of the Galveston, Harrisburg & San Antonio Railroad Company vs. the Houston Electric Company, on appeal from Harris County. The appellant sought to restrain the traction company of Houston from building a suburban line across its tracks. In the lower court a writ of injunction was secured, but it was later set aside. The decision was affirmed. In giving his opinion, Judge Fly said: "No additional burden will devolve upon appellant by the crossing constructed by appellee, and it has acquired no right by being authorized to cross the public road as would empower it to stop the wheels of progress and thwart the efforts of the public to obtain better and faster transportation. It has been held time and again in this state and others that no new burden or servitude is imposed upon a public street or highway by constructing and operating a street railway thereon where cars are propelled by electricity in the transportation of passengers."

PRIMA FACIE LIABILITY FOR INJURY FROM HANGING OR FALLEN WIRE IN STREET—In view of the dangerous character of electric-light and power wires, and the peril to which their suspension over the public streets exposes the public who constantly traverse and use the streets, the Court of Appeals of Maryland thinks it both just and reasonable to hold that the injury of a person upon the surface of the street by contact with a hanging or fallen wire of that character, in itself, if unexplained, affords sufficient prima-facie evidence of negligence on the part of the owner of the wire to entitle the plaintiff to go to the jury in an action for damages for the injury. In the case before the court, Walter vs. Baltimore Electric Company, 71 Atlantic Reporter, 953, there was evidence that, as the plaintiff, a boy eight years old, was passing along a public street he swung himself around a pole standing in the pavement, when he came in contact with a hanging wire charged with electricity, and badly burned his head and his hand. The evidence did not show the existence of any sudden or unforeseen cause for the falling of the wire, nor show with certainty whether it fell before or at the time of its coming in contact with the boy. The court is of the opinion that the evidence was sufficient to raise such a prima facie presumption of negligence against the company as to call for an explanation from it, and therefore sufficient to carry the case to the jury, though, of course, the company should be permitted to rebut the presumption of negligence, and show by any lawful evidence, if it could do so, that it had fully discharged its duty to the public in the erection and maintenance of its wires.

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INDUSTRIAL ITEMS.

C. H. HUGHES AND COMPANY, formerly of 120 Broadway, haye moved to the United States Realty Building, 115 Broadway, New York.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY has commenced work on 130 200-horsepower motors for the Long Island Railroad.

THE STAR EXPANSION BOLT COMPANY, New York, N. Y., makers of the Star expansion bolts, has moved its New Orleans, La., sales office to 504 Audubon Building, where strangers and friends alike will be welcomed by D. S. Miller.

THE F. W. WAKEFIELD BRASS COMPANY, Vermilion, Ohio, is distributing an illustrated price list of electroliers. This list is devoted particularly to the new square fixture and contains a number of illustrations of this type, affording the recipient a large variety to select from.

THE DUPLEX METALS COMPANY, New York, N. Y., is distributing an attractive catalogue devoted to an explanation of the many uses of copper-clad steel wire and giving some useful data. This company is also distributing a circular entitled, "Is Copper-Clad Steel Wire An Experiment?" This circular presents some interesting figures.

THE RAPID MOTOR VEHICLE COMPANY, Pontiac, Mich., is increasing the capacity of its plant to meet the growth in its business. The new electrical equipment which is to be furnished by Allis-Chalmers Company, will consist of two 600-kilowatt generating units. The generators are 240 volts, sixty-cycle, three-phase machines directly connected to cross-compound-condensing engines.

THE TRUMP MANUFACTURING COMPANY, Springfield, Ohio, manufacturers of water wheels, transmission machinery, etc., is distributing a catalogue devoted to Trump Turbines for low and medium heads and also to scroll type turbines for head ranging from fifty to 300 feet. This publication contains views and diagrams of all parts of these machines in addition to concise descriptions, tables and data.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is distributing the November number of its regular publication. This issue contains several good descriptions of new apparatus, among which may be named: "Electric Forge Blowers," and "The Elmo Washing Machine," also useful information and data. In addition this number contains an instructive editorial entitled "Sincerity in Business."

PETTINGELL-ANDREWS COMPANY, Boston, Mass., dealers in electrical merchandise, has recently distributed the November issue of its publication, entitled "Juice." This number contains articles which should be of interest to the trade generally, prominent among which may be named, "According to Schedule" and the editorial, "Team Work." These articles embody excellent suggestions for business of all kinds, but particularly the electrical industry.

THE MARION STEAM SHOVEL COMPANY, Marion, Ohio, is now building a second electric shovel for the Casparis Stone Company and has placed an order with Allis-Chalmers Company for the necessary electrical apparatus. It will include two seventy-five horsepower series wound direct-current motors of the railway type and one 150-horsepower composite motor, with the necessary controlling devices. Something over a year ago the Marion Company built the first electric shovel for this customer and its success has been extremely marked. The new machine will be practically a duplicate of the first.

THE ALLIS-CHALMERS COMPANY has recently sold a gas-engine generator set to T. F. Fulkerson of Sapulpa, Okla. The engine is of the standard four-cycle double-acting tandem. It is rated at 360 horsepower when making 200 revolutions per minute and will operate on natural gas from the Oklahoma belt. The frame and slide are cast in one piece, which is extremely heavy, as are all the essential parts of the machine. The generator, which is direct-connected to the engine, is a sixty-cycle, three-phase, 2,300-volt machine. The exciter is belted to the generator and develops 120 volts. In addition to this the Allis-Chalmers Company has also just received an order for two 300-kilowatt, direct-current, engine-type generators and nineteen direct-current motors, which are to be installed in the plant of the McKeesport Tin Plate Company at Portvue, Pa.

THE HERSCHEDE-LIEBENSTEIN COMPANY, Cincinnati, Ohio, has moved to larger quarters at Room 1101, Provident Bank Building. The company carries an electrical construction, supplies and machinery business.

THE STANDARD ELECTRIC ACCUMULATOR COMPANY, of New Jersey, has been made the subject of a petition in bankruptcy. The company manufactures storage batteries at 91 Mercer street, New York city. It was alleged that the company is insolvent, and admitted in writing its inability to pay its debts. The company was incorporated in May, 1906, with a capital stock of $1,500,000. The liabilities are announced as $11,843.

THE CHARLES L. KIEWERT COMPANY, NEW YORK AND MILWAUKEE, is distributing a booklet devoted to the "Trucolor" pure carbon arc lamp. This lamp is the most recent product of the Kiewert Company and radiates a white, color true, steady light, which makes it particularly adaptable for interior illumination of stores and show-window lighting. The mechanism of the "Trucolor" lamp is practically the same as that of the "Aurola," another lamp manufactured by this company.

THE AMERICAN DISTRICT STEAM COMPANY, Lockport, N. Y., has published Bulletin No. 116, which is a reprint of the excellent paper by its manager, Chas. R. Bishop, on "The Advantages of Central-Station Heating to Electric Companies." This paper was read before the New England Section of the National Electric Light Association at its Portsmouth, N. H., meeting on September 10, 1909. It was abstracted at considerable length in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 6, and its merits are therefore well known to our readers.

THE CROWN WOVEN WIRE BRUSH COMPANY, Salem, Mass., reports that although there have been many changes in the use of dynamo brushes during recent years there continues a marked advancement for the Crown woven wire brush for low-voltage generators and rotary converters. These brushes are also being used on generators needed in the manufacture of many electro-chemical products. In the automobile industry a large demand for Crown brushes had been created for igniter and magneto work. Large quantities of these brushes in various sizes are being shipped to Canada, England, Germany, and many other foreign countries.

THE AMERICAN CONDUIT AND MANUFACTURING COMPANY, of Pittsburg, Pa., has issued a folder descriptive of its "Galvanite" rigid conduit. In this circular the well-known merits of this type of conduit are clearly stated, among the advantages that it possesses being the fact that its interior surface is thoroughly insulated and the exterior surface is coated with electrically deposited zinc, thus forming a perfect conductor, so as to insure the automatic grounding of the system, without need of special grounding clamps. The company is anxious to furnish detailed descriptive matter and other information in relation to this conduit upon request.

THE COLLIN ARMSTRONG ADVERTISING COMPANY, 25 Broad street, New York city, has recently been formed by men of long experience and acknowledged ability in advertising business. The president, Collin Armstrong, was for nearly twenty-five years financial editor of the *New York Sun*, in which position he not only established the reputation of the financial pages of that paper, but also of its advertising service. Mr. Armstrong is generally conceded to be a leader in the line of financial publicity. For the past eight years he was treasurer and manager of the advertising agency of Albert Frank & Company. His associates in the new company are Harry L. Cohen and Chas. Hartner, who also were connected with Albert Frank & Company for some twenty years.

DATES AHEAD.

International Independent Telephone Association. Annual convention, Chicago, December 7, 8 and 9.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) November 9, 1909.

939,212. SHOE-LAST. Adam J. Buch, Portsmouth, Ohio. Filed January 17, 1908. The toe piece is provided with an electrical heater.

939,223 and 939,224. PROCESS FOR ELECTRICALLY REMOVING IRON-OXID SCALE. Charles W. Danforth and Noble Jones, Sharon, Pa. Filed June 25 and August 28, 1909, respectively. The scale on the surface of the metal is subjected as cathode to the action of an electric current, while submerged in a solution containing bisulphate of an alkaline metal.

939,245. CREDIT SYSTEM. Jacob O. Greenwald, Milwaukee, Wis. Filed September 21, 1905. Describes a form of telephone system.

939,258. ELECTRIC SWITCH. Frederick Hoerle, Plainville, Conn. Filed November 12, 1907. Secondary contacts are mounted on

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the base having a slot (extending from its edge), in which is fitted a post pivotally united to the switch arm. Connections are provided between the post and the primary contact.

939,292. TEST FOR FIRE-ALARM APPARATUS. James G. Nolen, Chicago, Ill., assignor of one-half to Frank B. Cook, Chicago, Ill. Filed September 24, 1903. A normally open switch is adapted automatically to close a short circuit around the testing device upon the operation of the signal-transmitting devices.

939,293. FIRE-PROTECTION SIGNAL-SYSTEM. James G. Nolen and John E. Shepherd, Chicago, Ill. Filed April 25, 1904. A water-tank float operates a signal-transmitting instrument in conjunction with a sprinkler system.

939,331. ALTERNATING-CURRENT ELECTRIC MOTOR. John T. Schaaff, Washington, D. C. Filed March 9, 1906. A phase-retarder is included in the circuit of one of a number of separate electromagnets.

939,337. SYNCHRONIZING DEVICE FOR PICTURE-MACHINES AND PHONOGRAPHS. Paul Seiler, Oakland, Cal., assignor of one-half to Samuel Joseph Johns, San Francisco, Cal. Filed October 7, 1908. Includes separate motor and ticker circuits, a phonograph, a picture machine, and a rhythmical make-and-break device in the ticker circuit, with means on the picture machine for simultaneously closing both circuits.

939,338. ELECTRICAL TRANSMISSION OF GRAPHIC MESSAGES. Gilbert Sellers, Chicago, Ill. Filed July 18, 1908. An apparatus for electrically transmitting messages, pictures and images of objects, comprises means for translating the image into a series of electrical impulses of varying intensity, a transmission-circuit, and means for retranslating these electrical impulses into a duplicate of the sending image including a series of revolving reflecting surfaces.

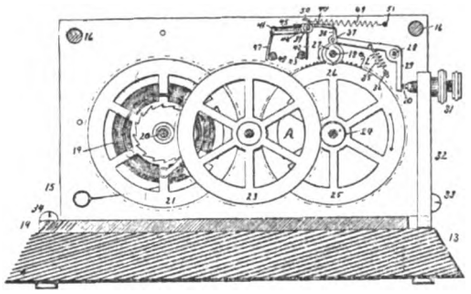
939,339. ELECTRIC TRANSMISSION OF MESSAGES. Gilbert Sellers, Chicago, Ill. Filed November 25, 1908. Similar to the preceding.

939,441. APPARATUS FOR PRODUCING ELECTRIC DISCHARGES. Harry Pauling, Gelsenkirchen, Germany, assignor to The Firm of Salpeters-Aure-Industrie-Gesellschaft, Ges. M. B. H., Gelsenkirchen, Germany. Filed December 18, 1905. The distance between a pair of electrodes is varied by movement of a conductor. The discharge may be extinguished by a blast device.

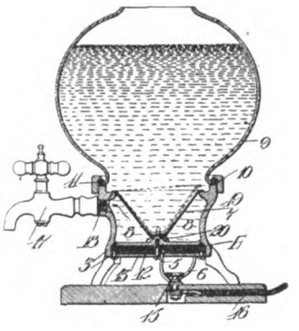
939,442. PROCESS FOR THE PRODUCTION OF VOLTAIC HIGH-CURRENT ARCS. Harry Pauling, Gelsenkirchen, Germany, assignor to The Firm of Salpetersäure-Industrie-Gesellschaft, G. M. B. H., Gelsenkirchen, Germany. Filed August 13, 1906. The process consists in elongating the voltaic arcs produced at the place of greatest proximity of the electrodes by causing them by suitable means to propagate along the electrodes and in passing the gas to be acted upon by the electrical discharges in currents of equal quantity and velocity in inclined direction against each other and meeting in the plane of the electrodes.

939,501. COUPLING FOR ELECTRIC CONDUCTORS. Jesse L. Hinds, Syracuse, N. Y., assignor to Crouse-Hinds Company, Syracuse, N. Y. Filed April 1, 1909. Describes a kind of slotted compressible sleeve with means for compressing the same.

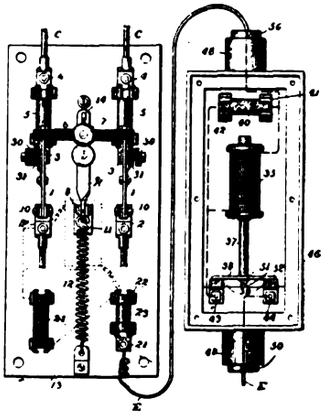
939,507. TELEGRAPH SENDING-MACHINE. John A. Hulit, Topeka, Kans., assignor, by mesne assignments, to The Hulit Transmitter Company, Topeka, Kans. Filed September 3, 1908. Compriaes a frame, a rotary circuit closer mounted therein, a motor for driving said circuit closer, and manually controlled stops for stopping said motor with the circuit closed and for stopping said motor with the circuit open.



939,507.—TELEGRAPH SENDING-MACHINE.



939,605.—ELECTRIC WATER-HEATER.



939,730.—AUTOMATIC ELECTRIC CIRCUIT-BREAKER.

939,357. MAGNETO-ELECTRIC MACHINE FOR IGNITION PURPOSES. Charles A. Vandervell and Frederick I. Hoffman, London, England. Filed September 25, 1908. Comprises a current distributor, including a box of insulating material and having a series of paths joined up as one continuous path, contact pieces arranged in these paths, an armature, shuttle carried by the armature, the shuttle constituting a contact piece connected to armature, and means for permitting the shuttle to travel in the continuous path and make contact with the contact pieces arranged therein.

939,370. BLOCK-SIGNALING APPARATUS. Stephen A. Wood, Providence, R. I., assignor to United Electric Signal Company, Providence, R. I. Filed May 14, 1906. Comprises a target-arm, a second arm for operating the first arm and arranged and adapted to engage and disengage with it, and means for rocking the second arm.

939,383. TELEGRAPH-TRANSMITTER. Benjamin F. Bellows, Cleveland, Ohio. Filed July 29, 1907. A vibrator is deflected by a spring-actuated device under the control of the key lever.

939,401. TELEGRAPH SYSTEM AND APPARATUS. Thomas B. Dixon, New York, N. Y. Filed November 25, 1904. Renewed March 5, 1909. Describes a system of multiplex telegraphy.

939,409. ELECTROMAGNETIC RELAY. David I. Garretson, New York, N. Y., and Marcus O. Anthony, Englewood, N. J., assignors to Garretson-Anthony Company. Filed October 27, 1908. There are two contacts, one stationary and the other elastically mounted and connected with an armature. The electromagnet is so located that the armature may approach the magnet pole-pieces but is prevented from meeting them by the meeting of the contact pieces.

939,439. TELEPHONE ATTACHMENT. Henry R. Palmer, Seattle, Wash. Filed March 3, 1908. Describes a form of tubular receiver-supporting standard having telescopic sections.

939,523. MAGNETIC ORE-SEPARATOR. Wayne D. Ludwick, Seattle, Wash., assignor to Northwest Metallurgical Company, Seattle, Wash. Filed September 22, 1906. Renewed May 20, 1909. Magnets are spaced around the lower interior portion of a drum mounted to rotate in the receptacle of the separator, and further magnetic means are provided to remove magnetic material from the exterior of the drum.

939,599. TWO-POLE SNAP-SWITCH. Louis Kellner, New York, N. Y. Filed December 5, 1908. Comprises a sleeve having an arcuate rib with a central lug, a standard having a hole to receive this lug, a rocker plate having an arcuate slot to receive the rib, and a spring tensioned by the rocker to impel the sleeve and move the same angularly when it is released from the standard.

939,605. ELECTRIC WATER-HEATER. Henri O. Levy and George N. Blanchard, San Francisco, Cal., said Blanchard assignor to said Levy. Filed March 29, 1909. The heating unit comprises two sheets of insulating material and an interposed flat coil composed of a winding of bare wire and intermediate asbestos twine; a shellac coating on the inner surfaces of the sheets unites the sheets and winding to each other when heat is applied thereto.

939,625. APPARATUS FOR STRENGTHENING WEAK ELECTRICAL CURRENTS. Anton Pollák, Paris, France. Filed August 7, 1908. A microphone is used in combination with an electromagnetic device.

939,626. ELECTRICALLY-ACTUATED TRAIN-SWITCH. Joseph Y. Porter, Detroit, Mich. Filed December 10, 1908. Describes a form of trolley bridge.

939,630. MINER'S ELECTRIC LAMP. Hermann Remané, Berlin, Germany, assignor to Deutsche Gasglühlicht Actien Gesellschaft (Auergesellschaft), Berlin, Germany. Filed May 22, 1908. The lamp is carried by the removable cover of the battery box, rotation of a ring on the cover securing the latter to the box.

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939,650. ELECTRICAL CONTROLLING SYSTEM FOR ROLLING OR SLIDING SHUTTERS, ELEVATORS, ETC. Lester G. Wilson, Larchmont, N. Y. Filed May 23, 1908. Describes the switches and connections for the operating electric motor.

939,658. TROLLEY-HEAD. Joseph J. Bennett, Pittsfield, Mass. Filed December 3, 1907. Has a rack device for limiting the rotary movement of the harp.

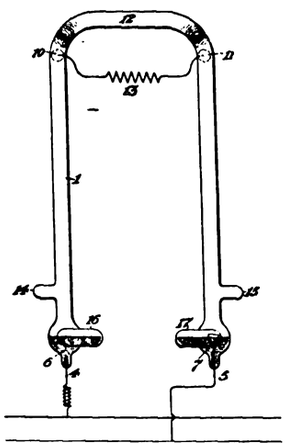
939,659. RAILWAY TRAFFIC-CONTROLLING SYSTEM. Henry Bezer, Newark, N. J. Filed January 18, 1907. Describes an electric traffic-controlling system for railways.

939,683. TELEGRAPH-TRANSMITTER. George M. Goddard, Rutland, Vt., assignor of one-third to George C. Thrall, Rutland, Vt., and one-third to Rutland Machine & Automobile Company, Rutland, Vt. Filed May 29, 1908. The key lever co-operates with cam and clutch mechanism for the shaft.

939,689. COUPLING FOR ELECTRIC CONDUCTORS. Jesse L. Hinds, Syracuse, N. Y., assignor to Crouse-Hinds Company, Syracuse, N. Y. Filed April 1, 1909. Similar to No. 939,501.

939,708. MERCURY AND OTHER VAPOR ELECTRIC LAMP. Henry A. Kent, Bound's Green, and Harold G. Lacell, Finchley, England, assignors to Silica Syndicate Limited, London, England. Filed December 1, 1908. Means in close proximity to the electrode are provided for raising the temperature of the latter to substantially that of its companion of different polarity, to prevent condensation of the vapor.

939,719. REMOTE ELECTRIC-CONTROL SYSTEM FOR SEARCH-LIGHTS AND THE LIKE. Alexis Le Blanc, New York, N. Y. Filed February 5, 1909. Comprises a motor, an electro-magnetically actuated switch for operating the motor, a local circuit for the actuating coil of the switch and motor, relays for controlling the local circuit, a controller and an independent source of current for operating one of the relays, whereby the switch is actuated to vary the speed and direction of the motor.



939,912.—GAS OR VAPOR ELECTRIC LAMP.

939,723. ELECTRIC-MOTOR FAN. Nathen A. Locke, Fulton, N. Y., assignor to Hunter Fan & Motor Company, Fulton, N. Y. Filed January 27, 1908. Comprises a frame, a vane-wheel (one of which parts is movable toward and from the other), a motor, power-transmitting means supported by the frame and interposed between the motor and vane-wheel, a switch for controlling the operation of the motor, and means operated by the switch for moving one of said parts toward and from the other.

939,730. AUTOMATIC ELECTRIC-CIRCUIT BREAKER. William F. Meter and William L. Rideout, Oshkosh, Wis., assignors to Electrical Manufacturing Company, Oshkosh, Wis. Filed July 22, 1908. In combination with a switch is an electromagnet in circuit with the switch to open the switch, also means constructed to open the circuit before the switch contacts are broken.

939,750. ALARM FOR CARDING-MACHINES. Eugene P. Schmitt, Seymour, Ind. Filed April 16, 1908. Comprises a vertically movable roving roller, a contact carried thereby, an electric circuit, and a single pair of terminals arranged on either side of the contact and adapted to be bridged by the moving contact in the extreme movement of the roller in either direction.

939,756. TELEPHONE SYSTEM. Frank E. Summers, Scotland County, Mo. Filed March 10, 1908. An emergency signal device is provided at each telephone instrument.

939,791. SELF-WINDING MECHANISM. Aaron D. Blodgett, Newton, and Fred S. Atkinson, Brookline, Mass., assignors to Blodgett Clock Company, Boston, Mass. Filed March 1, 1909. Is electromagnetically operated.

939,863. ELECTRIC SWITCH. Joseph H. Rusby, Nutley, N. J. Filed February 23, 1907. Describes a double-acting push-button switch.

939,872. PNEUMATIC-DESPATCH SYSTEM. Percy R. Shill, Leytonstone, England, assignor of one-fourth to Charles William Bluemel, one-fourth to Frank Henry Bluemel, and one-fourth to Ernest Adolphus Bluemel, Wolston, England. Filed August 14, 1908. Is electrically controlled.

939,904. CENTRIFUGAL MACHINE. George N. Goddard, Newton, Mass., assignor to American Tool & Machine Company, Boston, Mass. Filed November 11, 1905. Is driven by an electric motor the armature of which is mounted directly on the vertical shaft.

939,910. MAGNETO-GENERATOR. Robert H. Hassler, Indianapolis, Ind. Filed March 23, 1908. Comprises a cylindrical support providing a lubricating reservoir, a series of magnets arranged about the axis of the support and projecting at one end to form a multipolar magnetic field, a shaft in the reservoir and carrying an armature in the field, and means whereby the shaft may be revolved.

939,912. GAS OR VAPOR ELECTRIC LAMP. Peter C. Hewitt, New York, N. Y., assignor to Cooper Hewitt Electric Company, New York, N. Y. Original application filed April 9, 1904. Divided and this application filed June 29, 1905. The method of securing a closed metallic circuit between electrodes of a vapor electric apparatus, for the purpose of starting, consists in connecting the electrodes by passing the starting current between the electrodes within the container for a portion of the way adjacent to the electrodes, and for the remainder of the way more remote from the electrodes passing the current outside of the container.

939,924. ELECTRIC WARP STOP-MOTION. John Regan, New Bedford, Mass., assignor to Crompton & Knowles Loom Works. Filed March 18, 1909. The warp stop-motion for looms comprises a filling fork having a magnetic member thereon, an electric circuit, an electromagnet supported on a stationary part of the loom, a drop device to close the circuit and energize the electromagnet to hold the filling fork from being moved, a weft hammer to engage the filling fork and move it to operate mechanism to stop the loom.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 15, 1909:

486,068. ELECTRIC LOCOMOTIVE. Wm. E. Allington, East Saginaw, Mich.

486,078. ARMATURE FOR DYNAMO-ELECTRIC MACHINES AND ELECTRIC MOTORS. Charles S. Bradley, New York, N. Y.

486,094. SECONDARY BATTERY. Rudolf Eickemeyer, Yonkers, N. Y.

486,123. ELECTRIC METER. John Perry, London, England.

486,149. TEST-CIRCUIT FOR BURGLAR-ALARM SYSTEMS. Edmund R. Wilder, Kansas City, Mo.

486,176. ELECTRIC FORGE. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

486,212. CIRCUIT CONTROLLER. Harry W. Leland, Jersey City, N. J.

486,213 and 486,214. GOVERNING ELECTRIC MOTORS.—Robert Lundell, New York, N. Y.

486,234. ARMATURE FOR DYNAMO-ELECTRIC MACHINES. Albert L. Parcelle, Boston, Mass.

486,241. ELECTRIC SWITCH. Ernest P. Warner, Chicago, Ill.

486,243. ELECTRICAL ANNUNCIATOR. Franklin S. Carter, Burlington, N. J., and George P. Stumpf, Philadelphia, Pa.

486,264. ELECTRIC BATTERY. John J. O'Lalor, Boston, Mass.

486,282. MESSENGER-CALL SYSTEM FOR BUILDINGS. Frank H. Fuller, Springfield, and Charles B. Perkins, Holyoke, Mass.

486,315. ELECTRIC RAILWAY CONDUIT. Augustine W. Wright, Chicago, Ill.

486,324. SIGN FOR ELECTRIC LAMPS. Edwin W. Clay, Louisville, Ky.

486,333. TROLLEY FOR ELECTRIC RAILWAYS. Augustus H. R. Guiley, South Easton, Pa.

486,334. REGULABLE ELECTRIC LAMP. George W. Hall and Joseph J. De Marr, Georgetown, Colo.

486,338. ELECTRIC ALARM. Henry A. Hull, New Brunswick, N. J.

486,354. ELECTROMAGNETIC BELL. James J. Ross, Detroit, Mich.

486,377. ELECTRIC ARC LAMP. Daniel Higham, Boston, Mass.

486,417. REGULATOR FOR DYNAMO-ELECTRIC MACHINES. Alexander Dow, Elgin, Ill.

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CONTENTS.

EDITORIAL:
Electric Mine Hoisting 1019
Improving an Old Central Station 1020
The Money Value of One Day's Telephone Service 1021
Development of Electrical Undertakings 1021
Prospects for Chicago Electrical Show 1022
President Vail on the American and Western Union Combination 1022
Technical Publicity Association 1022
Empire State Gas and Electric Association 1023
Chicago Electric Club 1023
American Institute of Electrical Engineers, Pittsburg Section 1023
New York Electrical Department News 1024
Resuscitation After Electrocution 1024
Germicide Properties of Ultra-Violet Rays 1025
Electrically Manufactured Water Gas 1025
Civil Service Examinations for Engineers and Draftsman 1025
Improving Conditions at Home and Abroad 1026
Copper Consolidation Certain 1026
Transformer for 500,000 Volts 1026
The Boston Electrical Show 1027
Annual Meeting of the American Society of Mechanical Engineers 1030
The National District Heating Association 1031
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
The Titanium Arc 1035
Public Lighting Fixtures for Arc Lamps 1037
CENTRAL-STATION PRACTICE:
Development of Electrical Undertakings 1039
Brooklyn Section, National Electric Light Association 1041
Care of Storage Batteries 1041
Electrical Opportunities in Mexico 1042
A New Crude-Oil Internal-Combustion Engine 1042
ELECTRIC TRACTION:
Electrically Operated Cogwheel Railway, Montreux-Glion, Switzerland 1043
Meeting of Central Electric Railway Association 1045
Electric Railroad in Carlsbad 1046
Pennsylvania Tunnels Inspected 1046
Damage by Electrolysis 1047
INDUSTRIAL POWER:
Electrical Propulsion of Ships 1048
Standardization of Machine-Tool Motors 1049
Austro-German Waterpower Dispute 1049
Electric Drive in Textile Mills 1050
The World's Production of Calcium Carbide 1050
FINANCIAL REPORTS OF ELECTRICAL COMPANIES 1051
INDUSTRIAL SECTION:
Modern Condenser Design; a Good Example and a Remarkable Test Result 1052
Electric Power in a Gas Plant 1054
The Sunray Arc Lamp 1054
Electric Railway Tower Wagon 1055
The Heany Multiple Alternating-Current and Direct-Current Arc Lamp 1056
Telephone Train Dispatching on the Atchison, Topeka & Santa Fe Railway System 1056
CURRENT ELECTRICAL NEWS 1057
RECORD OF ELECTRICAL PATENTS 1064

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ELECTRIC MINE HOISTING.

The application of electric motors to mine hoisting, which has made considerable progress of late years in the United States and Mexico, has reached its greatest development hitherto in Germany and France, especially in the former country, and its least, among the great mining centers of the world, in Great Britain, although even here a committee recently appointed by the Royal Commission on Mines commented very favorably on the subject. There seems to be no question, in fact, that the electric mine hoist must eventually displace entirely the steam hoist which for many years has held paramount sway, and in this connection it is interesting to note that the German Government permits a maximum speed of 1,980 feet per minute for hoisting men by electricity as against a maximum of 1,188 feet per minute allowed in the case of the well-tried steam hoist.

The question of hoisting by means of electric motors is not such a simple one as might appear on the face of it. Other applications of electricity in mines, as lighting, pumping, air compressing, ventilating, etc., furnish a comparatively constant load, and hence with these the load factor is high and the application of electricity is fairly simple, the load being both desirable and profitable from an operating standpoint. The special problem in these cases is entirely one of safety from shock and from igniting the gases or coal dust present in the mines. With electric hoists, on the other hand, the load is intermittent and extremely variable, and special precautions must be taken to equalize the load, both to improve the load factor and to prevent dangerous surges on the line.

When the hoist is designed to operate on a comparatively slight grade the problem is not so difficult. In a recent example of grade hoisting, in the mine of the Washington Coal and Coke Company, at Dawson, Pa., the grade varies from 5.0 to 8.5 per cent. The hoisting drum is six feet in diameter and is driven by a 500-horsepower, direct-current, non-reversing, compound-wound motor controlled by a semi-automatic, magnetically controlled, unit-switch controller. Line surging is practically eliminated in this case by using an accelerating relay on the controller to prevent the starting switches from closing too rapidly. A safety relay is also provided which opens the resistance switches in cases of excessive overload. A further protection is afforded, as in case of the cars striking an obstruction, by a feature in the design which permits the motor automatically to be brought up to full speed again should the

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relay operate when the motor is running. In this particular installation the empty cars run down the slope under gravity and are controlled in their descent by a brake on the hoist drum. The hoist is installed on the 800-foot level, and it may safely be said that it could not be operated in the existing circumstances by any other than electric power.

When the haul is a straightaway one up a vertical or nearly vertical shaft, and the loads are considerable, the problem reaches its greatest complexity, but even in this case it has been satisfactorily solved. In such cases considerable assistance is afforded by using a balanced system of hoisting, in which the weight of the rising full cars is compensated by the weight of the descending empties, so that only the dead weight of the load itself is to be overcome by the motors, in addition, of course, to the friction loads.

Among the various successful methods which have been evolved for more or less straightaway electric hoisting, one of the most promising, when alternating current is used (as is commonly the case), is the motor-generator flywheel system. This is particularly applicable for extremely heavy hoisting, and in cases where the hoist is unusually long. The first cost is admittedly high, but the resulting economy and perfect control of the system make the installation especially worth while under these circumstances.

A noteworthy example of the motor-generator flywheel system is that in the mine of the El Oro Mining and Railway Company, Ltd., in Mexico. This set consists of a 350-horsepower, alternating-current, fifty-cycle, three-phase, 3,000-volt, induction motor, and a 320-kilowatt, direct-current, 250-volt, interpole generator, with a 40,000-pound flywheel, nine feet in diameter, mounted between the two machines on the common shaft. The seventeen-kilowatt, 125-volt exciter is belted to a pulley on the main shaft of the set at the side of the flywheel.

The chief purpose in using the motor-generator flywheel set for hoisting lies in the fact that the flywheel acts as a reservoir for energy which can be drawn upon when the peak loads are encountered, especially in accelerating. In this way the motor input is equalized in a degree depending on the kinetic energy of the flywheel. The slip in the motor must, of course, be varied in amount if this flywheel energy is to be utilized just when it is required. In the El Oro mine hoist this is accomplished by an arrangement which automatically cuts in and out grid resistances connected to the motor secondary. When the power is shut off, the set will rotate over an hour before coming to rest (unless a brake be applied, which will stop the machinery in less than five minutes). This permits the hoist to be used for some little time in case the current is accidentally shut off, and it is for this reason that the exciter is driven from the set instead of separately. No repairs beyond the usual attention to the brushes, have so far been necessary in this particular installation.

The Ilgner-Halske system has been employed with considerable success in Europe, there being about sixty examples of its use in Germany alone. Many other systems might also be noted, but enough has been said to show that the problem of the electric mine hoist can be and has been solved, and that the electric hoist is meeting with increasing favor. Each particular mine, of course, usually presents a special problem, so that no one system can be regarded as universally the best. However, in view of what has already been accomplished, there seems to be no mine-hoisting problem which cannot be advantageously met by the electric motor.

IMPROVING AN OLD CENTRAL STATION.

The improvement of operating conditions in power plants of long-established design is one of the most attractive fields which can be entered by the consulting engineer. Interesting as are stations of the latest type of equipment and the most modern arrangement, it is the old plant which is always with us; the relatively out-of-date installation which is most commonly encountered in visiting commercial systems. In an art advancing as rapidly as that of applied electricity, existing plants must inevitably be constantly falling behind the standards of present-day practice; and yet many of these old stations can be maintained at good productive efficiency, all things considered, or else improved by really striking percentages in their costs of operation. The reward for a careful analysis of the service conditions in an old station often pays many times over for the expense of the investigation.

An instance of what can be done in a single year in a station of inferior design, judged by modern standards, is afforded by a 500-kilowatt plant serving a manufacturing town of about 15,000 inhabitants, and which was examined by a consulting engineer recently, in connection with a change of ownership. The plant was in poor condition generally when the investigation was begun. All the generating units were belt driven, and both sixty and 133-cycle machinery was in service. The wiring in the station was poor and intricate; the alternators of the same frequency and voltage were not connected for parallel operation under any circumstances; the engines, piping and condensers were in bad condition; the steam pressure was too low, and the load run off separate units with little regard to what the rest of the plant might be doing. On account of the low steam pressure the engines carried the steam through to the end of the piston stroke at full load. This threw too much steam upon the condensers, and in consequence the engines often operated on high back pressure. The boilers were unable to furnish enough steam under these conditions and often a part of the street lighting load of the plant had to be cut out to enable the engineer to raise the steam pressure to normal.

Outside the station the insulators were missing on many cross arms; poles were not set deep enough, and many were badly decayed. Circuits were mixed and run haphazard, with little regard to their potential and relation to other lines. Lines no longer in use in the supplying of lighting and power service to customers encumbered the poles and hazarded the safety of linemen. Primary and secondary circuits were often not separated at cross arms, and in some cases a wire as small

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as No. 4 B. & S. was used in the middle of a line built with No. 0000 on each side of the former. With the system in this condition it was not surprising that the station fuel consumption per kilowatt hour delivered at the busbars was 8.2 pounds, or that the cost of operation per kilowatt-hour, exclusive of fixed charges and general expenses, was 2.88 cents. The cost of coal per ton delivered at the station was $4.88, for the year.

Following the engineer's investigation and report, the station was taken in hand, and the distribution system also put in better condition. The 133-cycle machinery was disposed of, a voltage regulator installed in the station, and tub transformers installed for the arc-lighting service in place of the direct-current belted dynamos formerly used. The station piping was rebuilt, a direct-connected alternator driven by a modern engine added, and the existing alternating-current generators wired to the switchboard so that they could be operated in parallel. This enabled the station attendants to divide the load in an efficient manner, and to forego the operation of several lightly loaded machines when one or two could carry the business. All the lines were put in safe condition and standardized for sixty-cycle service from station busbar to consumers' transformers. The steam generating plant was put in shape to handle the load without dropping out of condensing service, and the piping was almost entirely rebuilt. The installation of the voltage regulator was the means of greatly increasing the satisfaction of the public with the service, as under the old régime there were constant complaints that the lighting was inferior. The power sales were increased about one-half after the improvements.

The operating results of the station showed a remarkable gain in efficiency for the year after the changes above outlined had been effected. The coal consumption per kilowatt-hour delivered at the switchboard fell off one-third, to 5.5 pounds. The cost of coal per ton for the year was $4.98, practically the same each year, and the station labor cost per kilowatt-hour manufactured remained substantially the same, or 0.71 cent, in the second year against 0.725 cent before. The total cost at the switchboard was 2.14 cents per kilowatt-hour generated.

These figures are not cited for their absolute, but for their relative value. In this day a plant which cannot generate electricity at a lower figure than the above station, omitting all the expenses except those of mere station manufacture, does not measure very near the lines of efficiency now possible even in small central stations. When one recalls the fact that this plant had no means of measuring its generated output only four years ago and considers the point that the general design of the station has remained substantially unchanged for many years, the pecuniary value of the changes reviewed above impresses one. The saving in station cost per kilowatt-hour which was secured represents more than half its total fuel bill. In other words, the plant is better off by $525 per month than it was before the analysis of its operation was made. What has been done in the single case here cited can be done elsewhere, if managers will take a broad view of the benefits of skilled engineering advice and if power plant experts will not overlook the possibilities of improving even the more antiquated installations which are now in service.

THE MONEY VALUE OF ONE DAY'S TELEPHONE SERVICE.

A suburban telephone subscriber in the Boston district of the New England Telephone and Telegraph Company took occasion recently to determine the actual value of one day's service in connection with his business. During this day he called up eight parties from his own telephone, received five incoming calls, and called three times in the transaction of business on other lines than his own wire. The actual cost of this use of the telephone facilities of his community was twenty-eight cents, the rental of his own instrument being eight cents, and the in and out of town charges twenty cents.

Assuming that the transaction of business took the same time over the tlephone that it would have in a personal visit, and allowing one minute per call to obtain the desired party, it was found that the use of the telephone made a net saving of three-and-one-half hours, compared with the actual time it would have taken under the most favorable circumstances to make the rounds of the different parties in a well-planned trolley and steam railroad circuit. To have visited the called parties in person would have necessitated traveling twenty-five miles inside the metropolitan district, at a conservative cost of fifty cents, and this time would have been largely wasted so far as productive work went. This business man's time happened to be worth approximately $1.25 per hour, so that the actual net saving in the day's use of the telephone was $4.62. This was made up as follows: Credit to telephone, three-and-one-half hours at $1.25, and fares for twenty-five miles; total, $4.90. Debit to telephone (cost of service), $0.28. Net saving, $4.62.

The results clearly indicate that even to the man of small means the telephone is a definite money saver, and that its yearly net value to even a moderate sized community may rightly be expressed in the millions of dollars.

DEVELOPMENT OF ELECTRICAL UNDERTAKINGS.

Under this caption there appears on other pages of this issue the first part of a most interesting and instructive paper by S. J. Watson, of Bury, England, in which the author makes some excellent suggestions on electrical distribution, to which the attention of central-station men in this country is especially directed.

Among several other things noted, Mr. Watson estimates that within the radius of the Manchester (Eng.) Town Hall there are some twenty central stations having a total capacity of 100,000 kilowatts which probably cost in the neighborhood of $10,000,000. The author calculates that in this case, by interconnecting these generating stations at a cost of about $750,000, a reduction of spare plant would result, from an existing thirty-seven per cent to about twelve per cent, besides giving an increase in load of 25,000 kilowatts without any further expenditure. This is one of the best arguments in favor of centralization of electrical generation.

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Prospects for the Chicago Electrical Show.

It is reported that never before in the history of Chicago's annual electrical shows has there been such an early demand for space and it is predicted that before the middle of December every available square foot of the Coliseum will have been contracted for the January show by the leading electrical concerns of America representing every branch of the industry and science. While the majority of the concerns taking space are located in Chicago, the list of exhibitors will include companies as far west as California and east as far as New York and Boston. Several of last year's exhibitors have taken larger space than heretofore and in the list of exhibitors are many who have never before been represented in the Chicago show.

The scope of the exhibits is particularly broad, the jobbers and manufacturers predominating with an unusually large percentage of electrical engineering and laboratory companies in the show. The National Electric Lamp Association, the General Electric Company, the Commonwealth Edison Company, the Simplex Electric Heating Company, the Western Electric Company, Chicago Telephone Company, the Swedish-American Telephone Company, will be among the largest exhibitors. Two electric automobile concerns are already in—the General Vehicle Company and the Baker Electric represented by Ralph Temple. The Cosmopolitan Electric Company is exhibiting for the first time and so is Macbeth-Evans Glass Company. No less than seven pneumatic cleaners have already signed for space.

Contracts made during the last week include Illinois Appliance Company, Oral and Motion Manufacturing Company, Chicago Pneumatic Tool Company, Fort Wayne Electric Works, Perfection Vacuum Cleaner Company, Acme Wire Company, Chicago Fuse Wire and Manufacturing Company, Electrical Testing Laboratories, Long Beach Electric Manufacturing Company, Cutler-Hammer Manufacturing Company, Hahl Automatic Clock Company, Schneible Company, National Carbon Company, G. L. Jackman, Henry Newgard & Company, Wonderful Pump, Milwaukee Vacuum Machinery Company, E-Z Vacuum Cleaner Company, Stolz Electrophone Company, Electro-Magnettic Tool Company, Kimble Electric Company, Sefton Manufacturing Company, United States Light and Heating Company, and Macbeth-Evans Glass Company.

The management is not ready to disclose the scheme of decoration which D. H. Burnham & Company has designed for this year's show, but it is said that in novelty, beauty and brilliancy it will surpass everything that has ever before been seen in the Coliseum. As from the general trade exhibits, there will be more unique and novel displays than ever before, making the exposition of more than ordinary interest to the thousands who attend outside of the trade.

The management is spending more money than ever on exploitation this year. It is desired to break all records in the matter of attendance. Attractive souvenirs will be offered every day. Special efforts and plans are also being made to bring into Chicago everybody in the middle west directly or indirectly interested in the allied electrical trades, particularly the central station men. Interesting electrical lectures and demonstrations are planned for every day.

The Electrical Show will open Saturday, January 15, and run until January 29, being open daily except Sundays.

President Vail on the American and Western Union Combination.

President Theodore N. Vail, of the American Telephone and Telegraph Company, to whose energetic efforts the plans for the control of the Western Union Telegraph Company by the American Telephone and Telegraph Company are due, was interviewed recently concerning the transaction. When asked if he considered the transaction amenable to the Sherman anti-trust act he said: "So far as I know there is to be no merger. We intend to live up to the law in its spirit as well as its letter, and if we thought the purchase of Western Union stock was in violation of the law we should not have made it."

Mr. Vail said that the Mackay Companies has only 80,000 of the 300,000 shares in the Bell Company and thought there was no reason for any impression that the Mackay Companies would be effective in the enlarged company.

Mr. Vail also said that the acquisition of the Western Union would mean no new financing on the part of the American Telephone and Telegraph Company. The report that Mr. Baker, one of his vice-presidents, was to succeed Colonel Clowry as president of the Western Union, was also without foundation. There will, however, be changes in the operating staff of the Western Union, and American Telephone and Telegraph men will take the place of some of the Western Union directors.

With regard to the question of telephone and telegraph poles, Mr. Vail said that the object of the acquisition of the Western Union stock was to increase efficiency which would mean cheaper service.

On being asked his opinion of the effect of the recent telephone merger on the suit just decided in favor of the Western Union Company by Special Master E. W. Burdett, President T. N. Vail of the American Telephone and Telegraph Company stated that there would probably be no immediate settlement. The suit, which is really between the Bell Company and the American Speaking Telephone Company, a subsidiary of the Western Union Telegraph Company, has been in the courts for twenty-eight years, and has been twice decided in favor of the Western Union company, and once in favor of the Bell Telephone Company. About $6,000,000 was involved, and after the decision last August the American Telephone and Telegraph Company appealed the case to the Supreme Court of the United States.

Technical Publicity Association.

At the meeting of the Technical Publicity Association held on Thursday evening, November 11, at the National Arts Club, New York city, the feature of the evening was a debate on the value of special issues of ttrade journals.

The argument was opened by James H. McGraw, president of the McGraw Publishing Company, who spoke ably for the affirmative. The matter was discussed to the contrary by Robert Frothingham, advertising manager of *Everybodys,* and in the affirmative by J. G. Frederick, managing editor of *Printers' Ink.*

In the absence of President Redfield, O. C. Harn was toastmaster. Howard M. Post, chairman of the publicity committee, reported satisfactory progress. The next meeting will be held on Thursday, December 8.

An Anti-Forgery Electric Pen.

An electric pen, calculated to prevent forgery by erasure or alteration, has recently been invented by a London (Eng.) man. This pen makes a large number of very closely spaced, almost imperceptible perforations, and the line is rendered distinct and indelible by a slight charring of the paper around each of these tiny holes.

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EMPIRE STATE GAS AND ELECTRIC ASSOCIATION.

FIFTH ANNUAL MEETING AT NEW YORK

The most successful meeting which has thus far been held of the Empire State Gas and Electric Association took place on November 17 and 18 at the Engineering Societies Building, New York city. Owing to the absence of President W. T. Mohhis, R. M. Searle presided.

The first day was given over to reports of various committees and later the "Electrical Session" was held and the following papers were presented: "An Electrical Show in a Community of 45,000" by P. T. Glidden; "Electric Meter Testing" by C. G. Durfee; and "Electric Light and Power Development in New York State" by C. H. B. Chapin.

These are all live subjects, especially that on meter testing, since the smaller companies have not taken up the subject to the extent that should be the case.

Thursday morning's session was called the "gas session," and the following papers were read: "Fuel Appliances" by W. K. Eavenson; "Gas Prepayment Meter Practice" by M. H. Spear, and "Accidents" by C. D. Robinson. In the absence of Mr. Spear his paper was read by Frank Hellen. The paper on fuel appliances was excellently illustrated by slides, the author calling especial attention to the necessity of proper gas and air connections when the appliances are used under pressure.

This was followed by a most enjoyable luncheon at the Engineers' Club, at which some fifty-odd attended. After luncheon there was a general session at which the following reports were considered: Committee on accounting, committee on arrangements for sectional meetings, committee on insurance, committee on taxation. The first was of considerable importance, as the committee prepared an elaborate set of answers to questions which should greatly aid small companies in making their annual reports to the Public Service Commission.

The following officers were elected:

President, Chas. R. Huntley; Vice-presidents, M. J. Brayton and R. M. Searle.

Treasurer, G. W. Curran.

Secretary, C. H. B. Chapin.

Executive committee, Walter R. Addicks, G. W. Curran, F. L. Dame, P. T. Glidden, J. J. Humphreys, Jr., and L. C. Purdy.

Chicago Electric Club.

A subject which, during the past few years has received more or less prominence throughout the entire country, and one which is particularly interesting to residents of the state of Illinois, namely, "The Deep Waterway," was chosen as the topic of an address delivered at the regular meeting of the Chicago Electric Club on Wednesday, November 17, by W. Clyde Jones, Illinois state senator. In introducing the subject, Senator Jones told of the period of destruction which, until recent years, has prevailed. Forests, waterways and other natural resources have been destroyed and utilized with no thought given to the future, and it was not until during the past administration that any definite steps were taken to curtail these alarming conditions.

A few years ago former President Roosevelt appointed a commission charged with an investigation of conditions regarding water commerce. Since that time four annual conventions have been held, and apparently this commission has at last stirred the people into action.

According to the speaker, twenty years ago there was more commerce on the waters of this country than there is today. As the railroads developed, they did their utmost to destroy this commerce by paralleling rivers, charging only low rates along these paralleling lines and making up for the deficiencies by charging higher rates in other locations. They also purchased wharves, steamboat lines, and other institutions with the object in view of absorbing this apparent prosperity of the water transportation companies. During this time the products of the Mississippi Valley have doubled, while the transportation facilities of the railroads have increased but one-eighth.

Regarding the deep-waterway channel from the lakes to the gulf, Senator Jones said that the people of Chicago have already expended nearly sixty million dollars in constructing the drainage canal from Chicago to a few miles beyond Lockport. After completing this canal a bill was drawn up in the Illinois Legislature to the effect that the state ask Federal aid in completing the canal from its present terminal near Lockport to the Mississippi River.

Senator Jones' solution of the problem is that the state extend the present canal from near Lockport through the Desplaines River to Utica. This would require an expenditure of twenty million dollars, which has already been authorized by popular vote, but, according to the speaker, the possible waterpower that may be developed by making this extension would earn two-and-one-half million dollars yearly for the state. After this, extending the waterway to the Mississippi River would require only ten million dollars, and the securing of this amount from the government should not be difficult.

Following this address, Dr. C. P. Steinmetz, who was a guest of the club, was called upon and indorsed the points emphasized by the speaker. He said that the entire question of deep waterways and the conservation of natural resources was one of vital interest.

Bion J. Arnold added that he had learned more by listening to the address of Senator Jones than while attending the last convention of the waterway congress, of which he is a member.

American Institute of Electrical Engineers, Pittsburg Section.

The regular meeting of the Pittsburg Section of the American Institute of Electrical Engineers was held in the Carnegie Lecture Room on Tuesday evening, November 9. Papers were presented by H. N. Muller, electrical engineer of the Allegheny County Light Company on some "Applications of Concrete to Central Station System"; by F. W. Scheidenhelm, consulting construction engineer, on the "Uses of Reinforced Concrete in Railway and Power-House Work"; and by Stephen Q. Hayes, engineer with the Westinghouse Electric and Manufacturing Company, on "Concrete Construction in European Power Plants."

Mr. Muller in his paper described some reinforced concrete slab construction for switchboard work and also for the construction of semi-portable transformer houses to be placed in basements and at the rear of stores and factories.

Mr. Scheidenhelm showed a number of pictures of power-house construction and bridge construction as used by the West Penn Railways Company.

W. M. Kinney of the Universal Cement Company and B. P. Rowe of the Westinghouse Electric and Manufacturing Company discussed the papers. As the papers consumed a large part of the evening no further discussion was offered.

Long-Distance Telephony in Europe.

Recent reports from Italy state that a long-distance telephone line between that country and Germany will shortly be put into operation. The line connects Milan and Frankfort-on-the-Main, via the St. Gothard Tunnel.

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New York Electrical Department News.

Commissioner J. H. O'Brien, of the Department of Water Supply, Gas and Electricity, of the City of New York, announces the establishment on December 1 of an independent office for The Bronx, to be located at the Municipal Building, 177th Street and Third Avenue. The Chief Engineer of Light and Power has ordered Inspector Francis J. Fitzpatrick with twenty-one years' experience in the department to take charge.

On and after that date all applications for permits and certificates relating to work in The Bronx will be filled at the new office, instead of at the Park Row Building, Manhattan, as formerly, and all permits and certificates for The Bronx will be issued directly from the Municipal Building in The Bronx.

Commissioner O'Brien also announces that on December 1 a working agreement with the New York Board of Fire Underwriters will go into effect. Under this agreement the commissioner will certify, and, therefore, legalize, the certificates of the New York Board for electrical equipments installed in premises involving fire risks only, such as private buildings and small stores. The New York Board certificate so certified by the department becomes legally the latter's own certificate.

It will be necessary, however, for all persons installing electrical wiring or appliances in the city to continue to file the usual application for inspection, as, in order to keep legal control of the situation, the department will decline to place its certification upon an underwriters' certificate unless the usual application for inspection shall have been filed with the Bureau of Electrical Inspection.

The territory of the New York Board of Fire Underwriters in New York city comprises the following divisions:

All of the Borough of Manhattan.

All of the Borough of The Bronx lying to the westward of the Bronx River.

So much of the Borough of Brooklyn as lies to the westward of the following line: Starting at Newtown Creek and Meeker Avenue; thence southeasterly along the borough line to Jamaica Avenue; thence southwesterly along Jamaica Avenue and New York Avenue to Montgomery Street; thence westerly along Montgomery Street to Franklin Avenue; thence southwesterly across Prospect Park to Prospect Park West and Fifteenth Street; thence southerly along Ninth Avenue to Sixty-sixth Street; thence westerly to the Narrows.

So much of the Borough of Queens as lies northwestward of the following line: Starting at Newtown Creek and Meeker Avenue and following the westerly and northerly boundaries of Calvary Cemetery to the Old Bowery Bay Road; thence northerly to Bowery Bay.

In the above designated territory—that of the New York Board—the department will not certify the underwriters' certificates for equipments in buildings owned or controlled by the city, theatres, moving-picture machine establishments, churches and other places of public assemblage where it is believed that a panic, as well as a fire hazard, may exist. In the case of these buildings the department's individual certificate will be required, as formerly.

All persons are warned against placing in service any electric wiring or appliances that have not been approved by the department, either by an independent certificate or by a certification upon a certificate issued by the New York board.

Incident to the establishment of this working agreement a joint advisory board of engineers has been constituted. This board, consisting of Messrs. Lacombe, Sever and Wynkoop, for the city, and Stewart, Forsyth and Bruen, for the New York Board of Fire Underwriters, met for organization on the evening of November 18 in the board room of the American Institute of Electrical Engineers.

The purpose of this advisory board is to consider and report on all matters relating to the electrical inspection service in the city of New York. Since these reports will be prepared in duplicate, one copy being submitted to the Commissioner of Water Supply, Gas and Electricity, and the other to the head of the New York Board of Fire Underwriters, a uniformity of rules, interpretations, approvals and inspection methods, which has not existed hitherto, may now be anticipated.

Arctic Plant Life and Auroras.

In a recent article in *Cosmos,* Professor Lemstroem, of the University of Helsingfors, Finland, adduces considerable evidence to show that the abnormal growth of vegetation in the polar regions is due to the effect of electric currents which flow between the earth and the atmosphere and produce the aurora borealis.

From a study of the concentric annual layers of growth of conifers growing in various latitudes, between the sixtieth and sixty-seventh parallels, Professor Lemstroem finds that the thickness of the annual layer varies according to a definite law, showing maxima and minima which indicate a period of ten or eleven years, coinciding with the period of sun spots and auroras.

Resuscitation After Electrocution.

Dr. Louise G. Robinovitch recently gave a demonstration before officials of the New York Edison Company of her methods of resuscitating electrocuted living beings. A rabbit, which was the subject operated on, was brought back to life by her after being electrocuted and pronounced dead by competent physicians who were in attendance.

Miss Robinovitch also gave a demonstration of the action of Leduc currents, by which anæsthesia was produced in a rabbit, without, it was claimed, the bad after-effects which are consequent on the use of chloroform, ether, etc.

In the first demonstration the current which had killed the animal was switched back into its body again, connections being made with a point over the heart and at the base of the spine. By turning on the current and then off again and by keeping up the action steadily the muscles of the heart and lungs responded to the artificial excitation. With the first tiny natural action it was necessary for Doctor Robinovitch to proceed with great care. She gave the rabbit one little chance to improve its natural efforts and then helped it along again with her machine.

Within three minutes the rabbit could breathe without artificial aid and its little heart was performing its regular functions. Half an hour after it had been pronounced dead it was hopping around the room, a little dazed, perhaps, but very much alive.

It was claimed by the demonstrator that the same methods can be applied to human beings.

The X-Ray and Diphtheria Toxin.

An account of Gerhartz's experiments on the effect of the X-ray on diphtheria toxin appears in a recent issue of the *Medical Record.* His experiments were of two series. In one he took known amounts of a toxin of known strength. From twice to six times the fatal dose for rabbits of definite size was given. In each series there were two rabbits of the same size.

To one was given the toxin unaltered, and to the other a similar amount which had been exposed for a longer or shorter time to the X-ray. In each case the toxin which had been so treated was less toxic than the untreated. In the second series the similar doses of the toxin were given at once to rabbits, one of which was exposed to the X-rays. Here, too, the rays showed a definite protective influence.

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Germicide Properties of Ultra-Violet Rays.

There can be little doubt that the ultra-violet rays are the friend of man in many ways. A series of carefully conducted researches has already shown that it is the ultra-violet rays in sunlight which are responsible for the production of ozone in the air, and the presence of ozone is an unmistakable sign that there is a complete absence of organic impurity. In great industrial centers where a pure air is needed most, the murkiness of the atmosphere acts as an effectual barrier against the rays, and therefore their beneficent work is largely hindered. The plea for the ultra-violet rays is therefore merely the plea for sunshine itself.

Later investigations have shown that the ultra-violet rays have an interesting action upon water, resolving part of it into hydrogen gas and peroxide of hydrogen. It has for long been maintained by some observers that the freshness of air, particularly after a welcome or long-delayed shower of rain, is due to peroxide of hydrogen, which readily oxidizes organic matters or impurities with which it may come into contact. The presence of peroxide of hydrogen in the immediate proximity of waterfalls has also been suspected.

Further, the ultra-violet rays are inimical to disease organisms. Whether this destructive action is due directly to the rays or to the oxidizing products which they effect is a matter which has not received a definite answer.

Among the best artificial sources of ultra-violet rays is the quartz mercury lamp. This, when immersed in clear water affected with ordinary microbes and the coli bacillus, destroys those organisms within the radius of a foot in a minute. It is also a curious fact that the ultra-violet rays have been found to check fermentations.

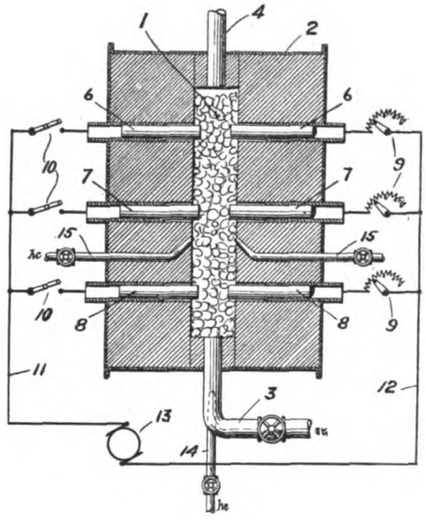
Lastly, it is probable that ultra-violet rays are largely concerned in the great assimilative processes of plant life. It has been found, for example, that the assimilation of carbon by the leaves of wheat takes place about five times more rapidly when the sky is clear—that is, when ultra-violet rays obtain—than when it is cloudy. Altogether, the evidence of experiment is in favor of the conclusion that the ultra-violet rays fulfill a role of benefit to the human race, and the further study of their nature and action will be watched with interest.—*Abstracted from the Lancet (London, Eng.), October 16, 1909.*

Electrically Manufactured Water Gas.

That there is never a lack of methods for gas enthusiasts to get around the use of the more convenient electric light is shown by a recent patent for a process of making water gas by electricity.

In this method the patentee, Charles E. White, of Philadelphia, proposes to heat up a conducting, refractory material by the passage of an electric current, and then to pass steam and the necessary hydrocarbons through the heated mass.

The accompanying diagram shows a cross-section of the furnace as well as the electrical connections. The refractory material is contained in a chamber, 1, and is surrounded by a non-conducting sheath, 2. Current from the generator 13 enters through switches and rheostats to the conducting tubes 6, 7 and 8. Steam enters through the pipe 3, and



ELECTRIC GAS-GENERATOR.

hydrocarbons are forced in through pipes 14 or 15. Water gas, with the proper mixture of hydrocarbons, issues from pipe 4.

Considerable advantage is claimed to result from the constant heat, and the ability to heat the steam and the hydrocarbons independently. The inventor does not state, however, whether this advantage will be great enough to offset the greater cost of the gas, nor does he state in what way the "electrified" gas will produce a better illuminant than the direct use of electricity for lighting purposes.

Civil-Service Examinations for Engineer and Draftsman.

The United States Civil Service Commission announces an examination on December 15, 1909, to fill two vacancies in the position of assistant engineer at $1,080 per annum each, National Museum, Smithsonian Institution, and vacancies requiring similar qualifications as they may occur.

The examination will consist of the subjects mentioned below, weighted as indicated:

SUBJECTS.	Weights.
1. Letter-writing (a letter of not less than 150 words on some mechanical and electrical engineering subject. Competitors may select either of two subjects given)	10
2. Practical questions in mechanical and electrical engineering (comprising the construction and operation of the heating plant and electric lighting and elevator machinery in first-class public buildings)	65
3. Experience in mechanical and electrical engineering work	25
Total	100

Age limit, twenty years or over on the date of the examination.

Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to any local secretary of the board of examiners, for application Form 1093. In applying for this examination the exact title as given at the head of this announcement should be used in the application. An early application is necessary to permit of time for shipment of examination papers.

The United States Civil Service Commission announces an examination on December 14 and 15, 1909, to secure eligibles from which to make certification to fill a vacancy in the position of mechanical draftsman, $1,500 per annum, Engineer Department at Large, Portland, Ore., and similar vacancies as they may occur.

The examination will consist of the following subjects, weighted as indicated: (1) Machine design, thirty per cent; (2) shop work, ten per cent; (3) drawing, thirty per cent; (4) training and experience (rated on application), thirty per cent. Two days will be required for this examination. The subject of drawing will be given on the second day, and in connection with this subject the use of handbooks of mechanical engineering formulas will be permitted.

The appointee will be expected to design the details of simple but heavy machinery and castings; should be familiar with machine shop, foundry, and forge work; should have had some experience in the drafting department of a machine shop; should be able to determine the dimensions of machine parts when the conditions are given, and calculate the stresses and weights. Experience and qualifications along these lines must be indicated in the application.

Applicants should at once apply to the United States Civil Service Commission, Washington, D. C., for Form 1312.

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Improving Commercial Conditions at Home and Abroad.

The increased commercial activity which has characterized conditions in the United States during the past few months is beginning to make itself apparent in other parts of the world. The records of the Bureau of Statistics of the Department of Commerce and Labor, which have during the past several months indicated a marked improvement in both the internal and foreign commerce of the United States, are now showing improved conditions in the foreign commerce of many of the countries of the world.

Argentina's imports in the six months ending with June, 1909, show a gain of $9,000,000 over the same months of last year; exports a gain of $28,000,000. Australia, while showing a slight decline in imports, shows an increase of $7,000,000 in exports in the first six months of 1909 over the corresponding period of 1908. Austria-Hungary for the seven months ending with July last shows an increase of $18,000,000 in imports and $2,000,000 in exports. Belgium for the eight months ending with August shows a gain of $34,000,000 in imports and $14,000,000 in exports. Brazilian imports for the six months ending with June, 1909, show a drop of $8,000,000, but the exports meantime show an increase of $23,000,000. British South Africa shows for the eight months ending with August, 1909, a gain of $6,000,000 in imports and $11,000,000 in exports. Canada's imports for the five months ending with August, 1909, are $142,000,000, against $112,000,000 in the corresponding months of last year; and her exports, $97,000,000, against $90,000,000 in the same months of last year. Cuba for the twelve months ending June 30, 1909, shows imports $84,000,000. against $97,000,000 in the preceding fiscal year; and the exports, $116,000,000, against $97,000,000 last year. Egypt shows, for the eight months ending with August, 1909, a decline of $9,000,000 in imports, but an increase of $6,000,000 in exports. France for the eight months ending with August, 1909, shows an increase of $10,000,000 in imports and of $48,000,000 in exports. Germany shows, for the six months ending with June, 1909, an increase of $47,000,000 in imports and of nearly $3,000,000 in exports. British India for the four months ending with July, 1909, shows a decrease of $20,000,000 in imports, but an increase of $30,000,000 in exports. Italy shows for the eight months ending with August, 1909, an increase of $29,000,000 in imports and of $12,000,000 in exports. Japan for the seven months ending with July, 1909, shows a decrease of $21,000,000 in imports, but an increase of $5,000,000 in exports. Russia in Europe for the six months ending with June, 1909, shows a decline of $1,250,000 in imports, but an increase of $75,000,000 in exports. Switzerland for the six months ending with June, 1909, shows an increase of $5,000,000 in imports and of $4,000,000 in exports. The United Kingdom shows for the nine months ending with September, 1909, imports, $2,189,000,000, against $2,121,000,000 in the same months of 1908; and exports, $1,350,000,000, against $1,390,000,000 in the corresponding period of last year—an increase in imports but a decline in exports. Imports into the United States in ten months ending with October, 1909, the latest period for which figures are available, amounted to $1,195,000,000, against $900,000,000 in the same months of the preceding year; and exports, $1,360,000,000, against $1,403,000,000 in the corresponding months of the preceding year; while for the single month of October the figures are, imports, $127,000,000, against $102,000,000 in October of last year; and of exports, $199,000,000, against $172,000,000 in the same month of 1908.

These increases in foreign commerce both in the case of the United States and of other countries, while indicating in some degree an increase in quantity of merchandise moved, are in part due to higher prices. Just as lower prices in many articles immediately followed the commercial depression of 1907-8, an advance in prices has, in many cases, followed the improved conditions of 1909.

Copper Consolidation Certain.

Further conferences between the Amalgamated Copper, Cole-Ryan and Guggenheim interests were held recently for the purpose of discussing plans for consolidation of the copper properties of the above-named interests. The statement was made on good authority that negotiations had progressed to a point warranting the assertion that the merger would be brought about before the close of the year.

There will probably be an issue of preferred and common stock, the preferred to be a six per cent stock on a basis of profits from thirteen-cent copper. There would then be available six per cent dividends on the common stock on a basis of sixteen-cent copper. However, it is understood that no agreement has been reached in the matter of capitalization.

Transformer for 500,000 Volts.

The Allgemeine Elektrizitaets-Gesellschaft has built, for testing purposes, a transformer having a capacity of fifty kilowatts, at 500,000 volts and fifty cycles, regarding which the following data are given: The transformer is of the core type with concentric windings. The low-tension part has two coils for 1,040 volts, each wound directly on the legs. The high-tension winding, with twenty-eight coils for each leg, is separated from the primary by a number of insulating cylinders. Each high-tension coil has 377 turns, and develops about 9,000 volts; that is, nearly twenty-four volts per turn. Accordingly as the low-tension coils are connected in series or parallel, the ratio of transformation is 1,040 to 500,000 or 2,080 to 500,000 volts. The high-tension terminals had to be constructed with special care. They are made of wood and cardboard, pass through oil directly to the high-tension coils, and extend about two metres above the oil case, their entire length being 2.6 metres. The floor space covered by the transformer measures 1.9 by 2.4 metres, and the oil required is 8,000 kilogrammes. The total weight of the transformer, including oil, is 13,000 kilogrammes. At 500,000 volts the spark discharge takes place between needle points at a distance of 1.3 metres.—*Abstracted from Elektrotechnische Zeitschrift (Berlin), October 14.*

Dehydration of Transformer Oil.

The relatively new process for removing moisture from oil to be employed for insulating transformers consists in bringing the oil in contact with sodium. This metal reacts on the water, forming hydrogen, which liberates itself, and soda, which drops to the bottom of the oil vessel. Sodium is added to the oil gradually in small quantities, at the rate of about twenty-five grammes to 100 litres, until a further addition no longer causes any formation of hydrogen. The quantity of sodium necessary naturally depends on the degree of humidity contained in the oil, but 500 grammes of sodium for 100 litres of oil are usually more than sufficient. The oil should be stirred several times a day for one minute at a time, and after several days it may be used. The process may also be applied to oil contained in transformer cases in service. In this case the sodium is cast in small bars, attached to iron wires, and immersed in the oil.—*Abstracted from L'Industrie Electrique (Paris), September 30.*

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THE BOSTON ELECTRICAL SHOW.

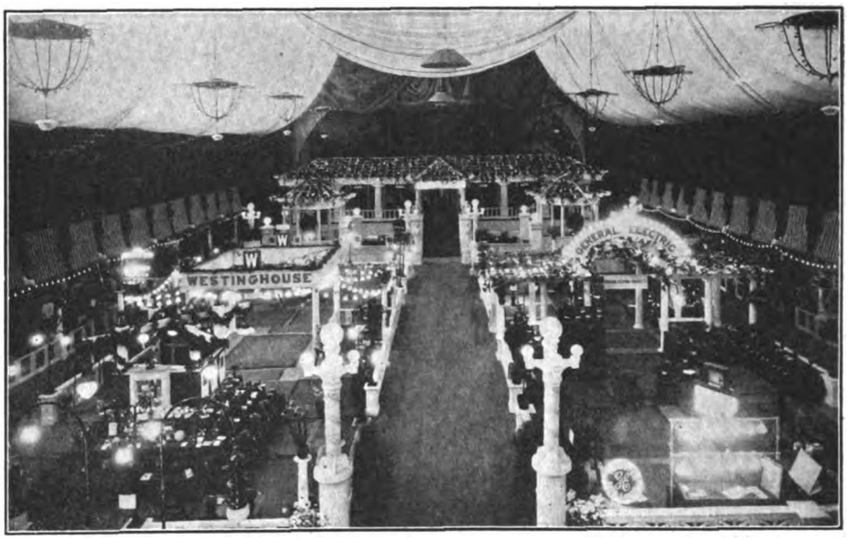
SUMMARY OF THE EXHIBITS AT THE FIRST GREAT ELECTRICAL EXHIBITION IN NEW ENGLAND.

From the great crowds that flocked to the Mechanics Building in Boston daily from November 15 to 25, and from the satisfactory reports of the exhibitors, it is evident that the first Boston Electrical Show more than fulfilled its mission of educating the public in and around "The Hub" to the numerous advantages of electricity in its many applications for industrial, domestic and public purposes. Every feature of the exhibition was planned with much care and executed in an admirable manner. Great credit is due to the management for the excellence of the arrangements and to the Edison Electric Illuminating Company of Boston, and the Boston Elevated Railroad Company for aiding materially in the success of the show.

The general scheme of illumination and decoration and the leading features of the exposition were described in these columns in the last issue. At the risk of reiteration it may be advisable to mention a few of the more striking features. The illumination of Huntington Avenue from Copley Square to Massachusetts Avenue with a multitude of flaming arc lamps produced not only a most spectacular "Great Yellow Way" leading to the show from both directions but proved an effective demonstration of the most modern ideas in street lighting. Within the exposition building, and even on its roof there was also a blaze of light. A popular and very valuable feature proved to be the series of lectures given by E. L. Ovington on some of the more mysterious electrical phenomena, such as those associated with wireless and high frequency tests. L. D. Gibbs, Day Baker and L. Bishop lectured on the utilitarian value of electric lighting, electric power, electric heating, and electric vehicles and did much to make the use of electricity still more popular.

Among the exhibits the largest and most striking was that of the Edison Electric Illuminating Company of Boston, which had possession of the stage and the floor directly in front of it and had converted all this space into a beautiful replica of an Italian garden. Not only were the scenery and lighting effects in harmony with this scheme, but even the attendants were attired in bright Italian costumes. The company supplies current to thirty-eight communities and suburban sections about Boston, and each of these was represented by a charming maiden, who distributed literature relative to the particular section and descriptive of the Edison service available and also registered the names of visitors from the respective section. Each registry counted as a vote and every day the company made a present to some charity in the town whose fair representative had secured the most votes on the preceding day. A pleasing feature of the exhibit was the periodical appearance of a group of minstrels who discoursed sweet music, both vocally and on their mandolins. During these intervals the lights were dimmed and a moon was made to rise on the painted scene at the rear. On the whole the general arrangement of the entire exhibit was so effective that every spectator was most favorably impressed.

The Boston Elevated Railway Company had a very interesting display of signals and safety devices for safeguarding its passengers. A working model of its electro-pneumatic block semaphore system was shown in connection with a miniature electric railway. There was also exhibited an electro-pneumatic interlocking switch system. The reliability of action and perfection of control of these devices was clearly demonstrated to the public and explained in detail by the company's numerous representatives.



GENERAL VIEW OF THE FIRST BOSTON ELECTRICAL SHOW.

The Simplex Electric Heating Company occupied a prominent booth on the main floor jointly with the Simplex Electrical Company. The latter company showed a line of its well-known wires and cables; Wm. S. Davis was in charge of this exhibit. The Simplex Electric Heating Company had a very complete line of its numerous heating appliances, including toasters, percolators, heating pads, ovens, water heaters, radiators, ranges, chafing dishes, flatirons, etc. The use of these appliances was demonstrated, and this attracted considerable attention. Representing the company were Frank Stone, Roger Ingalls and Charles Emerson.

The Campbell Electric Company, of Lynn, Mass., represented by L. E. Gott, showed a complete line of portable X-ray and high-frequency apparatus. There were also shown sets of X-ray tubes and electrodes of all descriptions for medical purposes, eight-day-time switches, bell-ringing and other low-voltage transformers particularly for low-voltage tungsten lamps, as well as the Thermo flashers for use with electric signs.

The Gray National Telautograph Company showed in operation one of its instruments in the booth of the Stuart-Howland Company. Chas. O. Crawford, the New England manager of the company, was present and explained the operation of the instrument.

The Franklin A. Snow Company, of Boston, and the H. B. Camp Company, of New York, jointly occupied the booth in which was shown a section of a manhole in which Camp conduits were used. A large number of samples of both straight and curved duct of Camp manufacture were also shown.

The Diehl Manufacturing Company, of Elizabethport, N. J., made a display of its line of slow-speed motors, the new type "G" motor, a number of small motors, and a working demonstration of its individual sewing-machine motor for both alternating and direct-current circuits. There were also shown oscillating and swivel trunnion fan motors and a motor-driven coffee mill. Wm. P. Miner, of the Boston office, was in charge.

The Allis-Chalmers Company, of Milwaukee, was one of the largest exhibitors at the show. Four booths near the main entrance were occupied. These were tastefully decorated with bay trees, palms, boxwood and other shrubberies, as well as a multitude of chrysanthemums. Facilities were afforded the company's guests to rest while listening to the music. The exhibit consisted of direct and alternating-current motors of various sizes and types, centrifugal pumps, portable air compressors, lighting and power transformers, clutch pulleys, and other mechanical transmission devices, and two large swinging racks containing photographs of the various products of the company, and numerous views in its several works. The company was represented by Messrs. Pardee, Merrill, Pestell, Vrabek, Ober and Watson, of the Boston office, and F. G. Bolles, commercial engineer of the Milwaukee office, who was in charge of the exhibit.

The Blake Signal and Manufacturing Company had an exhibit of its signaling devices on the main floor.

The Dow Surgical Battery Company, of Boston, devoted its space to an exhibit of electrical vibrators and Arnold electric cleaners.

The ELECTRICAL REVIEW AND WESTERN ELECTRICIAN occupied a booth on the main floor, where copies of the current issues were distributed and electrical men cordially welcomed.

The Hurley Machine Company, of Chicago, had a number of its Thor motor-driven washing machines in operation. Its booth was in charge of N. Herbert Haberle, of the New York office. The Thor

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washing machine was also shown in the "electrical house" in the basement exhibit.

The Ley Construction Company, of Springfield, Mass., showed a number of photographs of electrical installations made by the company.

The "1900" Washer Company, of Binghamton, N. Y., exhibited an electric washer and wringer, whose merits were explained by A. S. Terry, of the Boston office.

The Stackpole Battery Company, of St. Marys, Pa., occupied a space on the main floor and was represented by Harry E. Stover and Oliver Turgeon.

The Perfection Dish Washer Company, Portland, Me., made an exhibit of the Perfection and Yankee dish washers. G. M. Cram was in charge of this exhibit.

The Shelton Electric Company showed a set of its vibrators and electric hair-drying machines.

The Duntley Manufacturing Company showed a number of its electric vacuum cleaners in operation in its attractively decorated booth.

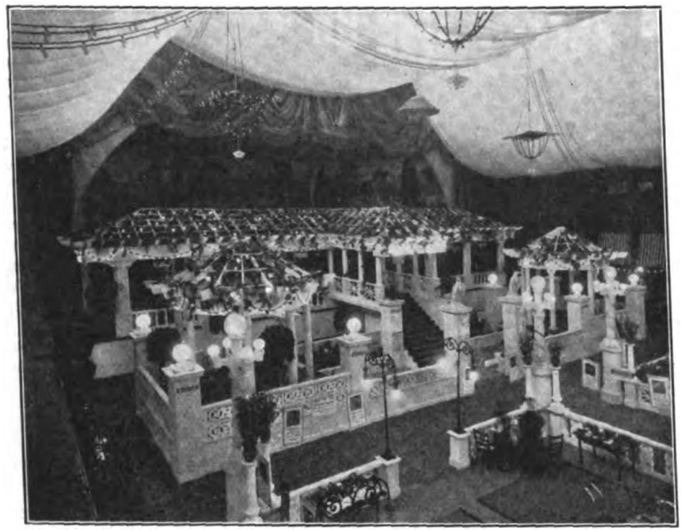
Wm. J. Murdock & Company, of Chelsea, Mass., exhibited apparatus for wireless telephony and telegraphy.

The Poole Printing Company and the Whitlock Printing Press Manufacturing Company, of Boston, Mass., showed in operation a number of motor-driven printing presses, linotype machines and paper cutters.

The Boston Electrical Contractors' Association made an attractive display of electrical decorations, fixtures and various appliances. The exhibit drew considerable attention.

The Rae Electric Vehicle Company, of Boston, exhibited one of its cars that had been run over average roads for a distance of some 15,000 miles and was in excellent condition.

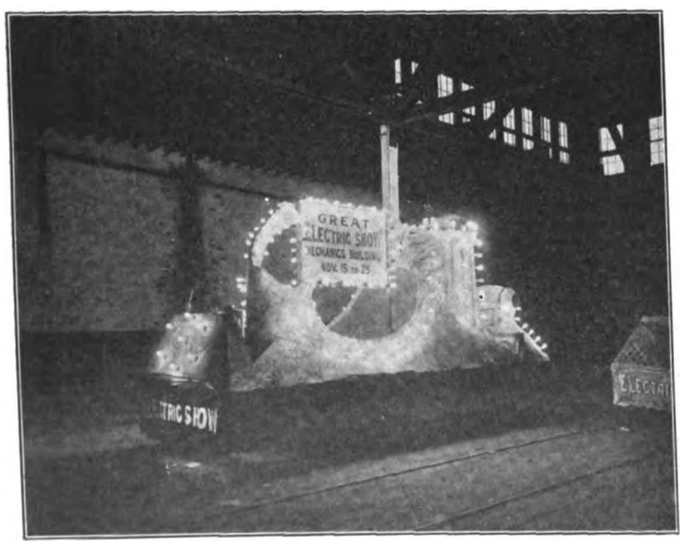
The Radio Reflector Company, of New York city, showed a board on which were mounted lamps of various candlepowers, some with Radio reflectors and some without, thus demonstrating the increased light possible through their use. S. S. Adams was in charge.



General View of the Booth.

In the Interior of the Booth.

EXHIBIT OF THE EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON.



ONE OF THE ELECTRICAL FLOATS THAT ADVERTISED THE BOSTON SHOW.

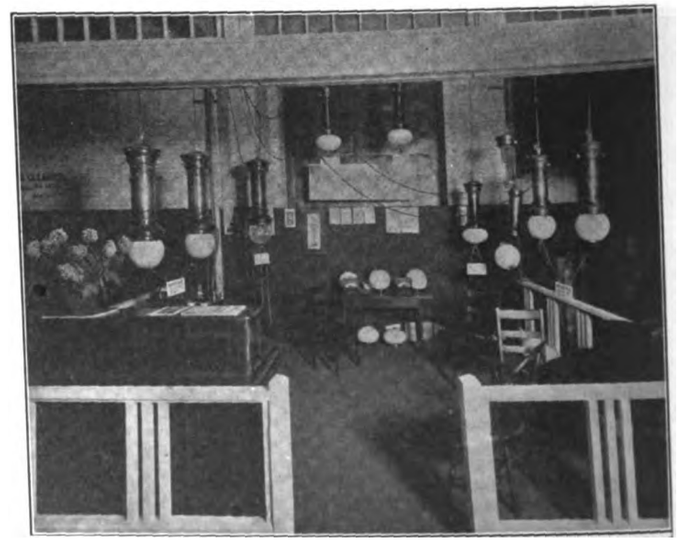


EXHIBIT OF THE AMERICAN FLAMING ARC LAMP COMPANY.

Duren & Kendall, the New England agents for the Santo vacuum cleaner, made a demonstration of this appliance.

The Electric Cleaner Company, of Chicago, through its sales manager, John M. Rodger, made a display of its electric vacuum cleaners.

The New York Electrical School distributed literature descriptive of its courses and showed a number of photographs of work done at the school. John L. O'Connor, secretary and treasurer, was in charge of the booth.

The Westchester Appliance Company, of New York, showed a line of Diamond dry batteries. J. H. Cooper and L. W. Wales, Jr., were in attendance at this exhibit.

The J. H. Day Company, of Cincinnati, showed in its space a motor-driven dough mixer, as used on all United States battleships; also a motor-driven ink mill, egg beater, egg and cake mixer and rubber cement mixer. G. H. Petrie was in charge of the exhibit and assisted by E. A. Johnson.

The Electric Storage Battery Company, of Philadelphia, showed a cell of type H-77 Exide battery, this being a sample of a 25,000-ampere "stand-by" battery recently installed at the Atlantic Avenue station of the Boston Edison Company; nine standard sets of electric vehicle batteries; Exide sparking batteries; car-lighting batteries; automobile electric headlights operated by Exide sparking

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batteries; a duplicate of the Chloride Accumulator used for wireless telegraphy by Jack Binns on the steamship "Republic;" a nickel-plated model of one of the first Holland submarine torpedo boats. A larger model of the more modern Holland torpedo boat was exhibited in another part of the hall, this being ten-and-one-half feet long. To give an idea of the enormous Exide batteries carried by all these torpedo boats, one of the large, heavy shell rubber jars used was on exhibition. F. J. Stone, manager of the Boston office, L. C. Kerrick and T. P. Belford represented the company.

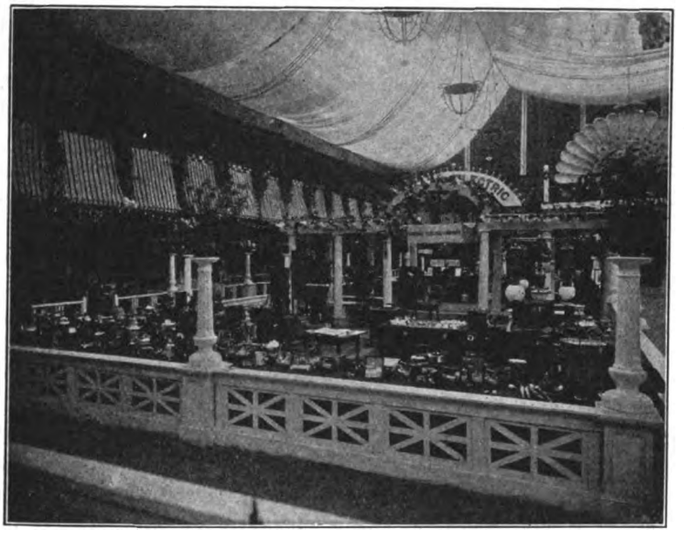
The New York Pole Company, of which G. M. Gest is general manager, had on view a full line of cages such as it uses all over the United States and Canada in reinforcing tubular trolley poles. H. H. Stannard, commercial engineer, was in charge of the exhibit.

The Albert and J. M. Anderson Manufacturing Company, of Boston, showed a line of "Anderson" time switches, a 4,000-ampere remote-control switch, electrical line material and also a general line of switches. Alf. E. Anderson, George Crane and Andreas Anderson represented the company.

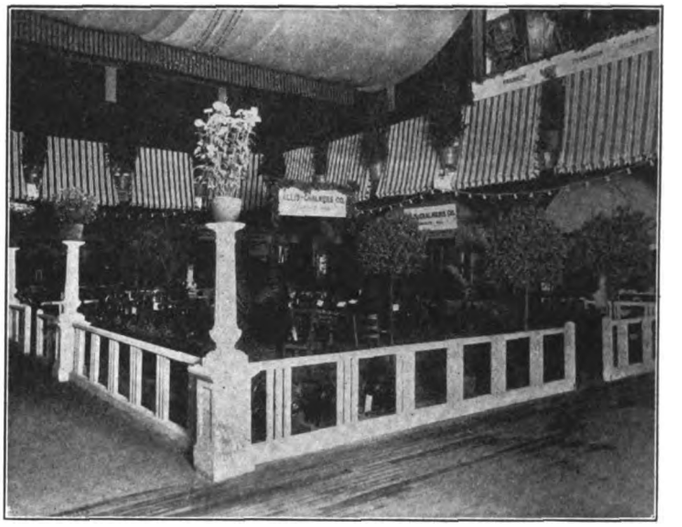
designs of copper and silver tea kettles and coffee percolators elicited much comment, as did a new line of soldering irons embodying the spiral wire handle and removable tips in soldering tools. Other new heating devices exhibited were the solder-melting pot, sealing-wax heater, automatic flatiron, "cast in" unit frying pan and tea kettle and foot warmer. There was also shown a line of flaming arc lamps, intensified arc lamps and a multiple automatic cut-out hanger with rope suspension. A feature worthy of mention was a motor-driven braiding machine in operation, showing the method of making cord for General Electric heating devices. In the center of the booth were motors operating Ingersoll-Rand drills and the Bridgeport Safety Wheel Company's grinder. A line of small motors not in operation permitted close inspection. A large assortment of fan motors, rheostats, compensator panels, circuit-breakers, meters and instruments, a multiple rectifier, a 10,000-volt lightning arrester and a display of automobile accessories completed the exhibit. Those present of the company's representatives included C. B. Davis, J. P. Felton, E. G. Brokaw, G. E. Hunter, S. W. McCollum, O. F. Brastow, G. F. Steele, A. C. Kilgour,

booth, and similar pyramid of Alphaduct at the opposite corner. An assortment of Condit pipe caps, steel and galvanized conduit fittings and boxes, set screw box connectors, Condit-Marlin cable hangers, etc., were displayed. The exhibit was in charge of Geo. S. Dow.

In the Westinghouse Electric and Manufacturing Company's exhibit was shown a very complete assortment of the smaller pieces of apparatus which it manufactures. The booth was divided into three sections. In the first section were exhibited several sizes of its small DA and DZ power motors, its type S, type CCL and textile motors, together with control devices for controlling the different motors; a very complete line of portable and switchboard instruments, as well as economy coils, tailors' irons, buffing motors, fan motors, rectifiers, and other detail apparatus in general. Several motor applications were in operation. These were placed around the outside of this part of the exhibit, while a large pyramid was built in the center, on which the various pieces of apparatus were mounted which were not operated. Hanging from four cross-arms, which were supported from the center of the pyramid, were several types of Nernst lamps;



GENERAL ELECTRIC COMPANY.



ALLIS-CHALMERS COMPANY.

The Dearborn Drug and Chemical Company, of Chicago, occupied a booth in charge of P. H. Hogan, its New England agent.

S. R. Bailey & Co., of Amesbury, Mass., showed a Bailey electric victoria equipped with the new Edison battery. Edwin W. M. Bailey had charge of this exhibit.

The Baker vacuum cleaner was exhibited by R. C. Baker, of Boston.

C. S. Knowles, of Boston, displayed a complete line of electrical supplies in his booth on the basement floor.

Three "Detroit" electric vehicles comprised the exhibit of the Boston Garage Company.

The Dodge Motor Vehicle Company, of Indianapolis, Ind., had on exhibition one of its $2,000 coupès and a $1,600 Stanhope. H. Ware Lincoln, of the electrical department of the Boston office, had charge of this exhibit.

The Massachusetts Fan Company showed an exhaust fan driven by a C. & C. motor.

The General Electric Company's booth, as shown in the illustrations, was a very attractive one. From the pergola there were suspended 120 tungsten lamps partly covered by vines. The exhibit included displays of the latest developments in heating apparatus and lamps. Attractive

W. G. Wragg, J. A. Wilson, H. J. Moore, L. C. Lloyd, from the Boston office, F. W. Willcox, of the Harrison Works, and F. H. Gale and J. R. Lovejoy, from the general office, Schenectady. The exhibit was installed by D. W. Shugg, of Schenectady.

In the booth of the Stuart-Howland Company, of Boston, were exhibited the following specialties: Excello flaming arc lamps, Voltmer daylight lamps, Sterling incandescent lamps, Pacific Heating Company's appliances, Hartford lime switches, Crouse-Hinds condulets, Couch & Seeley telephones, and Holophane reflectors, besides a number of fixtures, table lamps, etc. The company was represented by A. E. Payne, George Wahn, J. B. Bailey, H. McKay and others of its force.

The Bay State Electric Company, of Boston, showed an artistically arranged dining-room table decorated with electrically lighted flowers and fruits. C. A. Rounds, manager, was in charge.

The Edison Manufacturing Company and Edison Phonograph Company exhibited a number of phonographs. In attendance were John Pelzer and M. J. Reid.

S. B. Condit, Jr., & Co., of Boston, showed a full line of its noted specialties, including the Orangeburg fibre products. A large pyramid of Sterling flexible metallic conduit was located at one corner of the

mounted on the Nernst lamps were four oscillating fan motors with Westinghouse pennants, and with the stop plugs removed, allowing the oscillating fan motors to make a complete circle. In the rear of the exhibit was shown a complete line of motor-driven household devices, as well as electric flatirons, toaster stoves and sewing-machine motors. The company had demonstrators in this part of the exhibit, and for the first time there was given a public demonstration of popping corn on the Westinghouse toaster stove, a new application which has been added to the already many applications which this little toaster or cooking apparatus has. In the center of this part of the exhibit were operated several types of washing machines and vacuum cleaners. The company also had a very complete display of tungsten lamps. At the side of each entrance was a large iron column, which supported two goosenecks, from which was suspended a seventy-five watt and a 100-watt tungsten series lamp with Holophane reflectors. Over each of the reception rooms were festoons of twenty-five-watt low-voltage tungsten lamps; while over the main passageway was a line of various sizes of tungsten lamps for both 110 and 220 volts, ranging in sizes from the twenty-five-watt to the 250-watt lamps. Among those attending at the exhibit was G. M. Bates,

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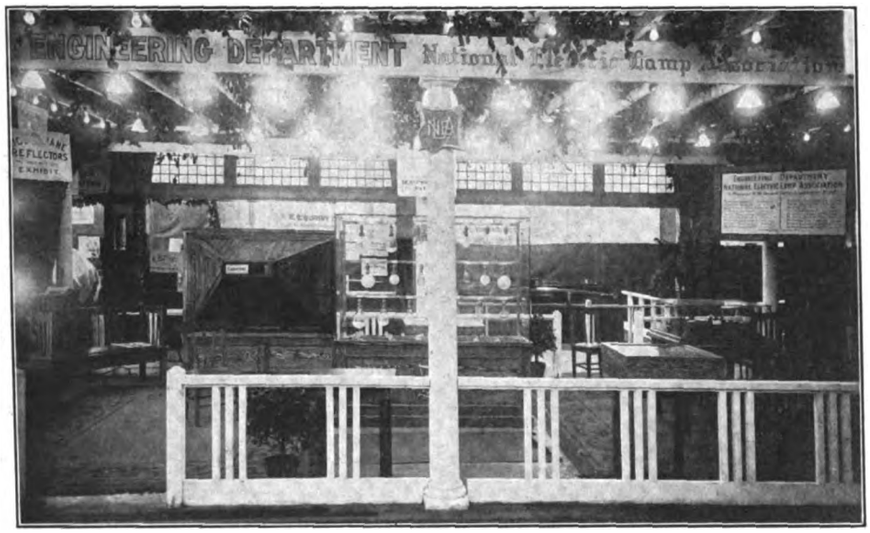
manager of the company's Boston office, together with the following from his office: C. P. Wahn, I. P. Sprague, M. B. Chase, S. S. Bell, D. A. Crowell, W. Noyes, S. St. J. Morgan, E. C. Morse, G. S. Gibbs and E. C. Baugher.

The American Flaming Arc Lamp Company, of Boston, had on exhibition ten of its flaming arcs. Novelties to electrical visitors were its multiple alternating-current lamp, burning with nine to ten amperes and seventy-two volts at the arc, and its multiple direct-current lamp with five-and-one-half, seven-and-one-half and ten amperes, and seventy-five to eighty volts at the arc. C. D. Lanning, president; J. D. Robinson, manager and treasurer, and Malcolm H. Baker were in attendance at this booth.

The booth of the Engineering Department of the National Electric Lamp Association was prominently located and attractively decorated in harmony with the general decorative scheme of the show. On the beams composing the roof were placed tungsten sign lamps and rows of the regular 110-volt tungsten lamps equipped with Holophane glassware. The exhibit consisted in general of all regular



NATIONAL ELECTRIC LAMP ASSOCIATION.

types of tungsten, tantalum and Gem 110-volt lamps, tungsten sign, miniature and street series lamps and tungsten multiple lamps burning at various angles. A large case, composed of two similar compartments, each containing men's furnishing goods of identically the same patterns and colors, was lighted respectively by carbon and tungsten lamps to show their relative color value. In another case were displayed the important steps in the manufacture of the carbon lamp, from the cellulose to the finished lamp. Still another interesting feature was the exhibit of tungsten ores and oxides, pure tungsten, the filament as squirted and finally the filament ready for mounting. The exhibit of carbon lamps made in the early sixties by Henry Goebel attracted much attention. Among those in attendance at this exhibit were P. F. Bander, A. C. Andrews and C. O. Brandel.

A. F. Neale, of Boston, showed a Baker electric coupé and a victoria.

The Invincible electric renovator was shown in the booth of the Electric Renovator Manufacturing Company, of Pittsburg.

An exhibit that proved to be a source of attraction was that of the Electric Testing Laboratories, of New York city. Among other features, a color booth, illustrating the color effect of different electrical illuminants on the same fabrics was shown. N. B. Thompson was in charge of this display.

The Godfrey Specialty Company, of Boston, exhibited the Polar flaming arc and the Sunray arc lamps. E. N. Godfrey was in charge.

Columbia electric vehicles were exhibited by J. H. MacAlman, of Boston.

The Studebaker Brothers Company, of New York, through its Boston branch, exhibited one of the 1,500-pound electric wagons for light delivery work, and one of the new landaulets. Herbert L. Converse represented the company.

G. M. Gest, the well-known conduit engineer and contractor, of 277 Broadway, New York city, made an exhibit of a manhole nearly finished and showing his method of construction as applied to underground work. Cables of all sizes were drawn into the manhole and a fine example of cable splicing was shown. Gest's patent cable rack and hangers were also built into the manhole.

The Clapp-Eastham Company, of Boston, showed an interesting exhibit of wireless telegraph apparatus for private installation, X-ray outfits, etc. A feature of this exhibit was one of Prof. Elihu Thomson's multiphase motors. In charge of this exhibit were M. Eastham and O. K. Luscomb.

The National-Acme Manufacturing Company, of Cleveland, had on exhibition a motor-driven automatic screw machine in operation; various examples of the work turned out by the machine were also shown. M. M. Brunner, John F. Judd and Oliver Henn were in attendance.

The Holtzer-Cabot Electric Company, of Boston, in its booth near the main entrance showed a large line of its telephones, annunciators, alternating-current and direct-current motors from one-twelfth to fifteen horsepower, gas-engine igniters, auto horns, wireless operators, head receiver, etc. A novelty show was a "fool proof" apartment-house vestibule telephone and letter box. Motors for grinding and drilling were displayed in operation. C. W. Holtzer, T. W. Ness, A. P. Waterman and Messrs. McElroy, Archie and Balcomb were in attendance.

The booth of the Condit Electrical Manufacturing Company, of Boston, was located near the main entrance and contained many new and interesting features, the most important of which were the remote-controlled electrically-operated oil switch and the Burnham voltage regulator. A full line of carbon-break direct-current circuit-breakers, together with various types of oil switches, were mounted for operation on switchboard panels. Among other pieces of apparatus were exhibited pole line switches, engine-governor control switches, disconnecting switches, testing clips, etc. A complete line of Shawmut specialties were shown. The company was represented by S. B. Condit, Jr., C. C. Badeau, G. A. Burnham, A. E. Green and F. D. Masterson.

Annual Meeting of the American Society of Mechanical Engineers.

The thirtieth annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, 29 West Thirty-ninth Street, New York, December 7 to 10 next.

The entire social entertainment will be in charge of the members resident in and about New York, under the immediate direction of a local committee appointed by them, of which William D. Hoxie is chairman. For Wednesday afternoon, December 8, an excursion is planned which members and guests will be asked to attend in a body, and during the balance of the time there will be opportunities for smaller parties to visit places of interest. In the evening there will be a more or less popular lecture for members and guests on agricultural machinery.

The professional papers assigned to the meeting are as follows: "Tests on a Venturi Meter for Boiler Feed," by Charles M. Allen; "The Pitot Tube as a Steam Meter," by George F. Gebhardt; "Efficiency Tests of Steam Nozzles," by F. H. Sibley and T. S. Kemble; "An Electric Gas Meter," by C. C. Thomas; "Tan Bark as a Boiler Fuel," by David M. Myers; "Cooling Towers for Steam and Gas Power Plants," by J. R. Bibbins; "Some Studies in Rolling Mill Engines," by W. P. Caine; "An Experience with Leaky Vertical Fire-Tube Boilers and the Best Form of Longitudinal Joint for Boilers," by F. W. Dean; "Testing Suction Gas Producers with a Koorting Ejector," by C. M. Garland and A. P. Kratz; "Bituminous Gas Producer," by J. R. Bibbins; "The Bucyrus Locomotive Pile Driver," by Walter Ferris; "Line-Shaft Efficiency, Mechanical and Economic," by Henry Hess; "Pump Valves and Valve Areas," and finally "A Report on Cast-Iron Test Bars," by A. F. Nagle.

In addition to the above papers there will be several valuable reports submitted by the several committees of the Gas Power Section.

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THE NATIONAL DISTRICT HEATING ASSOCIATION.

FIRST ANNUAL CONVENTION, COLUMBUS, OHIO, NOVEMBER 10 AND 11.

The first annual convention of the National District Heating Association was held at the Great Southern Hotel, Columbus, Ohio, on November 10 and 11 last.

WEDNESDAY MORNING SESSION.

President A. C. Rogers called the first session to order on Wednesday morning, November 10, and then proceeded to deliver his address, for the title of which he took "The Objects of the Association, Past, Present and Future."

Mr. Rogers said that there were in Ohio about fifty district heating companies that are really auxiliary to electric generating companies. At the recent Toledo convention of the Ohio Electric Light Association he met about twenty-five men who were interested in district heating. After the completion of the convention some of these men and himself held a meeting and formed a temporary organization, with a membership of between five and ten. Some four hundred and fifty return reply postal cards were straightway sent out, and from each of the heating companies there was received either an affirmative reply or a communication asking for information. From this small beginning the association was formed.

Mr. Rogers opined that specialization in this line is yet in its infancy, that there is much to be accomplished, and that by meeting together results can be gained that will be very beneficial. He gave as his opinion that the future is a matter of time and development. He had a record of probably over five hundred district heating companies scattered through the United States. He ventured to hope by this organization to have an engineering spirit and a co-operation that will work for good and betterment of the district heating business.

H. W. Hillman, of Grand Rapids, Mich., formerly president of the Michigan Electric Association, enthusiastically congratulated Mr. Rogers and his associates who were responsible for the formation of the association. He went on to tell of the inter-relation of heating and electrical companies and said that the latter would give much support to the heating men. He spoke of the benefits of the autographic recording steam meter, which is not only a curve-drawing instrument, but an integrating meter as well. It will give the record of the variation in steam consumption every minute of the twenty-four hours and a cumulative record of the total consumption during the month. With regard to the value of this to the electrical end, he said that the steam meter could be taken right into the factory and connected on to the steam mains and tests made not only in connection with an ordinary machine shop or an ordinary factory, but in connection with a furniture factory, where steam is used for dry kilns, and for winter heating and for different purposes, such as in the vulcanizing department, and so on, of large companies. Then we will be able to know the exact horsepower-hours that they use for power and all kinds of heat.

Such a meter is also capable of installation in a building. A customer who has used steam at his own plant frequently makes the statement that last year and for several seasons it has cost him only six hundred dollars for coal. He does not want to add generator service; he never has any repairs to his boilers, and so on; and the result is that that is his cost. Now, with the old condensation meter there is no opportunity to install it in this instance and others which will develop like it; but this meter will be capable of installing in such a plant, and the instrument, with its variations and plugs, etc., will enable one to tell just exactly the amount of steam which that man is using and when he is using it.

At this point the president called upon the secretary to read the report of the committee on constitution and by-laws. The report was then presented and discussed, and after several amendments had been made, was duly adopted.

After some discussion on the time for holding the annual meetings and the advisability of affiliation with the National Electric Light Association, the president was authorized to appoint a committee on nomination and another on place and time of meetings. This concluded the morning session.

WEDNESDAY AFTERNOON SESSION.

The Wednesday afternoon session was called to order by the president at 2 p. m.

The secretary read the committee appointments as follows: Nominating committee, A. L. Bailey, H. W. Hillman and Robert Ilett; committee on convention, George D. Higgins, T. E. Riedhead and William Wolls.

G. C. Richardson, of the Builders' Iron Foundry, Providence, R. I., then addressed the convention on "The Venturi Meter and Its Use in Power Plants."

The author briefly related the history of water measurement from the time of the Romans down to that of Venturi, who in 1797 published a paper on his researches on the flow of fluids, in which he called attention to the sucking action at the end of a pipe in which water was flowing. Clemens Herschel, of Holyoke, in 1886, made the first practical application of this principle in a device which he modestly designated the Venturi meter. Connet and Jackson further improved on Herschel's work and evolved the so-called "Type D Register," which was characterized as making the Venturi meter "a practical working tool." This instrument showed directly on a dial the total number of gallons which had passed through the meter tube. The latter was connected to the register by two small pipes, one transmitting the inlet pressure and the other the throat pressure. To the register was later added a chart recorder which autographically recorded on a strip of paper the various rates of flow for every hour of the twenty-four.

The "Type D Register" with the chart recorder is still being placed on gravity-supply lines, the service for which it was designed. In many towns and cities it has disclosed interesting and unsuspected details of the water system, such as abnormal consumption, thefts of water, underground leaks of large magnitude and blow-off valves carelessly left open.

The Venturi meter, even in its early stages, was used also for measuring brine, hot feed water for boilers, etc.

The Type D Register and chart recorder, however, did not prove itself well adapted for metering hot water supplied to boilers, although in numerous instances the results have been very satisfactory. Frequently a meter tube and a manometer would fill the bill for this service, making a very simple, accurate and inexpensive combination. The standard manometer is essentially a U-tube half filled with mercury, one branch being piped to the inlet and the other to the throat of the meter tube placed in the feed line. The rate of flow in pounds per hour is shown directly on a scale between the two mercury columns.

Several years ago a new instrument was devised called a "recording manometer." This soon evolved into the "Type M Indicator-Recorder," the construction and principles of which the author explained by reference to actual instruments which he exhibited. The first Type M Recorder was placed in the boiler-feed line of a heating company's plant. Artistically, the initial charts were excellent,

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representing as they did most naturally the rays of the setting sun. The pen worked night and day, back and forth, across the chart, with hardly a half hour's rest. This was the way the meter told the manager that his firemen were putting water into the boilers at most irregular rates. After some "moral suasion" on the manager's side the firemen got into the habit of watching the recorder, and this led to opening the feed valves less wide and less frequently, giving a much better chart, and consequently a much more even flow into the boilers. The manager considered this alone worth more than the cost of the meter.

For hot-water heating companies, the Venturi meter can be placed on the outgoing water. Then, knowing the temperature of the return water, the temperature of the outgoing and the number of pounds of outgoing as shown by the meter, the total number of heat units put into the system for each twenty-four hours can be determined. Knowing also the amount of coal burned and its calorific quality, the efficiency of the plant can be determined.

The Venturi meter is also entering the field of air, gas and steam with most promising results. Of these three, the measurement of steam is of prime importance, and experimental data on the subject are now in the course of preparation. It would, therefore, seem that the Venturi is destined to fulfill commercially its theoretical promise to "measure anything that flows;" in a word, to become a universal meter.

President Rogers then told of the successful application of the Venturi meter in the plant of which he is the superintendent of the heating system. He had also used the simple manometer tube that Mr. Richardson had mentioned, in order to measure the average gallons pumped per minute, from which can be obtained the total gallons per day and the total gallons per month. From this, with the coal charged up against the station, he was able, in a very satisfactory manner, to get the absolute heat unit sent out of that station into the hot-water heating system.

Professor Knight said that possibly, in measuring hot water used, with the expansion or evaporation of water, with the reduction of pressure, it would lead to a false pressure at the throat. There is bound to be a reduction of pressure at that point. He said that just as soon as the pressure in there is reduced, a certain amount of water will evaporate. He wondered whether or not that would cause the results to vary.

Mr. Richardson replied that in the Massachusetts Institute of Technology report on the Venturi meter (which he referred to in his paper), it was found that a certain amount of water evaporated. Tests were thereupon made which proved this amount to be small. All the meters are made for a standard temperature of sixty-two degrees Fahrenheit. For higher temperatures a correction must be applied, which is only two per cent for 212 degrees.

Mr. Hillman told, among other instances, of a case of a department store complaining about its bills for current. It was thought that the janitor was using too much light in connection with the cleaning out between six o'clock in the evening and eight o'clock the next morning. Therefore a curve-drawing water meter for the boiler was put on the first floor, and the first chart taken showed that, whereas the store required seven kilowatt-hours between a quarter of five and six o'clock, the janitor used nineteen kilowatt-hours during the night; he used three times as much current as they required in their business!

Mr. Stein told of several special makes of steam meters which could be used in a like connection.

C. R. Bishop, of the American District Steam Company, protested against a remark by a previous speaker that central heating stations do not know much about what they were doing. Most central heating companies that pretend to call themselves central heating companies, he said, not only know what their income is; they know every division of expense in their plant; they know what every factor of operation is; they have quite as complete records as anyone could ask. Even one of the southern towns keeps barometric records. One of the previous speakers, he said, wants the meter to show operating conditions. One can make as frequent readings as one wants to find out the periods of day in which water is used. His company had done this in its schoolhouse work. It was desired to find out whether the janitor was using as much after school hours as before. It is also true in churches, theatres, and buildings of that kind. They are all kept; there is no guessing at all. He knew plants that keep their transmission-loss data so carefully that their records are daily.

Mr. Hillman said he had met several men that morning who agreed with him that there was a deplorable lack of knowledge. They did not seem to know about their cost, and said they were glad to come there and knock elbows and learn from each other.

Mr. Gifford spoke of some experiments he had made on hot-water heating with a view to regulating the flow of water on each job. In these experiments it occurred to him that the Venturi meter would serve to get the difference in the head. He found by getting a valve made that he could control it very accurately by getting a one-inch valve. He stated from memory that he could deliver anywhere from twenty-four to 168 pounds of water per minute through the one-inch valve and that he could do that at a twenty-pound differential or five-pound differential. Furthermore, he could run it up to a forty-five-pound differential and get the same flow per minute. A valve of that kind seemed to him to be an important adjunct to hot-water heating. He thought it should be easy to develop along that line a cheap valve to do that work.

The secretary announced relative to the question of valves, that the Columbus Railway and Light Company is using a hot-water valve on the return end of the hot-water radiators supplied by them which has an adjustable orifice.

Some other gentlemen also contributed to the discussion, which proved to be of great interest.

The next number on the programme was a paper by Professor Knight, of the Ohio State University, Columbus, Ohio, on "The Determination of Deterioration in Underground Heating Mains."

Starting with the fundamental and axiomatic principle that anything which lessens the value of a plant, or that shortens its useful life, is a cause of depreciation, Professor Knight proceeded to state some of the chief of such causes as follows: (1) A piece of apparatus may become obsolete through a change in the methods of doing the work. (2) It may become less efficient in the performance of its duties as the natural wear and tear on it proceeds, until such time as a matter of economy it must be replaced by a new apparatus. (3) The apparatus may be such that its efficiency is not impaired by the wear and tear incident to use, nor to the effects of corrosion or decay. It would to the end perform its functions with its original efficiency. Here wearing out or decay would determine its life. (4) Through increased business a system or part of a system may become too small, so that it becomes

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necessary to replace it with larger apparatus. In this case the apparatus may still be serviceable in a smaller capacity and would have a certain value when taken out. (5) Changes in the operation of a system or the discontinuance of some service may result in some part of it becoming useless. Without such changes these parts may still have a considerable period of usefulness, but are of such character that when once abandoned could not be made use of elsewhere. (6) Neglect to take proper care of or make necessary repairs on the apparatus. (7) Causes external to the plant, company or corporation, such as legislation affecting service, rates, franchise right, etc.

In an effort then to fix the depreciation of any system it is of the first importance to determine which of these causes are operative and to what extent. It is evident, too, that with a system of any magnitude some parts may be affected to a greater or less extent than others by the same causes. It seems logical, therefore, to divide the system up into as many parts as practicable and determine as accurately as possible to what extent each is affected by these various causes. In the final estimate each part is to be given a weight, equal to its rate times the proportion of its cost, to that of the whole plant.

While it is realized that the assignment of proper values to the different factors is, in the end, very largely a matter of judgment, it is believed that an average of the sum of a number of individual judgments is likely to be more nearly correct than a single one covering the whole system. In addition to this method of investigation, each suited to its own particular part can be applied, and thus a truer value of the depreciation of each part determined, this, of course, giving a more exact value to the whole.

The professor proceeded to show how the above principles work out in practice by considering in great detail a system made up of about 22,000 feet of pipe lines, forming the distributing system of a hot-water heating plant with pipes ranging up to one foot in diameter.

A most interesting discussion followed the reading of Professor Knight's valuable paper. Several members spoke on the depreciation of pipe and conduit, the causes thereof, and their experiences in the way of remedies.

President Rogers said his company had good results in putting in conduit with oil-treated hemlock shavings. Even after twelve years the pipes were in good condition, even the mill marks being plainly discernible.

Mr. Harding had had trouble due to the acids naturally in the soil which caused such corrosion that the pipes had to be relaid every three years.

Mr. Gifford said that, regarding the soil, he had noticed in his experience, the wood boxing stands up better in clay than it does in sand. In three or four instances he had had to take up lines which had been in sand and gravel, very porous soil, enclosed in two thicknesses of two-inch hemlock, for five years; the first thickness was entirely gone and the second thickness had just started to be attacked. But the shavings and the boxing protecting the piping, and the pen marks and the mill marks were still on it. He opined that the air has something to do with causing rot, and the more porous the soil the worse it is for the wood conduit. He had had occasion to take up some line that had gone through a cinder yard of a plant. Cinders were a very bad proposition. It seemed to him that clay answered the purpose as well as any soil.

Secretary Wolls stated that in investigations on the Columbus plant, the test for electrolysis was made on these mains and none was found to exist. Answering a question by Mr. Bishop, he said that one of the main lines passes under three different street-railway tracks, and, of course, the neutral of the railway is grounded. Tests were made for electrolysis on two other portions of the system and no deflection on the instrument was obtained.

This concluded the discussion.

On the motion of Mr. Harding, a hearty vote of thanks was unanimously accorded to Mr. Richardson and Professor Knight for their papers.

The next paper presented was by W. E. Taylor, of Toledo, Ohio, on "Thermostats and Thermostatic Action."

Mr. Taylor said, in part, as follows:

"A thermostat is nothing more or less than an automatic valve operated by a variation in temperature by means of an element whose action is more or less uniform under a change of temperature. Under a rise in temperature this element expands and when the temperature falls it contracts, and it is this expansion and contraction that controls the compressed air, which in turn operates the system.

"In one type of thermostat the element consists of a strip of brass and steel welded together. These metals have a different coefficient of expansion, and being welded together the expansion causes the strip to buckle, thereby opening and closing an air port. Another type uses a liquid called 'Rigolin' enclosed within a metal disk. This liquid boils at a very low temperature, and at a temperature of seventy degrees Fahrenheit it generates a vapor which causes the disk to become inflated or deflated, thus operating an air valve. A third type uses for its sensitive element a tube of hard rubber. Within this tube is a piston connected with an air valve, and as the tube expands or contracts, the air valve is opened or closed.

"The ideal system of heating should consist of many points of supply in numerous small units, but here is where the cost interferes with the result. The quantity of heat is supplied by means of fewer units, resulting in abnormal temperatures in the immediate vicinity of the units and variation at any other points of the room, a condition beyond the power of any regulating system to control, unless the units of control are divided with as many as there are changes of temperature.

"Thermostats as used today operate on averages. I do not know that any condition created or met by district heating systems influences the position of the thermostat. Some of you have them in use on your systems, some operating on averages, others, perhaps, more closely fulfilling their function, depending upon the character of your work, but I am safe in saying that as a rule they give reasonable satisfaction where installed for duty within the range of their action."

Mr. Riedhead asked if there is a system of thermostatic control for steam heat where the customer is using heat on a flat-rate basis, which would be fair, of course, to the companies furnishing heat.

President Rogers gave as his opinion that the question was a very general one. He considered the thermostat as quite essential, even where a condensation meter is used. He regarded it as essential to the buyer of the heat.

Mr. Taylor said he should have stated that the economy generally attributed to the use of automatic temperature regulation has been very accurately estimated to be about thirty to thirty-five per cent. He thought that answered the question.

President Rogers said he did not know of any steam apparatus that has not some thermostat governing those conditions, nor of any steam heating without thermostats.

Mr. Gifford stated that in his experience in heating thermostatic control

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was always adopted. He agreed with Mr. Taylor that the saving was about thirty per cent. The thermostat was certainly an advantage to the customer and to the operating company. If placing a thermostatic control on the shop would save the operating company any heat, it is, of course, an advantage to them. On a meter basis, it will save the consumer some money. The trouble with compressed air has been that the air line in the street has deteriorated and gone down. He knew of a number of instances where this had happened, both from soil conditions and possibly from corrosion or electrolysis; and there have been devices put out on the market that would handle it from local conditions. From various tests he had made he figured on at least thirty to thirty-five per cent control. He did not think that plants that have them would give them up.

Mr. Bishop said that if you can regulate the windows like they do in a schoolhouse, and everything is arranged on that basis, the thermostatic regulation works out very decidedly in favor of the company, but where it helps the public to waste the heat, as by leaving the windows open (the thermostat regulating the temperature to still keep the room warm), it is not quite so profitable.

Professor Knight said that what was wanted was an automatic regulator to shut steam off when the windows and doors are open.

After some further remarks by other speakers, President Rogers closed the discussion with some entertaining observations on the human element to be considered in the matter.

After the close of the above discussion, the members present were agreeably entertained by E. C. Adams, of the Anchor Packing Company, Detroit, Mich., with sleight-of-hand tricks in "An Hour with the Mysterious."

This closed the Wednesday's proceedings.

THURSDAY MORNING SESSION.

The Thursday morning session was called to order by the president at 9 a. m., when, after some routine business matters had been disposed of, Harold McGeorge, of Cleveland, Ohio, proceeded to read his paper on "Air Leakage Around Windows; Its Prevention, and Effect on Radiation." An interesting discussion followed.

The president thereupon introduced to the meeting Mr. Gaskell, secretary of the Ohio Electric Light Association. Mr. Gaskell, who was greeted with applause, said that from his personal observation of the convention, the affair was most earnest and praiseworthy. He emphasized the necessity of making the association of practical value to its members. In order to make it an assured success it was necessary to keep it constantly in touch with the district heating companies of the country, so that it would be desirable for each and every one of them to become a member of the association. To this end it was advisable first to publish the proceedings, even if it were necessary to get advertising to raise the money, although he thought it were better compatible with the dignity of the association to avoid raising money in this way if possible.

He told of the experiences of the Ohio Electric Lighting Association in regard to the distribution of its proceedings, it being found advisable to distribute free copies only to members and to those who read papers before the association, thereby making it an extra inducement for outside companies to join, in order to obtain the bound volumes of the transactions of the conventions. He advised the sending out of an immediate circular letter to all the district heating companies in the United States, advising them that they would receive a printed copy of the 1909 Proceedings of the association provided they sent in an application for membership and remitted the dues for 1910.

With regard to the necessity for keeping the association constantly before the public, Mr. Gaskell advised the convention that it was necessary to work twelve months of the year and not only at convention times. The central office of the association should always be ready to answer with dispatch all inquiries of any nature that may arise, and a committee of members should be appointed to attend to this department. The men appointed on the committee should be experts and all questions should also be discussed further at the annual meeting, so that such matter may be printed in the proceedings, so as to be available for record. By these means would the association be made of intense practical value to its members and its prosperity be assured.

Mr. Gaskell went on to speak of the advisability of admitting manufacturing companies and the like as associate members, a policy which had been adopted with much success by various electrical associations throughout the country. He also recommended that considerable attention be paid to entertainment features, and furthermore suggested, that for a three days' convention, ten papers would be found ample to listen to and discuss. In conclusion, Mr. Gaskell made the very excellent suggestion that all papers should be printed and distributed ahead of time. This would not only enable a paper to be read when its author was unavoidably absent, but would permit the members to read up the subject and so be better prepared for the discussion.

Mr. Gaskell's remarks were received at the finish with loud applause.

The president heartily thanked the speaker for his instructive discourse and remarked that the association would duly profit thereby. In closing the session he communicated the information that Mr. Wolls had extended an invitation to the members to visit the Mound Street Heating Plant in the city, of the Columbus Railway and Light Company. He therefore adjourned the convention until 2 p. m. to enable the members to avail themselves of this excellent opportunity.

THURSDAY AFTERNOON SESSION.

The Thursday afternoon session was devoted chiefly to the reading of the following papers: "Some Remarks on District Steam Heating," by W. J. Kline, of the American District Steam Company, of Lockport, N. Y.; "Heating and Ventilating a Modern Building," by H. W. Woodward, of Cleveland, Ohio.

The election of officers was also settled, after the first recommendation of the Nominating Committee had been declared lost for lack of a seconder to the motion for acceptance. Eventually A. C. Rogers, superintendent of heating of the Toledo Railways and Light Company, Toledo, Ohio, who was president of the tentative organization, was unanimously elected president. J. H. Harding, of Laporte, Ind., is the first vice-president, H. W. Hillman, of Grand Rapids, Mich., the second vice-president, and F. E. Riedhead, of Paducah, Ky., third vice-president.

The new secretary-treasurer is D. L. Gaskill, of Greenville, Ohio. Mr. Gaskill is also secretary of the Ohio Electric Light Association. Grant Miller, of Toledo, Ohio, and W. A. Wolls, of Columbus, Ohio, are directors.

Iowa Telephone Companies Prosper.

The net assessment of the telephone and telegraph lines in Iowa amounts to $3,661,946.88, according to the tenth annual report of the executive council on the assessment of telephone and telegraph companies. The total pole mileage amounts to 82,608.72 miles.

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ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

THE TITANIUM ARC.[1]

BY WILLIAM S. WEEDON.

Many years ago a series of experiments was started in order to determine which substance, among the materials available, would give the maximum light efficiency when used as arc electrodes. The work covered a large number of elements, compounds and mixtures, with considerable variation in the preliminary treatment.

Among the substances that were tried there was none which gave as high efficiency in candlepower per watt, as material which contained the element titanium. Of these materials the carbide of titanium can be obtained in the market in several forms, and as this is probably the most convenient and important material in this work, its varieties are given.

1. Carbide containing more carbon than is necessary to form the combination TiC, in which the excess of carbon is in the form of graphite.

2. Carbide containing only as much carbon as is necessary to form the carbide TiC, or less than this amount, the latter kind being in all probability a mixture of the carbide TiC and metallic titanium, a small amount of iron also being present.

3. Carbide containing a rather low percentage of carbon and a fairly high percentage of iron.

In the early stages of the experiments the second class of material seemed to be the most satisfactory, while the third class gives an arc which possesses certain objectionable characteristics. In particular the presence of iron seems to cause

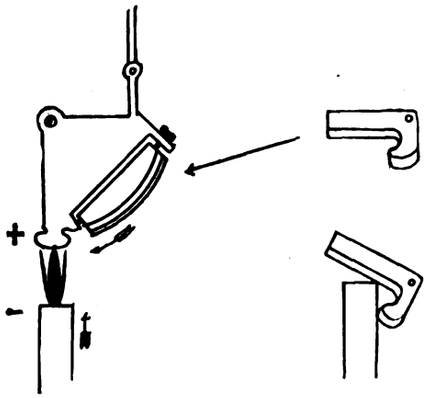

FIG. 1.—STARTING THE ARC.

unsteadiness. As is well known, metallic arcs are far from steady under ordinary circumstances, and in this case the iron seems to accentuate the tendency to unsteadiness.

CHARACTERISTICS OF THE TITANIUM ARC WITH DIRECT CURRENT.

The arc, as obtained from the carbide, possesses an extremely luminous inner path, while little light is given by the outer mantle and none whatever by the craters. To give the best results the titanium carbide electrode should be the cathode and placed below an anode of copper, the latter being inactive and not wasting appreciably. The light is almost pure white, only the faintest tinge of yellow being noticed when observed from a distance.

After running for some time, there is deposited a "button" of titanium oxide on the copper anode, which causes unsteadiness at times. The phenomenon known as "hissing" or "positive blow" occurs occasionally, resulting in the production of a peculiar jet of flame from the anode, in a consequent variation in light intensity, and in a decrease in voltage across the arc. Further, another difficulty is caused by the formation of an oxide layer on the surface of the titanium carbide electrode. It will be seen that this leads to complications in starting the arc after it has

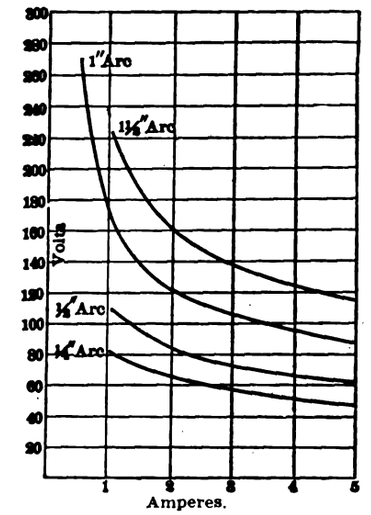

FIG. 2.—VOLT-AMPERE CURVES.

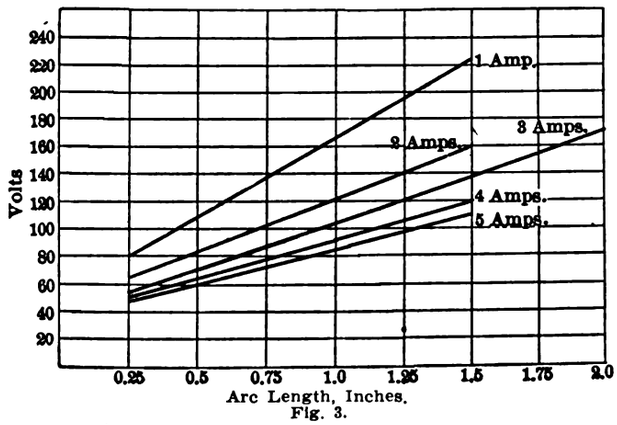

Fig. 3.

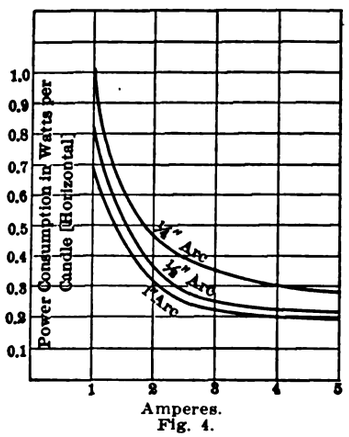

Fig. 4.

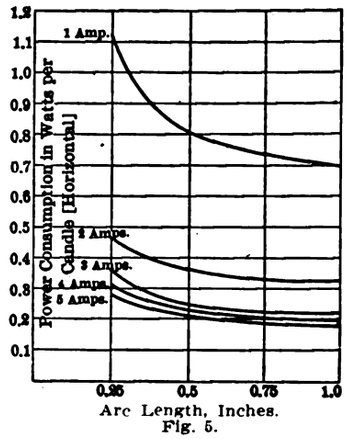

Fig. 5.

CHARACTERISTIC CURVES, TITANIUM ARC LAMPS FOR DIRECT CURRENT.

[1] A paper read before the American Electrochemical Society at New York on October 28, 1909.

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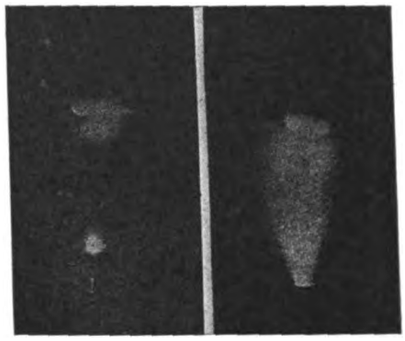
been extinguished for a short time, since the oxide is non-conducting.

The button on the anode does not offer serious difficulty, since a device by Mr. Halverson, designed for the magnetite lamp, overcomes this obstacle. The device referred to is an anode "rocker" connected with the lamp mechanism, so that the arc plays upon one portion of the anode while running, but strikes from another portion. By adapting this idea of the rocker anode, it has been found possible to strike the arc, even though the cathode and anode both have non-conducting surfaces. The starter and method of operation are shown in Fig. 1.

It will be seen that the arc is struck from the side of the lower electrode just below the tip, and after the current is established the electrodes return to running position, the arc running along the anode and climbing the cathode until it also is in normal position.

show that titanium carbide arcs are most satisfactorily operated on a constant-current circuit rather than on a low-voltage multiple circuit (with the necessarily short arc length).

Some photographs have been taken in order to give a comparison of the various arcs. Since these were taken through the globe, the reflection of the flame is some-



F.g. 6. Fig. 7.

the inner path giving a large portion of the light, but the outer mantle also luminous.

Fig. 9. The titanium arc. Lower electrode (cathode) titanium carbide. Upper electrode copper. Arc length one inch, current three amperes. Structure very clearly defined, inner path giving nearly all the light.

Fig. 10. Same as Fig. 9, but showing tendency for the outer mantle to form in layers. This occurs occasionally, and does not interfere with the steadiness of the arc.

Fig. 11. Titanium arc, flickering due to air currents. This arc is very sensitive, and the air currents must be controlled carefully by suitable draft arrangements.

Fig. 12. This shows the tendency of the titanium arc to "crawl" up the side of the anode, owing to air currents or improper centering of electrodes.

Fig. 13. The titanium arc is also sensi-

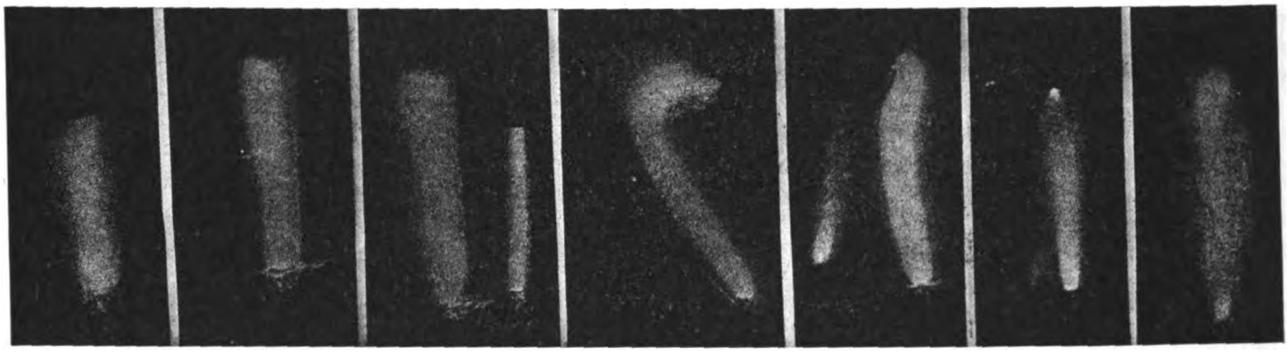


Fig. 8. Fig. 9. Fig. 10. Fig. 11. Fig. 12. Fig. 13. Fig. 14.

CHARACTERISTIC APPEARANCE OF VARIOUS ARCS.

The titanium arc is a flame arc, and the efficiency increases with increase in current density and with increase in arc length. The volt-ampere curves are given in Fig. 2, and the volt-arc-length curves in Fig. 3. The power-consumption curves, shown in Figs. 4 and 5, indicate that we have here a very efficient arc. At three amperes, 103 volts and one-inch arc length, we have only 0.228 watt per horizontal candlepower. The mean spherical candlepower at 2.87 ampers, ninety-five volts (273 watts), is 535, and the mean hemispherical candlepower 737.6. On this basis the power consumption is 0.51 watt per mean spherical candlepower and 0.37 watt per mean hemispherical candlepower; this corresponds to an efficiency of 1.96 mean spherical candlepower, or 2.70 mean hemispherical candlepower per watt.

The electrical measurements given were made at the arc terminals, and the photometric measurements were made through a clear glass globe of the usual thickness.

A study of the efficiency curves will

times reproduced in the photographs, and should not be confused with the arc itself.

Fig. 6 shows the plain carbon arc. Note the absence of light in the arc stream, while the terminals are very luminous.

Fig. 7 shows the arc obtained from Conradty's flame carbons. The arc stream is luminous as well as the terminals, but

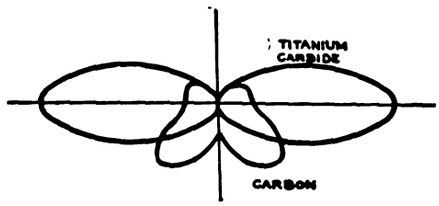


FIG. 15.—LIGHT DISTRIBUTION FROM CARBON AND TITANIUM ARCS.

there is an entire lack of structure in the flame.

Fig. 8. Magnetite as cathode and copper as anode. Arc length one inch, current three amperes. No light is given off by the terminals, and all comes from the path of the arc. Structure shown clearly,

tive to irregularities in the composition of the electrode. In this photograph a dark space is observed around the anode, and this causes flickering. The titanium used contained iron.

Fig. 14. This photograph is not very clear, owing to the confusion caused by the reflection in the globe. It represents the tendency to darken around the cathode, and this seems to be due to the presence of some impurity in the carbide. At times the dark space will appear, extending part of the way up into the arc from the cathode, and often will dance up and down for some time. It differs from the darkening around the anode in that its limit is sharply defined. When pure carbide is used this does not often occur.

As is to be expected, the distribution of light from the titanium arc is quite different from that of the carbon arc. Fig. 15 will serve to show the difference in this respect, although the figure is not drawn to scale. It is to be noted that flame arcs are better for street illumina-

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tion than the ordinary carbon arc, even at the same mean spherical candlepower.

PREPARATION OF THE TITANIUM CARBIDE ELECTRODES.

For the initial experiments the electrodes were made as follows: The lump material is coarsely powdered and then pulverized in a ball mill to a high degree of fineness. It was then worked in a roller mill with oil, glycerine or other suitable binder. After the material was thoroughly plastic it was extruded through a nozzle by means of a hydraulic press, the sticks being cut to suitable lengths.

After drying at ordinary temperatures, and then in a gas oven, the electrodes were fired at high temperature, preferably in an electric furnace of the carbon-tube type. After firing, the sticks should be firm and without cracks. If fired at too high a temperature they are liable to be brittle.

It was thought necessary to copper plate the electrode to prevent oxidation during burning in the lamp. This phenomenon is characteristic of titanium carbide. A bare electrode oxidizes at a point one-eighth to one-fourth inch below the tip, the stick swells, and the top falls off. The copper plating effectually prevented this, and did not interfere materially with the running of the arc.

The life of the carbide stick varies, of course, with the current density and inversely with the diameter of the electrode. At about three amperes a stick one-half-inch in diameter wastes away at the rate of one-fifteenth to one-tenth-inch per hour.

During the running of the arc the whole of the upper surface of the electrode does not melt, but simply appears moist at the point at which the arc is playing. The more nearly the composition of the stick approaches metallic titanium, the higher the melting point, and it is certain, from a number of experiments made in connection with the preparation of these sticks, that metallic titanium is one of the most refractory metals known.

The titanium carbide arc may also be operated with alternating current under certain conditions, but the results of this work cannot be presented at the present time.

THE TITANIUM SUB-OXIDE ARC WITH DIRECT CURRENT.

The material used in these experiments was prepared in the electric furnace by the reduction of rutile. Its preparation is quite easy, since the melting point of the product is much lower than that of the carbide.

The character of the arc is almost identical with that of the carbide arc, but the light is much steadier and the tip of the electrode does not oxidize and fall off. It is, therefore, not necessary to plate the sticks or cover them with a metallic sheath.

There are certain objections to this electrode, and among these are the tendency to form large, troublesome deposits on the anode, and the fairly rapid consumption of the sub-oxide stick.

The sub-oxide gives a light efficiency even better than that of the carbide. At 3.4 amperes, seven-eighths-inch arc length and 100 volts, 2,100 candles (horizontal) are obtained. This gives a power consumption of 0.162 watt per horizontal candlepower, or an efficiency of 6.17 horizontal candlepower per watt. The distribution of the light is the same as with the carbide.

The heavy deposit on the anode is probably responsible for the fact that the difference in potential between the terminals is about fifteen volts higher than is the case with the carbide at equal arc length and current.

The sub-oxide electrodes cannot well be operated with alternating current, this being due to difficulties caused by rectification.

The above work was carried out in the research laboratory of the General Electric Company.

Production of Titanium.

Titanium ore in the form of rutile, which is titanium dioxide, has been mined in Nelson County, Virginia, where a plant has been erected to extract the metal from the ore. Titaniferous iron ores are mined in New York, Minnesota and Wyoming.

Aside from its rapidly increasing use in the manufacture of arc-lamp electrodes, titanium is used to increase the toughness of steel and cast-iron. Rails treated with titanium and laid in places on railroads where the wear was especially hard are said to have shown much less wear than untreated rails.

A report on the production of titanium and other rare metals in 1908, prepared by Frank L. Hess, has just been issued by the United States Geological Survey and may be obtain free by application to the director of the Survey, at Washington, D. C.

The Philadelphia Electric Company has been authorized to install 171 additional and ornamental arc lamps on Market Street, between Second and Sixteenth streets.

PUBLIC LIGHTING FIXTURES FOR ARC LAMPS.

BY GILBERT MULOCK.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 13, H. Thurston Owens said many complimentary things concerning street-lighting conditions abroad, especially as regards the fixtures in use. The writer is glad to see attention directed to this important and sadly neglected subject. Not long ago the following item appeared in a daily paper, which would make it appear as though

FIG. 1.—MODEST AND UNOBTRUSIVE.

FIG. 2.—CONSPICUOUS BUT GROTESQUE.

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some interest was being taken in the subject:

"LIGHTING PROBLEM SOLVED.—The municipal-lighting problem has practically been solved, one of the latest agents being the 'Flaming Arc' light of 3,000 candlepower and upward. * * * * Los Angeles, Denver and other cities are turning their attention to making street lighting ornamental, as well as useful. Detroit is one of the cities having towers up to 2,000 feet high bearing powerful electric lights. * * * * Besides electricity, many municipalities are lighted by gas, acetylene, gasoline and benzine."

FIG. 3.—BOTH THE OLD AND NEW.

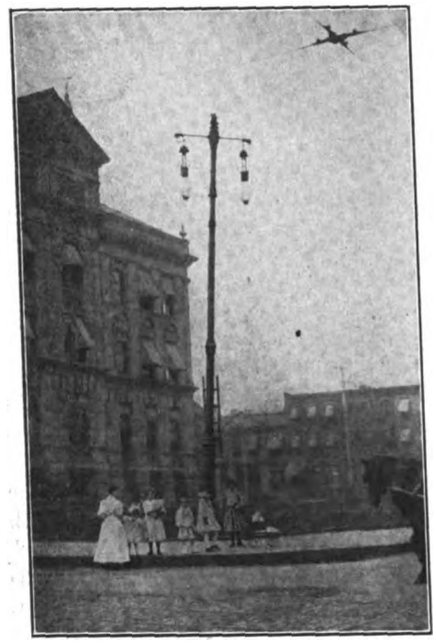

FIG. 4.—AN OLD-TIMER.

Probably the most interesting portion of the above statement is contained in the intelligence that benzine is included in the list of modern illuminants. While it is true that we have made long strides in the improvement of interior illumination, street lighting in this country is still largely in its infancy, and is far from being satisfactorily solved.

The writer has at random been collecting notes and snapshots of the good and bad in street lighting, but these are confined to American installations. Some of these are given in the following. Where overhead wiring is in use for lighting circuits it is frequently essential for many reasons that the lamps be hung from the poles which carry the lines. For such a condition the lamp shown in Fig. 1 is, in the writer's opinion, unobtrusive and well located.

Let us now turn to Fig. 2, which is a grotesque lamp-post on an important street, where the lamps are supplied through underground conduits. The one feature of interior lighting which has justly received the greatest attention since the advent of illuminating engineering is that of the importance of keeping light sources of high intrinsic brilliancy out of the line of vision. The same should hold good in exterior lighting, and it seems odd in this enlightened age to see an equipment which would have proved satisfactory from a lighting standpoint changed for reasons which evidently pertain to operation. The lamp was formerly suspended from the "crook" close to the curb, but now an unsightly mast arm has been added, so that the full 2,000 (?) candlepower of the open arc lamp may be utilized to its detriment.

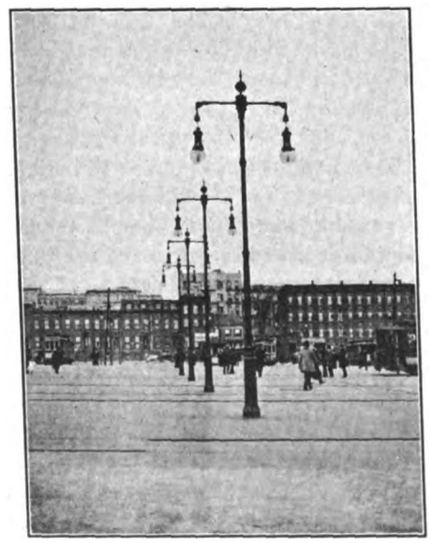

FIG. 5.—CLEAR GLOBES SPOIL THE EFFECT.

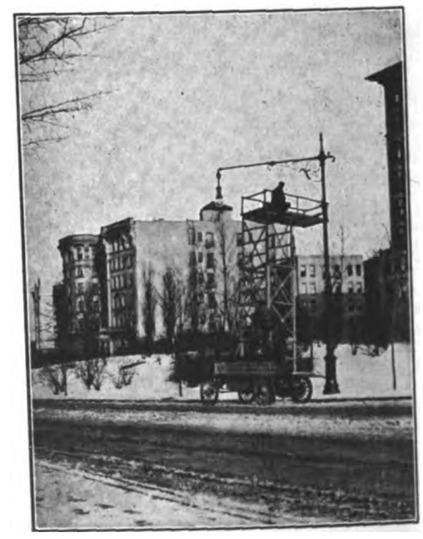

FIG. 6.—AN EXCELLENT EQUIPMENT.

We heard some time ago that the open arc had seen its day, but there are a few thousand with us yet. When the change from the open to the enclosed type is made care is not always taken to remove the unsightly and unnecessary hood, and that shown in Fig. 3 hangs over the door of the city hall of a good-sized, prosperous community.

As city halls offer good examples, we will see by examining Fig. 4 a post which adorns the grounds of one, in a city which stands among the first twenty in point of population. If the post were straightened, the lamps changed to the flame type and the ladder removed to a less conspicuous location, it could be said that art and utility were combined to enlighten and please.

Attention to details is essential if we are to raise our public lighting to a standard which will be the equal if not the envy of Europe. The lamps shown in Fig. 5 are installed at a trolley terminal and are admirably located, but the alternate glare and shadows from clear lamps hung less than twenty feet above the street level are most objectionable. Alabaster globes and a flexible-pipe joint in place of the plain wires forming the connection between the lamp and pole would raise this installation from mediocrity to merit.

Referring again to Mr. Owens' article, we find an illustration of an artistic fixture in Berlin, where the trimmer has lowered the lamps for cleaning, and while this is better than climbing a high pole, why not use an electric auto with a skeleton tower, such as that shown in Fig. 6? Notice also the contrast between the fixture shown here and that in Fig. 2; one costs as much a year as the other.

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CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

DEVELOPMENT OF ELECTRICAL UNDERTAKINGS.[1]—I.

BY S. J. WATSON.[2]

It is, I believe, usual that a chairman's address at the commencement of each session should deal with some particular subject, and I, therefore, propose to make a survey of various points of interest in connection with the development of electric supply undertakings during the past fifteen years. I have personally been engaged with supply undertakings for about seventeen years, and may fairly claim to have been closely in touch with the subject.

In looking backward, one cannot help but be impressed with the remarkable growth that has taken place during a comparatively short period of time, and the tremendous amount of work involved in the equipment and setting to work of the various power stations with their distributing systems.

Complete statistics are, unfortunately, not available, but, in order to illustrate the growth that has taken place, I have prepared a table, giving a summary of the records contained in issues of certain English electrical papers in 1894, 1899, 1904 and 1909, so that you will see, and, I hope, appreciate, the improvements which have taken place during three periods, each of five years.

It is no small thing to find that the amount of capital invested has increased from four to nearly sixty millions of pounds ($300,000,000) in fifteen years, but such a fact does not necessarily imply that the capital is being employed to greater advantage from the engineering or even from the financial point of view, and in order to show that progress has, indeed, been made, I have also shown on the table (the English pound sterling has been taken as the equivalent of $5.00) what the increase has been during each period of five years, and the extra cost of dealing with such increase.

This method of ascertaining the cost of the extra units sold from year to year, and also the extra capital charges incurred in supplying the extra units, gives some very valuable assistance when working out the price to be charged to cover the cost of supplying large consumers. I have personally used this method for some years, and you may, perhaps, be interested to know that applying it to the past seven years' records of the undertaking with which I am connected, during which time the output has increased nearly tenfold, and large extensions have been carried out to plant and mains, I find that the extra generating costs amount to 0.586 of a cent per unit, the extra capital charges on plant to 0.308 of a cent per unit, the extra distributing costs, *i. e.*, repairs and capital charges on mains, etc., to 0.468 of a cent per unit, and the extra management charges to 0.174 of a cent per unit, so that the total additional cost of supplying the extra units amounts to 1.536 cents per unit. The load factor of the increased output has been 23.2 per cent.

The figures given in the table need little explanation, but I would particularly call your attention to the fact that the capital cost per kilowatt of plant and mains installed has decreased from $695.00 in 1894 to $360.00 in 1909, the number of units sold per $5.00 of capital invested has increased from 3.4 to 14.2, the average price charged has been reduced from 12.32 cents to 4.32 cents per unit, and the gross profit has gone up from 3.3 per cent to 6.6 per cent. It is also of interest to note that, whereas the cost of the plant and mains added during the period 1894 to 1899 was $460.00 per kilowatt, the cost of the additions during the period 1904 to 1909 was only $285.00 per kilowatt, and that the additional working expenses for the increase in the output between 1894 and 1899 was 4.26 cents per unit, whereas the cost for the increase in output between 1904 and 1909 was only 1.36 cents per unit. A number of other contrasts might be made, but I will only mention that there is a difference of 293,095 kilowatts between the total capacity of the plant installed and the maximum load recorded, that is to say, that no less than thirty-seven per cent of the total plant is provided as spare. This represents a capital expenditure of over $30,000,000.00, which is entirely unproductive, inasmuch as it does not earn one penny of income. In this connection I would remind you that Parliament has recently granted powers to the London supply undertakings to interconnect their power stations. It is evident from these figures that such permission was badly

RECORDS OF SUPPLY UNDERTAKINGS.

Year	1894.	1899.	1904.	1909.
Number of undertakings	30	100	225	290
Capital expenditure	$ 22,364,625.00	$ 59,479,965.00	$191,422,290.00	$289,090,710.00
Plant installed	32,108 kw.	112,631 kw.	454,565 kw.	795,036 kw.
Increase in capital	.....	$ 37,115,340.00	$131,942,325.00	$ 97,668,420.00
Increase in plant	.....	80,523 kw.	341,934 kw.	340,471 kw.
Capital outlay per kilowatt	$695.00	$525.00	$420.00	$360.00
Cost per additional kilowatt	.....	460.00	385.00	285.00
Maximum load	.....	78,866 kw.	269,680 kw.	501,941 kw.
Per cent to plant installed	.....	70 per cent	59 per cent	63 per cent
Units sold	15,231,181	76,432,250	349,003,935	824,819,503
Increase in output	.....	61,201,069	272,571,685	475,815,568
Per cent increase	.....	410 per cent	357 per cent	156 per cent
Units sold per $5.00 expenditure	3.4	6.4	9.1	14.2
Units per additional $5.00 expenditure	.....	8.2	10.3	24.4
Revenue	$ 1,960,385.00	$ 7,781,310.00	$ 23,815,555.00	$ 37,641,605.00
Per cent to capital	8.7 per cent	13.1 per cent	12.4 per cent	12.8 per cent
Increase in revenue	.....	$ 5,820,925.00	$ 16,034,245.00	$ 13,826,050.00
Revenue per unit	12.32 cents	9.78 cents	6.54 cents	4.32 cents
Revenue per additional unit	.....	9.10 cents	4.64 cents	2.68 cents
Working expenses	$ 1,215,105.00	$ 3,930,575.00	$ 11,670,440.00	$ 18,407,520.00
Per cent to revenue	62 per cent	51 per cent	49 per cent	49 per cent
Cost per unit	7.64 cents	4.94 cents	3.20 cents	2.14 cents
Cost of additional units	.....	$ 2,715,470.00	$ 7,739,865.00	$ 6,737,080.00
Cost per additional unit	.....	4.26 cents	2.72 cents	1.36 cents
Gross profit	$745,280.00	$ 3,850,735.00	$ 12,145,140.00	$ 19,234,085.00
Per cent to capital	3.3 per cent	6.4 per cent	6.3 per cent	6.6 per cent
Increase in gross profit	.....	$ 3,105,455.00	$ 8,294,390.00	$ 7,088,970.00
Per cent to additional capital	.....	8.3 per cent	6.3 per cent	7.2 per cent
Load factor total output	.....	11.0 per cent	14.7 per cent	18.7 per cent
Load factor additional output	.....	.....	16.3 per cent	23.3 per cent

[1] Chairman's address at opening meeting, Institution of Electrical Engineers, Manchester (Eng.) Section, October 22.

[2] Borough Electrical Engineer, Bury, Eng.

Note.—The English money values have been changed in all cases to approximate American figures.

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wanted. There is no doubt that where power stations are situated within a reasonable distance of each other, the cost of running interconnecting cables would be small compared with the saving of expenditure on plant.

I roughly estimate that within a distance of eight or ten miles of the Manchester (Eng.) Town Hall there are some twenty public generating stations, having between them a total capacity of 100,000 kilowatts, which has probably cost over ten million dollars. To construct a system of mains partly above and partly below ground so as to interconnect these generating stations would cost about $750,000.00, but by so doing it would be possible to reduce the quantity of spare plant from thirty-seven per cent to, say, twelve per cent, and enable the existing stations to supply an increase in load of 25,000 kilowatts without any further expenditure, thus making use of existing plant, having a value of about $2,500,000.00 at a cost of $750,000.00 on mains. Some additional expenditure would be necessary to provide converters at some of the existing works, but against this might be put the saving in working expenses through running the plant at higher efficiencies.

It was about the year 1894 that the fight was taking place between the respective advocates of high-tension alternating and low-tension direct-current systems. Judged in the light of later knowledge, it must be admitted that both sides had very good grounds for their arguments. The generation of high-tension alternating currents for transmission over large areas has become the standard practice, although, by the way, such currents are not single, but multiphase, and low-tension direct current is still very largely employed, and, in point of fact, absolutely essential for many purposes, although the pressure now used is mostly 220 or 440 volts instead of 100.

In the earlier years of their existence there is no doubt that much better results were obtained from the direct currents than from the alternating-current stations, owing to the assistance of storage batteries, which in nearly all cases formed part of the equipment, and also to the much higher efficiency of the distributing systems, but at the present time, principally owing to the increase in the outputs and in the supply area, and also to improvements in alternating-current transformers, there is very little difference between the results obtained from either system.

Bearing in mind the rapidity with which power stations were constructed one after the other about 1894, it may be said that, with the knowledge and experience then available, the majority of the work was carried out on lines that have very well withstood the test of time. On carefully considering the matter, it appears to me that only one serious mistake was made, which has only become apparent as one extension after another has had to be carried out to meet the demands of a rapidly increasing business. I refer to the somewhat common practice originally adopted of erecting the generating stations in thickly populated districts in order to keep down the expenditure on mains, without taking into consideration either the facilities provided for obtaining delivery of fuel, the provision of an adequate supply of water for condensing purposes, or providing ample room for extensions.

The growth which has taken place was very much underestimated, and in consequence of this want of foresight, it has been necessary in many cases to construct new generating stations on more suitable sites, or to make good the deficiencies of the existing sites at considerable expense.

The reductions in the average cost per unit between 1894 and 1909 is, of course, appreciable, and has been brought about principally through the increase in the output and the better load-factor conditions, but these influences, important as they undoubtedly are, would not appear to be sufficient to account for the reduction which has taken place in the fuel cost, and, speaking broadly, there has not been any considerable change in the design or arrangement of generating plants to account for this reduction. Not the least important factor has been the increase in the size of generating sets. The limit appeared to have been reached with the 500-kilowatt bipolar machine, but with the advent of the multipolar design, largely through being able to use carbon brushes, the sizes rapidly increased to about 1,500 kilowatts, and today the Manchester turbine-alternators of 6,000 kilowatts are the largest in use in this country, although one hears of 10,000 and 15,000-kilowatt sets being used on the European and American continents.

In dealing with the changes that have taken place in connection with prime-movers, one is bound to make some reference to the steam turbine, which, although obtainable in the smaller sizes as far back as 1894, was not generally accepted as a satisfactory article in the larger sizes until five or six years ago. For alternating currents, plants of 1,000 kilowatts and upward, turbines have now, however, become standard practice.

In the early nineties a difference of opinion existed as to the relative advantages of single-acting and double-acting engines; a similar problem is with us today in regard to the principle of turbine construction. With the small plants of, say, 250 kilowatts used in the past, it would probably have been difficult to prove that any great difference existed between one type of engine and the other, although in the still larger sizes the double-acting engine has been the most successful. At the present time equally good results are apparently being obtained from both the impulse and the reaction type of turbine, but if we accept as a sign of the times what is being done in other countries, it would appear that the impulse machine is being used to an increasing extent in the large sizes. The tendency of turbine construction is to increase the clearances, reduce the number of stages, and to shorten the length between bearings, and progress along these lines is likely to be more successful with the impulse rather than with the reaction machine.

A question of some importance to supply undertakings is to what extent the costs can be reduced by the employment of exhaust-steam turbines. Many generating stations are wholly or partly equipped with reciprocating engines, and the advisability or otherwise of installing exhaust turbines to work in connection with such plants requires consideration.

The advantages to be derived are twofold: (1) The total capacity of the plant will be increased by an expenditure on the turbine sets only without any extensions of steam-raising plants. (2) The fuel consumption will be appreciably reduced.

In order to illustrate the effect of installing exhaust turbines in an existing generating station, it will, perhaps, be of interest to work out an example, and I, therefore, assume a case where 4,000 kilowatts of reciprocating plant is installed, consisting of six compound sets having a capacity of 2,000 kilowatts, and two triple-expansion 1,000-kilowatt sets. With a moderate degree of superheat and a vacuum of twenty-six inches, the steam consumption at full load, excluding condensers and other auxiliaries, will be about twenty-four pounds per kilowatt-hour for the compound sets, and 18.5 pounds for the 1,000-kilowatt sets. Al-

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lowing for 1,000 kilowatts to be a standby, the total steam consumption will be 66,500 pounds for an output of 3,000 kilowatt-hours, an average of 22.2 pounds per kilowatt-hour.

To enable exhaust turbines to be used, the reciprocating plant would have to run under non-condensing conditions, that is to say, with the exhaust steam a few pounds above atmospheric pressure. The steam consumption at full load would then become about thirty-one pounds per kilowatt-hour for the small sets, and 24.5 pounds for the large set, or a total consumption of 86,500 pounds steam for the output of 3,000 kilowatt-hours, an average of 28.8 pounds per kilowatt-hour.

The condensation and other losses between the engine exhaust outlet and the exhaust turbine inlet will probably amount to ten per cent, so that there would be 77,850 pounds of exhaust steam to be utilized.

An exhaust turbine with a good vacuum will give one kilowatt-hour for about 37.5 pounds of steam, and therefore the extra capacity obtainable would be 2,076 kilowatt-hours, and the over-all steam consumption of the plant on a load of 5,076 kilowatts would be 17.0 pounds per kilowatt-hour. The result of adding exhaust turbines is, therefore, an increase of sixty-nine per cent in the capacity of the generating plant under condensing conditions, and a reduction in the steam consumption of 23.4 per cent.

In some cases the capacity of the reciprocating plant, if worked non-condensing, will be curtailed, but as the majority of the small plant in existing stations has been designed to give full outputs under such conditions, I do not make any allowance on this score.

It is as well to point out that, although the reduction on steam consumption on the prime-mover works out at 23.4 per cent, the actual saving in the fuel used per unit sold will be very much less, after making allowances for the constant losses in auxiliaries, condensation, and the extra power required to obtain the high vacuum; moreover, the probability is that some seventy to eighty per cent of the total output is already being supplied by the 1,000-kilowatt sets, having a consumption of 18.5 pounds per kilowatt-hour, so that the saving on the steam consumption of the remainder of the output consisting, largely of peak loads, will only be a percentage of a percentage.

The cost of installing two or more sets of exhaust turbine plant having a total capacity of 2,076 kilowatts, together with high vacuum pumps and condensers, will be $90,000 to $105,000. The same capacity of plant, including a single unit 2,076-kilowatt turbine set with its necessary complement of steam boilers, etc., could be provided for $110,000 to $125,000, and the steam consumption on one set of plant of this size would certainly be less than 17.0 pounds per kilowatt-hour.

These figures would appear to show that for public generating stations the circumstances would have to be exceptional to result in any ultimate advantage from installing exhaust or mixed-pressure turbines as compared with high-pressure turbines of equal capacity. In the latter case the first cost would be slightly more, but the steam consumption would be less. A very wide field, however, exists for the application of exhaust turbines for other purposes, such as collieries, rolling mills, shipyards, and other industries, particularly where large non-condensing engines are used. In many such cases the output could be increased 100 per cent with the same consumption of fuel, and electric motors supplied from the generator connected to the exhaust turbine could be substituted for the many small non-condensing engines usually required for other duties, and so effect a still further saving in the fuel consumption.

[To be continued.]

Brooklyn Section National Electric Light Association.

Frank W. Frueauff, of Denver, president of the National Electric Light Association, was the guest of honor at the meeting of Brooklyn Section, National Electric Light Association, that crowded the rooms of the Edison Club in the Johnston Building, on November 9.

Mr. Frueauff declared he had been greatly interested in listening to the reading of Julian N. Walton's paper on "The Storage Battery and Its Application to the Electric Vehicle." He agreed with Mr. Walton that in some respects the electric vehicle today is superior to all rivals.

Other papers on technical and commercial subjects followed that of Mr. Walton. Secretary Baily announced that there were then 294 members in the Brooklyn Company Section.

Gas Engines Drive Belgian Station.

The new generating station recently put into operation at the works of the Société Metallurgique du Hainaut, at Charleroe, in Belgium, includes two 1,250-horsepower gas engines.

Care of Storage Batteries.[1]

French industry in, at least, three important centers, Rouen, Lille and Mulhouse, is assisted and encouraged by technical and industrial societies. The last of these towns is in Alsace, but the industry is Gallic and the proceedings of the Mulhouse Society are still reported in French. Among the useful parts played by the Rouen Society is an arrangement by which its members can have the disinterested services of a first-class engineer, who is ready to give advice on the installation of machinery and steam power, and to make periodical visits of inspection or to advise on an emergency. An electrical engineer of high standing is also at the service of members.

The following information is taken from the report of this official, M. G. Thullier, for last year:

In addition to supervising the reception of new plant and assisting at several installations, he made twenty-eight emergency visits. These are charged at the modest rate of thirty-five francs per half day to the member of the society, and users of electricity in Rouen frequently become members of this excellent society in order to take advantage of this expert service. From the result of his observations, M. Thullier makes some interesting notes on the use and care of a battery of accumulators.

M. Thullier notes that the working capacity and durability of a battery of accumulators depends upon constant inspection of the battery and the regularity with which the charge of electricity is renewed each day, allowing for waste. It is well understood that a battery which has yielded 500 ampere-hours, for instance, should be charged with more than this amount, say, about 600 ampere-hours. In order to be able to charge a battery then, we must know how many ampere-hours it has given out since the last charging, if we are to save time and avoid hesitation and uncertainty in the operation. We must also know what proportion of the total output has been yielded. If the battery has been nearly exhausted, it must be recharged slowly, *i. e.*, with a comparatively weak current. In short, the attendant of the battery must keep a proper record, so that he may know each day what has been done with the battery the day before.

When the battery is charged the attendant tests the voltage, seeing with his volt-

[1] Abstracted from *The Electrical Engineer* (London, Eng.), September 10, 1909.

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meter that it is about three volts, and ascertains by examining them one by one that none of the cells is short-circuited.

As in general the charging is done with a number of amperes sensibly constant, he has to increase the voltage as the charging proceeds, for the voltage at the limit of each cell ought to increase uniformly, except in the case of the reduction cells which have worked more or less.

As the charging proceeds, and as the voltage at the limits increases, the readings of the voltmeter enable us to see whether or not the separate cells are being equally charged. This is the most effectual kind of supervision and gives the best tests of the condition of the battery.

As the charging proceeds, the attendant, knowing exactly the number of cells in the circuit, and knowing that he ought not to exceed 2.65 volts per element, allowing for such as may be in a bad state, he ought to succeed in diminishing his amperage, bringing it almost to zero by the time the charging is finished, *i. e.*, when the voltage of the battery is equal to 2.65 multiplied by the number of cells. For example, if the battery is working with fifty-six cells, the charging is finished when the voltmeter shows $56 \times 2.65 = 148$ volts, and the amperage ought to be practically zero. At this moment the electrolyte should mark twenty-six degrees Beaumé, but this will not be the case unless each cell shows twenty-two degrees Beaumé at the commencement of the charging. This is, therefore, a very important point, and care should be taken that on charging the electrolyte has a density of twenty-two degrees Beaumé in each cell.

Finally, effervescence of the electrolyte is a sign that the charging is finished, but it may not occur. Again, a chocolate-brown color of the positive pole, contrasting with the matt gray of the negative pole, is another useful indication, but we must repeat that the readings of the voltmeter are the surest guide in this delicate part of the management of a battery.

We may sum up in the following rules: (1) Keep the electrolyte in all the cells at the same density, from twenty-two to twenty-six degrees Beaumé. (2) Never allow the voltage to fall below 1.8 per cell, nor the maximum number of amperes. (3) Never charge to above 2.65 volts per cell, nor the maximum number of amperes. (These two maxima should be fixed by the supplier of the battery and recorded in writing.) (4) Cut off the current when the battery is giving out more amperes than it is made to supply. This is a strong measure, but it is the only thing to do if the cells are to be kept in good order.

Electrical Opportunities in Mexico.

An American consul in Mexico reports that a company, composed largely of American citizens, and capitalized at $500,000, has secured a concession from the local government for developing a valuable waterpower in his district. The especial business of the company will be the owning, operating, and conducting of electric-power business, and the use of franchises, concessions, and contracts connected therewith. The work to be done consists of dam building and the establishment of the necessary machinery needed in an electrical plant, together with lines for the transmission of power. Everything that is to be used in an undertaking of this kind will be purchased, and manufacturers of the United States in the field for Mexican trade in the lines indicated would do well to investigate. Full information as to the needs of the company can be obtained from the president or the secretary, whose names and addresses may be obtained by writing to the Bureau of Manufactures, Washington, D. C., quoting File No. 4114.

An Enterprising Blacksmith.

A correspondent in Sheridan, Mont., states that Rudolph Flick, the local blacksmith of that burg, tired of waiting for a company to install electric light and power in the town, has put in a plant of his own. The power is derived from Mill Creek, which flows by his shop. A small ditch taken out above gives a ten-foot fall, sufficient to drive the wheel and dynamo and furnish power to light his residence and shop, and also a local department store. It is believed that by going about a mile further up the creek, says our correspondent, a plant can be put in for $5,000 sufficiently large to furnish power to light the entire town.

The Platinum Situation.

It is reported that the Russian producers of platinum are preparing to take measures which will result in a substantial increase in the price of platinum, which at present is from $27.00 to $27.75 an ounce for refined metal, and from $30.25 to $31.50 for hard metal. About ninety-five per cent of the world's supply of the metal comes from the mines in and around Nijni Taguil.

A New Crude-Oil Internal-Combustion Engine.

Consul Frank W. Mahin states (*Consular Report* No. 3612) that an engineering firm at Duffield, Derbyshire, England, has recently produced an engine, suitable for either marine or stationary purposes, which is designed to use heavy crude oils, such as cost in England six or seven cents a gallon. It is thus described by a writer for a technical periodical:

The engines, which are of twenty-five horsepower with two cylinders, and of fifty horsepower with four cylinders, run on the Otto cycle. The vaporizer is a feature of special interest. It is heated by the exhaust gases, and in it the oil, after having been preheated by passing through a jacket around the exhaust pipe, and having been atomized by compressed air, undergoes a process of fractional distillation. The portion of the oil that is of a lower flash point than about 220 degrees Fahrenheit is vaporized, and, meeting a current of air, which has also been preheated, is drawn into the cylinders; a certain amount of water is also injected, this having been found to improve the smoothness of running as well as to increase the power. The constituents of the oil that have a flash point above 220 degrees Fahrenheit and form the "hard base," are thrown against a collecting surface, whence they run down into a receiver as a thick, black, tarry liquid. This arrangement prevents the trouble which attends the use of heavy crude oils through the "hard base" entering and scoring the cylinders and clogging the valves. The governor regulates the supply of air and oil and the resulting vapor in such a way as to secure that the mixture admitted to the cylinders is correctly proportioned to the load on the engine; and by means of a hand lever, which can be locked in any position, it can be almost instantly set to give a speed variation of over fifty per cent. For starting, a spray of oil from the atomizer, worked from a reserve of oil and compressed air normally left in the tanks provided for the purpose, is lighted and directed upon the vaporizer, which in consequence is quickly heated, a few turns of the flywheel then sufficing to set the engine in motion.

In his inaugural address delivered on October 23 last, the president of the Staffordshire (Eng.) Iron and Steel Institute opined that the gas turbine would probably play an important part as a prime mover in the near future.

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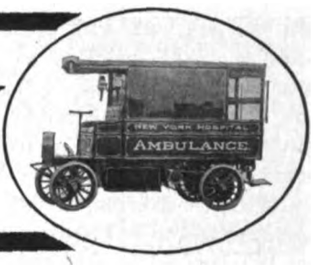
ELECTRIC TRACTION



ELECTRICALLY OPERATED COGWHEEL RAILWAY, MONTREUX-GLION, SWITZERLAND.

BY FRANK KOESTER.

Glion, a town at the northeast end of Lake Geneva and much frequented by tourists, possessed one of the earliest inclined cable railways in Europe. In 1886 an electric trolley system was also installed having two conductors, for direct current, composed of slotted pipes. In 1892 a cogwheel road was also built running from Glion to Les Rochers de Naye. The railway described in this article is an extension of this cogwheel road and runs from Glion down to the main railway station at Montreux, which is a central point for tourists and the altitude of which is about 1,300 feet above sea level.

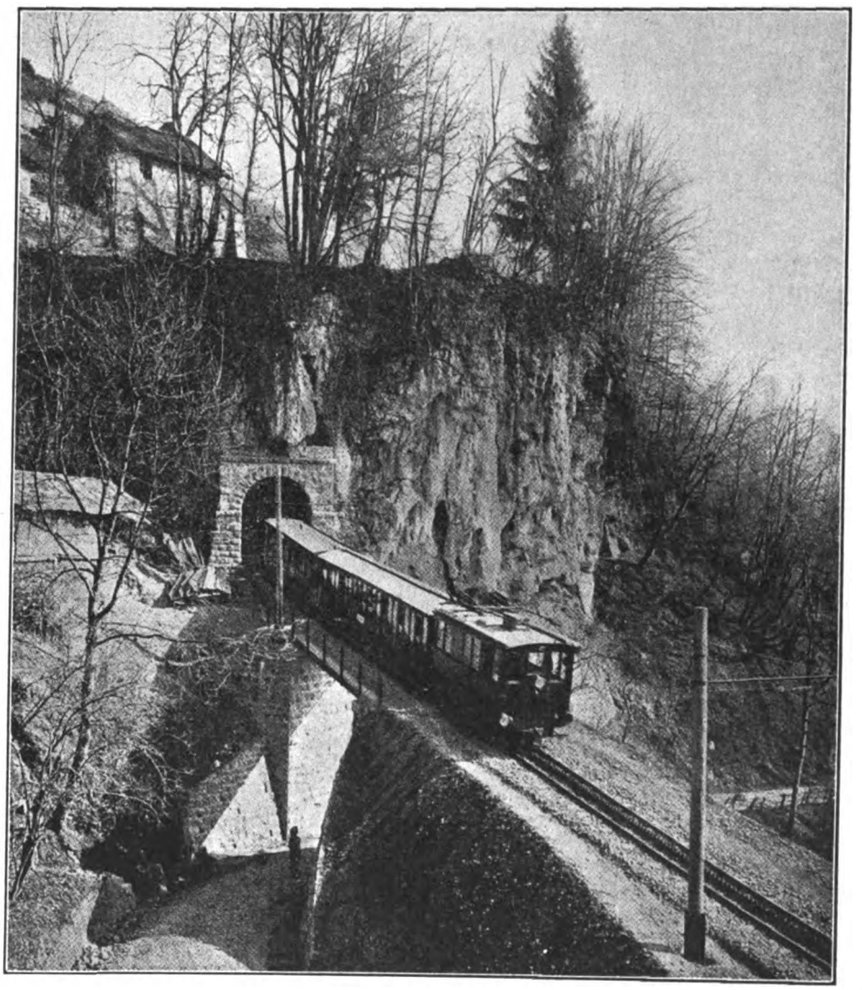
The total length of the new extension is 9,545 feet, of which the main portion, 8,800 feet, belongs to the cogwheel or rack section. The difference in altitude between the lowest and uppermost station is 964 feet, the average grade is 105 feet in 1,000, while the steepest grade is 130 in 1,000. A large portion of the road consists of tunnels, about one-third of which are on curves. The smallest radius of curves on tracks in the open is 262 feet, at stations 196 feet, and for switches as low as 164 feet, the average radius of all curves being 266 feet.

The gauge of the road is 31.5 inches to harmonize with the system previously operated. At the Montreux railway station an additional rail is provided to accommodate the Montreux Oberland Railway,[1] which makes connection at this station, and the gauge of which is 39.4 inches (one metre). This stretch is 1,237 feet long.

The station at Montreux is located partly within the first tunnel. After leaving this tunnel, which is on a level grade, a second tunnel is promptly reached that is 1,277 feet long and the steepest grade of which is 128 in 1,000. The substation is situated at the upper outlet of this tunnel and will be described later. Just beyond the second tunnel a structural steel bridge 200 feet in length spans the valley, crossing a stream, several streets and over the top of a building. The bottom chord of the truss is within three feet of the roof of this building. The grade over the bridge is 108 in 1,000. A station is situated just above the bridge, and, as the road is single-track, a turnout switch is provided here.

From here on the grades are steeper, being as much as 130 feet in 1,000. Entering the third tunnel, 274 feet in length, the road crosses under the above-mentioned cable road. After crossing a reinforced concrete bridge twenty-three feet long and passing through the fourth tunnel of eighty-five feet length the road soon enters another tunnel, the length of which is 1,266 feet. This tunnel forms a loop with a radius of 262 feet, a grade of 130 feet in 1,000, and forming three-quarters of a complete circle. The upper outlet of the tunnel is 164 feet above the lower. The remaining portion of the road runs over retaining walls along the slope of the mountain and before entering the terminal station at Glion, where connections are made with the Glion-Naye cogwheel road, which has been in operation since 1892, as mentioned above. This is also the terminus of the cable road spoken of. This station is 459 feet long, part of it lying along a four per cent grade, and the balance being level.

The tunnels have a clear width of 12.5



TYPICAL SCENE ON THE MONTREUX-GLION COGWHEEL RAILWAY IN SWITZERLAND.

[1] See article by B. F. Hirschauer in ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of February 6, 1909, page 249.

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feet and are built with arched tops, the distance to the spring of which is fourteen feet above the rails. The lining of the tunnels is of concrete and brick. Drainage trenches are provided on one side of the tunnels.

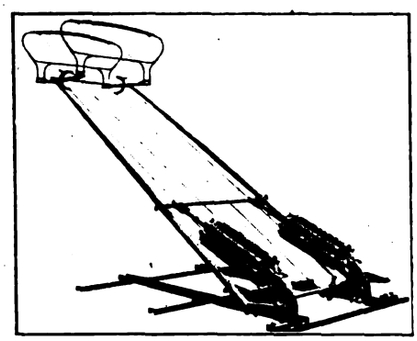
In the construction of this road many obstacles had to be overcome, as its course is under and alongside of buildings, such as restaurants, dwellings, schools, etc., and it was necessary to carry on the work without interfering with the use of these structures. As some of these buildings rest upon solid rock, no blasting was allowed.

The rails, 38.75 feet in length, are bolted to steel crossties 5.57 feet long, embedded in ballast and at intervals in concrete to prevent sliding. Rails of forty-five and fifty pounds to the yard are used. The racks are of the "Abt" type, similar to those of the Glion-Naye Railway, and are in sections of 5.9 feet in length, weighing sixty-six pounds per section. The normal pitch of the teeth is 4.75 inches and as the pitch diameter of the cogwheel is necessarily somewhat smaller than the diameter of the adhesion wheels on the truck axle, the pitch of the first few teeth at the entering end of the rack is somewhat less than the normal, being 4.25 inches. As will be seen later, the mechanism on the locomotive is so arranged that proper entrance of the cogwheel into the first teeth of the rack is brought about.

The racks consist of two toothed rails bolted on either side of the vertical member of an inverted T-iron in such manner that the teeth are staggered, thus necessitating a gear set consisting of two cogwheels. The advantage of this arrangement lies in the fact that a broken tooth on one rack will not interfere with proper operation, and furthermore the running is smoother than it would be with a single set of teeth.

Current at 8,000 volts, fifty cycles, is drawn from the power house at Montbovon and is stepped down and converted at a substation, located at the mouth of Tunnel No. 2, to 600-volt direct current. This substation may be run in parallel with the substation of the Montreux-Bernese Oberland Railway at Chernex. With this arrangement either of these stations may be a reserve for the other line. Each of these stations has a storage battery to further assist in case of emergencies.

Owing to the comparatively short length of the new road, two copper conductors of nine millimetres diameter are used. These are carried on the steel arms of wooden poles, the lower ends of which terminate above ground and are contained within channel irons which form footings sunk into the earth. At stations the conductors are twenty feet above the rails, while in the tunnels they are as low as thirteen feet and in open stretches the distance above rails is fourteen feet.



COLLECTOR BOWS.

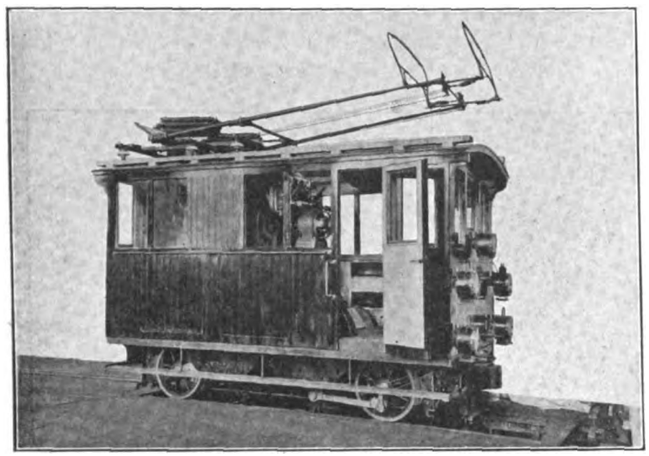
In order that the smoke from steam locomotives, which also run over these tracks, may not damage the conductors these are made of steel, instead of copper, at low points; and, for this same purpose, the conductors are swung out of center.

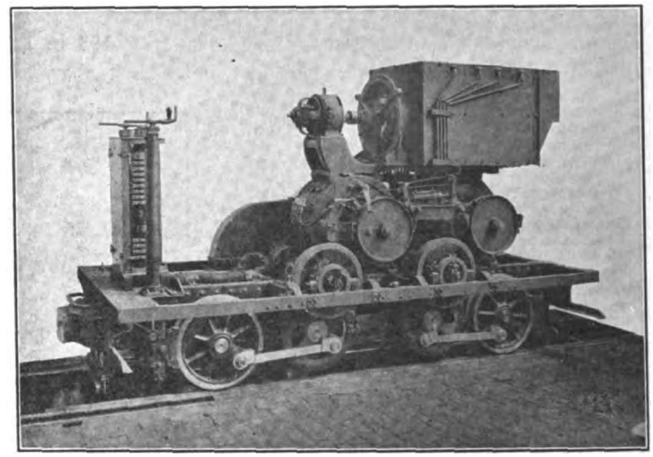
The rolling stock at present consists of three electric locomotives, four passenger cars, five flat and two box cars for freight and three smaller baggage cars. The locomotives are constructted to operate both as cogwheel or adhesion machines, the latter when on ordinary grades.

Each locomotive is equipped with two 110-horsepower motors geared by means of intermediate axle and gearing to the cogwheel axles, on the ends of which crank wheels are fitted which are connected to the truck axles by pitman rods, the two cogwheel axles being located between the truck axles. The front truck axle is also provided with a cogwheel, so that there are three cogwheel or pinion sets which mesh in the racks.

When running on the ordinary grade, where no rack is provided, the operation is as follows: Friction clutches are mounted on one end of each intermediate axle, the hub of the outer half of the clutch having rigidly attached to it a gear wheel which meshes with the gear teeth forming part of the crank wheel driving the truck axle upon which the rack pinions run loose. The inner member of the clutch is keyed to the intermediate axle and provided with three dogs engaging with the outer member in such manner as to allow a loose motion amounting to fully one-half of the pitch of the teeth of the rack. It will thus be seen that provision is made for the proper engagement of the teeth of the pinions with those of the rack when the locomotive reaches a steep grade or the beginning of the rack.

The two propelling motors are connected permanently in series, although there was taken into consideration that, if either motor should become inoperative,





VIEWS OF LOCOMOTIVE COMPLETE AND WITH BODY REMOVED, MONTREUX-GLION COGWHEEL LINE.

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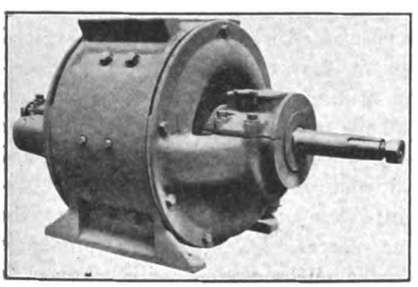
the locomotive would be put entirely out of service.

The locomotives are equipped with brakes as follows: A hand brake operated by a crank simultaneously acting upon the cogwheel and truck axles; another hand brake acting upon the intermediate axle either by shoes or by a strap brake; an automatic brake acting by means of brake straps or bands direct on the motor shafts (this latter brake is automatically put into action when the speed exceeds thirteen to fourteen kilometres per hour, and is released by hand when necessary); an electrical short-circuiting brake is also provided for use in emergencies or in making the descent.

Special attention was given to the design of the controller in providing numerous steps, so that the speed regulation might be very gradual. For the purpose of cooling the rheostats, especially on the descent, a motor-driven ventilating fan is installed. This set and the box for the rheostats may be seen in the illustration mounted upon the motors.

The locomotives are provided further with lightning arresters, fuses, automatic



PROPULSION MOTOR, 110 HORSEPOWER.

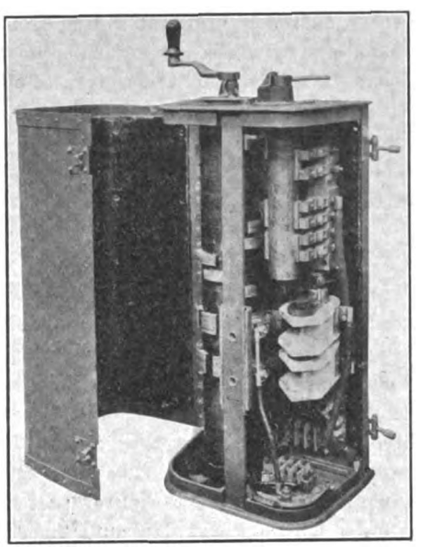
overload and underload circuit-breakers, a hand switch, a complete set of modern measuring instruments, speedometer and ground detector. The trains are equipped with electric heating, lighting and signal systems.

The total weight of each locomotive is 31,240 pounds, of which 12,012 pounds represents the electrical equipment. The latter was furnished by the Maschinenfabrik ,Oerlikon, Oerlikon, Switzerland, which company also supplied the entire electrical equipment for the overhead line construction, substations, etc.

The passenger cars are 6.5 feet wide over all and thirty-eight feet long, having a seating capacity of fifty-six. A passenger train is usually made up of two such cars. As these cars are also used on the steam road mentioned herein, they are equipped for lighting with storage batteries of 130-ampere-hour discharge capacity. The freight cars have a carrying capacity of ten metric tons. All cars, both passenger and freight, are provided with ordinary shoe brakes and also with a cogwheel brake similar to the one on the locomotive which are actuated by hand.

The maximum speed of a train going up a grade of 130 feet in 1,000, and having a total weight of about forty-five metric tons, is twelve kilometres (7.5 miles) per hour, while on the descent it is 6.25 miles allowable speed per hour.

It might be of interest to give a report of a test, under the supervision of the Swiss Federal Railway officials, of the automatic brake equipment. A train of 45.2 metric tons weight was running up a grade of 126 feet in 1,000 at a speed of nine kilometres (5.6 miles) per hour, when the current was suddenly cut off. It continued forward, due to its momentum, 5.7 feet during 2.8 seconds. It then



CONTROLLER.

started downward and after 5.2 seconds had acquired a speed of 8.1 miles and covered a distance downward of thirty-five feet. At this point the automatic brake became operative and within 3.6 seconds time and a distance of 27.8 feet the train came to a standstill. As, of course, the locomotive is always on the downward end of the train, and as the cars were not coupled to the locomotive during this test, it was noticed that the cars did not have any tendency to separate themselves from the locomotive owing to their lighter weight and lesser momentum than that of the locomotive. After inspection it was found that no portion of the locomotive equipment or of the rack was at all damaged.

The cost of the road per kilometre was 825,000 francs, or $264,000 per mile. It was opened to the public April 8, 1909.

Meeting of Central Electric Railway Association.

The regular bimonthly meeting of the Central Electric Railway Association was held in the Palm Room of the Claypool Hotel, Indianapolis, November 18. The attendance was above the average, many coming from Detroit and distant points in Ohio.

The meeting was called to order by the president, A. A. Anderson, general manager of the Indianapolis, Columbus & Southern Traction Company. After the reading of the minutes of the Detroit meeting by the secretary, A. L. Neeamer, President Anderson announced that the programme consisted largely of reports of committees and reviews of the work of the American Street and Interurban Railway Association's annual convention, held in Denver in October.

The standardization committee reported in favor of the adoption of a standard drawbar—one leading up to a universal automatic pocket. The committee thought the time was rapidly approaching when the law will demand an automatic coupler for interurban cars and suggested the advisability of preparing for it. The idea of the committee is to develop an M. C. B. coupler, and the committee asked that it be granted further time, since there are matters relating to the same subject being considered by the electric roads and the Indiana Railroad Commission.

The report was discussed freely, the speakers agreeing that it is necessary to do something to overcome the difficulty of coupling cars of different heights. Blue prints of an emergency coupler were exhibited. The committee was continued for further investigation and asked to report at the next meeting.

The committee on the carrying of the United States mail on interurban cars reported that it had been unable to obtain any satisfactory results from its labors with the Postoffice Department or Congress relative to an increased compensation for carrying the mail. The committee cited a number of mail routes that are now being served by the interurban roads at one-third the rate formerly paid to star route agents. In discussing the report the members of the association expressed some doubt as to whether a traction road could cancel its contract with the government.

The committee on publications made a report recommending that technical and trade journals should have a wider margin and should otherwise be improved so as to make binding of loose leaves more feasible,

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the committee being continued and instructed to take the matter up with the publishers.

The first paper on the programme was read by J. G. Callen, electrical engineer, of Boston, Mass., on "A Centralized Testing Organization: Its Functions in the Management of Electric Railways." Mr. Callen said that the business of electric lines has become one of the largest developments of modern times. There are problems of great importance connected with the business, but none of more importance than that of ascertaining the cost of operation per car mile. Mr. Callen explained the advantages to be derived from the establishment of laboratories in which road material, lubrication, fuel, etc., may be tested. He said the buying of coal is important, in order to secure the quality that will give the best power and produce the least scale in the boilers. He said the best results are obtained by placing the whole matter in the hands of a fuel engineer.

Mr. Callen's paper was well received and a committee appointed to report on the suggestions relative to the advisability of establishing a test laboratory.

AFTERNOON SESSION.

The first paper of the afternoon session was read by A. D. B. Vanzandt, publicity agent, Detroit United Railway, Detroit, Mich.

Mr. Vanzandt's paper emphasized the point that the publicity department of a railroad is the connecting cog between the actual operating of the railway and the people through the press. It mentioned the two kinds of publicity, namely, advertising and news, and treated fully the distinction between the two. Beneficial methods of advertising were discussed and the various mediums classified according to their worth. In a like manner the news end of the publicity was treated and many valuable suggestions made.

This paper brought out a hearty discussion and a number of questions were satisfactorily answered by Mr. Vanzandt.

J. B. Crawford, superintendent Winona Interurban Railway, Warsaw, Ind., read an interesting paper reviewing the work accomplished by the Transportation and Traffic Association.

President Anderson announced that the remainder of the session would be devoted to a review of the work of the Denver convention and called on A. W. Brady, president of the Indiana Union Traction Company, who is an officer of the American Street and Interurban Railway Association. Mr. Brady said he had prepared no formal report, but said the convention was an unqualified success. The subjects were ably treated and heartily discussed. He praised the exhibits, the Denver electric lines and the citizens for the generous hospitality during the meeting.

E. C. Carpenter, claim adjuster, Indiana Union Traction Company, gave an interesting and instructive report of the work of the Claim Agents' Association, and reviewed the papers read and the incidents related on that subject before the Denver convention.

Mr. Carpenter's report incidentally brought out the question whether it is best to stop electric cars on the near or far crossing in cities. There was considerable division of opinion concerning this practice and apparently good argument in favor of both crossings.

The ladies attending the convention from Michigan, Ohio and Kentucky were taken in charge by those attending from Indiana and given a trolley ride at 2 o'clock. A theatre party was given to all the delegates remaining over Thursday night.

The next meeting will be held in Columbus, Ohio, January 28, 1910.

7,000 Steel Wheels Ordered.

Traction interests of Brooklyn have placed with the Carnegie Steel Company, of Pittsburg, orders for 7,000 steel wheels for electric cars, announcing that it is the intention to do away with the chilled iron wheels which have been used under the Brooklyn cars so long. The Carnegie company has promised to deliver part of the order within thirty days and the entire order before February 1.

It is estimated that 4,000 tons of steel will be required in making the wheels. Part of the former armor plate shops of the steel company at Homestead have been pressed into service as temporary shops for making wheels.

Central Bureau Formed for Traction Lines.

Representatives of the leading underwriters' associations of the country met in Boston recently and organized the Central Electric and Lighting Bureau which it is planned will handle the electric traction and lighting risks through the entire field. United States Manager E. G. Richards, of the North British and Mercantile Insurance Company, was elected president, and General Agent Cofran, of the Hartford Fire, at Chicago, was elected vice-president. The headquarters of the Bureau will probably be in New York city.

Electric Railroad in Carlsbad.

It is reported that an electric railroad may be constructed connecting the suburb of Fischern, where the railroad stations are located, with Carlsbad. This is a much-needed improvement, as the distance is more than a mile and the carriage charges are high. The greatest opposition to a complete electric-railway system, which would be a boon to the 270,000 annual visitors to this spa, comes from the hotel and lodging-house keepers, who are able under present conditions to charge extremely high prices for rooms. The congestion during the three months when the number of "cure guests" is at its height will be relieved somewhat next year, when one and possibly two large hotels will be built, equipped with modern conveniences. This will be appreciated especially by the Americans, who, to the number of 8,000, come to Carlsbad annually during the summer season.

Pennsylvania Tunnels Inspected.

Headed by President McCrea, officers and directors of the Pennsylvania Railroad made a trip of inspection through the company's Hudson and East River tunnels on November 18, on a special train of four cars which left Philadelphia at nine o'clock. Stops were made at all the points of interest, including the new uptown station and the Long Island terminals, and Vice-President Rea explained the underground system to the other officers. The company announces that the entire system will be open to traffic on June 1, 1910. Twenty-four electric locomotives, weighing each 330,000 pounds, will be used to handle the daily traffic.

New Cars on Broadway, New York City.

Pay-as-you-enter cars, slightly smaller than those now in use on the Madison Avenue line, were put in service recently on the Broadway and Amsterdam Avenue route, New York city. Similar cars will be gradually added to the Broadway-Columbus Avenue line, and it is expected that by December 1 both lines will be composed entirely of pay-as-you-enter cars. Fare boxes will not be a part of the equipment at first, but they will be added in about two weeks.

The merchants and gentry of Swatow, China, it is reported, say that as the business of the port is increasing they do not want to be behind the times, and so have subscribed $200,000 to establish an electric traction system in the city.

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Damage by Electrolysis.

The municipal engineers of several American cities have been seeking information for the prevention of electrolytic damage to pipes and other metallic substructures. To this end E. N. Lake, chairman of the electrolysis subcommittee, Board of Supervising Engineers, Chicago Traction, of Chicago, submitted through the Bureau of Manufactures the following four questions for investigation by American consular officers in ten of the largest European cities:

The use of the track rails for the electrical return circuit of street-railway lines.

The permissible drop in potential over the return circuits of street-railway lines.

The maximum difference in potential between track rails used as return circuits and gas pipes, water pipes, or other metallic substructures contiguous to the track.

Regulations or practices with reference to electrically connecting track rails to gas mains, water pipes, or other metallic substructures.

Mr. Lake made a thorough study of the responsive consular reports, and furnishes the following résumé:

In answer to the first question, rails are used in all the cities named for return circuit. The summary of answers to the other questions follow:

City.	Permissible Drop in Potential Over Street-Railway Return Circuits.	Potential Difference Between Track Rails and Contiguous Pipes.	Electrical Connections Between Negative Return and Contiguous Pipes.
London	7 volts, maximum drop...	Pipes, +1.4 volts; pipes, —4.2 volts.	Permitted under special regulation.
Paris	1 volt per kilometre; 5 volts maximum.	Average of 1 volt normal operation.	No information.
Berlin	No specific regulation....	No specific regulation....	Not permitted.
Vienna	5 to 7 volts at maximum traffic.	Maximum observed, 1 volt.	None used.
St. Petersburg	1.5 volts maximum in city; 3 volts maximum in suburbs.	No regulation.....	Not permitted.
Moscow	Maximum 1.5 volts in city; 3 volts in country.	No regulation.....	Not used.
Glasgow	7 volts, maximum drop...	Maximum observed, less than 1 volt.	Permitted, but not practiced.
Liverpool	7 volts, maximum drop...	Maximum, 4.5 volts.....	None used.
Brussels	No specific regulation....	No specific regulation....	None used.
Christiania	Maximum drop about 10 volts.	Maximum about 5 volts..	No information.

The following additional notes taken from the letters and regulations received, while not bearing directly upon the four main queries, will be of interest in considering the general question of electrolysis.

London.—Return feeders may be uninsulated if laid within three feet of the track rails and electrically connected thereto at intervals of not more than 100 feet, otherwise they must be insulated unless they are of such sectional area that they will reduce the difference of potential between the ends of the uninsulated parts of the return below the maximum limit of seven volts.

If any part of the return circuit is uninsulated it must be connected with the negative terminal of the generator and the negative of the generator must also be grounded through an ammeter to two separate earth connections, one of which may be a water main.

Paris.—When electrical installations are in public highways or are for electric railways, applications for permits must contain complete information and specifications as to the proposed installation. These are passed upon by the several departments, and when permits are issued provision is made for close supervision of the governmental department interested. A three-wire system at 1,200 volts between trolley wires may be used, provided the track rails are used as the neutral conductor. The resistance of a rail joint, where the tracks are used for return circuit, must not be greater than the resistance of ten metres (32.8 feet) of unjointed rail.

Berlin.—Grounding of rails to earth or to pipes is not permitted, and artificial earth plates are prohibited. The city exercises a supervision over the matter of potential differences in the earth through the jurisdiction of the city official engineers. No specific potential differences or potential drops are mentioned in the requirements, but power is reserved by the city to investigate and prescribe in accordance with the conditions applying to each individual case.

Vienna.—The license regulations of the Austrian railway ministry provide for supervision of the return circuit conditions in a manner similar to that noted with reference to Berlin, except that in Vienna there is a municipal street-railway system. A periodical examination is made by means of a test car of the electrical condition of track joints and return circuits.

St. Petersburg.—Maximum potential drop in return circuits was originally specified as five volts per verst in suburbs and two-and-one-half volts in city. This is equal to about 7.5 volts and three-and-three-quarter volts per mile, respectively. This is now three volts and one-and-one-half volts maximum between any two points on the system.

Moscow.—Equalizing rheostats are used in the negative return cables. Underground pipe systems are divided into sections by insulating joints.

Glasgow.—The Glasgow authorities consider the board of trade regulation of seven volts maximum drop between any two points of the return circuit as far too high and have limited their drop to two and three volts. The lead sheaths of their own cables are connected by the tramway department to the track rails at every manhole or at an average interval of about 350 feet.

Liverpool.—Board of trade regulations apply and are the same as in London.

Brussels.—There is only a general regulation without specific requirements as to potential differences or drops, which provides that the electrical conductivity of the return shall be such as to avoid all harmful "electrolytic actions."

Christiania.—In addition to the bonded rails for the return circuit an auxiliary copper conductor, about No. 8 B. & S. gauge, is soldered to the bonds at each rail joint.

Construction of a Street Railway.

A franchise for the construction and operation of a street railway in a city of Latin America has been granted by the municipal governmment to two residents of the city. The franchise calls for either single or double track and the use of any kind of power, and the railway is to run through the principal streets of the city and about a mile beyond the municipal limits. The consul submitting the report states that the concessionaires have interested capital from the United States in the enterprise. Further particulars may be had by addressing the Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C., and referring to file No. 4117.

New Automatic Railroad Station Announcer.

Consul-General Richard Guenther, of Frankfort, reports that a new automatic station announcer is about to be tested on the Prussian state railways, with a view to its adoption. The apparatus, which is of the size of an ordinary cigar box, is easily installed in each car and compartment. All of them are connected with the baggage car, from where the device is operated. By closing of a contact all the announcers respond at once and make the name of the next station appear.

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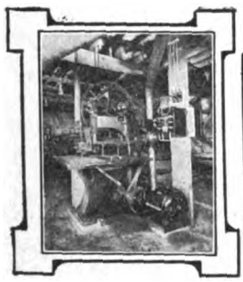
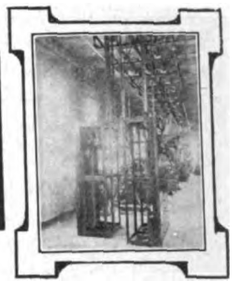


Industrial Power



Electrical Propulsion of Ships.

There have been many attempts to apply batteries to the propulsion of boats, but these experiments have nowhere resulted in lasting commercial results; the prospects of seeing a large ship laboriously hauling an acre or two of batteries through the surf was almost too much to expect, and although many attempts have been made from time to time, it remained for the introduction of high-speed and efficient prime-movers, such as internal-combustion engines and steam turbines, together with the tremendous advance in the art of designing and building dynamo-electric machinery, before the application of the electric motor could be reasonably put forward as a means of propeller-shaft driving for main marine work.

An important step in this direction took place in 1903, at St. Petersburg, when a vessel was constructed and put into service by the firm of Nobel Brothers. In this craft was a tank vessel of 1,150 tons displacement, intended to carry oil on the Volga and in the Caspian Sea. The propulsive plant of this interesting vessel consisted of three Diesel engines, driving three direct-current motors, each serving to drive one of the three propellers, the control for which being carried out from the bridge. The regulation was effected by means of varying the exciting current of both the generators and also the motors, by which means also the reversing of the propellers was carried out. The vessel speed was, however, only very low; when light, eight knots, and when loaded, 7.4 knots; the total power of the engines was 360 brake-horsepower, 120 horsepower each. The generating plant was situated about amidships, while the motors were placed right aft in a separate motor room. The control being arranged from the bridge, the engine-room staff did not know in what direction the propellers were running, while the staff in the motor room, knowing it, were unable to bring about any change. The complete control of the drive was carried out by the engineer on the bridge, and he steered and maneuvered the ship without having any contact with the engine-room staff.

As stated before, the advent of the internal-combustion engine and the high-speed steam turbine has brought about conditions which now make the commercial possibilities of the electric motor for main marine propulsion appear well within sight, and some very interesting suggestions have during the last few years been made as to its application to such very important work and exacting conditions; in America and on the Continent of Europe some of the most important members of the engineering world have been at work on this subject.

Some hesitation may at first be apparent as to the reason for introducing electricity between the prime-mover and the propeller, to which point we all wish to apply the power of the prime-mover with the least possible of losses; and, on the face of the matter, it certainly does appear that if compared with the existing slow-running marine engines, with their slow-running propellers, etc., under those circumstances, the application of electricity, or any other intermediate, would be a wasteful and unnecessary, if not a ridiculous, idea.

But as the march of science goes on we find that prime-movers are introduced (such as steam turbines, etc.), which, to be economical in fuel, must be run at such revolution speed—many times that of the efficient propeller—in order that it may produce the utmost thrust per horsepower delivered to it. As you all know, the modern reciprocating-engined cargo boats have propeller speeds of from sixty to 120 revolutions per minute, and work with great comparative economy as compared with steamers that have been fitted with steam turbines. In some cases the propellers have been raised in speed to meet the high speed of the turbine. It is a well-known fact that the steam turbine to be economical in fuel must be run at a high blade speed and be supplied with dry or superheated steam, and must be run also on a high vacuum; on the other hand, the propeller is a piece of mechanical machinery that to be efficient must be run at low speed, so that it becomes very evident that direct-coupled turbines mean for main marine propulsion a compromise of a very wasteful nature, *i. e.*, the turbines are brought down in revolution speed, and the propellers are correspondingly raised in revolution speed. The consequence is that the propeller cannot produce the maximum of thrust, and the turbine cannot produce the utmost amount of horsepower from a given amount of steam or fuel burnt, as compared with what is possible if some such reduction gear, such as electrical power transmission, is introduced between the high-speed steam turbine and the comparatively slow-speed propeller that could then be used. As an example, take the *Lusitania*. The trial figures show that the propulsive efficiency worked out at about forty-eight per cent—this with the turbines and propellers running at 186 revolutions per minute—and the power was about 16,375 horsepower in each of four shafts. Now Doctor Caird asserts that had the *Lusitania* been fitted with slow-speed reciprocating engines with the propellers only running at eighty revolutions per minute, and, of course, larger in diameter than those used at present, that the power required by the propellers for the same vessel speed of twenty-five knots would only have been 52,830 horsepower, or only 13,207 horsepower on each shaft, and that the propulsion efficiency for the above power would be about sixty per cent instead of forty-eight per cent; so you see what the running of the propellers at slow speed means, as it is not the fact that it is essential that the reciprocating engine is more economical than the turbine, but the fact rather of running the propeller at a comparatively low speed, making large blades and low pressures per square inch of propeller blade possible, and consequently taking better grip of the water, thus producing the maximum of thrust per unit of powe.

[1] Abstract of a paper read before the London (Eng.) Association of Foreman Engineers and Draftsmen, by William P. Durtnall, September 4, 1909.

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It will thus be seen that if electric motors are coupled to slow-speed propellers, the same propulsive efficiency may be obtained per horsepower delivered by the motor shaft to the propeller shaft.

Now we will come to the matter of steam consumption, and we will leave the matter of auxiliary driving out, so as to get the proper comparison for the fuel burnt per horsepower for propulsion only in each case.

The figures stated in the trials of the above vessel go to show that the amount of steam per shaft-horsepower was 12.77 pounds per hour, therefore requiring 836,435 pounds of steam (this for propulsion only). Now if the propellers were driven by induction motors (say, two 8,188 horsepower each) on each shaft, these motors can be made with a mechanical efficiency of, say, ninety-three per cent, which to supply them with sufficient electrical energy to do this work of 16,375 horsepower on each shaft would require, say, 52,403 kilowatts (leaving out the small amount of loss that would, of course, take place between the generators and the motors). To meet the above conditions, we will assume to put on board five 10,480-kilowatt turbine alternators running at 1,000 revolutions per minute, and these, when supplied with steam at, say, 160 pounds pressure, superheated by 100 degrees Fahrenheit, and running on a vacuum of twenty-eight inches (which can under these circumstances be obtained at sea in the Atlantic, but, of course, not in the Red Sea), the guaranteed steam consumption can be eleven pounds per kilowatt-hour delivered to the terminals of the generators. This means that 576,433 pounds of steam per hour would be used for propulsion only, which is a saving of no less than thirty-one per cent in steam and (therefore) fuel, that is, taking the speed of the propellers and motors as at present, namely, 185 revolutions per minute. A further reduction in the power required, and, therefore, fuel, is quite possible, insomuch that it is quite within the range of practical possibility to build motors of this size that would run with economy at, say, 150 revolutions per minute, and at the same time to be of such diameter that they would get into the narrow after-lines of the vessel, at least in the same places as the present space occupied by the present turbines. It must be remembered that I do not propose to use motors with a lot of different windings on them to be able to change the revolution speed, as this is done in my "Paragon" system by means of the generation current at various periodicities. This in turn allows the motors to run at such a speed which may be desired in practice, with the consequent absence of complicated controllers and without the necessity of wasteful resistances, etc.; so it will be very evident to you that the power transmission efficiency will be the highest possible electrically.

I will leave to your own imagination what this tremendous saving in fuel will mean, and the following items will be at least reduced by a like amount: Boilers, stokers, trimmers, feed pumps, draft fans, funneling, coal bunkerage, dead water in boilers, smaller steam and exhaust pipes, condensers and their circulating water, pumps of all kinds, and many other things that make up the steam plant of a modern liner.

Ship owners will be well advised to look right into this matter, and I am of an opinion that the coming competition in the shipping trade will compel the shipbuilders to employ high-speed superheated-steam turbines to produce the power, and to adopt electrical means to transmit the same to slow-speed propellers, for the above reasons; and when this is done, such low coal consumption per ton of displacement per mile at any given vessel speed will then be recorded that it will be a most difficult thing for shipping firms to exist commercially without it.

There is another prime mover that is now making very rapid headway to the front, *i. e.*, the internal-combustion engine, with its light weight and high thermal efficiency, and this in the next decade will be extensively adopted for propelling ships and also for working auxiliary machinery on the same, in conjunction with electrical power transmission. These interesting prime-movers will show further economies, especially in those vessels that only require power up to, say, 1,000 shaft-horsepower. At present, above that power, the high-speed superheated-steam turbine is top dog as regards its practical application, inasmuch as the reversing and speed regulation can be carried out electrically, so that the engines may run at high speed (much above that of the propeller) always in the same direction, and at constant speed rotation, irrespective of the speed of the propeller, or whether the vessel is going "ahead" or "astern," and this control can be very efficiently brought about either from the engine room or from the bridge.

Standardization of Machine-Tool Motors.

At the eighth annual convention of the National Machine Tool Builders' Association, held in New York last month, a preliminary report was presented by a committee appointed about a year ago to consider the standardizing of electric motors for machine tools. This report covered the results obtained from a meeting held about the first of the year with the American Association of Motor Manufacturers, which body is also endeavoring to evolve a standard type of motor especially adapted to the particular requirements of machine tools.

Specific questions were asked in a circular letter sent out under date of September 14 to the members of the association, replies being received from about one-third of them. To only one of the questions asked was a unanimous reply received, the motor manufacturers affirming that it would be beneficial to make the dimensions of the base and of other important parts conform to a standard for motors of a given horsepower. Replies to other questions on tolerances, maximum speeds of motors, peripheral speeds of gears, etc., showed no such uniformity. Eighty-four per cent were in favor of tolerances, while the remaining sixteen per cent preferred exact dimensions. Regarding the question of maximum speeds, the majority of the replies favored a speed of 1,200 revolutions a minute for the smaller motors, say up to five horsepower. Other replies on this and other questions showed a great diversity of opinion.

Austro-German Waterpower Dispute.

A new difficulty has arisen in recent months in connection with the proposals for the utilization of waterpowers in Bavaria for state and private purposes, says *The Electrical Review*, of London, Eng., in consequence of differences of opinion between Bavaria and Austria in regard to sovereign rights and obligations in respect of the adjoining territory.

Austria claims the right of artificially diverting waters rising in Austria and flowing over into Bavaria, but the latter country disputes the possession of the right. If the dispute were a theoretical one the solution could be left for the distant future to solve. But Austria seems to make the supply district of the Chiemsee a serious matter, and to desire to withdraw about one-third of the waterpower of the Alz. So long as this danger threatens it is considered that no industrial undertaking will be willing to as-

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sume a concession for the use of water-power in the country.

The Badische Anilin und Sodafabrik has for years been seeking a concession for the erection of nitrogen works by the use of a portion of the fall of the Alz, which is the second largest waterpower in Germany. The Government made inquiries of manufacturers as to their prospective demands for power, but these were unsatisfactory, and it then seemed as if the Baden company's application would be granted. In the meantime the dispute has arisen with Austria, and although the subject was discussed several months ago in Vienna between representatives of both governments, no progress was made towards a settlement.

It is believed that Prussia is also interested in the question, although to a less extent than Bavaria, and the hope is expressed in the latter country that Austria will consent to have the problem referred to the Hague Court of Arbitration for decision.

Electric Drive in Textile Mills.

One of the regular correspondents of *The Electrical Engineer,* of London, Eng., writes in a recent issue of that paper as follows:

"A good answer to those who are against electric driving is that all firms giving it a trial in one or two rooms, adopt it all through their mills and for new extensions. I have interviewed a spinner who installed the electric drive in a new mill some time ago. He was so satisfied with the results that he employed it in a second mill as well, making such minor improvements as he had found desirable. This gentleman, who is a mechanical engineer as well as a spinner, was surprised that other spinners, knowing the details of their business so well, were blind to the advantages of the electric drive. I learned that the cost per horsepower for electricity generated on the spot, and for steam driving was about the same; also the cost of plant in the first instance was similar.

"His first mill had two high-speed turbines, but he had found them so satisfactory and reliable that if he were redesigning he would instal one large unit instead of splitting the load, as experience showed that there was no more likelihood of a generator and turbine going wrong than there was of an ordinary mill engine—and no one would think of installing spares in the latter case. The constant working speed produced a finer and more even thread than is got by steam driving direct, and this finer yarn gives the firm a better position in the market and enables it to secure orders in preference to other spinners.

"Another point worthy of notice was that the starting load on Monday morning in the case of the electric drive was only 6.5 to 7.0 per cent in excess of Saturday morning's. In the steam drive there are many cases where the Monday morning load is as much as 200 horsepower above normal in a total of 1,300 horsepower. As the electric drive is fifty per cent faster than steam, much cheaper and lighter belts are used, and this all reduces the losses. His shafts were direct-driven from one end by motors. It was his opinion that electric driving was the only way to modernize old mills, and that for new mills even, it possessed distinct advantages."

Electricity from Ocean Waves.

A Victoria (Australia) inventor of a wave engine proposes to build a pier at Sorrento, a town in that state, for a fifty-horsepower installation which will be utilized to generate electricity for use by the municipality. The power is to be obtained from the rising and falling with the waves of a free buoy, the movement of which will be converted into rotary motion for driving a dynamo. There is no record to hand of any similar application of wave motors being put in practice.

Electrical Standardization in Canada.

At a recent conference of municipal engineers in Toronto, Canada, the standardization of equipment for municipal hydroelectric undertakings was considered in some detail. It was decided, among other things, that no motor exceeding ten horsepower in rated capacity shall be supplied with power from electric-light mains.

The World's Production of Calcium Carbide.

Up to the present time waterpower stations of about 360,000 horsepower have been built for the manufacture of calcium carbide. Scandinavia, Switzerland, the United States and Canada each employs from 52,000 to 70,000 horsepower for this purpose; Italy, 46,000; France, 35,000, and Spain, 20,000. The carbide factories of Germany use only 9,700 horsepower, and those of Great Britain still less. A 25,000-horsepower plant being erected in Scotland has not been taken into account in these figures. There are small establishments in the Argentine Republic and in Japan. All of these installations are capable of producing 300,000 tons of carbide a year; but the present consumption does not yet reach 200,000 tons, and the works are therefore utilized only to about two-thirds of their capacity; Germany produces only about one-quarter of its consumption; Great Britain, one-eleventh. Norway, on the other hand, consumes only a small part of its production, and exported about 37,000 tons in 1908. With some installations recently completed, Norway is capable of producing 80,000 to 90,000 tons of calcium carbide a year, which is nearly one-half of the present world consumption.—*Translated and abstracted from Journal fuer Gasbeleuchtung (Munich), October 23.*

Copper Production for October.

The copper production for the month of October was given as 124,657,709 pounds by the Copper Producers' Association, as compared with 118,023,139 pounds in September. The total consumption as indicated by deliveries for domestic use and export, was 122,620,855 pounds, against 102,188,932 pounds delivered in September. This increase in the sales of copper reduced the total added to stocks 2,036,854 pounds, making the total stocks on hand on the first of this month 153,509,626 pounds.

In some quarters a small decrease in stocks had been expected in view of the large buying of the last month, but disappointment over the increase shown was tempered by the fact that the domestic deliveries during the month totaled 66,339,617 pounds, against 52,105,155 for September, a gain of 14,254,462 pounds. The deliveries for export, 56,509,626 pounds, were also large, comparing with 50,077,777 in September.

Multiplex Wireless.

According to the *Post Office Electrical Engineers' Journal,* an invention has just been patented in Berlin by F. van der Wonde which has for its object the adaptation of wireless telegraphy to multiplex working. The antenna is joined to a spiral device carrying a number of contact arms, which, when revolved, makes the following connections: (1) Transmitter joined up; (2) antenna earthed; (3) transmitter cut out; (4) receiver joined up; (5) earth disconnected; (6) receiver cut out. The speed of action is such that several revolutions take place during the time necessary for the sending of a Morse dot.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

CHICAGO RAILWAYS.

The report of the Chicago Railways Company for the month of September and eight months ended September 30, 1909, compares as follows:

	1909.	1908.
September gross	$1,066,056	$ 960,568
Expenses and taxes	718,855	789,462
Balance	$ 347,201	$ 171,106
Thirty per cent of gross	319,816	288,170
Interest on property, 5 per cent	198,324	146,448
Net earnings	$ 121,492	$ 141,722
City's share, 55 per cent	66,820	77,946
Company's share, 45 per cent	54,671	63,774
Eight months gross earnings	$8,188,754	
Expenses and taxes	5,429,890	
Balance	$2,758,865	
Thirty per cent of gross	2,456,625	
Five per cent interest on valuation of property	1,437,482	
Net income	$1,019,143	
City's share, 55 per cent	560,528	
Company's share, 45 per cent	458,614	

HOLYOKE STREET RAILWAY COMPANY.

The annual report of the Holyoke (Mass.) Street Railway Company has been issued for the year ended September 30, 1909. The income account compares as follows:

	1909.	1908
Gross	$488,919	$467,545
Operating expenses	263,549	311,066
Net earnings	$255,370	$156,479
Interest, taxes, etc.	128,618	109,134
Balance for dividends	†$ 96,752	$ 47,345
Dividends	85,888	82,144
Surplus	$ 10,864	*$ 34,799

*Deficit. †Equal to 9.01 per cent earned on $1,073,600 capital stock, as compared with 4.4 per cent earned on same capital stock in previous year.

WORCESTER CONSOLIDATED STREET RAILWAY COMPANY.

The annual report of the Worcester (Mass.) Consolidated Street Railway Company for the year ended September 30, 1909, compares as follows:

	1909.	1908.
Gross	$1,702,657	$1,626,143
Expenses	1,065,162	1,045,293
Net	$ 637,495	$ 580,850
Charges	394,156	375,722
Surplus	*$ 243,339	$ 205,128
Dividends	213,000	195,250
Surplus	$ 30,338	$ 9,878

*Equal to 6.85 per cent on $3,550,000 outstanding capital stock.

SPRINGFIELD STREET RAILWAY COMPANY.

The annual report of the Springfield (Mass.) Street Railway Company for the year ended September 30, 1909, compares as follows:

	1909.	1908.
Gross	$1,411,808	$1,317,138
Expenses	959,775	875,647
Net	$ 452,033	$ 441,491
Interest and taxes	261,526	255,801
Surplus	*$ 190,507	$ 185,690
Dividends	180,648	180,648
Surplus	$ 9,859	$ 5,042

*Equal to 8.43 per cent earned on $2,258,100 capital stock as compared with 8.22 per cent earned on same capital stock in previous year.

EMPIRE CITY SUBWAY COMPANY.

The New York Public Service Commission has issued a report covering the operations of the Empire City Subway Company, Limited, for the year ended December 31, 1908, as follows:

Subway rentals	$1,148,622
Miscellaneous revenue	8,741
Total revenue	$1,157,363
Operating expenses and taxes	522,359
Net income	$ 635,004
Other income	19,410
Total income	$ 654,414
Interest on funded debt	409,440
Net corporate income	$ 244,974
Surplus December 31, 1907	4,968
Total	$ 249,943
Dividends (5¾ per cent on $4,324,000 stock)	248,630
Surplus December 31, 1908	$ 1,313

KEYSTONE TELEPHONE COMPANY.

The report of the Keystone Telephone Company for the month of October and four months ended October 31, 1909, compares as follows:

	1909.	1908.
October gross	$ 91,560	$ 88,819
Expenses and taxes	45,544	43,420
October net	$ 46,016	$ 45,399
Charges, etc.	32,768	34,482
October surplus	$ 13,248	$ 10,917
Four months gross	364,411	351,006
Expenses and taxes	181,067	174,754
Four months net	$183,344	$176,252
Charges, etc.	134,596	138,166
Four months surplus	$ 48,748	$ 38,086

BERKSHIRE STREET RAILWAY COMPANY.

The annual report of the Berkshire (Mass.) Street Railway Company has been issued. The income account for the year ended September 30, 1909, compares as follows:

	1909.	1908.
Gross	$435,143	$406,150
Operating expenses	287,401	295,434
Net	$147,742	$110,716
Interest, taxes, etc.	113,032	109,439
Surplus	*$ 34,710	$ 1,277

*Equal to earning 2.1 per cent on $1,648,100 capital stock outstanding.

OLD COLONY STREET RAILWAY COMPANY.

The Old Colony Street Railway Company, of Boston, has issued its income account for the year ended September 30, 1909, which compares as follows:

	1909.	1908.
Gross	$2,934,281	$2,806,708
Operating expenses	1,847,859	1,821,451
Net	$1,086,422	$ 985,257
Other income	134,682	128,890
Total income	$1,221,104	$1,114,147
Changes	715,956	731,033
Balance for dividends	*$ 505,146	$ 383,114
Dividends	400,079	308,488
Surplus	$ 105,067	$ 74,626

*Equal to 6.2 per cent earned on $7,712,200 common stock, after deducting for a full dividend on $372,600 preferred 6 per cent cumulative stock.

AMERICAN LIGHT AND TRACTION.

The report of the American Light and Traction Company for the month of October and ten months ended October 31 compares as follows:

	1909.	1908.
October gross	$ 313,847	$ 278,220
Expenses	8,865	4,000
October net	$ 304,982	$ 274,220
Ten months gross	2,619,969	2,130,026
Expenses	88,055	40,000
Ten months net	$2,531,914	$2,090,026

CONSOLIDATED TELEGRAPH AND ELECTRICAL SUBWAY.

The New York Public Service Commission has issued a report covering the operations of the Consolidated Telegraph and Electrical Subway Company, for the year ended December 31, 1908, as follows:

Subway rentals	$1,000,560
Miscellaneous revenue	12,902
Total revenue	$1,013,462
Operating expenses and taxes	267,110
Net	$ 746,351
Other income	23,728
Total income	$ 770,079
Charges	677,281
Net corporate income	$ 92,798
Deficit December 31, 1907	28,424
Surplus December 31, 1908	$ 64,373

FORT WAYNE & WABASH VALLEY.

The report of the Fort Wayne & Wabash Valley Traction Company for the month of September and nine months ended September 30, 1909, compares as follows:

	1909.	1908.
September gross	$ 132,736	$ 122,442
Expenses	71,064	60,973
September net	$ 61,672	$ 61,469
Nine months gross	1,038,350	978,700
Expenses	608,539	553,469
Nine months net	$ 429,811	$ 425,231

KINGS COUNTY ELECTRIC LIGHT AND POWER.

The New York Public Service Commission has issued a report covering the operations of the Kings County Electric Light and Power Company, of Brooklyn, for the year ended December 31, 1908, as follows:

Non-operating income:	
Rents accrued from lease of electric plant and equipment	$ 777,533
Interest on bonds	46,520
Interest on securities, loans, etc.	2,308
Net corporate income	$ 826,361
Previous surplus	1,181,213
Total sprplus	$2,007,574
Dividends	800,000
Surplus December 31, 1908	$1,207,574

BOSTON & WORCESTER ELECTRIC REPORT.

The Boston & Worcester Electric Company's income account for the year ended September 30, 1909, compares as follows:

	1909.	1908.
Total income	†$96,505	$141,663
Surplus after dividends, etc.	*8,543	614
Previous surplus	4,753	.....
Total	$13,296	.....
Discount on notes	9,000	.....
Surplus September 30, 1909	$ 4,296	.....

*Increase of $7,929. †Decrease of $45,156.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

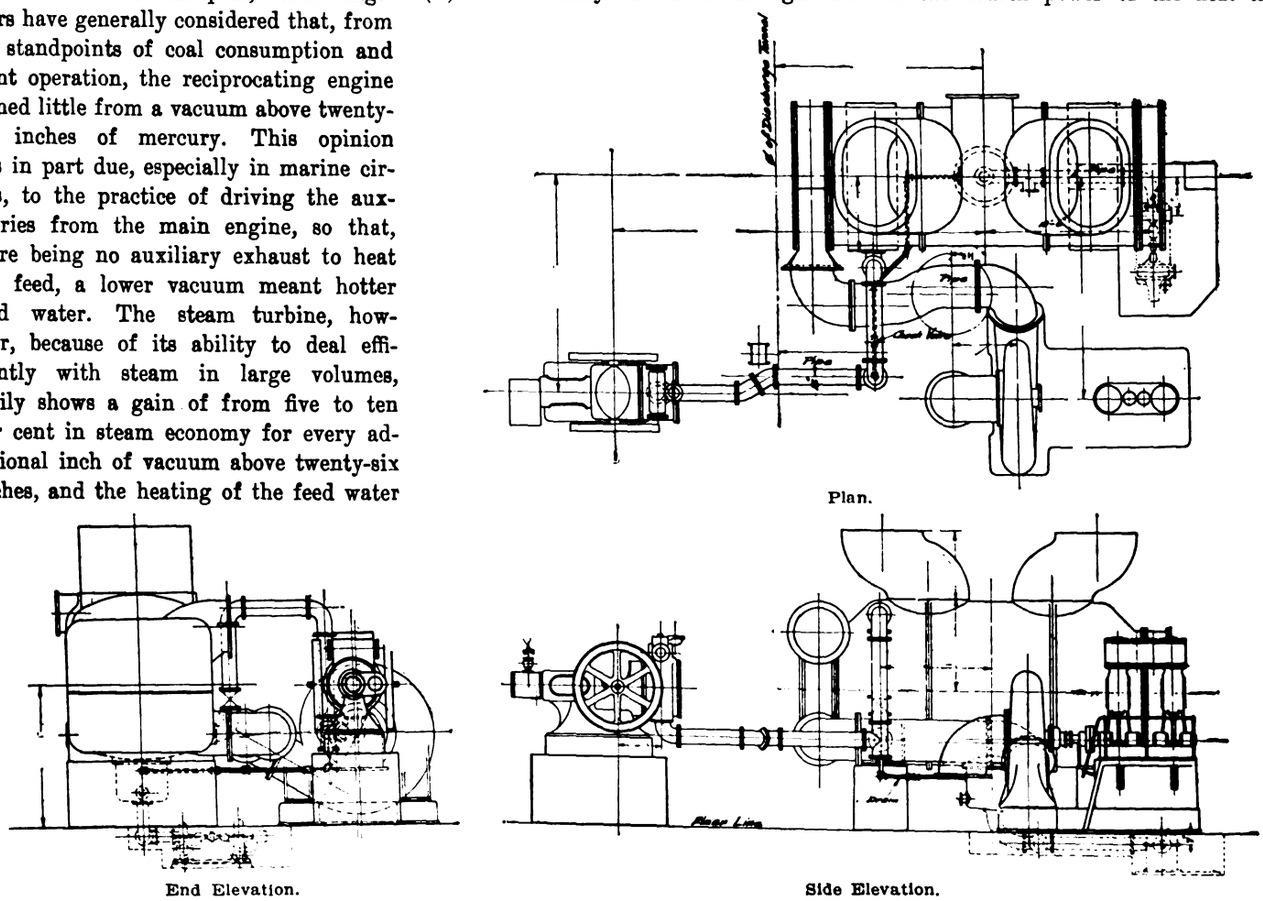
Modern Condenser Design; a Good Example and a Remarkable Test Result.

Some ten or fifteen years ago the designing and proportioning of surface condensers crystallized into a more or less standard practice, but the steam turbine, by its ability to make use of steam at low pressures and temperatures, or by its requirement of a high vacuum, has forced the question of condenser efficiency again to the front. In the past, steam engineers have generally considered that, from the standpoints of coal consumption and plant operation, the reciprocating engine gained little from a vacuum above twenty-six inches of mercury. This opinion was in part due, especially in marine circles, to the practice of driving the auxiliaries from the main engine, so that, there being no auxiliary exhaust to heat the feed, a lower vacuum meant hotter feed water. The steam turbine, however, because of its ability to deal efficiently with steam in large volumes, easily shows a gain of from five to ten per cent in steam economy for every additional inch of vacuum above twenty-six inches, and the heating of the feed water is properly left to the economizers or to heaters utilizing the exhaust of auxiliaries.

The activity of the several groups of tubes in a surface condenser can be quite accurately inferred from the rise in temperature of the water passing through them. By inserting thermometers in the water boxes it has thus been discovered that in the ordinary surface condenser most of the heat is absorbed—that is, most of the steam is condensed in the first few rows at the top. This at once suggested the possibility of a rearrangement of the tubes, so that more of them would approach the high efficiency of the top rows.

The transmission of heat through condenser tube surface may be affected by the following conditions, among others: (1) Whether or not the tube is flooded by water descending from the tubes above. (2) The velocity of water through the tube. (3) The velocity of steam against the tube. (4) Whether or not the tube is immersed in an atmosphere of air. (5) The material, thickness and cleanliness of the tube.

While much scientific investigation has been devoted to the effects of water velocity and of steam velocity, the possibilities of improvement in this direction are limited by the fact that excessively high steam velocities involve back pressure on the prime mover, while very high water velocities involve the consumption of an excessive amount of power in the circulating pumps. According to reliable experimenters, the heat transmission increases only as the square root of the water velocity, while the pressure and hence the power required to force the water through the tubes increases as the square of the velocity. That is, the power consumed by circulating pumps increases as the fourth power of the heat transmission when it is attempted to augment the latter by increasing the velocity of the water. As for the thickness of the condenser tube, it is found that this plays so little part in the final result that it can practically be neglected, while the material of the tube is usually determined by other considerations. Attention to the remaining items, namely, avoidance of air-drowning and avoidance of flooding has been rewarded with the most striking results.



Plan.

End Elevation. Side Elevation.

DIAGRAMS OF ONE OF THE FOUR WHEELER CONDENSING OUTFITS AT THE KENT AVENUE STATION, TRANSIT DEVELOPMENT COMPANY, BROOKLYN.

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Air-drowning is prevented by avoidance of air leaks, provision of sufficient air-pump capacity and arrangements for removing the air at the lowest possible temperature, and hence at the greatest density. The flooding of tubes has been met in various ways. That it becomes really serious in a large condenser will be appreciated from the fact that the large turbine condenser described later in this article discharges hourly over 220,000 pounds of condensed steam, equal to the discharge of a one-and-three-eighths-inch fire hose. This deluge of water pouring down from the upper tubes upon the lower would so effectively blanket the latter that there could be little direct communication of heat from the steam to the lower tubes.

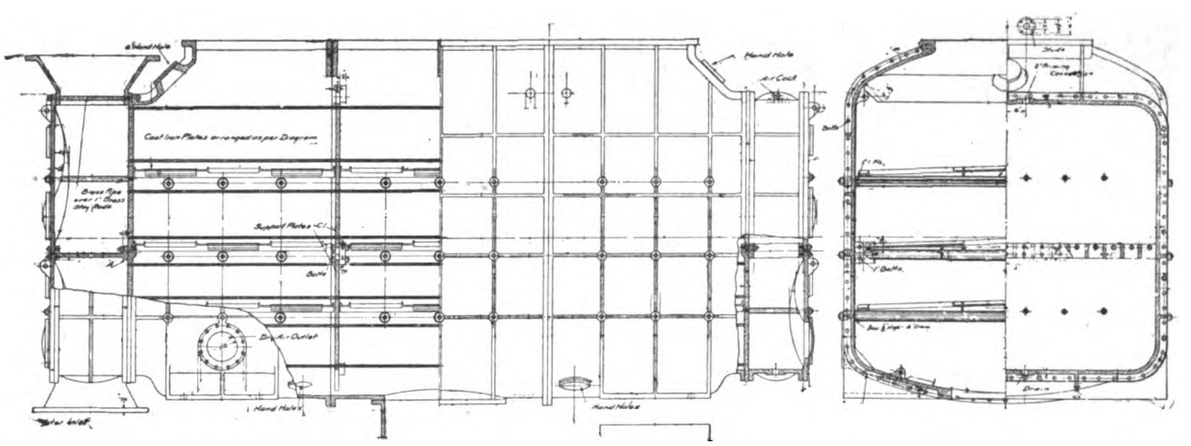
To avoid this flooding effect, some designers have arranged to have the steam flow horizontally through the condenser. This results, however, in a condenser occupying a great deal of floor space, and does not provide, moreover, for the flow of the air in the natural direction. Other inventors have sought to cut up such horizontally arranged banks of tubes into sections, place the sections one above the other, and then cause the steam to traverse the groups of tubes horizontally in succession, flowing first one way through the upper group, then in the opposite direction, through the next lower group, and so on. This involves, however, a cumbersome, heavy and ungainly condenser shell containing a great deal of waste space.

Equal or greater success has been attained with the much simpler arrangement illustrated in the accompanying drawings, showing one of four Wheeler "Dry Tube" condensers installed in the Williamsburg power station of the Transit Development Company, of Brooklyn, N. Y. In appearance this condenser is similar to the well-known Admiralty condenser, introduced by the Wheeler Condenser and Engineering Company about twenty years ago. It has the merits inherent in that design of being compact and easily accessible.

As will be noted, there are two exhaust steam inlets at the top of the shell to receive the steam from the double-flow Westinghouse turbines installed on the floor directly above. The circulating water from the Wheeler engine-driven centrifugal circulating pump is introduced into the lower compartment of the water box at one end and makes two passes through the tube before being discharged from the upper compartment of the water box. The condensation is collected in a cylindrical well, forming a part of the bottom of the condenser shell, whence it is removed by a Wheeler centrifugal hot-well pump. The air is taken from the side of the condenser at a point near the cold-water inlet and is exhausted by a Wheeler rotative dry-vacuum pump.

The novel feature of the condenser consists in horizontal baffles interposed between the several banks of tubes. These rain plates catch the water from the tubes above them and carry it to the outside against the shell, down which it flows to the hot well without coming in contact with other tubes. To permit the passage of the steam past these rain plates there are openings, around the edge of which the plate is turned up to form a vertical lip, preventing an overflow of water. These openings are so staggered that the steam will reach all parts of the tubes, insuring complete utilization of all the surface.

Simple as this expedient appears, the results obtained by means of it have been remarkable, as will be apparent from a consideration of the rate of heat transfer developed in this condenser under working conditions. It was formerly customary to assume the rate of heat transfer through surface condenser tubes, closed feed-water heaters and similar appliances as between 200 and 300 British thermal units per square foot per hour per degree difference of temperature between the water inside the tubes and the steam outside. Inasmuch as the temperature of the water within the tubes rises as heat is absorbed, while the temperature of the steam outside falls somewhat as the mixture becomes richer in air, it is necessary to adopt some method of calculating the average difference of temperature. A simple method is to take the arithmetic mean, that is, add the entering and leaving temperatures of the circulating water and divide by two to find the average water temperature, which is subtracted from the steam temperature, corresponding to the vacuum or from the mean between the latter and the hot-well temperature to give the mean difference in temperature.



LONGITUDINAL AND TRANSVERSE SECTIONS OF WHEELER "DRY-TUBE" CONDENSER.

There results then as a formula connecting the cooling surface in square feet, or S, the weight of condensed steam per hour, or W, the coefficient of heat transmission in heat units per degree difference in temperature per square foot of cooling surface, or U, and the mean difference in temperature, or D — the following equation: $S = W H/U D$; where H equals the total heat in the steam entering the condenser above the total heat in the condensation leaving the hot well, as determined from the respective temperatures and reference to the steam table.

The values of U obtained with the condenser herein described have been calculated from a test made on unit No. 6 in the above-mentioned plant on November 27, 1908. This condenser was designed to handle 180,000 pounds of steam per hour and to give a vacuum equivalent to

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two inches absolute pressure, with 70° Fahrenheit circulating water.

Results of test of Wheeler surface condenser at the Williamsburg power station in connection with Westinghouse-Parsons turbine unit No. 2:

Time of Reading.	Barometer Reading.	Vacuum, Inches of Mercury.
10:9	29.98	
10:35		28.5
10:55	29.99	
11:10		29
11:30		28.95
11:40		29
11:50		28.95
12:00	29.99	29
12:20		29
12:30		29
12:40		28.95
1:10	29.95	29
1:30		29
2:00	29.96	29
2:25		29
2:45		29
3:00	29.97	28.95
3:15		29
3:30		29
3:45		29

The transmission of heat per square foot per hour per degree difference of temperature was found in these tests, during which the rate of condensation varied from 164,586 pounds to 220,200 pounds of steam per hour, to be between 800 and 900 British thermal units, which is two to three times greater than is obtained from the ordinary surface condenser.

These results show that the guaranteed vacuum could have been maintained with even less condensing surface than was actually installed, although the latter is considerably below usual practice. That is, while the ordinary condenser would contain two or three square feet of surface per rated horsepower, this condenser contains only 1.5 square feet per rated electrical horsepower.

Another point to be noted in connection with the performance shown in the abovementioned test at the Williamsburg station is the high temperature of the condensate at all times, closely approaching the theoretical temperature of the steam vapor. Inasmuch as this condensate is used as boiler feed and as each 10° Fahrenheit amounts to about fifteen per cent of the fuel bill, this is also highly important from the standpoint of plant economy.

Electric Power in a Gas Plant.

The Providence Gas Company is making an innovation in the machinery used for handling gas by installing an electrical system for the purpose. Bartlett, Hayward & Company, of Baltimore, who have charge of the work, have arranged with the Allis-Chalmers Company, of Milwaukee, for the necessary generating equipment. This will consist of two complete units, each unit being made up of an engine and generator, direct-connected, together with the necessary condensers and electrical control apparatus. The engines are Allis-Chalmers Corliss, cross-compound, direct-connected to 300-kilowatt, 240-volt, direct-current generators.

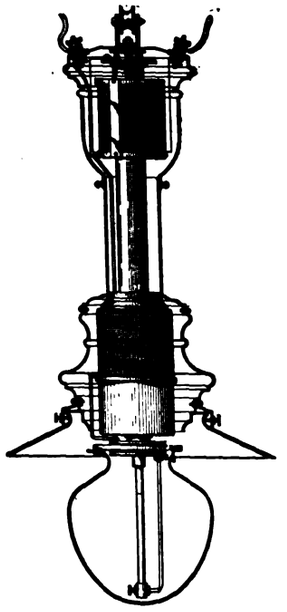
The Sunray Arc Lamp.

The carbon arc lamp reached a considerable degree of perfection some years ago and came into extensive use by reason of its many advantages, but whether because the most competent designers sought entirely new lines, or the inertia of large commercial interests retarded its progress in this country, it remained practically at a standstill for more than a decade.

An intimate experience with the arc lamp almost since its first commercial introduction and an appreciation of the fact that it has an added advantage of cheapness has led the Sunray Electric Lamp Manufacturing Company, New York, N. Y., to the determination to bring this neglected form of electric light up to a full realization of its possibilities. This company is placing on the market, therefore, an arc lamp called the "Sunray" which it claims will stand the severest tests of both theory and practice.

The Sunray lamp is much smaller than the old type of arc lamp. As may be seen in the accompanying diagram the arrangement of the mechanism of this lamp is perfectly symmetrical, being built on the concentric principle. A one-inch brass tube forms the axis and serves as the support of the other parts. The magnet is wound around this tube at the top and the resistance wire is on a porcelain spool at the bottom. Within this tube there is a square brass tube, which holds the upper carbon and has the pole piece of the magnet attached to the upper end. The dashpot is in the upper end of the outer tube. This tube thus serves not only as a support but furnishes a perfectly dust-proof enclosure for all of the moving parts.

The magnet is wound with fireproof insulated wire and has a practically complete magnetic circuit of soft iron. The resistance coil consists of a special wire having a very high specific resistance and low temperature coefficient. The dash pot has an automatic release on the down stroke, permitting of instantaneous pick-up and feed. This feature, combined with an accurately proportioned sensitive magnet and the Sunray clutch produces perfect regulation and an invisible feed with resulting steadiness in light.



SECTION OF SUNRAY ARC LAMP.

INDOOR TYPE SUNRAY ARC LAMP.

All of the parts are of ample strength and weight for their purpose and can be reached for attention as easily as the parts of an ordinary kerosene lamp burner. Sunray lamps are made to run in multiple on direct-current circuits of 110 to 120 volts and 220 to 240 volts. The 110-volt lamps are built in two sizes consuming 330 and 440 watts respectively, with 240 to 320 watts at the arc. The 220-volt lamps are made in three sizes consuming 440, 550 and 660 watts respectively, with 300, 375 and 450 watts at arc.

These lamps are regularly equipped with a single enclosing globe of opalescent glass, or with an opalescent outer globe and a clear inner globe. An illustration of a Sunray lamp as equipped for indoor service is shown herewith.

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Electric Railway Tower Wagon.

A new and very convenient method of application of trackless electric vehicles for electric-railway service is developed in the form of an electric tower wagon manufactured by the General Vehicle Company, of Long Island City, N. Y., views of which are shown herewith. The entire equipment of this tower wagon is mounted on the well-known two-ton chassis of that company. All spring supports and special parts are vanadium steel castings, and all renewable parts are accurately machined to size. Friction has been eliminated by the use of Hess-Bright ball bearings on the armature shaft, and Timkin roller bearings for all wheels and countershafts.

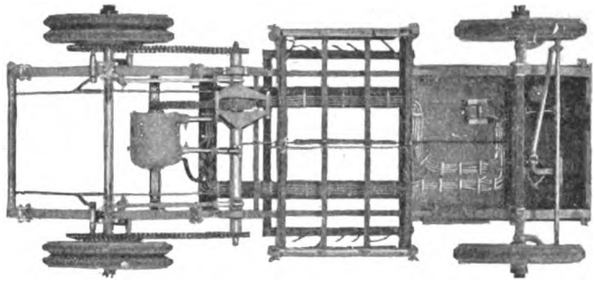
The illustrations show the entire construction of the chassis. The frame is constructed of steel channels of such proportions as will best support the mechanism and carry the load most efficiently. The forty-four-cell storage battery, which furnishes electricity to the motor at eighty-five volts, is suspended below the main frame in a substantial cradle, where it can be reached easily. The battery is in sectional form, in crates of such weight and size as can be easily removed and replaced from either side of the vehicle, entire or in sections.

The controller is the continuous-torque type, which changes motor speeds by degrees without interrupting the power supply. This gives a smooth, even acceleration, without jar or strain of any kind. This increases the life of the controller, battery, motor, chains, sprockets, gears and tires.

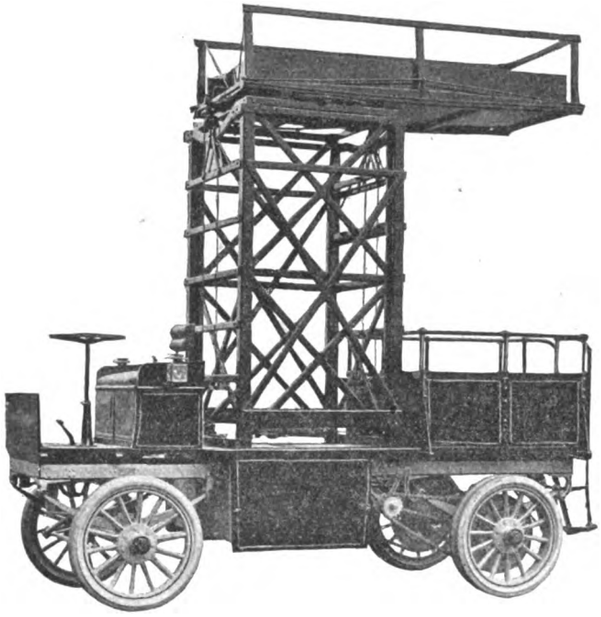
The single electric motor used is especially designed for the sort of service demanded in electric transportation. It is built along the lines of an electric-railway motor with strong, rigid shaft, simple, durable brush fittings, and a capacity for heavy overloads. The armature shaft of the motor turns on frictionless ball bearings which increase the value of the other advantages of this design. The motor is suspended on a cross-bar pivoted to the side frames in front of the rear axle. This pivoted suspension keeps the motor shaft parallel with the countershaft throughout the entire range of chain adjustment, and permits the successful use of an efficient silent chain drive. The motor is totally enclosed and protected from water and dirt at all times. It is high above the ground and may be easily examined from the rear by opening a hinged cover in the motor frame.

Easy-running roller-bearing chains drive the rear wheels from the countershaft. Large diameters and properly designed teeth, combined with the frictionless roller chain, decrease transmission losses to a minimum. A single broad silent chain of the tooth-link type drives the countershaft from the motor pinion. A simple and rigid adjustment is provided to keep the chain in its most efficient operating condition.

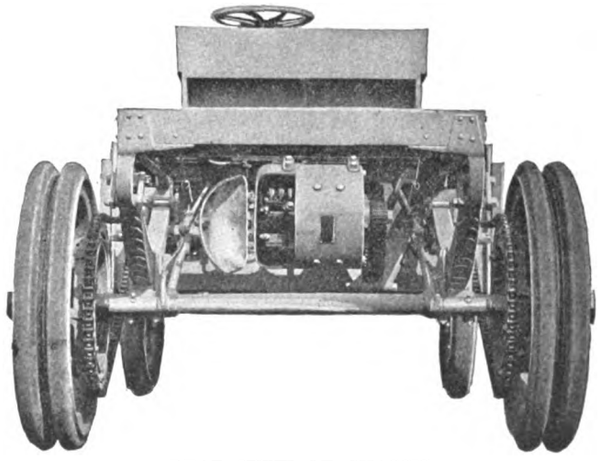
The artillery-type wheels have roller-bearing hubs, giving maximum strength and minimum friction. Solid rubber tires are used on all wheels. To carry the load easily and transmit tractive effort efficiently, the tires vary in design for different capacities. On the trucks of 4,000 pounds capacity and upward broad single tires are used in front, and solid double or twin tires on the rear wheels. The half-elliptic springs, both front and rear, are designed for the load liable to be imposed upon them according to standard capacity rating. Internal expansion leather-faced brakes on both rear wheels are controlled by a foot lever at the base of the steering post. The steering gear is wheel-operated through a vertical steering column, to the gear and sector, which can be relied upon at all times, and is simple, strong, and easily handled.



UNDERVIEW OF CHASSIS.



GENERAL VEHICLE COMPANY'S TOWER WAGON.



REAR VIEW OF CHASSIS.

The tower wagon has a speed of twelve miles per hour, and a range of service of forty miles on one charge of battery. The wagon has sufficient space for seven men in addition to the driver; also space for tools, and materials for repairs.

One of the important advantages of the electric wagon is its immediate readiness for service; where adopted it will not be necessary for electric-railway companies to maintain a team of horses constantly harnessed, ready for emergency service; the constant care of horses can be eliminated.

A broader adoption of electric vehicles by street-railway companies will enable them to entirely discontinue horse service. The amount of current required to charge

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the battery for wagon operation will not be any source of expense to the electric-railway company. The electric emergency wagon can be held always ready for immediate service, and drives at a speed to the limit of safety of city traffic.

The Heany Multiple Alternating Current and Direct Current Arc Lamp.

An extremely simple and efficient arc lamp with a number of new features and based on the Heany patents is being placed on the market by the Lord Electric

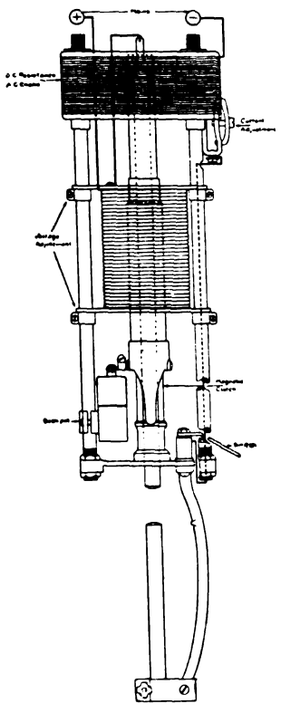

DIAGRAM OF HEANY LAMP.

HEANY ARC LAMP.

Company, 213 West Fortieth Street, New York, N. Y.

The most notable feature of this lamp is the combined core and clutch which regulates the length of arc. This core consists of two semi-tubular members pivoted together and arranged to slide on the carbon-containing tube which runs through the center of the solenoid. At the lower end of the clutch are two jaws adapted to grip the upper carbon. When the armature is energized by the coil surrounding it the semi-tubular members will act as like poles and repulsion will take place, throwing the jaws together and gripping the carbon. Responding at the same time to the effect of the solenoid coil, the carbon is drawn upward establishing an arc. As the current decreases slightly the jaws relax, allowing the carbon to slip downward. This obviates any breaking of the arc. The current consumption of this form of lamp is from three-and-one-half to five amperes at from ninety to ninety-five volts arc voltage on a 110-volt line.

Tests made with careful adjustment show a life of the carbons at one trimming of something over 200 hours. It is rather interesting to note that the following severe test of the lamp was made in order to demonstrate the electrical and mechanical stability of the lamp to the satisfaction of its makers: The lamp was taken burning from the line, plunged into water for twelve hours, and on being taken out was immediately put into the circuit again, burning as well as ever. The Lord Electric Company is also developing other types of arc lamps adapted for various lighting requirements, but embodying the same general principles.

Telephone Train Dispatching on the Atchison, Topeka & Santa Fe Railway System.

A system of telephone train dispatching has recently been completed and put into service by the Atchison, Topeka & Santa Fe Railroad Company on its Illinois division, between Chillicothe, Ill., and Dearborn Station, Chicago, a distance of 134 miles. On this circuit the dispatcher is located at Chillicothe. There are thirty way stations in which telephones and selective equipment have been installed.

With the completion of this circuit, the Atchison, Topeka & Santa Fe trains running out of Chicago are handled by the telephone as far as Newton, Kan. A total of 660 miles is covered from Chicago to Newton. There are on this section a total of 170 way stations, all equipped with standard Western Electric telephone train-dispatching apparatus and Gill bridging selectors. Each of these stations has direct communication over the telephone with the dispatcher of its division.

A New Electric Rectifier.

We have had an opportunity, says the *Lancet* (of London, Eng.), of examining a new instrument for rectifying alternating currents into unidirectional impulses. It is supplied by the Premier Ampero Electric Company, London, W., and will be found a most useful and efficient apparatus for charging accumulators, such as are used for motor ignition and various kinds of medical work, in those districts where the current from the main is an alternating one. The principle upon which it is constructed is somewhat the same as that devised by Doctor Batten some years ago, but it is more efficient and rather more silent in action. A great feature of this instrument is that the point on the pressure curve of the alternating supply, where the current is picked up and cut off, is adjustable and can be arranged to take place at the voltage of the cells. At such times as the charging current is at a lower voltage than that of the cells undergoing charge the circuit is open and no current can pass back through the rectifier. When properly adjusted, which is a very simple procedure, there is no visible sparking at the contacts. On our visit we saw the instrument converting an eighty-five-cycle alternating current into direct current and charging some ignition cells, and also running a small direct-current, shunt-wound electric motor, which latter, as is well known, will not work with an alternating current. If the main supply should fail from any cause the instrument cuts itself out of circuit automatically. It will work on any periodicity in ordinary use, starts and runs on any load, requires no attention, and is efficient in any position. The makers claim that the instrument will go for six hours a day for six months without attention, and then all that is needed is a new set of platinum contacts, at a trifling cost. The directions to be followed are extremely simple, and altogether we have seen no better instrument for its purpose.

It is predicted that logging by electricity will soon become the general practice in the woods of British Columbia, at all points where electricity is available. With the displacing of the steam engine, ninety-five per cent of the forest fires would disappear.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, NOVEMBER 12.—Louis Brennan, with his wonderful monorail, gyroscopically-balanced locomotive, is once more in the public eye. A few years ago Mr. Brennan demonstrated the possibilities of his remarkable invention in the form of a model which, owing to its small weight, could be made to run on a single wire, while its evolutions on a single rail were well-nigh perfect. Since then, the inventor has been working quietly upon a full-size locomotive, but this was far from complete when news reached him early this week that a German engineer intended to give public trials in Berlin with a similar contrivance having a length of seventeen feet. Without any hesitation, Mr. Brennan decided, incomplete as his engine was, to give public trials of his full-size structure. This is forty feet long and carries two gyroscopes three feet six inches in diameter, each weighing three-quarters of a ton. The gyroscopes work at 3,000 revolutions per minute. They are on a vertical plane, and the working of the unfinished car, with only a twenty-horsepower generator for supplying energy to the electric motors which drive the wheels, showed the degree of perfection obtainable. No feeling of instability was detected. Ordinarily an eighty-horsepower generator will be employed, but the apparatus which first came handy upon an emergency had to be used, or the demonstration could not have been given. The gyroscopes are driven by shunt motors. Mr. Brennan claims that the Germans have copied his ideas, hence his desire to get his full-size vehicle before the public. The vehicle is ten feet wide and will be thirteen feet to the roof, when this is fitted. At present only the driver's cab is enclosed. The car is mounted on four wheels, in pairs, on independent trolleys, and these readily negotiated a curve with a radius of thirty-five feet. It may be stated that Mr. Brennan has been financially assisted in his experiments by the British and Indian governments to the extent of $75,000.

The London County Council has at last evolved a system of electric traction which will overcome the objections of the Astronomer Royal to the construction of tramways in the neighborhood of the Royal Greenwich Observatory. The Astronomer Royal stated that neither the conduit system nor the ordinary trolley system, nor even the three-wire system, in which the currents in the return circuit are balanced, eliminated the danger of stray electric currents which would interfere with the working of the delicate instruments in the observatory. Consequently, it has been arranged to construct the tramways to which objection had been taken upon the overhead system, but using two wires instead of one for each track. In this way only can the complete insulation of all the conductors be assured.

In consequence of two recent accidents in which passengers upon the top decks of tram cars have received fatal shocks from the trolley standard, the Board of Trade has issued a warning to tramway authorities. On all cars there is fitted a red lamp, which should glow when the framework of a car is "alive," but periodical inspection of this circuit is not general and on each occasion the circuit has been interrupted. The Board of Trade now suggests a daily inspection to ascertain that the trolley standards are properly insulated, and also the provision of a magnetic blow-out fuse which will give an audible signal of the failure of the insulation.

The action by the General Electric Company against the English Welsbach Company for using the trade-mark "Aur" upon metal-filament lamps which the latter company is selling, promises to be a long and complicated affair.

An amusing case has just concluded in the law courts in which a music-hall performer who styled himself a "hypnotist, bloodless surgeon and medical electrician" has been ordered to repay to a pupil of his $5,000 paid as premium to be taught these learned professions. Frankly speaking, the whole thing was a sham, hypnotic "subjects" forming part of the "doctor's" traveling company. A part of the show was the "marvelous" feat of taking a shock at 30,000 volts, but the apparatus turned out to be no more dangerous than an ordinary hospital high-frequency equipment, to which added effect was given by firework paper. The exposure in court has had the effect of the "doctor" being driven off the stage of a music hall where he continued to perform after the verdict against him was pronounced.

At the meeting of the Institution of Electrical Engineers last night, a marble bust of the late Dr. John Hopkinson was presented by his widow. Dr. John Hopkinson was twice president of the institution and met his death in 1898, at the early age of forty-nine years, during a holiday in the Alps. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, NOVEMBER 11.—The French government has been engaged for some time past in organizing a system of military wireless telegraphy in order to make connection in the best possible way between the Eiffel Tower and the larger posts in various parts of the country and also to give the proper connection between the coast stations, so that the entire country is covered in this way. At the same time measures have been taken for the proper signaling in the Mediterranean region, so as to connect with the ports which are established at Algiers and Tunis. On the fifth of November the high power station at Toulon was opened for use, and it is exclusively devoted to military service like the stations on the north African coast at Oran and Bizerta. These stations use a standard wave length of 750 metres and work daily from 9 a. m. to midnight. It is intended from now on to use wireless signals between the coast stations and Paris to replace ordinary telegraphy as much as possible. For the battleships these are to be provided with an extensive outfit such as was recently installed on the Patrie. There is being erected a high power station on the coast of Rufisque, in Senegal, and this is to connect with the Eiffel Tower.

Peat is to be employed in a large electric plant recently erected in Germany at Aurich, in Hanover, and the Prussian government is interested in the enterprise. The station has already started to work and is furnishing current. It is located near extensive peat bogs, and is to use this kind of fuel exclusively. A large amount of current from this plant is to be used by the government for light and motors in the port of Emden.

It is intended to erect an electric plant of some size upon the Rhine in the region of Kembs, Alsace. This work is to be carried out in connection with the proposed improvements in the navigation in this locality, and a commission appointed by the different states interested in the matter is now considering the project. The final plans for the work are nearing completion at present.

In Austria there is to be installed a network of power lines covering the country in the region of Gloggnitz. The station is located on the falls of the Weissenbach. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., NOVEMBER 20.—At a meeting of the bondholders of the Mexican Northern Power Company, held in Montreal, permission was given for an increase of the bond issue from $7,500,000 to $10,000,000. The capital stock is also to be increased from $10,000,000 to $15,000,000.

The electric log piler recently installed by the Maclaren Lumber Company at Buckingham, Que., has proved a success. The logs are hoisted to the rollways by means of an endless chain which is run by an electric motor installed on a float placed in the eddy.

A special committee, dealing with the standardization of equipment, reported at a meeting, held in Toronto, Ont., of engineers representing twelve municipalities in the Niagara Power Union, in favor of the adoption of a luminous arc lamp in business districts and a similar type of tungsten incandescent lamp for use in the residential districts.

The city of Hamilton, Ont., will shortly launch an organized movement to get the Dominion government to build a new Welland Canal on the old Grand River-Hamilton Canal survey. It is claimed that the scheme would give Hamilton the cheapest power on the continent, and this, it is believed, will induce 350 manufacturers in Hamilton to throw their influence in its favor.

The Galetta Electric Power and Milling Company, which took over the plant of the Arnprior Electric Light and Power Company two months ago, is now supplying the town of Arnprior with electricity. The Galetta plant is one of the most up-to-date of electrical concerns. The waterpower is quoted at from 1,800 to 2,400 horsepower, with a twenty-eight-foot head.

The Board of Railway Commissioners for Canada, in reference to the application of the Bell Telephone Company against the Nipissing Power Company, has ruled that all electric power or transmission companies, whether federally or provincially incorporated, must obtain an order of the board before crossing the lines of any telephone company. The intent of the law was to protect the public.

That the Canadian telegraph and telephone companies will stand entirely aloof from the great merger that is on the point of consummation in the United States, is emphatically declared

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by the officials of the various companies in Canada. According to the New York despatches, the Bell Telephone Company of Canada is to become a part of the combine. This is absolutely denied, as the control of this company is firmly in Canadian hands. So, too, with the telegraph companies. Neither the Canadian Pacific Railway Telegraph nor the Great Northwestern is to form a part in the merger, although both have business connections with individual companies across the border. Besides the Canadian Pacific, the Great Northwestern and Western Union in Canada, the Mackenzie and Mann transcontinental railway system is building its own telegraph line, as is likewise the Grand Trunk Pacific Railway. To the Dominion government is left the non-productive lines on the St. Lawrence and Labrador, and that to the Yukon and other scattered bits in lone territories.

A definite announcement concerning the gigantic scheme of the Dominion Power and Transmission Company, which will build an electric passenger and freight line from Niagara Falls to Hamilton, Toronto and Windsor, in the province of Ontario, with a branch from Hamilton to Waterloo, Guelph and that district, may be expected early next year. The company is said to have matters in good shape for carrying the great undertaking into effect, and is understood to be only waiting the federal parliament's verdict on applications for certain other charters before making a move. The promoters are applying for power to secure running rights over the Radial Line from Burlington to Toronto. The Dominion company at present has an electric line running from Beamsville to Brantford. A new line for high-speed electric cars is to be built from Niagara Falls to Hamilton, and the present Radial Line extended from Oakville to Toronto. The London & Lake Erie Company, capitalized at $2,000,000, to run from London to Brantford, will be a second link in the big scheme, while the purchase of the Windsor, Essex & Lake Shore line, for which negotiations were begun some time ago, will probably complete it.

Among the important questions of international interest dealt with in the report of the International Waterways Commission, tabled in the Canadian Commons, are those concerning the Niagara and other hydroelectric enterprises. In regard to the diversion of 40,000 cubic feet of water per second from the lower Niagara, it was agreed that such would not seriously affect the scenic beauty of the rapids. The commission had heard nothing of the Long Sault damming project since November last. The new plan is now before the Dominion government. In respect to the Cedar Rapids proposition, the commission recommended the granting of the application of the Cedar Rapids Manufacturing and Power Company to construct power works on the north side of Cedar Rapids, and to divert 56,000 cubic feet of water per second from the St. Lawrence. American power plants divert from the Niagara Horseshoe Fall a larger amount of power than was supposed. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

POWER PLANT FOR SNAKE RIVER—Work is being pushed on the new $2,500,000 power plant of the Idaho-Oregon Light and Power Company in the Ox Bow of the Snake River. The plan is to construct a dam one hundred feet in height and to dig a tunnel through 1,000 feet of solid rock. The water is to be diverted from a long bend through the tunnel. At present it is intended to install a 100,000 horsepower plant, but arrangements are made so that the horsepower can be quadrupled. The large part of the power developed is contracted for by mining companies in the Seven Devils district.

NEW MEXICO POWER PROJECT—One of the most important hydroelectric projects in New Mexico is under construction at High Rolls. The water of the perpetual stream which flows through the town is to be utilized for generating power. The construction of the pipe line which is to carry the water from High Rolls to the brink of Box Cañon was started recently. At Box Canon the water will have a fall of 1,000 feet, with sufficient flow to generate 5,000 horsepower of electrical energy. The proposed hydroelectric plant will be admirably situated and more units can be added as the demand for power may justify. The Alamo Water Power Company, of High Rolls, is carrying out this enterprise. It will build transmission lines from the hydroelectric plant to the towns of Alamogordo, Tularosa and other places in this part of New Mexico. Later on the power transmission system may be extended to El Paso, Tex. H. La Salle is general manager and chief engineer of the company.

LIGHTING AND POWER.

(Special Correspondence.)

FESTUS, MO.—This city has voted bonds to the amount of $15,000 for electric lights. P.

ANGLETON, TEXAS—E. M. Masterson will begin at once the erection of an electric-light and ice plant. P.

FOREST GROVE, ORE.—A franchise has been granted to A. Welch to furnish an all-night electric street-lighting service for this city. A.

MERRILL, WIS.—It is stated that a large company is planning the construction of another dam across the Menominee River near here. The proposed dam will develop 6,000 horsepower. M.

RAMSAY, LA.—The Greenlaw Lumber Company of this city is installing a modern electric light plant.

NASHVILLE, ARK.—B. H. Rainwater, Junction City, Ark., is figuring on the installation of an electric-light plant. P.

TERRELL, TEX.—This city will vote, November 23, on the issuance of $10,000 in electric-light improvement bonds. P.

PAENIA, COLO.—The German Mesa Electric Illuminating Company has been incorporated with a capital stock of $2,500. P.

ACKERMAN, MISS.—Contract for installing a $35,000 light and water plant has been let to Walton & Wagner of Atlanta.

LINDSAY, OKLA.—A water system and an electric light system have recently been installed in Lindsay at a cost of $40,000.

SACRAMENTO, CAL.—The Great Western Power Company is preparing to supply power for the gold dredgers at Folsom, Cal. A.

MINNEAPOLIS, MINN.—It is proposed to install electric side lights on Central Avenue, and the St. Anthony Falls Bank has subscribed $1,000 towards it. C.

SANTA ROSA, CAL.—H. C. Eastman has been granted a franchise for an electric transmission line from Sebastopol to towns in western Sonoma County. A.

MARTINEZ, CAL.—Bids will be received up to December 6 for a fifty-year franchise for an electric distributing system along the roads of Contra Costa County. A.

SAN MATEO, CAL.—Bids will be received by the Board of Supervisors for the installation of electric lights in the East San Bruno and Colma lighting districts. A.

LAKE CITY, MINN.—The Lake City Lighting, Heating and Plumbing Company has the contract for the installation of electric motors in the elevators of Peter Beck & Son. C.

CHIHUAHUA, MEX.—The state government has granted to Manuel Gameros and Alberto Terrazas, both of this city, the right to develop hydroelectric power in this district. A.

SPOKANE, WASH.—The Northern Idaho and Montana Power Company has acquired the plant of the Big Fork Water Company, at Kalispell, Mont., and will enlarge and improve it. A.

OKLAHOMA CITY, OKLA.—At a recent election two twenty-one-year franchises were granted to the Oklahoma Gas and Electric Company for gas and electric-light privileges.

LAKE MILLS, WIS.—A special election is to be held at Lake Mills to decide whether to purchase the plant of the Creamery Package Company, to be used as a lighting and power plant. M.

SHERIDAN, ILL.—The Fox River Hydro-Electric Company has been incorporated with a capital of $54,000, to operate electric plants. The incorporators are: J. W. Carr, R. J. Rowe and T. H. Bellrose.

BEND, ORE.—Lolis Deener, of Prineville, vice-president and manager of the Pioneer Telephone and Telegraph Company, has applied for a franchise for an electric-light and power plant in this city. A.

CHESTER, S. C.—The new Eureka mill, as well as the old section of the plant, is being fitted out with electric drive, and the entire machinery of the plant will be driven by electricity as soon as the change is completed. L.

APEX, N. C.—The town has granted a twenty-year franchise to A. J. Martin, to build and operate an electric plant, which is to be installed by January 1, 1910. It is probable that power for industrial plants will also be offered. L.

PORTAGE, WIS.—The Southern Wisconsin Power Company are erecting an electrical transmission house that will cost $40,000. The building which will be completed, will be used as a distributing point of the electrical power from the Kilbourn dam.

GOUVERNEUR, N. Y.—The Oswegatchie Light and Power Company is preparing to build a hydro-electric plant at Hailesboro. The Oswegatchie River, which has a natural fall of twenty-five feet will be dammed, so that 3,000-horsepower will be obtainable.

DANBURY, N. C.—The state has granted a charter to the North Carolina Traction Company, $2,000,000 capital, to build a system of electric railways diverging out from Danbury, developing surrounding timber lands, etc. H. P. McKnight, of Southern Pines, is the principal stockholder, associated with him being E. Hillman, Aberdeen, N. C.; W. C. Reflert, Harrisburg, Pa., and E. L. Krafft, of Indianapolis. L.

SALT LAKE CITY, UTAH—The Manti Light and Power Company has filed application with the state engineer for ten cubic feet per second of the flow of Manti City Creek in Sanpete County for electrical power purposes. The company intends to erect a loose rock dam and divert the required water by means of a pipe line, half a mile long, to the power house. The plant

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will be equipped with two Pelton water wheels operating under a head of 444 feet of water and generating 430 horsepower. The power generated will be used for electric lighting and propelling machinery in Manti and towns in the vicinity.

STEVENS POINT, WIS.—The Dells Paper and Pulp Company of Eau Claire has given W. U. Uke & Company the contract to erect a dam about 900 feet long across the Chippewa River at Jim Falls. The structure will be on concrete and stone. A 50-foot head will be obtained. M.

OROVILLE, CAL.—The Western Power Company has completed its installation and current is now being supplied to the substation at Oakland. This company has one of the longest transmission lines in the United States, extending from Big Bend to Oakland, a distance of 158 miles.

DARLINGTON, S. C.—The Darlington Water and Electric Company has been granted a charter, with $50,000 capitalization, to conduct a general power and light business. The incorporators include A. P. Maloney, president; W. N. Haynesworth, vice-president, and L. C. Ritchie, secretary. L.

CANTON, N. C.—It is reported that another electric line in this section of the state will be built to extend from Asheville to Waynesville, via Canton, through the mountain section, a distance of about thirty-five miles. Mr. McCormick, of Chicago, is interested and is seeking to procure right of way.

YORK, PA.—To overcome the handicap of scant current during times of low water at the York Haven Water and Power Plant, the Edison Company, of this city, is installing a 525-kilowatt engine and generator at its local plant. This with other machinery put in will, it is thought, meet every emergency. O.

ROXBORO, N. C.—The town has let the contract for electric lights for Roxboro, Mr. J. Maxwell, of the General Electric Company, at Baltimore, having been in the town for some days in the interests of his company and in advising with the Council relative to the installation of the system. L.

CLINTON, N. Y.—Mr. C. A. Borst has made arrangements with the council whereby he has secured a contract to furnish municipal street lighting. He has just placed an order for station equipment with Allis-Chalmers Company, consisting of an engine and a 100-kilowatt, 2,300-volt, sixty-cycle, two-phase generator.

ROCK HILL, S. C.—The Rock Hill Water and Electric Company is chartered, with a capital stock of $100,000, to carry on a general power, light and water business. Those interested include A. P. Maloney, president; W. T. Fewell, vice-president; J. S. Mitchell, secretary, and L. C. Ritchie, treasurer. L.

ST. LOUIS, MO.—The Light and Development Company, of St. Louis, has made application to the Municipal Assembly for a franchise to run for thirty years and proposes, if the franchise is granted, to go into competition with the Union Electric Light and Power Company in supplying electric light in St. Louis.

JACKSON, GA.—The Schott Engineering Company, of Chicago, is building the power transmission lines to Macon, Ga., and other points, steel towers being used costing $500 each, and being set at a distance of 500 feet apart. The first line is being constructed from the power plant on the Ocmulgee River to Macon. L.

MARION, S. C.—The Marion Water and Light Company has been granted incorporation papers by the state, with a capital of $50,000, to conduct a water and light business, officers and stockholders being as follows: President, A. P. Maloney; vice-president, P. A. Willcox; secretary, J. S. Mitchell, and treasurer, L. C. Ritchie. L.

HUNTSVILLE, ALA.—Articles of incorporation of the Gurley Light and Power Works Company have been filed in the Probate Court. The company has an authorized capital of $10,000, and $6,000 of this amount has been subscribed. The corporation has a franchise at Gurley, and a contract to light the streets with electric lights.

ALBANY, N. Y.—The Islip Electric Light Company, of Islip, has been incorporated with a capital of $20,000. The directors are: William H. Moffatt, Frank D. Creamer, John H. Vail, Bradish Johnson, Stephen Kelly, Charles O. Doxsee, Caleb T. Smith, Benjamin Welles, Elliott J. Smith, George W. Weekes, Jr., Benjamin S. Raynor and Egbert Z. Smith of Islip, and J. Theodore Wulf of East Islip.

EAU CLAIRE, WIS.—The Wind Electric Power Company has been organized with a capital stock of $30,000 for the purpose of manufacturing a machine using wind power for the generation of electricity, which can be used to run farm machinery, and for other useful purposes. The incorporators of the company are Frank S. Culver, of Madison, and R. T. Lange and F. S. Lange, both of Eau Claire. M.

CHATTANOOGA, TENN.—A deal has been consummated by which the City Gas and Electric Company, of Murfreesboro, passes into the hands of Davis & Elam, proprietors of the Walter Hill Power Company. The two companies have been operating in Murfreesboro for several months, and the competition was so sharp that the price of electricity was exceedingly low. The new company has announced an increase in rates.

JUNCTION CITY, ORE.—The Northwestern corporation has purchased the electric-light plant here and will soon install a twenty-four-hour service. As soon as the transmission line can be built the city will be supplied with light and power from the plant at Springfield, which already furnishes electricity for that city and for Eugene.

KILBOURN, WIS.—The engine running the dynamo which furnishes Kilbourn with electricity for lighting was so badly wrecked recently that it is beyond repair. It has been decided to use power from the Southern Wisconsin Power Company's hydroelectric plant here. Kilbourn will be without lights until this arrangement is completed. M.

HAMPTON, VA.—Announcement is made that the Capital City Beach Corporation, which holds extensive water-front property above Buckroe Beach, has perfected arrangements with the Newport News & Old Point Electric Railway Company to extend its electric lines to the site mentioned, where a summer resort and numerous cottages will probably be built soon. L.

SALISBURY, N. C.—At midnight, November 15, electric power was turned on for the first time over the lines of the Southern Power Company, via Albemarle, the power coming from the Great Falls plant, in South Carolina. A transformer station, representing an outlay of $100,000 is in use here, this station to be used as a center of distribution for a number of towns within a thirty-mile radius. L.

SYRACUSE, IND.—The Syracuse Electric Power Company has completed its hydraulic plant on the Elkhart River, six miles from this city. The company has built a transmission line from the plant to Syracuse, Milford and Benton, a distance of seventeen miles. In addition to furnishing these towns with light and power, a large number of farmers have tapped the wires and equipped their country homes with current for lights and power for grinders, pumps and churns. The company was organized by J. S. Neff. S.

BRISTOL, VA.—The Bristol Gas and Electric Company has closed a deal for the harnessing of a river near Bristol, for the purpose of generating electricity for light and power purposes. The deal involves between $250,000 and $500,000, and under the contract with the water power company it is to deliver the current to a substation in Bristol on or before July 1. The power will be sufficient to run all of the industries in Bristol and many more. Ben L. Dulaney, of Washington, is the president and principal owner of the company.

ROCK HILL, S. C.—The Town Council has rejected three propositions made by the Philadelphia owners of the present city lighting plant, one to sell for $145,000, and the other two for short and long term contracts, and has voted for municipal ownership, and a petition for a $35,000 bond issue for lighting purposes was ordered circulated. The town will probably order the old company to remove its poles from the streets. From a different source is announced the organization of an electric-light and power company for Rock Hill, by local and other incorporators. L.

CHARLOTTE, N. C.—There is a rumor that the J. B. Duke interests, controlling the Southern Power Company, of this city, are considering the purchase of the entire Whitney plant, near Salisbury, N. C., upon which many hundred thousand dollars had been spent, prior to the suspension of operations, resulting from legal entanglements. The Whitney company rivaled the Southern Power Company in its possibilities, and the rumor of a possible merger of these two interests, with the Dukes as the largest financial backers, has created much interest in electrical circles. L.

NEWPORT, N. Y.—The directors of the Newport Electric Light and Power Company have made arrangements with George W. Fowler & Company, 20 Broad Street, New York, to offer for sale $50,000 first mortgage six per cent gold bonds of the Newport company, proceeds from which are to be used for extensions and improvements to the property. These bonds are part of an authorized issue of $75,000, permission for which issue was granted by the Public Service Commission, Second District, state of New York, in 1908. The Newport company owns valuable water rights on the West Canada Creek in Herkimer County, from which stream power is derived to run the plant. While at the present time less than 500 horsepower is being used, the available capacity of the stream at Newport exceeds 2,500 horsepower, and developments are now under way, whereby the full capacity of the stream may be utilized. A new dam and power house will also be constructed. Originally the electric system was direct current, but an entirely new system of alternating current high-tension service is being planned, and will be installed with transmission lines extending to Cold Brook, Poland and the surrounding country within a radius of fifteen to twenty miles, in which localities, franchises and municipal contracts have been secured. Work on these improvements will be started early in 1910.

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ELECTRIC RAILWAYS.

(Special Correspondence.)

MARSHALLTOWN, IOWA—It is proposed to raise $100,000 towards the construction of an interurban to Grundy Center. C.

OAKLAND, CAL.—The Oakland Traction Company has been granted a fifty-year franchise along Grant Avenue in this city. A.

SIOUX CITY, IOWA—It is stated that the Sioux City & Spirit Lake interurban will commence construction next spring. C.

LAWTON, OKLA.—The Lawton & Fort Sill Electric Railway Company has been incorporated, with a capital stock of $200,000.

STEVENS POINT, WIS.—Work has been commenced on the survey of the route of the Chicago & Wisconsin Valley Electric Railway to Portage. C.

MOLINE, ILL.—The Tri-City Railway Company is planning several extensions and improvements that will cost in the neighborhood of $1,000,000. V.

BERKELEY, CAL.—The Southern Pacific has begun work on its double-track electric ferry line from San Pablo Avenue eastward to the Santa Fe. A.

WINONA, MINN.—The La Crosse and Winona Traction Company has asked for a fifty-year franchise for an electric line to La Crosse, via Galesville. P.

HANFORD, CAL.—F. S. Granger, promoter of the Fresno-Hanford interurban electric railway, states that he has sold bonds of the company to the amount of $625,000, and that he expects to sell the balance. A.

MONTREAL, CAN.—The Canadian Car and Foundry Company has recently been organized, with a capital of $11,500,000. This new company, a consolidation of several smaller concerns, has elected N. Curry as president.

INDIANAPOLIS, IND.—The Commissioners of Marion County have granted the Beech Grove Traction Company, Louis McManies, president, a franchise to build a traction road over the Churchman Pike from Beech Grove to Indianapolis. S.

DELPHI, IND.—A $68,000 subsidy has been voted by Deer Creek, Monroe and Burlington townships in Carroll County in aid of the construction of the Delphi, Flora & Burlington traction line. E. W. Bowen, president of the company announced that the survey would be made at once and the contract let as soon as completed. S.

NEW CASTLE, IND.—Track laying on the Indianapolis, New Castle & Toledo line has been completed between this city and Indianapolis. The work on the car barns, overhead construction and the installation of machinery in the power house is being pushed. The purpose to have cars in operation before Christmas will be carried out. S.

NEW YORK, N. Y.—President Miller, of the New York, Westchester & Boston Railway, announces that his road will proceed at once with the building of a line to White Plains, in addition to its line through the Bronx and Sound shore section of Westchester, and that the contracts for building this part of the road have been let.

LOGANSPORT, IND.—A petition has been filed with the County Commissioners by the Indiana Northwestern Traction Company asking for a franchise to build and operate an electric road through Cass County. The company has surveyed a route which parallels the Panhandle tracks by way of Lake Cicott, Monticello and Renselaer. S.

CHARLOTTE, N. C.—The 4 C's Company, E. D. Latta, president, is preparing to build a short-cut line out First Street, which will divert a large part of its street-railway traffic from a grade-crossing to the new route passing under the Southern Railway, by which route it is expected that a line to the Catawba River, twelve miles distant, will shortly be constructed. L.

SEATTLE, WASH.—A subscription list with subscriptions to the amount of $160,000 has been circulated among the property owners in this city, Georgetown and the Dumwamish Valley, for the purpose of completing an electric line to Tacoma. The Tacoma Short Line when completed will parallel and compete with the line of the Puget Sound Electric Company.

SANTA ROSA, CAL.—The Highland Pacific Railway Company has filed articles of incorporation for the purpose of building seventy miles of standard gauge electric railroad from Lakeport, the county seat of Lake County, to Santa Rosa. When this is completed it is believed, that it is the purpose of the company to extend its line to the shores of San Francisco Bay and establish a terminal there.

FREEPORT, ILL.—Several local business men will endeavor to have the Rockford & Interurban Railroad Company take over the Freeport Railway, Light and Power Company's plant and franchise in this city and it is understood that men of wealth in this city will attempt to raise a bonus for the interurban company if it will consent to take over the holdings of the local company.

CHARLESTOWN, W. VA.—A charter was recently granted to the West Virginia Railway Company for the purpose of constructing a railroad from Keyser, on the Baltimore & Ohio, through Grant and Pendleton counties to the Virginia state line, and ultimately to connect with the Chesapeake & Ohio at Clifton Forge. The company has a capital stock of $200,000, and is backed by New York capitalists.

LAFAYETTE, IND.—The Indiana Northern Traction Company, with home office in Marion, Ind., has been granted a franchise by the Commissioners of Tippecanoe County, for the construction of an interurban road from Battle Ground to Reynolds. The company is capitalized at $500,000 and will, it is said, eventually build the road on north to Hammond. George A. H. Shiedler, E. W. Neal, B. F. Burk and George Breed are the directors. S.

NEW YORK, N. Y.—The Dry Dock, East Broadway & Battery Railway Company has recently filed an application to electrify a part of its line, between Centre Street and the Bowery. The company has no intention of running electric cars in Canal Street, and it will probably continue with horse cars, as in the past. There are at present five applications for street-railway companies for the use of the bridge.

TOLEDO, O.—Announcement has been made that grading will be started yet this fall on a new electric railway to operate between Alliance and Ravenna, O. The new line, which will be twenty miles long, will parallel the Cleveland & Pittsburg, giving a direct line from Alliance to Cleveland. A new company has been organized, but it is understood that Henry M. Everett, of the Lake Shore Electric, and C. R. Morley, of the Stark Electric, are interested in the movement. H.

INDIANAPOLIS, IND.—It is reported that a reorganization of the Indianapolis, Crawfordsville & Western Traction Company has practically been decided upon by the stockholders with Hugh Doughterty, of this city, as president, and A. E. Reynolds, of Crawfordsville, secretary. A petition will be filed in the Federal Court asking for a foreclosure and sale of the road, which is now in the hands of a receiver. It is the purpose of the reorganized company to buy the property. S.

BEAUMONT, TEX.—City Attorney Marvin Sourlock has asked permission of Judge David E. Bryant, of the United States Court, for permission to file suit against the Beaumont Traction Company. He asks to be allowed to sue on behalf of the city for damages done the paving by the traction company, and also to file a suit to forfeit the franchises of the company. If the latter request be refused, he asks in the alternative to be permitted to file an intervention in the United States Court to forfeit the franchises.

OCEAN CITY, N. J.—At a meeting of the Cape May Board of Freeholders J. Fithian Tatem and Olin Bryan, lawyers representing an electric railway company, requested that a combination bridge be built over Great Egg Harbor Bay from Somers Point to Beesley's Point. The lawyers said they represented interests that desired to run an electric road from Philadelphia to Cape May. The Freeholders favored the suggestion, adopting a resolution and appointing A. B. Smith, J. P. Fox and David Rodan a committee to further the project.

INDIANAPOLIS, IND.—W. T. Durbin, chairman of the board of trustees, representing stock and bondholders of the Indianapolis and Cincinnati Traction Company, has submitted to the court a plan of reorganizing the company. Charles L. Henry, president of the company, also the receiver for the property, has approved the plan, and April 10, 1910, is the date set for the reorganization. If the court approves the plan the work of constructing an extension of the line from Connersville to Hamilton, Ohio, will be commenced at once.

SILVER LAKE, IND.—The people of Lake and Clay townships are anxious to subscribe to a fund in aid of the construction of the Wabash and Northern Interurban Company's road through Lake and Clay townships. A proposition to vote a subsidy tax in those townships was voted down, and the promoters proceeded to survey another route. J. A. Barry, promoter of the line, says the company has let a contract for the grading, furnishing, ties, rails, cars, etc. He says that it is the purpose to have cars running by July 4, 1910. S.

CUMBERLAND, MD.—Henry L. Doherty & Co., of New York, have purchased the controlling interest in the Cumberland and Western Electric Company, running fifty miles through the Maryland mining region, from Calton L. Bretz, general manager of the Cumberland & Pennsylvania Railroad, who purchased it in his own right four years ago for about $200,000. The line has power houses at Clarysville and Reynolds and fourteen cars, and since Bretz controlled the line $150,000 has been spent in improvements. The purchasers operate trolley and electric light systems in various sections of the country.

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TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

ARABI, GA.—It is stated that a telephone system will be established in this city. The mayor can give information. B.

WADENA, MINN.—William Perrin is trying to secure the construction of a farmers' telephone line due north from Wadena. C.

SAN FRANCISCO, CAL.—All the wires of the Pacific States Telephone Company in Alameda will be placed in underground conduits.

VERGAS, MINN.—James Nesbitt, A. G. Schwarzrock and others have incorporated the Vergas Telephone Company, with a capital of $10,000. C.

CORDELE, GA.—Another farmers' telephone line is to be constructed, to have connection at Cordele with the Southern Bell Telephone and Telegraph Company. Orders for material have been placed. B.

CARY, GA.—B. F. Abney, of Cary, is said to be interested in the construction of a ten-mile telephone system from Cary to Danville, Ga. B.

PLAZA, N. D.—The Queen City Telephone Company is constructing a line to Powers Lake on the north and the Missouri River on the south. C.

CAMP CROOK, S. D.—The Belle Fourche Company will install a local telephone exchange and wire the town. The line to Buffalo will be completed. C.

ATKINSON, N. C.—The Pender Telephone Company has been organized here, with a maximum of $10,000 capital, by E. E. Murphy and associates. L.

PHILLIPSBURG, TEXAS—The Phillipsburg Telephone Company has been incorporated with a capital of $1,000, by John Stern, C. F. Meyer and C. C. Thiel.

DILLON, MONT.—The Montana Independent Telephone Company expects to have a new exchange and telephone system in operation here in a short time.

MART, TEX.—The Limestone Telephone Company has been incorporated with a capital of $4,500, The incorporators are Richard Blackwood, E. F. King and T. B. Moore.

BUTTE, MONT.—The Montana Independent Telephone Company has been incorporated by H. A. Fallwey, Chas. J. Kelly, Cornelius F. Kelly and others. Capital, $1,000,000.

FAYETTEVILLE, TEXAS—A new telephone line is under construction from here to Ellinger, Texas, and same is contracted by the Fayette County Telephone Company of La Grange.

PETALUMA, CAL.—The Petaluma Rural Telephone Company has been incorporated here, with a capital stock of $50,000, by D. M. Winans, T. G. King, G. B. Robinson, S. L. Stice, E. P. Long and Frank Whitlatch.

BEAUMONT, TEX.—The Cleveland Telephone Company, of Cleveland, Tex., is running a new telephone line from here to Cleveland. The line will include Silsbee, Kountze, Fuqua, Bragg, Milvid, and a number of other points.

ALBANY, N. Y.—The Allegany Telephone Company, organized to operate in Allegany County, was also incorporated, with a capital of $10,000. The directors are: Robert E. Lang, George J. Fisk and John B. White, of Belfast.

MANISTEE, MICH—.The board of supervisors has granted permission to the Manistee County Electric Company to build several dams on Manistee River. The first dam, at High Bridge, will be started at once and is to cost $2,000,000.

INDIANAPOLIS, IND.—Articles of incorporation have been filed in the office of the secretary of state of the Tennyson Mutual Telephone Company, Tennyson, Ind. Capital stock, $2,000. President, E. L. Simpson; secretary, Lawrence Bender; treasurer, T. A. Rhoads.

SANDY SPRINGS, S. C.—The farmers of this section have organized the Sandy Springs Telephone Company, which will begin business with about 100 subscribers. The lines will probably be connected with the Southern Bell Telephone Company long-distance system also. L.

DILLON, MONT.—G. A. Mellinger, constructing engineer for the Independent Telephone Company, is planning the company's new system. C. B. Vaughn, who resigned his position as local manager for the Bell Telephone Company, has accepted the position of local manager for the Independent Company. C.

FLINT, MICH.—The Michigan State Telephone Company is building a new central exchange, with capacity for a city of 100,000. The plant with equipment will cost $100,000. Private exchanges are also to be installed for the Buick Motor Company and the Weston-Mott. The Buick exchange will be the largest private installation in the state.

LAWRENCE, KAN.—The Bell Telephone Company has filed a statement with the City Council, formally refusing to accept a franchise recently granted it. The ordinance required the company to pay the City of Lawrence two per cent of the gross receipts; to bring the books to Lawrence for examination, and to maintain a forty-volt circuit; all of which the company refused to do.

WESTVILLE, IND.—The residents of this city and subscribers of the two telephone companies operating here, held a meeting November 12, and served notice on the two companies that unless they consolidate and do away with the dual service within a month they will discontinue the use of the service. The people insist on a single service and that the consolidated company must install some modern equipment and extend the lines throughout Laporte County. S.

GAINESVILLE, GA.—A telephone line has been built to Oconee Mills. A farmers' line has also been built along the Carnesville road. With this addition there are now twenty-three farmers' telephone lines connected with the Gainesville exchange of the Southern Bell Telephone and Telegraph Company, and it is stated that five other lines will be built into Gainesville within thirty days. There are 314 subscribers on the rural lines already in operation. B.

BURLINGTON, VT.—The Heath Telephone Company has been incorporated. The Heath Telephone Company, with a capital stock of $7,000, has filed with the secretary of state papers enabling it to do business in Vermont. It is incorporated under the laws of Massachusetts and is to begin work in Windham County in competition with the New England Telephone and Telegraph Company. Charles S. Goodrow, of Readsboro, is the Vermont representative of the corporation.

ELECTRICAL SECURITIES.

The past week has been marked by a number of sudden drops in nearly all stocks. On the whole the values have been held up and rallied from time to time by large stockholders and "inside" men, so that considering the little panics of the smaller stockholders there has been very little decrease in the value of securities.

The Aurora, Elgin & Chicago October gross earnings gained $18,000. The November gain has been greater.

Authorization has been given by the New York Public Service Commission, Second District, to the Northern Westchester Lighting Company, of Ossining, to issue $125,000 in bonds to pay for improvements.

The American Telephone and Telegraph Company advises holders of treasurer's receipts that the company will be prepared to issue on and after December 1 its engraved certificates of stock in exchange for treasurer's receipts upon surrender of such receipts at the office of the assistant treasurer, 15 Dey Street, New York city.

The Poughkeepsie Light, Heat and Power Company, of Poughkeepsie, N. Y., has sold to James A. Hutchinson, bond dealer, $100,000 first consolidated fives, due November, 1921, this amount being the balance of the authorized amount under this mortgage. The bonds are a first lien on the entire plant, subject to $75,000 fives, due 1914.

Interborough Rapid Transit October gross increased about $7,000 a day, and for the first half of this month about $8,300 per day, so that for the first four-and-one-half months of the current fiscal year gross gained close of $1,200,000, or seventy-five per cent, of the total gain of $1,616,093 for the entire fiscal year ended June 30, last.

The Boston & Worcester Street Railway has petitioned the Massachusetts Railroad Commission for permission to increase its stock from $2,025,000 to not exceeding $2,525,000, to be offered stockholders at $100 per share, the proceeds to be used for extension, improvement and additional rolling stock. The company also petitions for right to issue twenty-year four-and-one-half per cent bonds not exceeding $500,000.

The Atlantic & Pacific Telephone and Telegraph Company, a New Jersey corporation, has increased its capital stock from $25,000 to $250,000. The company belongs to the Bell Telephone system.

John I. Beggs, Edwin M. Bulkley, Adolphus Busch, James Campbell, F. S. Smithers, George R. Sheldon and Charles W. Wetmore, voting trustees of common stock, trust certificates issued under the United Railway Company of St. Louis, voting trust agreement of November 1, give notice that the common stock trust certificates may now be exchanged for the shares of the common capital stock of the United Railways Company, of St. Louis.

DIVIDENDS.

General Electric Company; quarterly dividend of two per cent, payable January 15 to stockholders of record December 4.

Kansas City Railway and Light Company; quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable December 1 to stockholders of record November 19.

Rochester Railway and Light Company; preferred dividend of one-and-one-fourth per cent, payable December 1.

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St. Joseph Railway, Light and Power Company; preferred dividend of one-and-one-fourth per cent, payable December 31.

Washington Railway and Electric Company; semi-annual dividend of two-and-one-half per cent on preferred stock, and an initial semi-annual dividend of one per cent on common stock.

NEW YORK.

	Nov. 22.	Nov. 15.
Allis-Chalmers common	15½	15
Allis-Chalmers preferred	55	53½
Amalgamated Copper	93⅜	90⅞
American Tel. & Cable	*80	*80
American Tel. & Tel.	143⅞	141¾
Brooklyn Rapid Transit	78¼	75¾
General Electric	163	162
Interborough-Metropolitan common	22⅜	22⅞
Interborough-Metropolitan preferred	55½	54¾
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	93	92¼
Mackay Companies (Postal Telegraph and Cables) preferred	76	75⅞
Manhattan Elevated	140	140
Metropolitan Street Railway	20	25
New York & New Jersey Telephone	123½	123½
U. S. Steel common	89¾	90⅜
U. S. Steel preferred	125¾	126
Western Union	79½	79
Westinghouse common	85¾	85
Westinghouse preferred	135	135

*Last price quoted.

BOSTON.

	Nov. 22.	Nov. 15.
American Tel. & Tel.	143⅞	141⅜
Edison Elec. Illuminating	250	.....
General Electric	163	162
Massachusetts Electric common	16	15¾
Massachusetts Electric preferred	80	.....
New England Telephone	134	134
Western Tel. & Tel. common	12¼	11¼
Western Tel. & Tel. preferred	.....	88

PHILADELPHIA.

	Nov. 22.	Nov. 15.
American Railways	45	45¼
Electric Company of America	12½	12⅛
Electric Storage Battery common	58½	59
Electric Storage Battery preferred	58½	59
Philadelphia Electric	12¾	13⅛
Philadelphia Rapid Transit	26¼	26¾
Philadelphia Traction	89	89
Union Traction	52½	52¾

CHICAGO.

	Nov. 22.	Nov. 15.
Chicago Railways, Series 1	98	104
Chicago Railways, Series 2	33	33¼
Chicago Subway	6	6¾
Chicago Telephone	136	136
Commonwealth Edison	119	119
Metropolitan Elevated common	16	16⅛
Metropolitan Elevated preferred	52	52
National Carbon common	96½	96½
National Carbon preferred	123	118½

PERSONAL MENTION.

H. BISHOP has been appointed manager of the San Benito Light and Power Company, of Hollister, Cal., taking the place of J. L. Galbraith.

P. G. JONES has established Pacific Coast offices for the American Electric Fuse Company, of Muskegon, Mich., at 121 Second Street, San Francisco.

R. A. McLAUGHLIN, formerly general manager of the McKinley properties in Galesburg, has been made general manager of new business for all of the McKinley companies.

WILLIAM S. TAUSSIG, secretary of the Chicago Electric Club and a well-known manufacturer's representative, will move on December 1 to 627 West Jackson Boulevard, Chicago.

PROFESSOR L. A. HERDT, head of the department of electrical engineering at McGill University, has been appointed honorary secretary for Canada of the American Institute of Electrical Engineers.

W. H. EVANS recently resigned as superintendent of the Central California Traction Company, in Stockton, Cal., to enter the electrical department of the Southern Pacific Company at Portland, Ore.

A. B. LEBENHAUM and E. B. PIKE, who recently sold their interest in the Butte Engineering and Electric Company, of San Francisco, are now handling electrical novelties, lamps and heating appliances.

HORACE L. BRUNN, of Cambridge, Mass., who has been for a number of years prominent in electrical work, has left for the Philippine Islands, where, as chief engineer of the Boston Standard Electrical Company, he is to take charge of important electrical work.

JOHN M. KLEIN, a member of the firm of Mathias Klein & Sons, Chicago, the well-known makers of Klein's construction tools, has just returned from a six weeks' trip to the Pacific Coast. Mr. Klein called on the company's principal customers and the leading dealers, and found them all very optimistic as to the future. Mr. Klein stated that construction work was quite active on the coast and considered the prospect for the coming season in the electrical lines very promising. The firm's business has shown a gratifying increase during the past few months. Customers who have been on the company's books year after year are using more Klein material than ever, and new users are being added constantly.

W. A. LAYMAN, vice-president and general manager of the Wagner Electric and Manufacturing Company, St. Louis, Mo., was a New York visitor this week, conferring with the company's Eastern representative, E. W. Goldschmidt, and meeting many eastern customers.

W. E. SHARP, vice-president of the Lincoln Traction Company, of Lincoln, Neb., was elected president of the corporation at the yearly meeting held on November 16. Mr. Sharp was president of the Citizens' Company at the time when it was merged with the Traction Company.

F. R. NEWMAN, superintendent of the York Railways Company, has resigned his position and will shortly be connected with the Southern Cambria Electric Railway Company, of Johnstown, as superintendent. Mr. Newman has been identified with the York Railways Company for the past four-and-one-half years.

HON. JACOB CANTOR, of New York, is the president of the Electrical Automatic Railroad Safety Signal Company, manufacturing the Lacroix safety signal device, invented by F. Lacroix, of Texas. The system is for the purpose of preventing railroad accidents, and includes among other things a telephone equipment in the engineer's cab.

JOHN A. JONES, of Lewiston, Me., has been appointed railroad commissioner of the state of Maine. Mr. Jones is a graduate of Bates College, and has been engaged in railroad construction for a number of years. He has surveyed and built over 400 miles of electric roads, among which are those between Portland and Lewiston, Camden and Belfast, and Rumford Falls and Bethel.

RALPH W. POPE, secretary of the American Institute of Electrical Engineers, has been making another extended trip on behalf of the local sections. Mr. Pope was authorized by the board of directors at its meeting on November 12 to visit the Institute sections and branches in the Central West. He left New York on November 14, coming direct to Urbana, Ill., where he addressed the Urbana Section at the University of Illinois. On November 16 Mr. Pope visited Chicago with Dr. C. P. Steinmetz, upon which occasion Dr. Steinmetz addressed the Chicago Section members in Fullerton Hall of the Art Institute. Mr. Pope's itinerary takes in also Madison, Wis., Minneapolis, Minn., St. Paul, Minn., Ames, Iowa, and Fort Wayne, Ind.

FRANK L. PERRY, one of the well-known electrical men of Chicago, and for many years business manager of the *Western Electrician*, is carrying out some very interesting and important work at his research laboratory in Chicago. Mr. Perry is specializing to a great extent upon a study of wave phenomena and the utilization of apparatus designed to operate through manifestations of oscillatory motion. It will be remembered that during the early experiments of the Wright Brothers, Mr. Perry made a close study of the aeroplane and elucidated then the suggestion of its use as a wireless telegraph station. During the past twelve months Mr. Perry has enlarged upon this idea, and has a very successful model which has been used to demonstrate his ideas in a number of lectures before engineering, scientific and commercial organizations. In a recent Sunday issue of the Chicago *Tribune* a double-page illustrated story described some of the work Mr. Perry is doing in this direction.

OBITUARY.

FREDERICK FAIRFIELD, manager of the Western Union Telegraph Company's office in New Haven, Conn., died suddenly of heart trouble last week. He was a veteran operator, having been in the employ of the company since boyhood, and his many years of service had made him widely known. During the Civil War, Mr. Fairchild was on duty as an operator in New Haven.

JAMES ELLIOTT DEFEBAUGH, editor of the *American Lumberman* and prominent in business and manufacturing circles in Illinois, died at Columbus Hospital, Chicago, on Sunday, November 21. Mr. Defebaugh had always been a ceaseless worker in the lumber field, and for months during the last session of Congress was engaged in the tariff fight on behalf of the lumber interests. He was an active member of the Chicago Association of Commerce and the Illinois Manufacturers' Association. Overwork, from attending to his many interests, contributed largely to Mr. Defebaugh's death. He is survived by a widow and one son.

NEW PUBLICATIONS.

MUNICIPAL SCHOOL OF TECHNOLOGY, MANCHESTER, ENG.—This polytechnic school has recently issued Vol. 1, Part 3 of its journal, containing "a record of the work of the school." These interesting publications contain abstracts of papers read by members of the staff and by students of the school, before various scientific and technologic bodies, of contributions to the technical press, and the like. The contents are departmentalized into sections on

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mechanical engineering, physics, electrical engineering and chemistry. The editing seems to have been very well done and the general make-up is surprisingly good. The idea might advantageously be copied by other schools and colleges.

THE TECHNOLOGY REVIEW—The October number of this quarterly publication of the Massachusetts Institute of Technology has just been issued and is replete with news of the Institute and of its alumni. Among notable items is an account of the development of the Technology Club in New York. The announcement of a new course in electrochemistry at the Institute is also of interest. A sign of national prosperity is evinced by the statement that the demand for Technology graduates is much in excess of the supply.

BULLETIN OF THE BUREAU OF LABOR—The May, 1909, number of this publication (issued by the United States Department of Commerce and Labor, Washington, D. C.), which has just come to hand, is concerned mainly with a long article by Frederick L. Hoffman on "Mortality from Consumption in Occupations Exposing to Municipal and General Organic Dust." Among other contents are the usual digests of reports of state bureaus of labor statistics, a digest of recent foreign statistical publications, court decisions affecting labor, etc.

INDUSTRIAL ITEMS.

THE MINNEAPOLIS STEEL AND MACHINERY COMPANY is furnishing one of its Muenzel producer-gas engines and gas-producer plants for the electric-light plant at Milbank, S. D., which is owned by Oscar Claussen, consulting engineer, St. Paul, Minn.

JOHN A. ROEBLING'S SONS COMPANY, of Trenton, N. J., has received a large order of wire from the Metropolitan Electric Company, of West Reading, Pa. Lines are to be installed by the Reading company to substations at Ringing Rocks, Mount Penn and Mohnton.

THE H. T. PAISTE COMPANY, Philadelphia, Pa., has recently issued the November number of its monthly publication, entitled "Paistery." In addition to the usual interesting editorial pages, this issue contains interesting descriptions of new sockets, outlets and rosettes.

J. G. WHITE & COMPANY, INCORPORATED, engineers and constructors, with offices at 43-49 Exchange Place, New York city, announce the opening of a branch office in the First National Bank Building, Chicago, Ill. Charles T. Mordock will be in charge of this office as manager. The company also has a branch office in the Alaska Commercial Building, San Francisco, Cal.

THE FORT WAYNE ELECTRIC COMPANY, Fort Wayne, Ind., has a contract for supplying electric machinery to the Corry-Deavitt-Frost Company. The power plant will be auxiliary to the one already in operation at that point, and will contain two generators, one capable of producing 450 kilowatts, and the other 187 kilowatts. A large modern switchboard will also be installed at the plant.

THE SHULTZ BELTING COMPANY, St. Louis, maker of Shultz sable belting, reports that it is taxed to its capacity to meet the demand for its product. At the present time the company is shipping belting to Italy, South Africa, Russia and other foreign countries. The company has just received an order from Sweden for 16,500 feet of belting. It has also equipped the electric railway and lighting plant in Natchez, Miss., with thirty-five-inch three-ply belting.

THE SIMPLEX ELECTRIC HEATING COMPANY, Cambridge, Mass., has recently distributed a series of six circulars describing nickel and silver plated electric devices. These circulars are devoted to the following Simplex products: Heating pads, electric flatirons, electric toasters, electric chafing dishes, electric coffee percolators, electric ranges and electric flatiron conductors. These publications are opportune at this time in facilitating the selection of Christmas gifts.

THE NATIONAL METAL MOLDING-COMPANY, Pittsburg, Pa., is distributing a booklet devoted to data in relation to the practical features of "Sherarduct," the rustproof, non-corrosive conduit. The rustproof and non-corrosive features of this conduit are secured by the pipe being subjected to the sherardizing process, in which zinc dust is anchored and impregnated uniformly into the metal over all parts, which cannot be separated from the pipe either mechanically or chemically.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, Ill., reports the closing of a contract for a common battery, multiple switchboard and telephones for the Crawford Telephone Company, Crawford, Neb., recently secured by L. R. Foote, its Nebraska representative. This board will be in the Kellogg company's latest type 3,000-line section, and while the present equipment is only for 300 common battery lines and twenty rural and toll lines, the telephone company expects to be operating many times this number of telephones within the coming year. The line construction in connection with this plant is far in advance of most towns of its size, and the major portion of the lines being distributed through cable. This company has looked far enough ahead to realize that the success of its undertaking depends in a very large measure upon the ease with which it can come into contact with neighboring towns and distant cities. Toll lines in service and under construction connect or will connect Crawford with all of the principal cities of the middle West.

THE BEARDSLEE CHANDELIER MANUFACTURING COMPANY, Chicago, Ill., is distributing an attractive booklet entitled "Holiday Suggestions" and devoted to electric and gas portable lamps. Among the twenty-odd illustrations contained in this publication are some of the newest and latest designs in portable lamps. Each lamp is described and the necessary instructions and data are given for ordering the same. This booklet should prove valuable at this time in facilitating the selection of appropriate Christmas gifts in this line. Copies may be obtained on request to the company.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY is beginning work at its East Pittsburg shops on a very heavy order for railroad motors for the Long Island Railroad, which represent almost a million dollars. This calls for 260 motors of 200 horsepower each, which will be used to equip part of the cars on the Long Island system, and is in line with the enormous development work that the Pennsylvania Railroad Company is now doing in anticipation of the completion of the New York terminals and tunnels under the North and East Rivers.

THE ALLIS-CHALMERS COMPANY, of Milwaukee, Wis., is receiving numerous orders for transformers from some of the large electric companies on the Pacific Coast, including the Great Western Power Company, of San Francisco; the Pacific Gas and Electric Company, San Francisco; the Bear Lake Power Company, Montpelier, Idaho; Portland Railway, Light and Power Company, Portland, Ore.; the Sacramento Valley Power Company and the Los Angeles Gas and Electric Company. These transformers vary in size from 200 kilowatts to 1,500 kilowatts, and for the most part are of the oil-filled, water-cooled type. Numerous other orders have also been received.

THE AMERICAN CONDUIT AND MANUFACTURING COMPANY, of Pittsburg, Pa., has prepared a compact folder in which the merits of "Wireduct," the non-metallic flexible conduit made by the company, are pointed out. This conduit is made of an inner tube of canvas, over which is wound a fire-resisting fiber tape, which adheres to it firmly. Over the tape is placed an outer covering of non-inflammable and moisture-proof material. The conduit is said to remain permanently flexible, but does not collapse nor make any kinks. Upon request the company will be glad to supply detailed information and literature in relation to this product.

J. G. WHITE & COMPANY, INCORPORATED, engineers and contractors, 43 Exchange Place, New York city, have just been awarded the contract for the double tracking of the Albany Southern Railroad between Rensselaer and Kinderhook Lake, N. Y., as well as the straightening of curves and the rehabilitation of a large amount of the present track of that company. In addition to the operation of its third-rail electric road between Albany and Hudson, N. Y., the railroad company furnishes electric light to the following towns: Rensselaer, East Greenbush, East Schodack, Nassau, North Chatham, Niverville, Valatie, Kinderhook, Stuyvesant Falls, Stottville, and also owns and operates gas plants in Hudson and Rensselaer, N. Y.

THE FANCLEVE SPECIALTY COMPANY, Jamaica Plain, Mass., has recently distributed its December bulletin, devoted to fittings for metal moldings. This bulletin, which is to be used in connection with the catalogue issued in April, describes regular and angle pattern molding boxes for metal moldings intended for making junctions at the angle formed by the intersection of walls and ceilings, and cover the excessive cutting made necessary in passing an elliptical-shaped molding through the ceiling, partitions or floors. There are also described switch junction or receptacle boxes, junction boxes, or mounts for surface fittings and outlet plates for metal moldings. In connection with this descriptive matter this bulletin contains specifications, diagrams and data which should prove useful to those interested.

DATES AHEAD.

International Independent Telephone Association. Annual convention, Chicago, December 7, 8 and 9.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

Toledo Electrical Show, Coliseum, Toledo, Ohio, January 31-February 5, 1910.

San Francisco Electrical Exposition, January 29-February 5, 1910.

Philadelphia Electrical Exposition, Philadelphia, Pa., February 14-26, 1910.

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RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) November 16, 1909.

939,969. INCANDESCENT ELECTRIC LIGHT. James T. Bigger, Owensboro, Ky. Filed April 17, 1908. An insulating plug mounted in the cap has, at one face, spaced dovetailed tongues embraced by and clamped to U-shaped contacts, the latter electrically connected to and controlling filaments of different lengths. A push-piece is slidably mounted in the plug and contacts with either selected one of the U-shaped contacts.

939,973. BLOCK SIGNALING SYSTEM. Frederick F. Brush, Detroit, Mich. Filed August 26, 1907. The semaphores are electrically actuated.

939,984. ELECTRIC RAILWAY SIGNALING APPARATUS. William J. Cook, Denver, Colo. Filed July 13, 1908. The locking device for a movable signal is electromagnetically released.

939,995. CURRENT COLLECTOR. George R. Forster, Fithian, Ill. Filed June 15, 1908. Two trolley wheels, arranged tandemwise, are each provided with an interior lubricating device and a series of anti-friction rollers for their supporting axial pins.

939,999. APPARATUS FOR RECORDING DEVIATIONS IN THE COURSE OF A VESSEL. Joseph Fraser and Charles Jumeaux, Auckland, New Zealand, assignors of one-third to Samuel Edgar Fraser, Waihi, New Zealand. Filed October 5, 1907. The magnetic needle is provided with an autographic recording device for deviations.

940,008. COMBINED PRIMARY AND SECONDARY BATTERY SYSTEM. Julius H. Gugler, Milwaukee, Wis. Filed June 17, 1909. Describes a system of electrical distribution, including primary and secondary batteries, switches, etc.

940,012. CONNECTOR. Theodore A. Hammond, Passaic, N. J. Filed March 18, 1908. A terminal connector for connecting an electrical conductor to a post is provided with a sleeve for engaging the conductor and has gripping members at its ends.

940,021. LUMINOUS ELECTRIC HEATER. William F. Howard, West Ealing, and Alban B. Cousins, Abingdon-on-Thames, England. Filed February 1, 1909. Each heating element consists of an exhausted bulb with an electric filament of zigzag or other shape extending longitudinally through it and connected to massive external terminals at the ends.

940,028. THIRD-RAIL ELECTRIC-RAILWAY SYSTEM. Charles Kozesnik, New York, N. Y. Filed April 25, 1908. Describes a form of surface-contact system.

940,043. SECONDARY BATTERY. William Morrison, Chicago, Ill. Filed June 8, 1903. Has a horizontal grid with openings or pores containing metallic zinc (electrically reduced from zinc oxide), this forming the negative electrode. The electrolyte is composed of a suitable alkaline solution.

940,047. ATTACHMENTS FOR TELEPHONES. John W. Nilsson, Balfour, N. D. Filed January 19, 1909. Comprises an audible signaling device, a second transmitter, and means to connect operatively the signaling device to a receiver fork.

940,112. MOTOR-CONTROL SYSTEM. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed September 11, 1907. The method of operating a number of series motors mechanically connected to drive a common load, consists in connecting the motors to the line with each motor field in series with its armature, impressing independent voltages on the field terminals of the several motors, and simultaneously varying the amounts of these voltages.

940,140. TELEPHONE-CALL-RECORDING DEVICE. George R. Fawkes, Waterloo, Iowa. Filed November 19, 1908. Describes in detail a ratchet device for autographically recording telephone calls.

940,151. RESISTANCE UNIT. Harry E. Heath, Lynn, Mass., assignor to General Electric Company. Filed October 3, 1906. An electric-heating resistance comprises a sheet of flexible heat refractory insulating material rendered partially conductive by a deposit of metal on the inner fiber thereof.

940,164. MOTOR-CONTROLLING DEVICE. Charles D. Knight, Schenectady, N. Y., assignor to General Electric Company. Filed January 21, 1907. Means independent of the starting rheostat are provided for causing the motor speed to be automatically and gradually varied a predetermined amount when the controlling element of the rheostat reaches a certain position.

940,171. COMBINED SWITCH AND FUSE-PIPE. Frederick Mackintosh, Schenectady, N. Y., assignor to General Electric Company. Filed September 30, 1907. The adjacent ends of the two sections of the switch blade overlap and are separated by an insulation. Plug contacts are connected respectively to these ends and means are provided for rigidly clamping together these overlapping ends.

940,176. LIGHTNING-ARRESTER. Charles T. Mason, Sumter, S. C., assignor to the Sumter Telephone Manufacturing Company, Sumter, S. C. Filed May 1, 1908. Comprises a coil having abrupt turns or angles and a flat face or side, a grounding block arranged exteriorly of the coil and extending along the flat face or side thereof, and means for detachably clamping the block to the coil.

940,188. PROCESS OF MAKING INSULATING FABRICS. Charles F. Peterson, Schenectady, N. Y., assignor to General Electric Company. Filed March 27, 1906. The process of making sheet insulating material consists in shellacing overlapping fragments of mica to a continuous web of material, covering the mica with a second web of material and applying a second coating of shellac.

940,209. ATTACHMENT FOR MERCURY-LAMPS. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company. Filed October 22, 1904. In combination with a vapor electric apparatus having a high initial resistance and a relatively low-running resistance, is a resistance unit in shunt with the lamp, having a negative temperature coefficient, and adapted normally to carry no appreciable current.

940,210. DYNAMO-ELECTRIC MACHINE. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company. Filed March 20, 1909. Electrical connections are provided whereby motor current is delivered to and generator current taken from the armature, the generator current being taken through the commutator. Unwound commutating poles are located at the points of commutation of the generated current and magnetized by the resultant armature reaction.

940,211. ELECTRIC-RAILWAY SYSTEM. William M. Stephens, Philadelphia, Pa., assignor to Railways Surface Contact Supplies Company, Wilmington, Del. Filed January 4, 1907. Describes a form of surface-contact system.

940,220. LIGHTNING-ARRESTER. Eugene W. Vogel, Chicago, Ill. Filed May 5, 1906. A conducting coil of wire is secured at its ends to posts which are mounted on an insulating base. A ground conductor is also supported on the base and has its ends projecting into proximity to the posts.

940,241. SYSTEM OF CONTROL FOR ELECTRIC MOTORS. Arthur C. Eastwood, Cleveland, Ohio. Filed December 3, 1908. Comprises a reversing switch, a series of independently actuated speed-controlling switches, a master switch, a single conductor between the master switch and the reversing and speed-controlling switches, and means at the master switch for producing successive reversals of the direction of current flow through the control conductor for causing successive closure of the switches.

940,266. MAGNETIC SEPARATOR. Walter B. Moore, Walla Walla, Wash. Filed September 23, 1907. A wall is arranged to rotate with a rotating magnetic means in a tank, and is spaced therefrom so as to provide a passageway for the material to be separated, the upper portion of the wall being flared outwardly.

940,282. ELECTRIC SEPARATOR. George D. Rogers, Gloucester, Mass. Filed December 30, 1905. The mixture is subjected to the influence of the rotating electric field of a polyphase coil.

940,284. TELEPHONE. Frederick G. Sargent, Westford, Mass. Filed March 3, 1909. Describes a form of telephone receiver.

940,288. STORAGE BATTERY. Alfred O. Tate, Toronto, Ont., Can., assignor to Tate Electrolytic Company of America. Filed February 24, 1908. A unifunctional storage battery plate embraces a series of thin narrow conducting strips all connected together electrically at one end and separated from each other by porus insulating material, all such conducting strips being insulated at their lateral edges from the electrolyte.

940,311. COMBINATION SWITCH AND BLOW-OUT. William C. Hafemeister, Cleveland, Ohio, assignor to the Van Dorn Electric and Manufacturing Company, Cleveland, Ohio. Filed July 12, 1907. A bellows is provided to blow an air jet between the contacts, one of which is fixed and the other movable.

940,318. ELECTRIC MEASURING INSTRUMENT. Adrian H. Hoyt, Penacook, N. H. Filed October 18, 1907. Describes a combination of ammeter and voltmeter, with switch and circuit connections.

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940,319. ELECTRIC MEASURING INSTRUMENT. Adrian H. Hoyt, Penacook, N. H. Filed January 20, 1908. Comprises a permanent horseshoe magnet, an armature frame surrounding a core and connected to a pointer, an armature winding, etc.

940,328. ELECTRIC SWITCH. Otto M. Knoblock, South Bend, Ind. Filed March 6, 1907. Describes a form of knife switch.

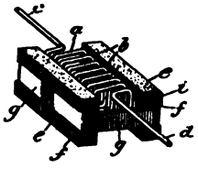
940,335. BINDING-POST. Henry E. Leppert, New Britain, Conn., assignor to the Hart Manufacturing Company, Hartford, Conn. Filed February 25, 1909. Comprises a stationary member with two opposing walls and two screw-threaded members, one free to revolve, etc.

940,359. TELEPHONE DETECTOR DEVICE. Theodore W. Ralph, North Augusta, Ont., Can. Filed November 16, 1908. Comprises a base, two tracks supported by the base and each provided with strips of current-conducting material separated by blocks of insulating material, a roller operating between the tracks, and an axle for the roller insulated therefrom and designed to operate over the top of the strips and blocks of the conducting and non-conducting material when the device is tilted.

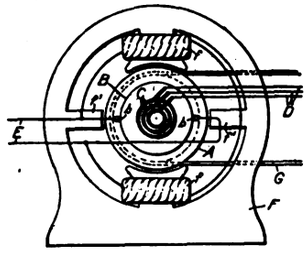
940,361. EGG-TESTER. William Rigling, Hamilton, Ohio. Filed September 2, 1909. Has an electric lamp contained in a bowl-shaped reflector over which is a shelf with egg-receiving perforations.

940,376. IGNITION SYSTEM FOR EXPLOSION-ENGINES. Paul R. Werner, Philadelphia, Pa. Filed October 5, 1908. Has primary and secondary circuits and a selector brush carried by a rotating shaft.

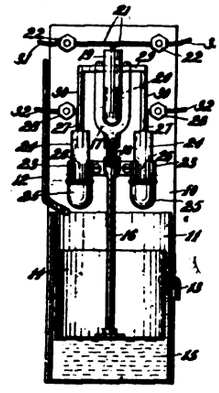
940,377. TYPE-CASTING AND COMPOSING MACHINE. William Ackerman, New York, N. Y., assignor to United States Graphotype Company, New York, N. Y. Filed December 28, 1905. A machine for registering upon a type-casting machine-controller the composition to be cast in the casting machine, comprises a keyboard having groups of keys representing a number of lay-outs or fonts or parts thereof, selective means for registering upon the casting-machine controller the several characters appearing in the several keyboard groups, and means whereby one at a time of these keyboard groups may be placed in operative connection with the controller registering means.



940,176.—LIGHTNING ARRESTER.



940,210.—DYNAMO-ELECTRIC MACHINE.



940,408.—DOUBLE-ACTING SWITCH.

940,392. ELECTRIC GENERATOR. Edward T. Kenney, Indianapolis, Ind., assignor to the Henricks Novelty Company, Indianapolis, Ind. Filed April 16, 1908. The rotor is laminated in a specified way.

940,393. BRUSH-HOLDER. Earle R. Knight, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Filed August 30, 1905. Parallel side plates are held a predetermined distance apart by a connecting plate having a flat portion forming a brush guide and an upper portion curved to receive a supporting stud.

940,397. BINDING-POST. Adam Lüngen, New York, N. Y., assignor to Edwards & Company. Filed January 16, 1909. Comprises a body having upwardly bent arms, a screw journaled in both of these arms and extending therebetween and having a head and a collar to prevent its longitudinal movement in either direction, and a traveling nut having a lower flat face guided against the body.

940,408. DOUBLE-ACTING SWITCH. Clarence J. Spellman, Wauwatosa, Wis., assignor of one-half to Charles W. Norris, Milwaukee, Wis. Filed December 7, 1908. Comprises a stationary mercury cup, a suitably operated member carrying a second mercury cup and a depending contact arm to dip within the first mercury cup, and a stationary contact to dip within the second mercury cup when the member is moved to withdraw the contact arm from contact with the mercury in the first mercury cup.

940,428. APPARATUS FOR NEUTRALIZING ELECTRICITY IN MOVING MATERIAL. William H. Chapman, Portland, Me., assignor to Chapman Electric Neutralizer Company, Portland, Me. Filed November 3, 1905. A comb conductor is located adjacent to the moving material and earth-connected, and an insulated conductor is located adjacent to the comb conductor and charged with electricity of the same polarity as that of the material to be treated.

940,429. METHOD OF NEUTRALIZING STATIC ELECTRICITY. William H. Chapman, Portland, Me., assignor to Chapman Electric Neutralizer Company, Portland, Me. Filed December 18, 1905. Consists in charging a conductor embodying fine radiating surfaces with electricity of high voltage and of a polarity opposite to that of the surface to be neutralized, interposing between the conductor and the surface to be neutralized a perforated screen of metal or other conducting material connected to earth and inserting a high resistance in the earth connection for causing an accumulation on the screen of the electricity radiated from the conductor.

940,430. PROCESS AND APPARATUS FOR NEUTRALIZING STATIC ELECTRICITY. William H. Chapman, Portland, Me., assignor to Chapman Electric Neutralizer Company, Portland, Me. Filed April 2, 1906. The apparatus for removing static electricity consists of a tube of conducting material connected to earth and having a longitudinal slot therein, a longitudinally disposed insulated conductor within the tube and means for supplying a high-voltage charge to the conductor.

940,431. MEANS FOR NEUTRALIZING STATIC ELECTRICITY. William H. Chapman, Portland, Me. Filed March 13, 1908. The means for neutralizing static electricity consist of an insulated cable connected with a source of high-voltage alternating electricity, a metal sleeve on the outside of the cable, a discharging conductor with a fine discharging point connected with the sleeve and a grounded conductor located adjacent to the discharging point.

940,444. VISUAL-SIGNAL APPARATUS. Rudolph Einbigler, New York, N. Y. Filed April 8, 1909. Comprises a nameplate mounted to swing, electromagnets for controlling the same, a station plate mounted to swing, an electromagnet for operating the same, and a controlling circuit for both sets of electromagnets to actuate both plates simultaneously from one station.

940,448. SPARK-PLUG FOR INTERNAL-COMBUSTION ENGINES. Maurice Eyquem, Paris, France. Filed April 28, 1908. Comprises a tubular electrode, a cock mounted on the latter and opening to the exterior, and a short-circuiting rod arrange on the plug of the cock and keyed so as to come in contact with the metal body of the spark-plug when the cock is open.

940,483. ELECTRIC CHIME. James E. Scovill, Chicago, Ill. Filed January 8, 1909. Comprises a frame with chime bells mounted therein, a chime-ringing device, a motor, a train of gearing for actuating the chime-ringing device, a motor circuit, a switch in the same, a relay provided with an armature adapted when energied to close the switch, and clock-controlled relay-energizing means.

940,487. ELECTROMAGNETIC TRACTION SYSTEM. Gardner L. Stanbro and Awrea D. Wagner, Norfolk, Va. Filed June 7, 1906. Describes a form of surface-contact system.

940,492. ARRANGEMENT FOR REGULATION OF SPEED OF COMPENSATED SINGLE-PHASE MOTORS. Engelbert Arnold, Karlsruhe, Germany, and Jens L. La Cour, Vesteras, Sweden. Filed November 23, 1908. A compensated alternating-current motor includes a main stator winding, a rotor winding provided with a commutator, brushes bearing on the commutator arranged to form with the rotor winding exciting and compensating circuits, an auxiliary stator winding along the magnetic axis of the exciting circuit, and means to shift the brushes toward and from each other without changing the direction of the axis of the compensation circuit.

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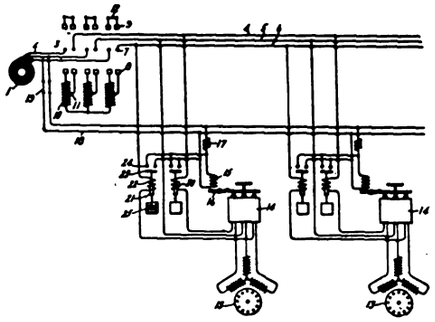
940,495. ELECTRIC PROCESS FOR MAKING PICTURES. Braxton D. Avis, Jr., Wallace, W. Va. Filed June 23, 1908. The method consists in preparing a conducting surface, coating the same with a film, the solubility of which is affected by light, exposing the film for the purpose of rendering different portions thereof insoluble in various degrees so as to vary electrical resistance of different portions of the film, and depositing a metal electrolytically upon the conducting surface through the film.

940,511. MOTOR-VEHICLE. Frank E. Case, Schenectady, N. Y., assignor to General Electric Company. Filed October 10, 1906. A number of current collectors are arranged normally in engagement with the supply conductor, several motors are provided, and motor-controlling switches connect these motors in series to one collector at starting and independently to different collectors for running.

940,526. ELECTRICAL RECEPTACLE. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Filed May 6, 1909. A screw shell for an electrical receptacle has a base cut away to form securing flanges, portions of the base being rolled over on the flanges to reinforce the same.

940,550. APPARATUS FOR STARTING ELECTRIC MOTORS. Sidney B. Paine, Newton, Mass., assignor to General Electric Company. Filed May 28, 1909. A system of distribution comprises a source of voltage, a number of conductors, a starting device connected between the source and the conductors for simultaneously energizing the conductors alternately with a portion of the voltage from the source and with full voltage from the source, a number of motors connected in parallel to the conductor, switches connected in series between the motors and the conductors, overload tripping devices for the switches, under-voltage electromagnetic tripping devices for the switches and conductors connecting the tripping devices to the source independently from the starting device.



940,550.—APPARATUS FOR STARTING ELECTRIC MOTORS.

940,555. SUSPENSION DEVICE FOR TELEPHONE AND TELEGRAPH CABLES AND OTHER ELECTRICAL CONDUCTORS. Emery C. Read, Franklin, Pa. Filed November 25, 1908. Describes a form of clip.

940,561. TAPPING-FURNACE. George O. Seward, Holcombs Rock, Va., assignor to Electro Metallurgical Company. Filed May 3, 1904. The process of operating an electric tapping furnace consists in closing the tap hole by means including a conductive material, and opening the tap hole by the heat from an electric current arcing to and carried through the conductive material.

940,574. TROLLEY-HARP. James T. Archer, Champaign, Ill., assignor of one-half to Francis M. Foltz, Urbana, Ill. Filed November 18, 1908. A plunger is slidably mounted in the housing.

940,610. GAS LIGHTING AND EXTINGUISHING APPARATUS. Victor C. J. Nightingall, Melbourne, Victoria, Australia, assignor to the Nightingall Gas Control Company, Limited, Melbourne, Australia. Filed June 8, 1909. Electrically operated means are connected at certain segments of a number of revolving segmental switches (operating simultaneously with variation of gas pressure) for supplying gas to certain burners, etc.

940,616. AUTOMATIC CUT-OFF FOR WEIGH-SCALES. Robert W. Romig, Pittsburg, Pa., assignor to the Fairbanks Company, New York, N. Y. Filed July 16, 1907. The power cylinder has an electromagnetically operated valve.

940,632. DYNAMO-ELECTRIC MACHINE. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed November 27, 1905. Includes a stationary armature comprising a core and supporting frame, a distributed armature winding comprising coils having end-turns extending beyond the core, a supporting ring for the end-turns, and means binding the end-turns to the supporting ring.

940,635. ELECTRODE ELEMENT FOR STORAGE BATTERIES. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to Edison Storage Battery Company, West Orange, N. J. Original application filed November 2, 1905. Divided and this application filed February 6, 1908. The element comprises a perforated tubular inclosing pocket composed of a strip of steel, non-deformable under normal working condition, containing a highly compressed mass of active material, and formed with a spirally arranged joint.

940,645. SWITCH. Lembert H. Moulthrop, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Filed September 12, 1908. Describes a form of push-button switch.

940,647. AUTOMATIC MAGNETIC CIRCUIT-BREAKER. William M. Scott, Philadelphia, Pa., assignor to the Cutter Electrical and Manufacturing Company. Filed January 19, 1907. An electrical switch comprises a movable contact member, a cam member for actuating the same, a member engaging the cam member to actuate the same by cam action, an actuator, and means for locking the actuator to the said member.

940,649. SHADE FOR ELECTRIC LAMPS. Nellie C. Bebin, London, England, assignor to Captain C. Wiener, Philadelphia, Pa. Filed March 12, 1906. An ornamental lamp-shade consists of a mesh beadwork cover for the globe.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 22, 1909:

486,457. INCANDESCENT ELECTRIC LAMP. Gustav A. Frei, Springfield, Mass.

486,488. ELECTRIC ARC LAMP. William O. Meissner, Chicago, Ill.

486,498. LIGHTNING ARRESTER. Harry G. Osburn, Chicago, Ill.

486,506. ELECTRIC SWITCHBOARD. Charles E. Scribner, Chicago, Ill.

486,507. TEST SYSTEM FOR MULTIPLE SWITCHBOARDS. Charles E. Scribner, Chicago, Ill.

486,524. DYNAMO-ELECTRIC MACHINE. George Baehr, Brooklyn, N. Y.

486,563. ILLUMINATED TIMEPIECE. Benjamin Haas, Jr., and Gustave Trouve, Paris, France.

486,569. ELECTRIC SIGNALING DEVICE. James J. Ross, Detroit, Mich.

486,575. PROCESS OF ELECTRICALLY REDUCING REFRACTORY COMPOUNDS. Thomas L. Willson, Leaksville, N. C.

486,612. ELECTRIC RELEASING DEVICE. William R. Hewitt, San Francisco, Cal.

486,624. ELECTRICAL METHOD OF, AND APPARATUS FOR, FORMING TUBES. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

486,625. ELECTRIC METAL-HEATING APPARATUS. George D. Burton, Boston, Mass.

486,626. ELECTRIC FORGING APPARATUS. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

486,627. ELECTRIC FORGE. George D. Burton and Edwin E. Angell, Somerville, Mass.

486,643. CURRENT DIRECTOR. James F. McElroy, Albany, N. Y.

486,644. CURRENT REGULATOR. James F. McElroy, Albany, N. Y.

486,656. CARBON-BRUSH HOLDER FOR DYNAMO-ELECTRIC MACHINES AND MOTORS. James J. Wood, Fort Wayne, Ind.

486,689. ELECTRICAL MEASURING INSTRUMENT. Edward Weston, Newark, N. J.

486,715. ELECTRIC DEVICE FOR VIBRATING TABLES. William L. Imlay, Camden, N. J.

486,729. ELECTRIC LAMP SHADE. Charles J. Miller, Philadelphia, Pa.

486,757. ELECTRIC ARC LAMP. James Brockie, London, England.

486,807. ELECTRICAL HOSE SIGNALING APPARATUS. William Fowler, Colorado Springs, Colo.

486,820. ELECTRICAL ANNUNCIATOR. Franklin S. Carter, Burlington, N. J.

486,838. ELECTRIC CLOCK. Martin V. B. Ethridge, Everett, Mass.

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CONTENTS.

EDITORIAL:
Competition of High-Pressure Gas....1067
Storage on Southern Streams....1068
Increase of Flaming Arcs at Boston....1069
Chicago Arranging for Complete Electric Lighting of Its Streets....1070
Wisconsin Electrical Association....1070
National Electric Light Association to Investigate Terminology....1070
Ohio Society of Mechanical, Electrical and Steam Engineers....1070
American Association of Electric Motor Manufacturers....1071
Removing Cancer by Electricity....1071
Transmitting Pictures Across the Atlantic....1071
Reducing Smoke in the "Black Country" in England....1071
Chicago Electric Club....1072
The Big Independent Telephone Convention....1072
Alabama Light and Traction Association....1072
The Determination of the Circle Coefficient of the Induction Motor....1073
A European Electric Train-Lighting System....1076
Diplomacy in Business....1077
The Value of Mathematics....1077
The Rougé-Foget Permutator....1078
A New Mercury Interrupter....1081
Street Telephone Stations on Poles....1081
Laws of Electrode Losses in Electric Furnaces....1082
Electric Smelting Costs in Sweden....1084
Cadmium Amalgams and the Weston Normal Cell....1085
ELECTRIC TRACTION:
A Modern Electric-Railway Substation....1086
Three-Phase Traction Systems....1087
Device for Preventing Collisions....1088
Increased Earnings of Wisconsin Railways....1088
CENTRAL-STATION PRACTICE:
Notes on Long-Distance Transmission....1089
Waterhammer and Steam Explosion....1090
A New Australian Central Station....1091
Waterpower in Iceland....1091
An International Congress of Radiology and Electricity....1091
TELEGRAPHY—TELEPHONY AND WIRELESS:
Automanual Telephone Exchange at Ashtabula, Ohio....1092
Neon and Electric Waves....1095
New Ruling on Telephone Installation....1095
INDUSTRIAL POWER:
Speed Control of Electric Motors....1096
Electric Developments in Birmingham, England....1097
BOOK REVIEWS....1098
FINANCIAL REPORTS OF ELECTRICAL COMPANIES....1099
INDUSTRIAL SECTION:
Installation of an Intercommunicating Telephone System in a Jewelry Manufacturing Plant....1100
Combined Disconnecting and Transfer Switch....1101
A Fire and a Quick Installation....1101
Arc Lamps for Various Phases of Illumination....1102
Allis-Chalmers Sales of Pumping Machinery....1102
What Constitutes a Good Lubricant?....1103
Central Electric Exhibit at Illinois State Convention....1103
Electrically-Heated Devices for Holiday Trade....1104
Underground Transformers....1104
Electrical Equipment for a Large Shop....1104
CURRENT ELECTRICAL NEWS....1105
RECORD OF ELECTRICAL PATENTS....1112

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COMPETITION OF HIGH-PRESSURE GAS.

While electrical supply systems are rapidly spreading over wider areas with the aid of high voltages, similar results on a smaller scale are being reached with gas.

One result of this is to increase the competition of gas with electricity in small places where the manufacture of gas in local plants is relatively expensive. It is in the towns that electric lighting has ever had its greatest advantage over gas, and it will be found that to maintain this advantage it will be more and more necessary to displace the small generating stations with transmitted energy from large systems.

As long as the policy of merging the small electric plants into the large generating and transmission systems is followed, there need be no fear that the electric light will not hold its advantage over even high-pressure gas.

The adoption of high-pressure gas for the supply in small places is due to the desire to reduce costs by production on a large scale and at points where low rates can be had for the transportation of materials. On this point it may be said that large-scale production is decidedly more essential to low costs in gas than in electric works. While the gas interests have thus much to gain by the concentration of production, they must pay a greater price for the distribution of the product.

A rough comparison may be made between the pressures of two, three or four inches of water at which many large gas plants distribute their product, and the 250-volt, three-wire system of electrical supply, as far as ability to cover wide areas and long distances is concerned. It is thus out of the question for these large, low-pressure gas plants to supply towns even a few miles distant by simply extending the regular distributing system. The other alternative is to compress the gas to five, ten, twenty or more pounds per square inch, according to the length of the transmission and other factors, and then to reduce the pressure at the place of use.

Where the gas must be compressed the extra cost begins. For the compression there must be provided machinery driven by electric motors, engines or waterwheels, and the first cost and operating expenses for such machinery are decidedly higher than the corresponding cost and expenses of transformers in an electric system. By compressing the gas the sizes of pipes necessary to convey it are greatly reduced, but these pipes must be of extra strength and have especially tight joints. The most expensive feature of the pipe system usually is the great length that must be laid to sell a given volume of gas annually.

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Having transmitted the gas to its points of use, the pressure must be reduced before consumption can begin. Two methods are in vogue to achieve this result, one being to connect the high-pressure gas main with a local, low-pressure distributing system through regulators that reduce the pressure to about the usual two or three inches of water. The other method is to distribute entirely with high-pressure mains, and to connect each meter with these mains through a service governor that gives any desired pressure at that particular meter only.

Against the greater economy of gas production at favorable points on a large scale, there must be a large investment in mains, governors and services to deliver the gas to consumers.

An illustration of the importance of the items last mentioned may be taken from a recent estimate of the cost of construction for a new gas plant to supply 8,000 consumers on the high-pressure system. This plant is to have its works for the manufacture of gas on a water front so as to get cheap transportation, and is intended to reach some ten towns within a radius of about twelve miles. To reach the 8,000 consumers in these towns it was estimated that 100 miles of high-pressure mains from two to six inches in diameter would have to be laid at a cost of $583,240, including the services and governors.

In this instance all of the mains are to operate at high pressure, and the meter of each consumer will be connected through a service governor. The cost just stated for mains, services and governors alone amounts to $5,832 per mile of line, and to $73 per prospective consumer, and these figures may be compared with the cost of 100 miles of electric line within a radius of twelve miles to connect with 8,000 consumers.

Gas of eighteen to twenty candlepower is to be sold by the above system at $1.00 per thousand feet, while gas of this quality would ordinarily sell for as much as $1.50 per thousand feet in towns of 3,000 to 11,000 population each, like the above, if made in local plants. It is evident that while the electrical supply system of a large city would have little to fear from dollar gas if extended to the above towns, small, local electric stations might find it inconvenient to meet the competition. One of the towns where a franchise for the above gas system is sought hesitates to let the cheap gas come in, because the town has a municipal electric plant. Of course a private electric corporation could expect no such mercy as the exclusion of low-priced gas, and hence the bearing of the above suggestions as to the extension of large electrical systems to the small towns.

The practice of transmitting compressed gas to small places has grown up mainly during the past ten years, and is now on the increase. In a state whose records are at hand compressed gas is sent to nine towns from four manufacturing plants. One plant in Illinois is reported to have more than 4,000 consumers supplied with high-pressure gas in several towns; a plant in Indiana has more than 4,000; and one in California has more than 5,000 such consumers.

All this goes to show that the gas companies are not slow to grasp to the smallest extent possible the advantages of transmission over a wide area from a large generating plant.

STORAGE ON SOUTHERN STREAMS.

Between the Potomac and the Mississippi the South is traversed by many large and powerful rivers, such as the James, of Virginia, the Catawba, of North and South Carolina, the Oconee of Georgia, the Tennessee River, of Tennessee, and the Alabama River, of Alabama. This older section of the South, with its numerous cotton mills, lumber factories and iron plants, has come to be a great user of power.

With steam coal at three dollars and more per ton in many sections of the South, there is a general turning to the rivers to solve the problem of cheap power, and the industrial advance of this section during the past decade has been largely based on water power.

In this situation electrical transmission has proved to be of prime importance, for the southern railways follow the high lands rather than the river valleys, and manufacturing plants must have cheap transportation as well as power. While electricity thus forms a perfect link between the industries of the South and its great source of power, there remains a weakness in that source which must as far as possible be cured—that is, the lack of constancy.

Unlike the power streams of New York and New England, with their numerous lakes and ponds, or those of California, with their great artificial reservoirs, the rivers of the South have but little storage capacity in most instances, as thus far developed. This characteristic of the southern rivers is all the more important in its bearings on the situation because the great power demands of the South are made by day rather than by night, and are in the main continuous through all the months of the year.

A result of the above is that the hydroelectric systems of the South have to be supplemented largely by steam power in many instances, such steam power being installed either by the electric systems or their customers. More than this, where an electric system is not in a position to guarantee constant power, it must accept lower rates per unit for its output. If the amount of electric power that can be supplied is uncertain, the consumer is less inclined to accept it at any price, and the installation of a steam plant equal to his entire demand puts him in a very independent position.

Such an instance came up last year at one of the large cotton mills of the South that is within transmission distance of three large hydroelectric plants, two of which are under construction and the third in operation, but neither of which could deliver constant power. At this mill plant the cost of run-of-mine steam coal is $3.70 per short ton, and yet a steam-boiler plant of 5,700 horsepower was installed to operate electric generators rated at 5,500 kilowatts, to supply power for the mills. When these mills take energy from one of the above hydroelectric plants, it can hardly be doubted that the interest and maintenance charges on the steam plant will affect the rate paid for transmitted power.

Storage of two quite different capacities is desirable on the southern rivers; first, storage to hold the entire flow of a

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stream during the night for use during the day, so as to double the mill load that may be operated during periods of low or moderate flow. The other class of desirable storage must have sufficient capacity to carry water from periods of large flow over several weeks or months of small flow, so as to increase materially the output of the plant during such dry periods.

It is safe to say that enough storage to hold the night flow at times of low discharge can be created at a large percentage of the large waterpower sites on southern rivers, if the developments are planned with this object in view.

How far the much greater storage capacities necessary to carry the surplus water of wet periods over several weeks or months of low river discharge can be created is a matter worthy of much investigation and study. Such reservoirs can no doubt be created at many points among the Appalachian Mountains, where most of the rivers under consideration have their source, but private interests can hardly be expected to construct such reservoirs at the headwaters of a stream unless they control most of the power sites along its course.

In some instances, however, it is practicable to create reservoirs at the power sites that will at least double the minimum flow of the stream during several weeks, and thus increase in the same ratio the amount of constant power. There is one such power site on a large southern river where high rocky banks permit a reservoir about ten miles long with a water surface of more than 100,000,000 square feet above the dam to be created. During three months of a recent dry year the discharge of the river at the power site just mentioned averaged about 1,500 cubic feet of water per second, amounting, if stored during the night, to 3,000 cubic feet for use on the wheels during twelve hours of each day. By a reduction of less than seven per cent in the head of the water at the dam, the above reservoir might have yielded 500 cubic feet per second from its stored water during the entire three months in question, or 1,000 cubic feet per second during twelve hours on each of seventy-five working days. This would have increased the available water from 3,000 to 4,000 cubic feet per second during twelve hours on each working day of the dry period.

The hydroelectric plants thus far constructed in the South show widely different storage capacities along their several streams, according to the areas of the reservoirs created by the dams. At one plant under construction for a capacity of 25,000 kilowatts the length of the reservoir behind the dam is about one-and-one-half miles and its water surface is some 10,000,000 square feet.

A plant operating with 24,000 kilowatts capacity has a storage area about three miles long and from 1,000 to 2,000 feet wide behind its dam. One of the best storage reservoirs in the South is behind a dam that maintains a head of twenty-five feet for a station containing generators of 6,600 kilowatts capacity. This reservoir extends twelve miles upstream, where the width is perhaps 1,000 feet on an average. More long reservoirs like this are to be desired.

INCREASE OF FLAMING ARCS AT BOSTON.

Some weeks ago attention was called to the use of flaming arc lamps at Copley and Park squares in Boston, and a considerable extension of this method of street lighting has since taken place there.

These flaming arcs operate with 6.7 amperes direct current and require 500 watts each. They are rated at 1,600 candlepower. According to the tests on the candlepower of these lamps, last April and May, while they were in regular operation at Copley Square, their average intensity at twenty-five degrees below the horizontal was 2,500 to 3,000 candles each.

The first installation consisted of three lamps at Copley Square mounted at the tops of poles with the center of each globe fifty-two feet above the ground. The results with these three lamps were so satisfactory that a fourth was added in the square to make a permanent installation, and nine of the 500-watt 6.7-ampere enclosed arc lamps that had been in use to light the square were displaced.

For these nine enclosed arcs, which operated with direct current, the total energy required was 4,500 watts, the aggregate candlepower at normal rating was 3,600, and the annual cost to the city was $831 for 3,828 hours of lighting. With the four flaming arc lamps now in use the total power is 2,000 watts, or something over forty per cent of the former amount; the combined candlepower as rated is 6,400, an increase of nearly eighty per cent, and the annual rate to the city is $625, or twenty-four per cent less than before. As a matter of general observation, there can be no doubt that Copley Square is much better lighted than formerly.

Between the fronts of the buildings on its opposite sides Copley Square measures approximately 400 by 400 feet, and thus contains some 160,000 square feet. As now lighted with the four flame arcs, the consumption of power is thus about 0.0125 watt per square foot.

Two flame arc lamps were also placed in Park Square last spring, and now there are in place or in process of erection sixteen other flame arcs at prominent points about the city of Boston, making a total of twenty-two of this type.

For the additional sixteen flame arcs the locations are one each in Adams, Post Office, Columbus, Merrimac, Central, Maverick, Breed, Pierce and Edward Everett squares; one at the Common and Beacon Street, Center and South streets and South Street and the Parkway, respectively; also two at North End Park and two on the Common.

In Park Square the two flame arcs have the centers of their globes forty-three feet above the ground, and at the other locations this type of lamp is placed much higher than were the enclosed direct-current arcs that were displaced.

Besides the above permanent installation of flame arcs, more than a dozen of these lamps were used temporarily to light Huntington Avenue and the outside of the Mechanics Building during the recent Boston Electrical Show. Many American cities might advantageously follow Boston's example.

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Chicago Arranging for the Complete Electric Lighting of its Streets.

The city of Chicago has in service for public street lighting about 13,000 arc lamps. It has been estimated that in order to completely light up all of its streets, many of which are now still illuminated by gas and gasoline lamps, it will require a total of about 29,000 arcs. Alderman B. W. Snow, chairman of the finance committee of the City Council, has taken up the matter with the Sanitary District of Chicago, from which other municipal body the bulk of the current now used for street lighting is secured. In a letter to President McCormick, of the district trustees, he sought the latter to consider the proposition of financing the extension of the electric service to all of the streets, which would require an investment of $2,000,000 to $2,500,000. As an alternative proposal, it was hoped to have public approval of a bond issue to this extent, but the latter scheme seems to be somewhat doubtful of being carried out.

President McCormick has made a counter proposition to the city, offering to purchase the city's transmission lines and substations now in service for bringing the Sanitary District's current from its main substation. The District has other substations located in the city limits, the lines running to some of which duplicate those of the city. The finances of the Sanitary District are in first-class condition, whereas those of the city are far from this state of affairs. The money that the city would get from the sale of its substations and lines to the district it could use advantageously for the installation of additional arc circuits. Considerable economy is expected from such an arrangement. In fact, President McCormick estimates that if the various governing bodies included within the borders of the Sanitary District would make more complete use of its hydroelectric power generated at Lockport, the resulting saving to the community at large would be no less than $1,000,000 a year. In this connection it may be said that the Sanitary District has for some time been urging the city to equip its pumping stations for electric service, so that it may be able to shut down all of its steam-driven plants, except for emergency service. By both these services the district would be enabled to build up its load factor to nearly 100 per cent both night and day. At present the Lockport plant is running much below capacity and the district tries to sell its surplus power for commercial purposes.

Wisconsin Electrical Association.

The first regular annual convention of the Wisconsin Electrical Association will be held on January 19 and 20, 1910, at the Hotel Pfister, Milwaukee, Wis. It will be remembered that this association is the consolidation and successor of the old Northwestern Electrical Association and the Wisconsin Electric and Interurban Railway Association, the merging of the two former bodies having taken place at the joint meeting held at Waupaca, Wis., June 28 and 29 last.

The arrangements for the coming meeting give promise that it will be one of exceptional interest as the best energies of all the electrical men in Wisconsin are represented in the new association. The programme is not sufficiently settled as yet, however, to permit of public announcement. The secretary and treasurer of the association is John S. Allen, of Lake Geneva, Wis.

National Electric Light Association to Investigate Terminology.

The November *Bulletin* of the National Electric Light Association makes the following announcement regarding the work of the terminology committee, of which W. H. Gardiner is chairman. This memorandum is as follows: "With respect to the work of the committee on terminology, the understanding is that this committee was appointed to draw up definitions of various terms used in the central-station business, and regarding which there may be some present confusion; and, if necessary, even to devise new terms. It is intended that the scope of the work of the committee cover the physical and technical departments of the business as well as the commercial end. Therefore, types of apparatus will be defined, as well as such items as "load factors" and various rates and methods of charging.

"The members of the committee on terminology are at present engaged in preparing as comprehensive lists as they each individually can, of such items or terms as seem to require definitions. I therefore, wish, at this time, to ask, through the *Bulletin* of the National Electric Light Association, those who are interested in this work to co-operate by forwarding to me lists of such terms as, in their judgment, may require definition. By the middle of December a complete composite list will be made up from all such lists, and will then receive the attention of the committee for individual definitions of each of its items.

"It is obvious that this work is one of moment, also one of magnitude and some difficulty, requiring the thorough consideration of very many items. I trust, therefore, that the committee will receive prompt co-operation from the members of the Association."

Ohio Society of Mechanical, Electrical and Steam Engineers.

The twentieth meeting of the society took place at Lima, Ohio, on November 19 and 20 last.

President F. W. Ballard took for the subject of his address "Power Costs for Factories." The speaker recommended the keeping of detailed cost accounts of operating machines in a factory, and also discussed the pros and cons of utilizing exhaust steam for heating buildings. He pointed out the economy of electric-driven pumps over those driven by steam, and mentioned further that the first requisite of low-service cost is a system of accounting and follow-up records. A discussion of electric motor drive concluded the address.

Other papers presented were as follows: "New Mechanical Engineering Laboratory at the Ohio State University," by Prof. E. A. Hitchcock (abstracted by Professor Magruder in the author's absence); "The Darling Oil Gas Producer," by A. B. Davis; "Turbine Pumps," by Wetmore H. Titus; "Coal-Handling and Ash-Handling Equipments," by David Gaehr.

The following officers for next year were elected: President, O. F. Rabbe; vice-president, Grant Miller; secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio; managers, Ira Cole, C. T. Baker and E. E. Adams.

Cincinnati was selected as the place of the next morning.

Public Service Commission Orders for Car Heating.

An order has been served upon all street-railroad companies in New York by the Public Service Commission, requiring that all closed electric and horse cars in service between October 15 and April 15 shall be equipped with suitable apparatus for heating. Whenever the temperature is less than forty degrees Fahrenheit a temperature not less than forty nor more than sixty-five degrees above zero must be maintained, unless the company is temporarily prevented from so doing by storms, accidents, or other emergencies beyond its control, and for which it is not responsible. This order is to take effect December 10.

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American Association of Electric Motor Manufacturers.

At the semi-annual meeting of the American Association of Electric Motor Manufacturers, held at St. Louis, Mo., on November 15, 16, 17 and 18 last, the provisional reports of the committees on standard motor speeds, standard pulleys and standard motor dimensions were presented, and the committees (which are working in conjunction with the National Machine Tool Builders' Association) were authorized to complete their investigations. Mention was made of the committee, which is working conjointly with a committee appointed by the National Electric Light Association, to draw up a very complete table of motor data and applications. The report of these committees will shortly be published by the association.

The next meeting of the association will be held some time in May, 1910, at Hot Springs, Va.

Chicago as Headquarters for the Sons of Jove.

At the seventh annual meeting of the Order of Rejuvenated Sons of Jove, held in Cleveland, Ohio, October 14 and 15, an account of which appears in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of October 30, Roy M. Van Vliet, manager Chicago office of the Cutler-Hammer Manufacturing Company, was elected Mercury.

This office for the past four years has been held by C. B. Roulet, of Dallas, Texas, and Chicago members of the association point to the change with pride, as the headquarters will now be in that city. The *Jovian Bulletin,* the official publication of the Sons of Jove, will now be published from the new headquarters in Chicago.

Electricity in Canadian Iron Mines.

The Grenville iron mines, which are located about half way between the Canadian cities of Montreal and Ottawa, make an extensive use of electric power for driving the various plants, as well as for lighting, pumping and hoisting. Most of the current is generated by the central power house, erected in 1903, which contains a 750-kilowatt alternating-current generator direct-connected to a 1,000-horsepower Nordberg-Corliss engine. There is another smaller power house containing a 200-horsepower engine and a 150-kilowatt generator, as well as a supplementary generating station on the Bouquet River for supplying extra power when required.

Removing Cancer by Electricity.

Dr. G. Hauer Everhart, of St. Luke's Hospital, Baltimore, Md., recently made what is stated to be the first operation in this country of Dr. E. Doyen's method of removing cancer by electricity.

The cancerous growth was located in the patient's mouth in this particular case. After the tissues were softened by the application of very hot sterilized air, the electrical currents were applied in such a manner as to kill entirely the growth in a way not possible with the surgeon's knife.

Dr. E. Doyen is an eminent French surgeon, and his process of applying electricity in the cure of cancer is designated "fulguration." It is claimed that the new method is an absolute success and that a recurrence of the disease is not possible when a thorough application of "fulguration" has been made.

New England Section, Illuminating Engineering Society.

The November meeting of the New England Section of the Illuminating Engineering Society was held on the evening of November 16 at the Edison Building, 39 Boylston Street, Boston. The general subject of discussion was "The Technique of the Application of Gas and Electricity in the Best Lighting of Modern Homes." The possibilities for the use of gas for this service were discussed by T. J. Little, of Gloucester, N. J. The availability of electricity in this line was presented by H. W. Moses and E. C. Kimball, of the Edison Electric Illuminating Company of Boston. There was a spirited discussion by the followers of each system, and the meeting was one of the best that has been held for a long time.

Transmitting Pictures Across the Atlantic.

Telegraphing pictures from London to New York is the problem at present engaging the attention of several scientists. In a lecture given before the Royal Society of Arts at London a few days ago Thorne Baker said that Professor Korn was likely to find a practical solution of sending photographs by the ordinary cable across the Atlantic, while he himself was endeavoring to perfect a wireless system for the same purpose, which had already given promising results in his laboratory.

A complete series of photographs was shown illustrating the progress that had been made since the first instruments of Professor Korn were installed in November, 1907, at the offices of *The Daily Mirror.* It is said that the Korn telautograph and the Thorne Baker telectograph will enable photographs of all kinds to be telegraphed for publication with a fair measure of success. The improvement in the processes of transmission within this relatively brief period is striking.

To Test Corporation Law.

In a recent suit brought in the Supreme Court of California, the Merced River Electric Company is attacking the state law which prevents corporations from creating a bonded indebtedness greater than the initial subscription of stock. This suit involves the question of whether the Secretary of State can be compelled to file corporation papers not in accordance with the law.

While the subscribed stock of the company is only $2,500, it is capitalized for $1,500,000, and wants to bond itself for an amount equal to the entire capital.

Reducing Smoke in the "Black Country" in England.

The "Black Country" in England has long been the popular designation of the great manufacturing district in South Staffordshire, in England, where even the very vegetation is blackened by the dirty pall of smoke which always hangs over the landscape.

A writer in a recent number of the *Windsor Magazine,* a popular British monthly, gives some particulars of a scheme which is being promulgated for doing away entirely with this smoke nuisance in the Black Country.

The idea of this scheme is to use the coal fuel, not in ordinary boiler furnaces, but in Mond producers, the resulting producer gases to be employed in driving gas engines coupled to electric generators at large central stations. The electricity will then be used for operating motor-driven instaliations in the various factories.

Missouri Attacks Bell Mergers.

Dispatches from Jefferson City, Mo., state that Attorney-General Major has received complaints from various parts of the state that the Bell Telephone interests are purchasing control of many Independent companies in Missouri. He has announced such purchases are violations of the state's antitrust laws. He is preparing to proceed in the Supreme Court either by asking for the appointment of a commissioner to take testimony or by ouster direct or by injunction, to prevent the Bell Telephone Company from purchasing other companies.

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Chicago Electric Club.

The regular midday luncheon of the Chicago Electric Club, held on Wednesday, November 24, was followed by an interesting address by George P. Barton, senior member of the firm of Barton & Folk, who chose for his subject "The Trend of Invention."

In introducing the subject, Mr. Barton said that the Electric Club is representative of industries which in all their branches have been founded upon inventions that have been patented. The trend of inventions may be viewed in three aspects: First, with respect to the inventions themselves from the engineer's standpoint; second, with respect to the rules and regulations and practice by which the inventor secures his lawful monopoly; and third, the influence of inventions upon society.

Confining himself to the second aspect, the speaker referred to April 30, in the year 1789, when the present form of government was inaugurated and the constitution went into effect with a provision relating to patents. In showing the wonderful development in patents since that time, the following statistics were quoted: In the year 1800 only forty-one patents were issued by the United States; in the year 1850, excluding patents for designs, there were issued some 884 patents for inventions; during the year 1900 there were issued 24,660 patents; and during the fiscal year, ended June 30, 1909, there were granted 34,332 patents for inventions. Assuming that there are now existing over 400,000 unexpired patents, the speaker stated that these patents contain in the aggregate at least 2,000,000 claims; that he had not counted them; that there might be three or four million. He said that some looked upon these outstanding patent claims as a menace to our industries. He said, however, that the great majority of patents were worthless, not benefiting anyone unless the solicitors; that one employe of an advertising agency had written over 15,000 applications for patents, earning for himself $60.00 a week on ten per cent of the amount charged the inventors by the agency.

That the examiners of the Patent Office, in association with the solicitors of patents, have worked out a code of patent law well understood between themselves, incomprehensible to the laymen, incomprehensible to foreign nations, and hardly recognized by the courts, was demonstrated in the case between the Benjamin Electric Manufacturing Company and the Dale Company. In this case the Benjamin company, on the strength of its invention, asked for seven claims, and by the time the Patent Office was through with the company it was the holder of four separate patents, granted upon divisional applications split off from the original one, the four patents containing altogether ninety-eight claims.

The speaker stated that there were now forty-two separate examining divisions in the Patent Office and 400 or more examiners; that the examiners would usually require division of an application when search was required in more than one division; that solicitors of patents, largely compensated by a fixed fee for each application, were apt to view with complacency the multiplication of their fees by acts of the Patent Office in requiring division. This divisional attenuation or splitting up of a single invention into numerous patents and claims was marked and significant; that this trend of invention was not for the benefit of inventors, investors in patents, manufacturers or the public.

Mr. Barton referred also to the embarrassments experienced by patentees in enforcing their rights in the courts, and made reference to the recent decision in the Selden Automobile Patent Cases, the court having stated, as a horrible example, that the record comprised thirty-six large octavo volumes which clients had to pay for.

In reply to a question as to the position of the legal profession on the subject of establishing a technical trial court, Mr. Barton said that in the Patent Office the examiners were educated, technical men; that there had been no action taken toward establishing technical trial courts to hear patent causes, but that the American Bar Association had recommended the establishment of a Patent Court of Appeals; that patent lawyers generally favored this, since there are now ten Courts of Appeal, counting the Court of Appeals for the District of Columbia, each for a different portion of the country, having final appellate jurisdiction in patent matters; that the proposed plan was to appoint a chief justice and to designate as his associates four circuit judges, who, presumably, would be named on account of their eminence in patent law.

The Big Independent Telephone Convention.

As previously announced, the next convention of the International Independent Telephone Association will be held at the Auditorium Hotel, Chicago, December 7 to 9, inclusive. Arrangements are practically complete for an unusually large and successful meeting. The large number of rumors concerning the affiliation of various Independent telephone companies that have recently been current have resulted in exceptional interest being taken in the coming meeting by all stanch followers of the Independent movement. As usual an extensive exhibit of telephones and telephone appliances will be made in connection with the meeting. As a reminder of the forthcoming convention there is being distributed a large folder showing a photographic reproduction of Chicago's water front with a conspicuous indication of the Auditorium Hotel, where the meetings are to be held.

Alabama Light and Traction Association.

The annual convention of the Alabama Light and Traction Association was held at Birmingham, Ala., on November 15 and 16. Among the papers presented were the following:

"Some of the Worries and Duties of the Central-Station Manager in a Small Town," by C. C. Henderson; "Public Service Possibilities," by C. D. Armstrong; "School for the Manager," by T. K. Jackson; "A Visible Side of Accounting," by G. S. Emery. C. M. Cory gave a talk on the corporation tax law, and Prof. E. E. F. Creighton delivered an interesting lecture on lightning arresters that was illustrated by experiments.

At the conclusion of the meeting the following were elected officers for the coming year: G. Howard Wilson, president of the Mobile Light and Railway Company, president; R. L. Rand, vice-president; Lloyd Lyon, of Mobile, secretary-treasurer.

Pittsburg Electric Booster Club.

The Pittsburg Electric Booster Club held its monthly "Short Circuit" at the Duquesne Hotel on the evening of November 29. The meeting was preceded by the usual dinner, after which A. P. Munning, general sales agent of the Cutler-Hammer Manufacturing Company, made an address on "Seventeen Years in the Development of the Controller Industry." H. F. Hetzel, of the Vesta Coal Company, enlivened the proceedings by his excellent rendition of a number of violin solos. The Midnight Quartette aided materially along similar lines, and on the whole the meeting was one of the most pleasant that has yet been held by the Pittsburg Electric Boosters.

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THE DETERMINATION OF CIRCLE COEFFICIENT OF THE INDUCTION MOTOR.

BY H. M. HOBART.

The quality of an induction motor is very dependent upon the value of σ, the circle coefficient,[1] and, other things being equal, the lower the value of the circle coefficient, the better is the induction motor. The general order of magnitude of the circle coefficient ranges between 0.03 and 0.10, and depends chiefly on the rated speed and periodicity and on the rated output.

A conception of the physical significance of σ cannot well be discussed within the limits of this article, the main object of which is to set forth a practical empirical method of estimating σ.

Some years ago, Behrend proposed that the circle coefficient should be estimated from the formula

$$\sigma = C \times \frac{\Delta}{\tau}$$

in which C is a factor stated by Behrend to depend "upon the shape and size of the slots and upon a great many other conditions of which we are still profoundly ignorant."[2] Behrend stated that for partly open slots, C varies between 10 and 15. The quantities Δ and τ denote, respectively, the values of the radial depth of the air gap and of the polar pitch at the air gap, both expressed in centimetres. It is important that it should be clearly realized that σ is a quantity which is not capable of exact predetermination. It is for this, among a number of reasons, that it is generally useless, in the practical designing of induction motors, to employ the highly mathematical theories which have been framed with the intention that they should be used by designers in predetermining σ. Sanely viewed, many of these theoretical investigations are valuable, but in so far as they tend to instill the impression that a high degree of accuracy is attainable in the predetermination of the circle coefficient of an induction motor, they are misleading and harmful.

The author's method of estimating σ has been largely based on the analysis of a large collection of experimental data. Here again a difficulty is encountered. The experimental observations are themselves subject to a probable error of a large amount, and it is safe to say that many of the experimental results which are believed to be quite accurate by those who have made the tests, are often inaccurate to the extent of thirty per cent and more. The method of test is rarely reported; the radial depth of the air gap is difficult to measure with any accuracy; the measuring instruments are often out of order, and finally, large mistakes are generally made by the test-room staff in entering up their results and in making their calculations from these data.

Nevertheless, in the large numbers of tests of which the author has brought together the alleged correct results have been of great value as affording the necessary basis for the empirical method which will now be described.

During the last five years the author has devised several methods[3] for predetermining σ. While each of these has led to good results for certain ranges of conditions, no one of these has thoroughly sufficed for the wide range of values of

TABLE I.—OBSERVED AND ESTIMATED VALUES, FOR σ, THE CIRCLE COEFFICIENT OF THE INDUCTION MOTOR, FOR 71 POLYPHASE INDUCTION MOTORS.

Size of Motor.	Reference Number.	Diameter at Air Gap — D — cm.	Gross Length of Core — Λ_g — cm.	Net Length of Core — Λ_n — cm.	Number of Poles.	Pole Pitch τ — cm.	Radial Depth of Air Gap — Δ — mm.	Number of Stator Slots.	Number of Rotor Slots.	Average Number of Slots per Pole — H.	Squirrel Cage or Slip Ring.	Observed Value of Circle Coefficient σ.	Estimated Value of Circle Coefficient σ.	Discrepancy—Per Cent.	Average Discrepancy.
SMALL.	1	29 0	10 0	9 0	4	22 8	0 65	72	96	21	Slip Ring	0 060	0 053	—12	
	2	29 0	10 0	9 0	6	15 2	0 65	72	96	14	Slip Ring	0 090	0 084	—6	
	3	29 0	14 5	13 0	4	22 8	0 65	72	96	21	Slip Ring	0 045	0 044	—2	
	4	29 0	14 5	13 0	6	15 2	0 65	72	96	14	Slip Ring	0 070	0 070	—7	
	5	30 5	15 2	13 7	4	24 0	0 80	48	67	14	Squirrel Cage	0 056	0 068	—14	
	6	31 7	15 0	12 6	2	48 5	1 50	30	49	20	Squirrel Cage	0 053	0 043	—19	
	7	32 0	20 0	18 0	6	16 8	0 75	54	72	11	Slip Ring	0 055	0 068	+24	
	8	35 6	11 4	10 3	8	14 0	0 82	72	96	11	Slip Ring	0 140	0 108	—23	
	9	35 6	15 9	14 3	4	28 0	0 66	60	55	14	Squirrel Cage	0 052	0 040	—23	
	10	35 6	15 9	14 3	6	18 7	0 66	72	55	11	Squirrel Cage	0 050	0 055	+10	
	11	35 6	15 9	14 3	6	18 7	0 66	72	90	14	Slip Ring	0 060	0 062	+3	11%
	12	35 6	15 9	14 3	8	14 0	0 66	72	96	11	Slip Ring	0 090	0 084	—6	
	13	35 6	15 9	14 3	8	14 0	0 66	64	55	8	Squirrel Cage	0 083	0 085	+1	
	14	35 6	15 9	14 3	10	11 2	0 66	60	90	8	Slip Ring	0 130	0 115	—12	
	15	38 0	20 0	18 0	4	30 0	1 90	72	105	22	Squirrel Cage	0 034	0 047	+4	
	16	38 0	20 0	18 0	6	20 0	1 00	72	106	15	Slip Ring	0 066	0 062	—6	
	17	38 0	20 0	18 0	8	15 0	1 10	72	105	11	Slip Ring	0 081	0 085	+5	
	18	38 0	20 0	18 0	10	12 0	1 10	72	105	10	Slip Ring	0 099	0 090	—9	
	19	38 0	24 0	21 6	6	20 0	0 80	54	72	11	Slip Ring	0 054	0 065	+20	
	20	38 0	24 0	21 6	6	20 0	0 80	108	144	20	Slip Ring	0 039	0 043	+10	
MEDIUM.	21	44 5	12 7	11 5	6	23 2	0 76	72	61	11	Squirrel Cage	0 048	0 061	+13	
	22	44 5	12 7	11 5	6	23 3	0 76	72	90	14	Slip Ring	0 045	0 062	+38	
	23	44 5	12 7	11 5	8	17 5	0 76	72	61	8	Squirrel Cage	0 062	0 072	+2	
	24	44 5	12 7	11 5	8	17 5	0 76	72	96	11	Slip Ring	0 090	0 086	—4	
	25	44 5	12 7	11 5	10	14 0	0 76	60	61	6	Squirrel Cage	0 120	0 112	—7	
	26	44 5	12 7	11 5	10	14 0	0 76	60	90	8	Slip Ring	0 170	0 135	—20	
	27	44 5	12 7	11 5	12	11 7	0 76	72	96	7	Slip Ring	0 176	0 137	—22	
	28	44 5	16 5	14 8	6	23 0	1 00	90	140	2	Slip Ring	0 042	0 053	+26	
	29	46 0	30 5	28 5	4	36 0	2 50	72	119	24	Squirrel Cage	0 048	0 049	+2	
	30	49 0	19 0	17 0	4	38 5	0 70	72	120	24	Slip Ring	0 032	0 030	—12	
	31	49 0	19	17 0	6	25 7	0 8	72	120	16	Slip Ring	0 50	048	—4	
	32	49 0	19 0	17 0	8	19 3	0 70	72	120	12	Slip Ring	0 064	0 065	+2	
	33	49 0	19 0	17 0	8	19 3	80	72	120	12	Slip Ring	0 063	0 065	+3	
	34	49 0	28 0	25 0	6	25 7	0 80	72	120	16	Slip Ring	0 042	0 044	+5	
	35	49 0	28 0	25 0	8	19 3	0 80	72	120	12	Slip Ring	0 056	0 056	0	
	36	50 0	21 5	19 5	4	39 0	1 50	60	84	18	Slip Ring	0 051	0 050	—2	
	37	50 0	21 5	19 5	6	26 0	1 60	108	126	20	Slip Ring	0 058	0 060	+3	
	38	50 0	21 5	19 5	8	19 7	1 30	120	141	16	Slip Ring	0 065	0 066	+3	
	39	50 0	21 5	19 5	10	15 8	1 40	120	141	13	Slip Ring	0 078	0 081	+4	
	40	50 0	28 0	25 0	8	19 7	1 00	72	96	11	Slip Ring	0 060	0 065	+8	9 3%
	41	53 3	14 6	13 0	8	21 0	1 14	72	120	12	Slip Ring	0 091	0 085	—6	
	42	53 3	19 7	17 7	4	42 0	1 14	72	67	17	Squirrel Cage	0 030	0 033	+17	
	43	53 3	25 0	22 5	8	21 0	1 25	72	120	12	Slip Ring	0 089	0 073	—18	
	44	58 0	24 0	21 6	8	22 8	0 90	96	144	15	Squirrel Cage	0 037	0 043	+16	
	45	58 0	24 0	21 6	8	22 8	0 90	96	144	15	Slip Ring	0 054	0 053	—2	
	46	58 0	24 0	21 6	8	22 8	1 10	96	144	15	Slip Ring	0 062	0 057	—8	
	47	58 0	30 0	27 0	4	14 0	0 70	144	180	35	Slip Ring	0 022	0 023	+4	
	48	58 0	30 0	27 0	8	14 0	0 70	120	160	18	Slip Ring	0 042	0 043	+2	
	49	76 5	22 3	20 0	6	40 0	1 58	108	126	20	Slip Ring	0 036	0 046	+27	
	50	86 0	25 0	22 5	10	27 0	1 50	150	252	20	Slip Ring	0 065	0 058	—11	
	51	88 0	36 0	23 3	12	23 0	1 50	180	216	17	Slip Ring	0 052	0 057	+9	
	52	90 0	17 0	15 3	12	23 6	1 00	144	180	14	Slip Ring	0 067	0 063	—6	
	53	90 0	23 0	20 6	6	47 2	1 00	144	180	27	Slip Ring	0 033	0 032	—3	
	54	90 0	23 0	20 6	12	23 6	1 00	144	180	14	Slip Ring	0 067	0 058	—13	
	55	90 0	32 0	29 7	8	35 4	1 00	144	180	20	Slip Ring	0 043	0 037	—23	
	56	90 0	32 0	29 7	12	23 6	1 00	144	180	14	Slip Ring	0 060	0 055	—8	
	57	90 0	32 0	29 7	12	23 6	1 14	144	180	14	Slip Ring	0 065	0 058	—11	
	58	94 0	40 0	36 0	12	24 6	1 00	108	144	11	Slip Ring	0 054	0 054	0	
	59	94 0	40 0	36 0	12	24 6	1 00	120	160	12	Slip Ring	0 054	0 053	—2	
LARGE.	60	105 0	16 5	15 0	20	16 4	1 00	120	180	8	Slip Ring	0 115	0 110	—4	
	61	105 0	42 0	38 0	16	20 6	1 45	192	288	15	Slip Ring	0 062	0 062	0	
	62	105 0	60 0	45 0	6	55 0	1 50	72	126	17	Slip Ring	0 033	0 034	+3	
	63	130 0	30 0	25 5	16	25 5	1 60	128	240	12	Slip Ring	0 100	0 079	—21	
	64	130 0	40 0	36 0	14	29 2	1 25	168	294	17	Slip Ring	0 050	0 045	—10	
	65	150 0	22 0	20 0	16	29 6	1 50	144	182	11	Slip Ring	0 075	0 075	0	
	66	150 0	22 0	20 0	16	29 6	1 50	192	216	13	Slip Ring	0 065	0 067	+3	6 8%
	67	150 0	28 0	25 0	14	33 8	1 00	168	210	14	Slip Ring	0 046	0 048	+4	
	68	150 0	28 0	25 0	14	33 8	1 40	168	210	14	Slip Ring	0 055	0 057	+4	
	69	170 0	22 5	20 0	28	19 2	1 60	420	378	14	Slip Ring	0 073	0 079	+8	
	70	300 0	75 0	67 5	30	31 4	1 75	450	720	20	Slip Ring	0 036	0 042	+16	
	71	314 0	41 0	37 0	72	13 7	2 30	864	648	11	Slip Ring	0 130	0 120	—8	

[1] I have substituted the designation "circle coefficient" for the heretofore customary designation "dispersion coefficient" in the belief that, at the commercial designing stage, it is preferable to relieve the mind from all concern as to the physical significance of σ, and to concentrate attention on the circle diagram relations which are based on this useful factor. This must not be taken as implying any wish to deprecate the importance of a clear understanding of the physical significance of σ.

[2] See p. 36 of Behrend's "Induction Motor."

[3] See "Die Wahl des Rotordurchmessers bei Induktionsmotoren." Elektrotechnische Zeitschrift, November 12, 1903, p. 933; "Die Voranberechnung von und für Drehstrommotoren." Elektrotechnische Zeitschrift, April 28, 1904, p. 340.

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τ, λg, Δ and H which are encountered in practice. The author has finally concluded that the object in view is best attained by employing a large collection of curves in the construction of each of which the method shown by practice to be most appropriate has been employed. The chart of curves, consisting of Figs. 1 and 2, incorporates the result of an attempt to put this view into practical form. Values obtained from this chart are appropriate for slip-ring induction motors. For squirrel-cage motors, the circle coefficient should be obtained by multiplying the chart values by 0.8. For convenience, the chart of curves for estimating σ is divided into two sections, Figs. 1 and 2. These are arranged in order of increasing values of H, the average number of slots per pole. The smallest number of slots per pole for which curves are shown is six, as indicated at the head of the first column of curves in Fig. 1. The greatest number of slots per pole for which curves are shown is twenty-seven, as indicated in the last column of Fig. 2. It is only in rare instances that a number of slots per pole less than six is employed, as in such cases the slots are usually of undesirably large dimensions. For instance, with the largest polar pitch employed in Figs. 1 to 3, viz., forty centimetres, the slot pitch for H = 6 is 6.7 centimetres, which corresponds to a slot width of 3.35 centimetres if the slot and tooth are of equal width. On the other hand, large numbers of slots per pole lead to undesirably small slot dimensions.

Thus with a polar pitch of fifteen cen-

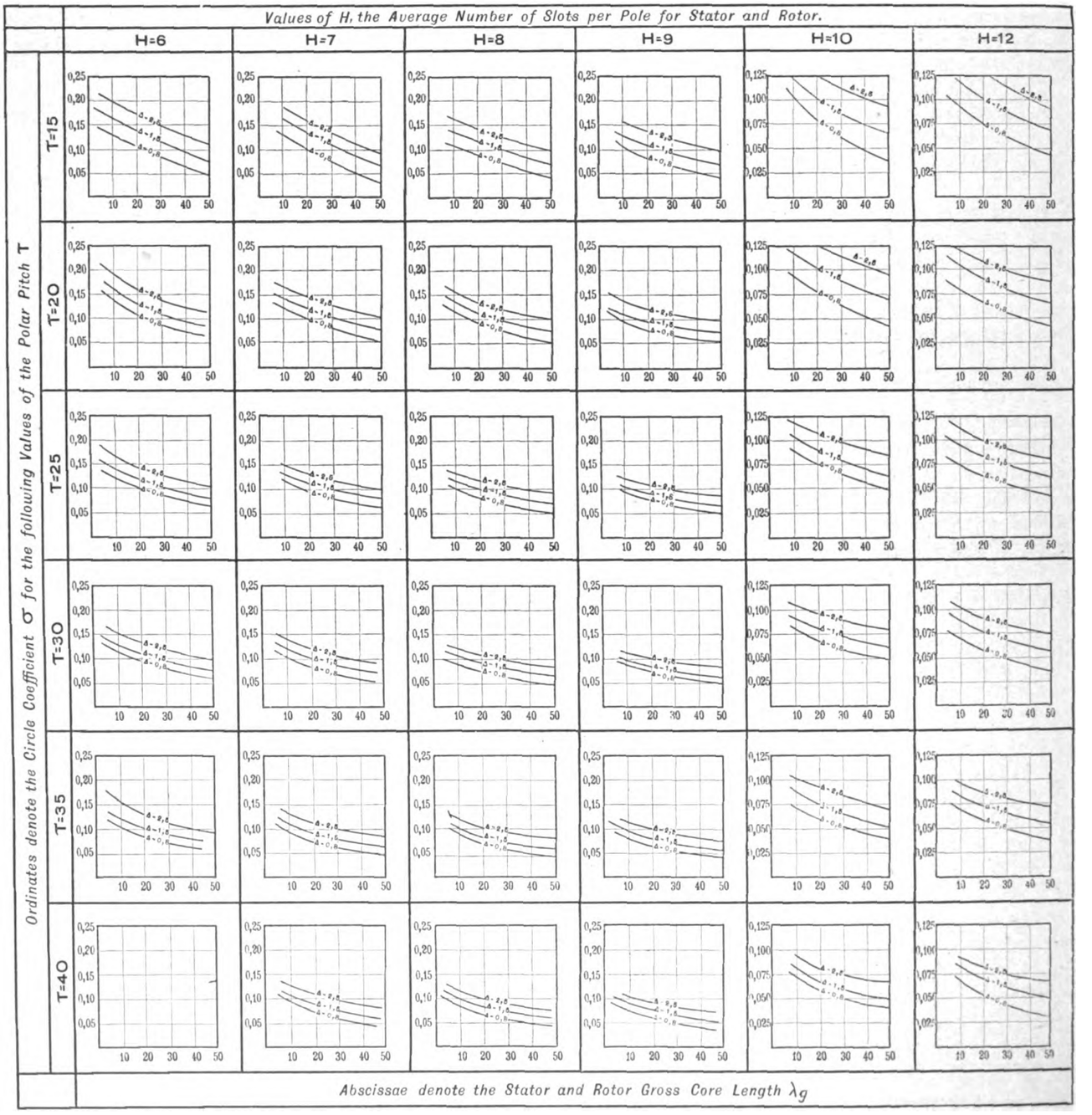

FIG. 1.—CURVES FOR THE ESTIMATION OF σ THE CIRCLE COEFFICIENT OF THE INDUCTION MOTOR.
These Curves Apply to Induction Motors with Open or Semi-Closed Slots and with Wound (Slip-Ring) Rotors. For Squirrel-Cage Motors Multiply the Values Obtained from the Curves by 0.8. Δ Denotes the Radial Depth of Air Gap in Millimetres.

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timetres (the smallest shown in Figs. 1 and 2), the slot pitch for H = 26 is only 0.6 centimetre, which is considerably too small to be practicable. It is for these reasons that curves for certain impracticable values of H and τ are not drawn in Figs. 1 and 2. In Fig. 1 no curves are drawn for such values of H and τ as correspond to a slot pitch greater than six centimetres. In Fig. 2 no curves are drawn which correspond to a slot pitch of less than 1.2 centimetres.

While a slot pitch of six centimetres is a value considerably greater than is usually employed in present practice, nevertheless we have extended the curves to include these limiting values in order to make them quite comprehensive, and to indicate better the influence of the various factors. The lowest value of the slot pitch for the slotted curves is obtained for H = 18 and τ = 15 when the slot pitch is 1.2 centimetres. The largest values occur when H = 7 and τ = 40, which correspond to a slot pitch of 5.7 centimetres.

In Table I are given certain technical data of seventy-one induction motors, together with the observed experimental values of the circle coefficient and the values estimated by means of the curves in Figs. 1 and 2. The estimation of σ for any of these motors from the curves is quite straightforward. For instance, motor No. 17, in Table I, has the following data: Δ, the air-gap depth, is equal to 1.1 millimetres; τ, the polar pitch, is equal to fifteen centimetres; λg, the gross core length, is equal to twenty centime-

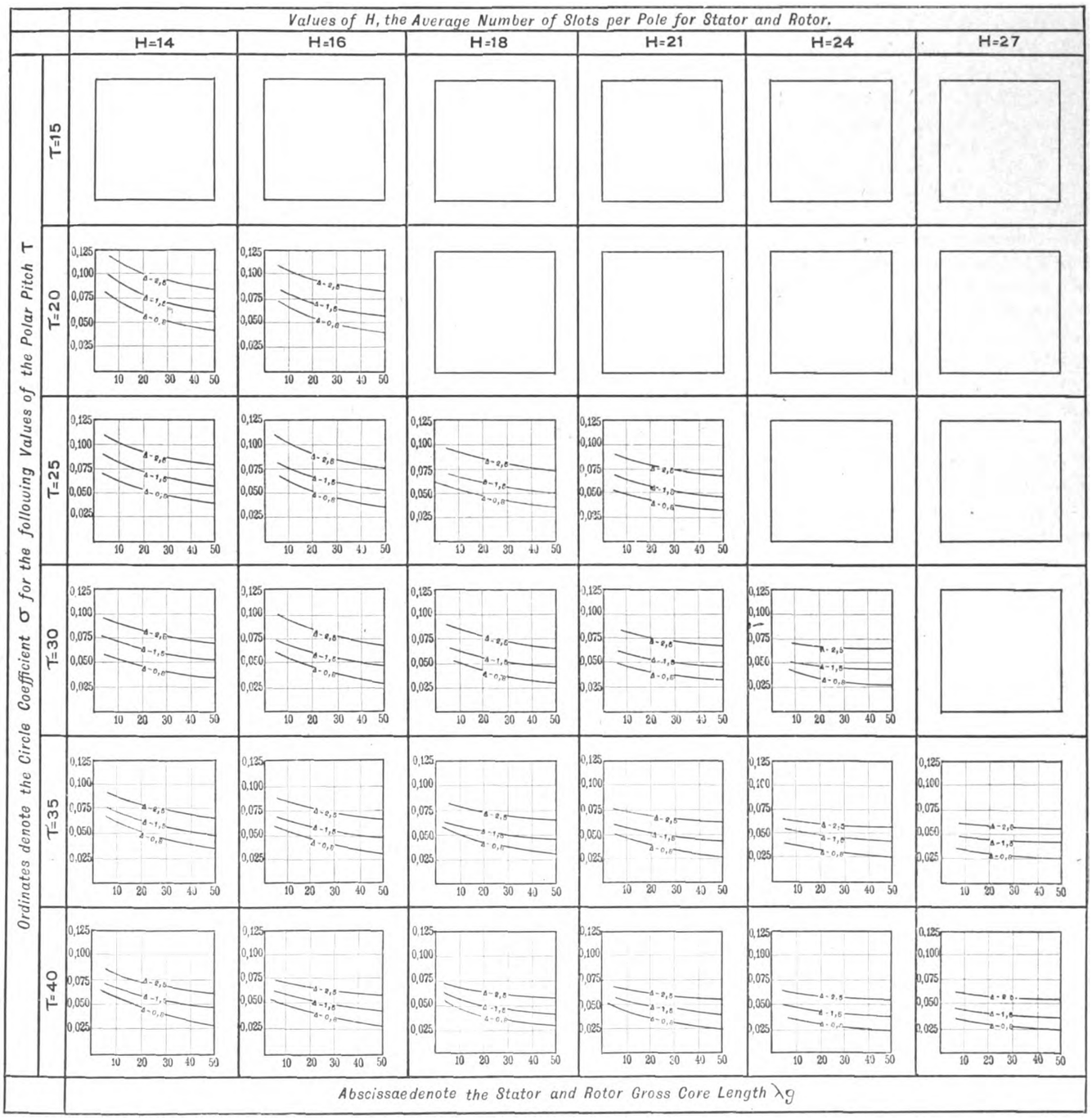

FIG. 2.—CURVES FOR THE ESTIMATION OF σ THE CIRCLE COEFFICIENT OF THE INDUCTION MOTOR.
These Curves Apply to Induction Motors with Open or Semi-Closed Slots and with Wound (Slip-Ring) Rotors. For Squirrel-Cage Motors Multiply the Values Obtained from the Curves by 0.8. Δ Denotes the Radial Depth of Air Gap in Millimetres.

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tres; H, the average number of stator and rotor slots, is equal to 11.1.

The curves for $\tau = 15$ and $H = 10$ are given in Fig. 2, column 1, and the top line, and for $\tau = 15$ and $H = 12$ in Fig. 1, column 2, top line. In the present case $H = 11.1$, which lies practically midway between $H = 10$ and $H = 12$. Hence we must interpolate between the values of σ corresponding to $H = 10$ and $H = 12$. For $H = 10$, $\lambda g = 20$, $\Delta = 1.1$, the value of σ is 0.083. Hence, for $H = 11.1$, σ is approximately

$$\frac{0.087 + 0.083}{2} = 0.085$$

The observed value of σ for this motor is 0.081. The discrepancy is 0.004, or five per cent, which is good agreement. It will be seen from the table that although in several cases there is a discrepancy of as much as twenty or thirty per cent, nevertheless the general agreement is very good.

The motors in Table I are arranged in the order of increasing values of D, the air-gap diameter. Motors having air-gap diameters up to forty centimetres are designated small motors; those with air-gap diameters from forty to 100 centimetres are designated medium-sized motors, and those with diameters greater than 100 centimeters are designated large motors. The average discrepancy between the observed and calculated values of the circle coefficient is entered in the last column of the table for each of these groups of motors. These discrepancies are obtained from the values calculated in the next to the last column for each of the motors. The + sign prefixed to the value of the discrepancy, signifies that the calculated value is greater than the observed value, and the — sign signifies that the calculated value is less than the observed value. In averaging these discrepancies in order to obtain the values in the last column, no account has been taken of the signs, but the values have been averaged arithmetically.

The discrepancies for the small, medium and large motors are, respectively, 11, 9.3 and 6.8 per cent. The discrepancy thus appears to decrease with the increasing size of motor. This is probably a chance occurrence, to which no significance should be attached. Nevertheless, it may be due to the fact that measurements on large motors may be made to a greater degree of accuracy, and the air-gap depths may be adjusted to a greater degree of precision than in small motors. These circumstances render the experimental values of the circle coefficient liable to greater error in small motors than in large motors.

In the calculation of the average discrepancy account may also be taken of the signs, indicating whether the discrepancy is positive or negative. The discrepancies calculated in this way are very small, as the positive and negative discrepancies neutralize to a large extent. The results calculated in these two ways are set forth in Table II.

TABLE II.—INDICATING DEGREE OF ACCURACY OF AUTHOR'S METHOD OF DETERMINING σ.

No. of Motor.	Size of Motor.	Average discrepancy between the estimated and observed values of σ. Neglecting signs.	Taking account of signs.
20	Small	11%	— 3%
39	Medium ..	9.3%	0
12	Large	6.8%	— 0.4%
71	Average ..	9.3%	— 0.95%

It is difficult to draw any conclusions as to the relation between the proportions of the motor and the nature and value of the discrepancy between the observed and calculated values of the circle coefficient. Were such generalization possible, it would be practicable to correct the curves in the chart to give more accurate results. Such corrections can only be made in the light of further experimental values, and, pending the accumulation of more such data, the curves in Figs. 1 and 2 appear to give as accurate results as can be obtained by calculation.

A European Electric Train-Lighting System.

Experience teaches that in an electric train-lighting system each car should constitute a complete and independent unit; that the use of the car should in no way be restricted on account of the lighting system, and that no regulation or adjustment by hand should be necessary whether the car runs at a high or low speed. This requirement of absolute independence makes severe demands on the automatic regulating apparatus. A device recently put on the market by Brown, Boveri & Company is intended to meet these conditions and at the same time prevent all overloads on the accumulators and thus increase and improve the economy of operation.

The individual car-lighting system of this firm comprises a direct-current shunt dynamo driven from a car axle by means of a belt or chain, an accumulator battery working in parallel with the dynamo, and a regulating apparatus, the duty of which is to conduct the energy produced by the dynamo to the battery and the lighting circuit in such a way that, under all conditions, the proper tension is supplied to the lamps and that the battery performs its normal functions of charging and discharging without overload. The dynamo is suspended pendulum-fashion from the car frame or truck, and the tension necessary for the belt or chain is supplied by its own weight or by springs. The position of the brushes is changed automatically when the car changes its direction of movement. The accumulators supply the current while the car is at rest, and they are usually so dimensioned that illumination may be maintained for seven to ten hours.

The chief object of the regulator is the control of the dynamo voltage, which of course varies with the speed of the car. When a train starts, the dynamo excites itself and its voltage rises with increasing speed until it has reached a value sufficient for charging the battery or lighting the lamps, when the machine is connected to the circuit by an automatic switch. The voltage would still continue to rise with increasing train speed, but this is prevented by inserting a resistance in the shunt circuit. This is effected automatically by means of the regulator, which revolves a contact segment under a number of contacts connected to resistance coils and places them in or out of circuit. The regulator consists of a magnetic field in which a coil is arranged so that it can rotate. The magnetic field is produced by two windings, one in shunt with the dynamo and the other joined to the battery, both working in the same direction. A third winding is connected with the lighting circuit and works in a direction opposite to that of the first two. The united effect produced by the windings produces a torque on the coil, which is resisted by a spring of such dimensions that it exerts a constant pull. This constant mechanical pull is maintained in equilibrium by the electrical torque on the coil, and this condition is utilized for regulating the resistance in the dynamo circuit. The system has been successfully introduced on the Swiss Federal Railways, and is being tested on lines between Berlin and Hamburg.—*Abstracted from Elektrotechnischer Anzeiger (Berlin), October 21.*

The 289th meeting of the New York Electrical Society was held at the Engineering Societies Building, New York city, on the evening of November 30. A. J. Marshall delivered an illustrated lecture on "The Significance of Public Decorative Lighting."

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DIPLOMACY IN BUSINESS.

BY WILLIAM WESTERFIELD.

We will assume that the object of every man in business is success. In order to be successful in business it is essential that every honorable means contributive to success be employed. There are many things that make for success that in a large measure are neglected by those whose first duty and aim should be to keep them in mind. It is a manifest folly to employ suave and diplomatic solicitors for the purpose of securing new business, while it may be there is a man at the manager's or cashier's window who, by failing to keep up the impressions made by the solicitor, constantly drive old business away.

There are certain common-sense rules of conduct that a man can apply to any business. It is very essential that those who deal with the public, have patience and forbearance, above all things. It may be urged that tact is most essential, but while we grant this, he must understand that tact is dependent upon the possession of patience and forbearance. Not only is tact required, but a good deal of diplomacy must sometimes be employed. True diplomacy is simply the sensible application of the old adage, that "a soft answer turneth away wrath." In order to stand before the storms of senseless wrath, as many business men do without resentment, one must have self-control, and every sense must be alert and active, in order that every advantage may be taken of the situation. A keen insight into human nature and human motives must be developed if success in dealing with the public is to be attained.

The man whose duty it is to deal with the public, and represent, say, a large, or even medium-sized central station, should be a man who can endure with unruffled countenance, things that other men would feel perfectly free to resent. A complaining patron comes in and, without ceremony, begins to abuse the company and everyone connected with it, because of some imperfection in the service, or the conduct of some employe, and no matter how much the same may be regretted by all interested, it is easy for the customer to assume that everything that is done is intentional, and he or she may not hesitate to assume that any shortcoming must be intentional. Often long and severe lectures are delivered by otherwise good customers with this assumption, though in sober moments they would acknowledge that they had nothing to support the assumption but a disordered imagination.

Now, to be abused, especially when one is innocent, is trying in the extreme to an untrained man. But if he will think a little, he will be able to get into a state of mind that will enable him to bear such demonstrations without seriously affecting him. We may assure ourselves that the people who do these things, soon after become heartily sorry, if not actually ashamed. They will realize in ninety-nine cases out of a hundred that they have not justified a good opinion of themselves. They will be self-condemned. Now if we allow ourselves to exhibit similar weakness in the presence of the people, it must be clear that we have lost standing in the eyes of those who condemn themselves for doing just what we have allowed ourselves to be vexed into doing. On the other hand, if we maintain our self-control, we will find that we have gained the respect of these people to such an extent that they will become ashamed to exhibit themselves to us after the manner of persons who lose sense and breeding over small vexations. If resentment is manifested, it also engenders permanent enmity, and may mean loss of business. There is no need to fear that the public will censure for lack of spirit. The Bible speaks well for the man who can rule his own tongue, and the people, as a matter of fact, admire a man who can do this. It is the part of wisdom.

I understand the desire common to most men to be victor over all things. There is but little honor to be hoped for as victor in a jawing match, but loss of self-respect is sure to be one of the results. If we want to win in a game of this kind, better we should do so through kindly indifference, or the timely pouring of "oil on the troubled waters." That is the really manly and wise method, and the more we employ it the more confidence we will have in it, and the more naturally we will be able to use it.

Metropolitan Property Must Be Sold.

The Supreme Court of the United States has recently refused to review the decree of the lower courts ordering the foreclosure of the $12,500,000 mortgage of the Guarantee Trust Company on a portion of the property of the Metropolitan Street Railways Company of New York city. The writs of certiorari to the Circuit Court of Appeals in the same suit were denied. Judge E. Henry Lacombe, who ordered the sale, set a new date for the sale of the property as January 22.

The Value of Mathematics.

In his inaugural address as chairman of the Birmingham (Eng.) Section of the Institution of Electrical Engineers, R. K. Morcom made the following remarks on the value of mathematics as a training:

"The value of mathematics, in particular, as a training, should never be overlooked. Given zeal, I believe that mathematics, and plenty of it, will take a man further than any other training. It will give him that most valuable commodity, a well-ordered mind. A common experience is that if a student experienced difficulty in, say, advanced arithmetic, he would go back to it as child's play after a bout with algebra, and when algebra begins to get vague a dose of differential will send him back to scoff at the former difficulty, and so on into higher fields. A sound mathematician can always more readily specialize on a physical subject than another man—he is trained to reason.

"Too many engineering textbooks are now written which make a boast of their non-mathematical nature. It certainly makes the book fatter and more expensive, but mathematics are labor-saving appliances, and should be used. Those who cannot use them should take the results they produce for granted, like a laborer with a complicated automatic.

"The number of successful barristers whose training has been mathematical is large, and any of us who have been in contact with a barrister on a technical subject must have been surprised at the great command of that subject which he can acquire at short notice. Take a mathematician, give him a workshop training, and let him read the technical papers instead of the sporting columns of the daily press, and he will make an engineer. If he also has the gift of common sense and zeal for his profession he will make a good engineer. An engineer whose knowledge of mathematics and pure science is rudimentary is to his truly educated confrère much what a pianola-player is to a pianist."

December Meeting, American Institute of Electrical Engineers.

The December meeting of the American Institute of Electrical Engineers will be held on the evening of the 16th of this month in the Engineering Societies Building, New York city. A paper entitled "Comments on Development and Operation of Hydroelectric Plants," will be read by Henry L. Doherty.

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THE ROUGE-FAGET PERMUTATOR.

BY F. C. ZANZIG.

The history of the permutator dates back to 1888, but only recently has it been on the market as a commercial success. A description of the Rougé-Faget Permutator is herewith contained, besides some operating characteristics of a nine-kilowatt machine, tested in the dynamo laboratory of Armour Institute of Technology. However, before describing the permutator in detail, it may be well first to define and classify it under some general head.

A permutator, as the name implies, is from an electrical point of view a machine which permutates (changes) alternating current to direct current. It is a rectifier and not a converter, as will be brought out later, in that the change from alternating to direct current is accomplished by rectification and not conversion. This distinction is based upon the usual definitions of rectifiers and converters. In the former the magnetic circuit, if there be one, is not a function of the direct current; in the latter, the electric circuit is definitely related to the magnetic circuit.

It is well known that in a rotary converter a portion of the direct current is rectified alternating current and the remainder is generated due to generator action, the ratio depending upon the number of phases. In a permutator the direct current is produced by rectification only. Based upon this difference we may use the term, "rectifying apparatus or machine," as a class to which this machine belongs, or as will be evident from the following description, the permutator is a static transformer with a non-inductive rectifier. That is to say, while in the rotary converter synchronous rotation is used to some extent to induce direct currents, in the permutator synchronous rotation is used only to collect direct currents. Stated in still other words, the current collected from the commutator as direct current is not generated, either wholly or in part, as in a converter.

The machine consists of three essential parts, namely:

(a) A transformer having a hollow iron cylindrical core.

(b) A synchronous motor for rotating the brushes about a fixed commutator.

(c) A set of revolving brushes for collecting the direct current.

TRANSFORMER.

The core (Fig. 1) of the transformer is built up of sheet-iron punchings laminated at right angles to the axis of the annular ring. It contains uniformly distributed slots parallel to the axis, as in the stator of an induction motor. It differs from the core of an induction motor stator in that the slots are usually not open to the inner periphery, but completely closed. The quantity of iron between the slots and inner periphery being small compared with the exterior portion of the ring, allows an appreciable flux to enter the core of the armature, which rotates within the hollow transformer core. In these slots the coils are placed and the core with its windings is mounted vertically upon a solid frame.

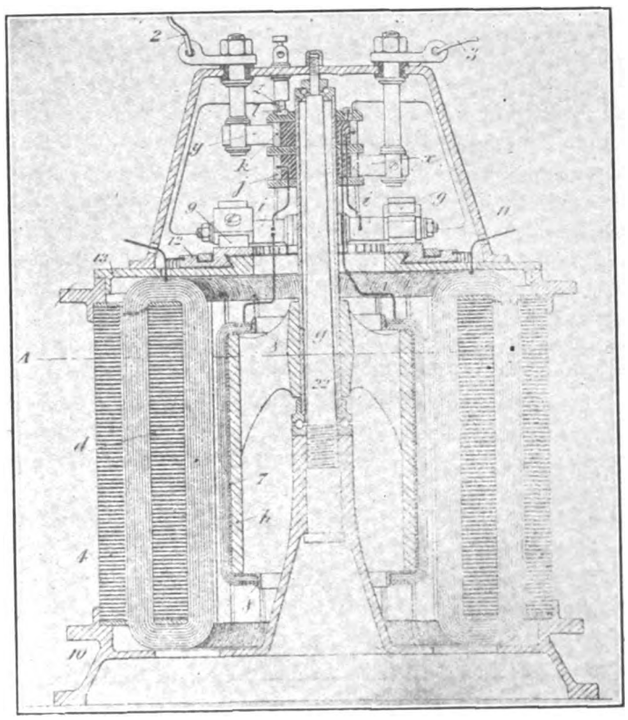

FIG. 1.—CROSS-SECTION THROUGH ROUGE-FAGET PERMUTATOR.

MOTOR.

The motor, whose armature rotates the brushes about the fixed commutator, is a synchronous motor. Its armature is fixed to a vertical shaft and rotates within the transformer core, thus allowing the use of a small air gap and also preventing unequal wear on the bearings. The core of this armature completes the magnetic circuit of the rotating field, at least that part of the flux which does not remain in the transformer core beneath the slots. The winding on the armature of the brush motor is an ordinary drum winding; in fact, it is the field of the synchronous motor and has been called armature probably incorrectly. It receives its excitation from the direct-current source of the machine through two collector rings. The coils are especially well insulated and in each slot above the coils there is wedged a strip of brass, which holds the coils in place; these brass strips also serve as conductors of a simple squirrel-cage rotor of an induction motor when the machine is being started.

COMMUTATOR AND BRUSH HOLDER.

The brush holder is fixed relatively to the armature, but capable of angular adjustments about the motor shaft. The brushes are equally displaced about the commutator and rotate at a uniform velocity when the machine is in operation. To eliminate the effects of centrifugal force the brush holder is designed to produce approximately uniform brush pressure upon the commutator for all working speeds. This is of kinematic interest only and needs no further mention except to say that uniform brush pressure is a desirable feature to maintain.

On the upper portion of the core frame is mounted a commutator. It differs in no way from the ordinary type except that commutating resistances are used. Fig. 1 shows a disk commutator with radial segments; this, it may be stated, need not necessarily be the case.

CORE WINDINGS.

The diagram of the windings of the machine under test is shown in Fig. 2. There are shown ninety slots for the sake of clearness—in reality there are only forty-five, both the external and internal coils occupying the same slots. It is seen that all these coils are alike, each coil consisting of three turns and having a pitch of seven slots. The coils, consisting of three conductors, are connected in series, and for a complete circuit about the core there are four coils, approximately ninety degrees apart. The terminal of the fourth coil is connected to the beginning of the coil adjacent to the first. Thus it is seen that the winding is symmetrical. When

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properly supplied with a two-phase current a four-pole rotating field will be produced. These coils the patentees of this machine have called "vectorial" coils or windings; the reason for giving them this name will be evident when we analyze their functions.

In this machine one phase is connected to rings I and II, and the second phase (two-phase machine) is connected to rings III and IV. In the more general type of permutator an independent winding is placed upon the core either in the same or separate slots. To elucidate the actions within the core the general type of permutator will be used as an example.

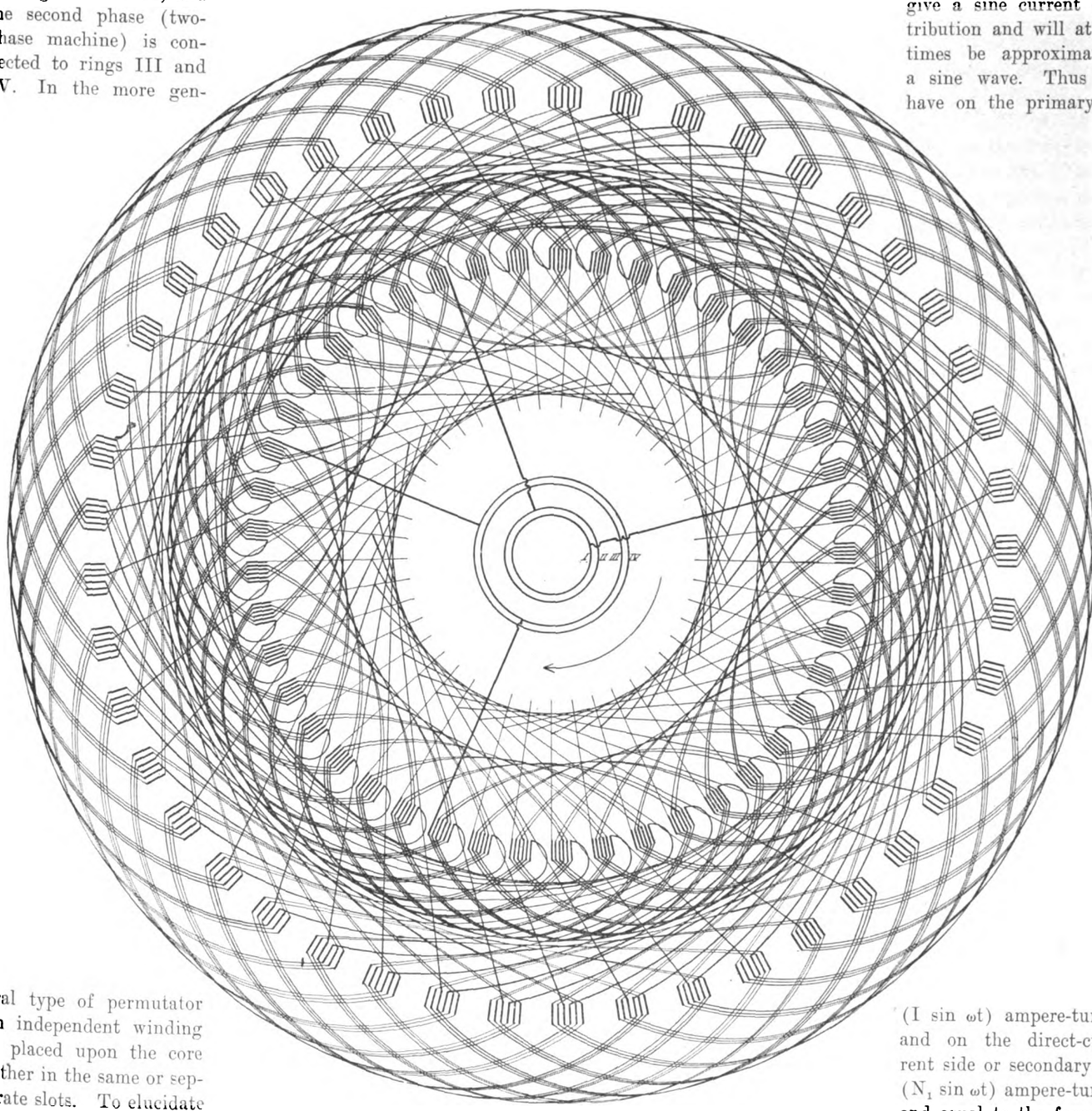

FIG. 2.—WINDING DIAGRAM OF THE PERMUTATOR.

The second winding mentioned in the last paragraph forms the primary winding of the cylindrical transformer core and differs in no way from that of an induction motor stator winding. The potential across the primary coils, as in any transformer, may have any value whatever; the secondary voltage, depending upon the ratio of turns, may be made equal to that value which gives the desired rectified voltage, which is 1.414 times the alternating voltage across the secondary or "vectorial windings."

Since the primary coils are so wound as to create in the core a uniform rotating magnetic field there will be generated in the secondary (vectorial) winding an electromotive-force having a wave similar to the impressed. That is, with a sine wave impressed upon the primary, there will be induced in the symmetrical vectorial windings an equivalent sinusoidal current distribution. The production of a sinusoidal current distribution to prevent electric and magnetic disturbances is brought about by winding the secondary with chord circuits (see Fig. 2). This diagram may represent the secondary with chord circuits. The direct current now circulating in this winding will give a sine current distribution and will at all times be approximately a sine wave. Thus we have on the primary N ($I \sin \omega t$) ampere-turns and on the direct-current side or secondary I_1 ($N_1 \sin \omega t$) ampere-turns and equal to the former, where

N = number of primary turns.

I = primary current (maximum).

N_1 = number of secondary turns interlinked with the flux, which is interlinked with N.

I_1 = direct current.

It is for this reason that these windings have been given the name "vectorial

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windings." It is evident that the direct current may now be represented as a vector under these circumstances.

Returning to Fig. 2 attention may now be called to the arrangement of terminal connections, which was heretofore left out of consideration. The angle between the terminals of each phase is 180 electrical degrees and between phases it is 270 degrees or — 90 degrees. Hence, the vector sum of the electromotive-forces is constant and equal to the terminal voltage on the direct-current side of the machine, *i. e.*, $\sqrt{2}$ times the voltage across one phase. This winding, it may be said, is the scheme generally used for the secondary of any permutator. In the winding diagram the direct-current brushes bearing on the commutator are not shown. There are four of them, ninety degrees apart, and opposite ones are connected together. From each set a lead goes to the direct-current terminals of the machine.

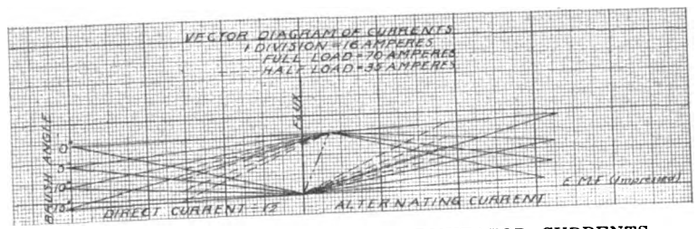

FIG. 3.—VECTOR DIAGRAM OF PERMUTATOR CURRENTS.

OPERATION.

Like a transformer, this machine may be directly connected to the line without serious results within the machine itself; that is, no auxiliary starting device is necessary—the closing of the switch starts the machine and it comes up to synchronism within a few seconds.

When the switch is closed on the alternating-current side the brush motor starts as an induction motor because of the brass strips of the previously mentioned armature. Attention was called to the well-insulated coils on this armature. Ordinarily the circuit of these coils is closed, practically short-circuited; however, since the coils are made up of many turns in series there is danger of breakdowns of insulation due to the high electromotive-forces induced when the switch is closed, should for some reason the armature circuit be open.

At the instant the circuit is closed an alternating current exists on the direct-current side of the machine. The frequency of this current is equal to the product of the line frequency by the slip and decreases to zero as the armature approaches synchronism. The impedance of the armature coils decreasing and becoming equal to the resistance at synchronism, allows sufficient current to excite the coils to cause the armature to fall into synchronism with the rotating field.

To reverse the potential of the direct-current terminals it is only necessary to open the alternating-current switch for a few seconds and again close it. If the brushes differ by 180 degrees (electrical) from their former position with reference to the same portion of the cycle when the switch is again closed, then the desired result is obtained; if not, the operation must be repeated. If the machine is separately excited it is evident that the reversal cannot be brought about by this means.

The parts of the armature which make it a squirrel-cage rotor have been mentioned with reference to the starting action. This rotor also serves as an efficient damping device for the prevention of hunting. To a limited extent the coils of the armature serve the same purpose. It must not be lost sight of that the kinetic energy of the moving system is comparatively small, and because of this fact the damping device is enormously more effective than in any rotary converter. This characteristic is not only advantageous in the machine itself, but also serves admirably when connected in parallel with other machines to prevent an interchange of energy between them.

To appreciate fully the power-factor curves in Fig. 4, it is desirable to explain a few points of interest with reference to the vector diagram in Fig. 3.

In this diagram the impressed alternating voltage is taken as the zero vector and the flux is shown, as indicated, lagging behind the electromotive-force by ninety degrees. The exciting current, as for any transformer, is the resultant current of the secondary (in this case it is rectified) and the primary current. This is true for this machine because the direct current may be vectorially represented as one side of the parallelogram, as shown in Fig. 3. It is evident that the electromotive-force of constant potential is in phase with the direct current, and that the same is true for the terminal voltage. The counter electromotive-force on the alternating or primary side (not shown) differs from the impressed both in phase and in value, due to the posi-

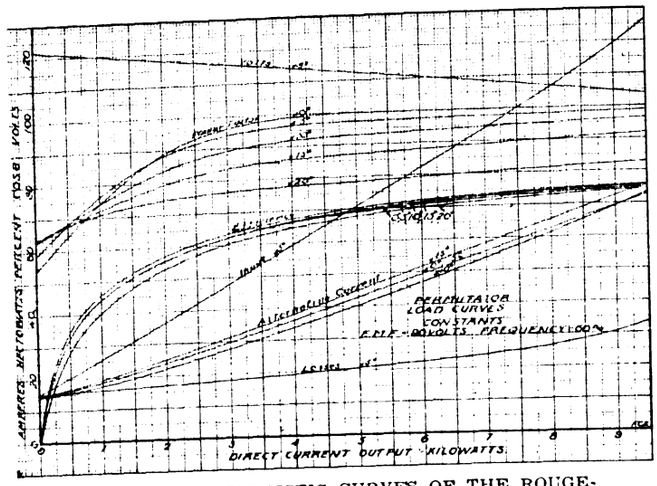

FIG. 4.—CHARACTERISTIC CURVES OF THE ROUGE-FAGET PERMUTATOR.

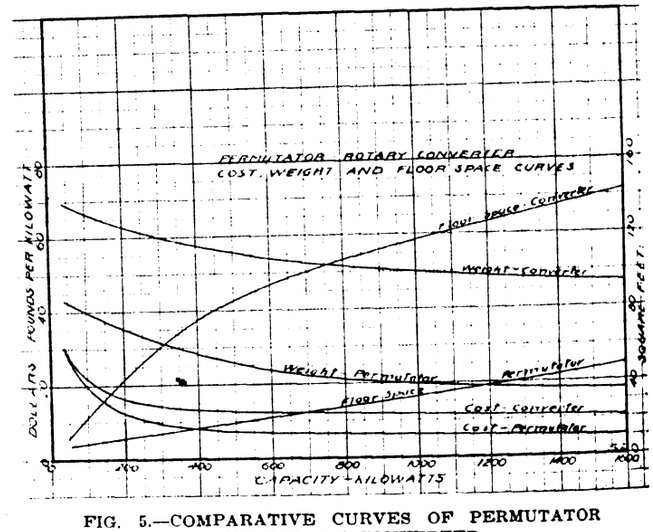

FIG. 5.—COMPARATIVE CURVES OF PERMUTATOR AND ROTARY CONVERTER.

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tion of the brushes, inductive drop and copper drop.

The magnetizing current is constant and is represented by the double dot and dash line. Now that this remains constant it is seen that by shifting the brushes in the direction of rotation, that is, clockwise, the direct current furnishes part of the excitation and nearly all with the brush set at zero degree. This necessarily decreases the wattless component of the alternating and thus increases the power-factor. Furthermore, an increase of load also increases the power-factor, very rapidly for small loads and very slowly for large loads, the rate of change depending upon the angle of lead given to the brushes.

Fig. 4 shows the effect produced upon the power-factor by varying the brush lead for any output. The angles given in this figure refer to the reading on a scale. For the curve marked ten degrees the brushes are in the neutral plane, for five degrees they lead by an angle of ten degrees (electrical), etc. The remaining curves in Fig. 4 and also those in Fig. 5 show the other characteristics of this machine. Considering the small size of this machine, one is impressed with the fact that in no wise are these characteristics inferior to those of the converter, except in regard to power-factor variation due to either leading or lagging currents brought about by simply varying the field strength of the converter.

The superiority of the permutator the reader has probably realized from what has already been said. A brief comparison between this machine and the converter in regard to its operating performance, weight, cost, etc., will probably be of interest.

We notice, in the first place, that its starting action is very simple, and when used to feed into a direct-current system simply requires the closing of the supply switch and then the feeder switch after synchronous speed is reached (something like five seconds are required to bring the largest made machine up to synchronism).

If separately excited, which would be the case in general, it will always come up in the right direction. In brief, practically the only apparatus on the switchboard would consist of recording and indicating instruments—all auxiliary starting apparatus being unnecessary.

The curves shown in Fig. 5 give some idea of the relative values of weight, floor space and cost of permutators and rotary converters. The customs duty (foreign machine) is not included in the cost of the permutator, but, on the other hand, the weight and floor space of the transformers, which would have to be used with converters, are not included.

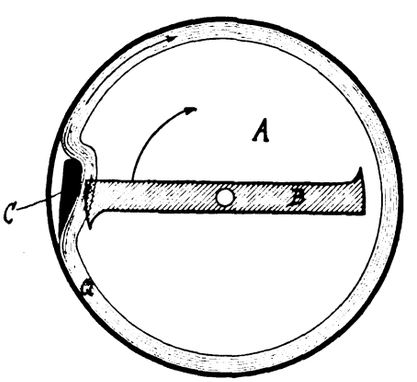
To sum up in tabulated form, the advantages of the permutator are:

(a) Self starting—simple action.
(b) No starting apparatus necessary.
(c) Synchronous speed attained within a few seconds.
(d) Cannot hunt.
(e) Operation simple.
(f) Less attendance required.
(g) Overload capacity large.
(h) Adaptable to frequencies between wide limits.
(i) Transformers unnecessary.
(j) Suitable for any voltage.
(k) Perfect parallel operation.
(l) Small weight.
(m) Low cost.
(n) Small floor space.

These are in brief some of the characteristics of this new rectifying apparatus, the development of which has just begun.

A New Mercury Interrupter.

The weaknesses of mechanical and Wehnelt interrupters are well known to workers with induction coils. Also, the old form of vibrating mercury interrupter had a limited capacity. The merit of having extended these narrow limitations belongs to Nikola Tesla and Hans Boas, who first constructed rotating mercury interrupters utilizing a stream of mercury for making and breaking a circuit, says Friedrich Dessauer. A number of apparatus of this type designed by other inventors are described and their defects pointed out. One that has been built by the author and stated to have given most satisfactory results is diagrammatically illustrated in the accompanying illustration. A vessel *A*, rotating around its axis, throws the mercury around in a ring. Contacts *B* are rigidly connected to the vessel. They are shown in the figure as contact rods, but may equally well be constructed in the form of a wheel with metal segments or the like. The number of these segments or contact rods is determined by the frequency of interruption desired. The contact rods are so dimensioned that normally they do not reach the mercury ring. A body *C*, called "knife" or "deviator," which does not move with the mercury, projects into the vessel. The knife may be stationary or it may rotate either in a direction opposite to that of the mercury or with it, but at a lower speed; in the latter case the frequency of interruption will be smaller. The knife has a curved form, so that the mercury flows over it and approaches the contact rods. Assuming, for the sake of simplicity, that the knife is stationary, then the revolving mercury ring will be deformed at one point of its path in such a way that each rotating contact piece will dip into it once each revolution.



NEW MERCURY INTERRUPTER.

It is evident that the knife may be replaced by some other suitable body, as, for instance, a piece which will deflect the moving mercury toward the top or bottom. The principle of the apparatus is that a moving figure of a fluid conductor, as mercury, produced by centrifugal motion is deformed at one or more points in such a way that a solid conductor forming the second contact will make connection with the mercury at these points and effect a make-and-break of the circuit. The quantity of mercury required is said to be very small and its oxidation almost nothing.—*Abstract from the Physikalische Zeitschrift (Leipsic), October 1.*

Street Telephone Stations on Poles.

A dispatch from New York states that the New York (Bell) Telephone Company has adopted the plan of having pay-station telephones in special boxes installed in the street, like the call boxes used by the police. The idea has been put to a practical test by the Independent companies at Buffalo and elsewhere, and has been found so thoroughly practical that the boxes will probably soon become familiar adjuncts to the service.

Those who have tried the street telephone say that the rumble and noise of the traffic does not cause any particular annoyance, as the head of the person using the telephone is inside the little box in which the instrument is placed.

Not only does the new idea encourage the use of the telephone, but the profit is large, the boxes being placed on the company's own poles, eliminating expense for rent. The directory books are chained inside the boxes.

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LAWS OF ELECTRODE LOSSES IN ELECTRIC FURNACES.—II.

BY CARL HERING.

CONDITIONS OF MINIMUM LOSS.

For a given normal current at which the furnace is to be operated, it will be noticed from formula (1) that when the heat-conduction loss for no current flowing (the first term), is made equal to half the C^2R loss (the second term), then the two terms are equal, and their sum is therefore equal to the total C^2R loss. It will be shown that this is the condition of minimum loss described above.

For a given length the first term (heat conduction) increases as the section increases and in direct proportion, hence in Fig. 4 this quantity is an increasing one, represented by an inclined straight line *oh*. The second term, however (half of the electrode loss), will decrease as the section increases, and in inverse proportion, hence this quantity is a decreasing one, represented by the hyperbola *ee*.

The sum of two such quantities always has a minimum value, as is shown by the curve *mm*, which represents the sum of the two ordinates, and is therefore the curve of the values of X (in watts) in formula (1). It will be seen that this minimum point is reached when the two quantities are equal to each other, that is, at the point where the two lines intersect. It is therefore at this point that the conduction loss is equal to half of the C^2R loss, which is the condition stated above.

If the same sets of curves be drawn for several other lengths of electrodes, as shown in dotted lines in Fig. 4, it will be noticed that the total loss at the corresponding minimum point always has the same value, namely, the height of the upper curve measured at its minimum point. This means that the minimum loss is determined only by the material, the temperature and the current, and cannot be further diminished by changing the dimensions. It is therefore a fixed quantity, determined by the given conditions of material, temperature and current, and no possible change of dimensions can reduce it. To reach this minimum requires a certain proportion between the length and the cross-section.

Let mX be this minimum total loss in watts. Making the two terms in formula (1) equal, solving for the ratio of S to L and substituting in (1) gives

$$mX = 2.984\ C\ \sqrt{krT} \quad \ldots\ldots\ldots\ldots\ldots (2)$$

from which the minimum loss in watts can readily be calculated for any given case. The constant 2.894 is a purely mathematical one, and includes no physical properties.

It is of considerable interest to note that this formula shows that this loss is independent of the dimensions and is fixed by the current, temperature and material (k and r); also that it increases in direct proportion with the current and not with its square; and, further, that it is independent of the amount of energy in the furnace, being a function merely of the current, which means that for a given input in kilowatts in the furnace, the minimum total electrode loss becomes smaller if the current is decreased and the voltage increased. For a given normal current, material and temperature, the conditions are fixed, and the electrodes may be determined; the minimum loss, then, of course, applies to this normal current and to none other; for if with the electrodes thus determined the current falls below this normal, the loss will, of course, be less, but so will also be the energy in the furnace. What is said above, of course, applies only to the normal current specified for operating that furnace.

The formula also shows that the minimum electrode loss increases only as the square root of the temperature, and not as the temperature itself, as might at first be supposed. This means that the temperature may be increased considerably without increasing the loss greatly.

The same is true of the heat conductivity k and of the electrical resistivity r, either of which must be decreased considerably in order appreciably to better the loss. Hence the choice of material is not as important a factor to reduce the loss as might at first be supposed, and such choice may therefore often be determined by other consideration, such, for instance, as size, convenience in handling, size of water jackets, terminals, etc., all of which will be shown to be far more favorable for graphite, for instance, than for carbon, although the minimum possible loss of energy seems to be slightly greater than for the latter. It will also be found that this minimum loss is in most cases quite small, much smaller perhaps than is generally supposed, hence a further reduction by reducing any of the determining factors in formula (2) should be carefully considered with respect to any possible attending disadvantages, chiefly as to size, as it may not be worth making. To reach this minimum loss with carbon, for instance, requires the electrodes to be far larger in section than for graphite (for a given length), and if not made of this much greater size the loss will not be the minimum, and hence may then exceed that of graphite. The differences between the minimum losses in these two materials (provided the best proportions can be realized in practice, which may not always be the case with carbon) does not seem to be great, yet the difference in the size is very great.

Another feature to be considered is, that in high temperature furnaces carbon may graphitize partly, and if it was correctly proportioned at first, it will evidently not be so later on, hence the loss will then become greater again. Graphite is stable and does not change, hence if correctly proportioned at the start, it remains so.

The resistivity r may be replaced by the reciprocal of the electrical conductivity K, and for comparing the qualities of materials as such, the current and temperature may be made unity. The result will then represent the loss in watts per ampere for one degree of temperature, and will therefore be characteristic of the material itself. Making these substitutions gives

$$mX' = 2.894\ \sqrt{k/K} \quad \ldots\ldots\ldots\ldots\ldots (3)$$

where K is in reciprocal ohm (mho), cubic-inch units.

This shows the interesting fact that the minimum loss depends on the ratio of the two conductivities—both may be large or both small and yet give the same result as far as the loss is concerned. The smaller this ratio, the better the material, as far as the minimum loss is concerned. Moreover the loss varies with the square root of this ratio, which must therefore be considerably diminished in order to reduce the loss materially.

In order to improve materials for electrodes when this minimum loss is the criterion, the electrical conductivity should be increased as much as possible, and the heat conductivity diminished as much as possible; but it is their ratio that is the deciding factor, hence the heat conductivity may even be increased and yet the ratio may be less, if the electrical conductivity has increased still more in proportion.

There is still another interesting feature about this minimum loss. The loss represented by the formula (2) is also equal to Ce, in which e is the drop of voltage in one electrode. Making this substitution gives

$$e = 2.894\ \sqrt{krT} \quad \ldots\ldots\ldots\ldots\ldots (4)$$

which is seen to be independent of the current, and which therefore means that

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for every material (k and r) there is a characteristic minimum drop of potential in the electrodes for one degree of difference of temperature, below which voltage it is not possible to go without again increasing the total loss; and this is independent of the capacity, the dimensions, and even the amount of the normal current, the total drop being dependent only on the temperature. It might be termed the "electrode voltage" of that material, as it is a characteristic property of it as an electrode material.

If by the term "electrode efficiency" is meant the voltage between the two inside or hot ends of the electrodes, divided by the voltage between the two outside ends, its highest possible value is determined by the total voltage of the furnace, the temperature and the material, and is independent of anything else. Hence for any given electrode material and temperature drop, the furnace voltage necessary to give any desired electrode efficiency may readily be calculated.

This minimum electrode loss is not merely a theoretical ideal which it is impractical to reach, but it is an eminently practical result which could probably be readily reached in most furnaces, with graphite, at least, if not with carbon also, when the data for its proper determination, namely, the two conductivities, exist. Attention should, however, be called to the flatness of this minimum curve *mm* near its minimum point, which means that great accuracy in the proportioning is not necessary, as slight variations in the proportions in either direction will make only a small difference in the total loss. For instance, in the case shown in Fig. 4, a change of ten to twenty per cent in the cross-section near the minimum point will increase the loss only about one to three per cent.

PROPORTIONS AND ECONOMY OF THE ELECTRODES.

Although the absolute dimensions of the electrodes are not fixed by the conditions for obtaining the minimum loss, yet the relation of the section to the length is. This is best shown analytically. If the two terms in formula (1) are made equal, which is the condition of minimum loss, the ratio of S to L is found to be a constant, determined by the material (k and r), the temperature and the current. That is, when

$$4.186\ kT.\quad S/L = C^2r/2.\quad L/S \text{ or,}$$

$$S/L = 0.3456\ C\ \sqrt{r/kT} \ldots\ldots\ldots\ldots (5)$$

This means that to get the minimum loss under given conditions of material, current and temperature, the cross-section must merely bear a certain relation to the length as given by this formula. The interesting conclusion from this is that any number of different electrodes will give the same result, as illustrated in Fig. 5, in which all have the same ratio of section to length, as required by formula (5). The cross-section in all these is ten times the length in inch units. It thus leaves one a choice of either the length or the section, but not of both, and this choice does not concern the loss of power—it merely affects the economy of electrode material. Practical considerations usually determine the length, and it is therefore generally the cross-section which is to be determined from formula (5).

Notice should be taken of the fact that the numerical value of this ratio will be different for different units, as, for instance, for inches and for centimetres; the actual sizes will, however, of course, be the same.

The rule concerning the economy of electrode material is therefore simply: Make the electrodes as short as practical considerations will permit. As the cross-section also diminishes with the length, the volume, or approximately the cost in dollars diminishes as the square of the length. Hence the great importance of making the electrodes as short as possible, when the economy of the electrode material is of importance; this choice of length will not affect the power loss, and can therefore be decided on its own merits and without regard to the power efficiency.

For a given length the formula may be written in the form

$$S = 0.3456\ CL\ \sqrt{r/kT} \ldots\ldots\ldots\ldots (6)$$

which means that for a given length, temperature and material, the section increases in direct proportion with the current; hence the importance of producing the required heat in the furnace by as high a voltage as possible, so as to diminish the normal current. This will not only make the electrodes smaller in the direct proportion as the current is diminished, but, as previously shown, it also diminishes the lowest possible loss of power in the electrodes; hence it is a double gain.

It will be noticed from (6) that the section diminishes as the square root of the temperature, that is, for higher temperatures it becomes smaller.

Letting the current density in amperes per square inch be represented by Cd, then formula (5) reduces to

$$Cd = 2.894/L\ \sqrt{kT/r} \ldots\ldots\ldots\ldots (7)$$

which shows that the proper current density to obtain the best possible proportions varies inversely with the length, and therefore directly as the section; hence it is quite incorrect to proportion electrodes on the basis of a fixed current density, as is often done. For any assumed length the resulting current density can readily be calculated from this formula so as to compare it with the maximum which the material will stand; if water-cooled at one end, it will stand much more; hence

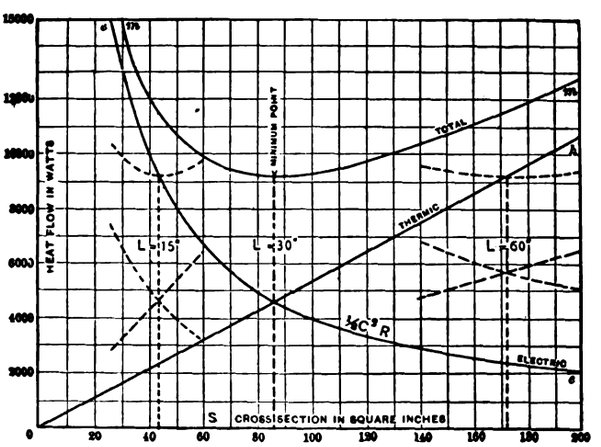

FIG. 4.

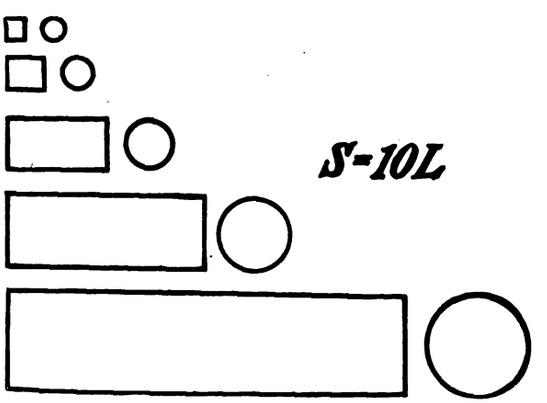

FIG. 5.

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water-cooling results in an economy of material.

Making C and T equal to unity in formula (5) gives

$$S/L = 0.3456 \sqrt{r/k} \quad \ldots\ldots\ldots\ldots\ldots (8)$$

which shows that per ampere and for one degree temperature there is a definite best proportion of section to length for each material which is a characteristic of that material and below which it is not possible to go in economizing without increasing the loss. Hence this figure affords a good means of comparison of different electrode materials when the economy of the material is the criterion. It shows that in this respect graphite is far superior to carbon, as electrodes of the former are very much smaller, as will be shown later.

Substituting in (8) the electrical conductivity K for the resistivity r, as was done in formula (3) for the convenience in making comparisons, this formula (8) reduces to

$$S/L = 0.3456 \sqrt{1/Kk} \quad \ldots\ldots\ldots\ldots\ldots (9)$$

This shows that, as far as economy of material is concerned, that material is best in which the product of the two conductivities is greatest. Hence, to improve a material in this respect either or both should be increased. But the improvement in economy is only in proportion to the square root, and hence is not as great in percentage as the improvement in either of the conductivities.

Comparing this formula (9) with the corresponding one (3) for the minimum loss, it will be noticed that the requirements for economy in material (9) and for economy of power (3) are different, and in some respects antagonistic, hence the choice of the material depends somewhat on the relative importance of these two economies. With graphite and carbon, for instance, according to the best, though crude, figures available for the two conductivities, the electrodes become much smaller for graphite, but the minimum loss is slightly less for carbon, provided both have their best proportions and, of course, the same length.

In this comparison of (3) and (9) it will be seen that both economies are improved by an increase of the electrical conductivity alone; hence this is always desirable. An increase in the heat conductivity alone improves the economy of material, but diminishes the economy of power; a decrease in the heat conductivity alone improves the economy of power, but increases their size. The final criterion depends on their quotient and product, as was described.

In formulas (5), (8) and (9) the relation is stated in the form of section divided by length; this was done because practical considerations usually fix the length, and it is therefore cross-section which remains to be calculated. By inverting these formulas so as to give the ratio of the length to the section they become more similar to (2), (3) and (4), with which they can then be better compared for making any further deductions.

RULES FOR DESIGNING ELECTRODES.

From the above the rules for the guidance of the designer may be briefly summarized as follows:

The temperature and the kilowatts are always given in the problem. The two conductivities or resistivities of the proposed materials must, of course, be available. From the kilowatts make the current as small and the voltage as high as practicable. From formula (5) calculate the proportion of the section to the length. The length is generally fixed by the width of furnace walls or other considerations; the only rule is to make it as short as practicable; this length then determines the section. The current density (7) is not a factor in calculating the proportions of electrodes except, insofar that it should not exceed practicable limits.

The electrode loss will then be the minimum possible, and is determined from formula (2) in watts; this is for one electrode and must therefore be multiplied by 2 to get the total. The electrode efficiencies are then readily determined.

These calculations should be repeated for each of the different materials available and the various advantages and disadvantages due to their different sizes, losses, terminals, etc., should be carefully weighed.

Never compare two electrodes of the same size but of different materials having different conductivities; such a comparison is unjust to either one or the other or both, as also to the designer, because it gives him an unwarranted confidence. They can be properly compared only when both have their best proportions.

In the concluding portions of his paper the author illustrated his method by numerical examples, and proceeded finally to an analytical proof of the fundamental equation, etc.

Electric Smelting Costs in Sweden.

In a recent report from Stockholm, Sweden, to the Canadian Department of Mines, Sir Cecil Spring-Rice makes the following statement regarding the development of electric smelting in Sweden:

Arrangements have been made with the Trollhatten Water Power Company for the construction and working of three electric furnaces for the production of pig iron. Each furnace is to receive a current of 2,500 horsepower and to produce 7,500 tons per furnace per annum. Two are to be in working, while the third is in reserve. The price of the current per horsepower per annum is 27.60 kroner for the first ten years, and 36.80 kroner the next ten. The ore is to be brought from Grängesberg, containing from 0.4 to 1.9 per cent phosphorus. Westphalia coke will be used, costing about twenty-one kroner at Trollhatten. It is calculated that the cost of production will be fifty-one kroner per ton pig iron. The sale price is fifty-eight kroner. With a production of 15,000 tons per year, the cost is calculated as follows:

	Kroner.
Three furnaces	150,000
Tools, etc.	15,000
Crushing apparatus for 35,000 tons ore and 7,000 tons coke	9,000
Electric motors, lighting, etc.	6,000
Transport of ore and coke from harbor	15,000
Transport of pig iron and slag	12,000
Houses and shelters	64,000
Harbor works, leveling, etc.	15,000
Laboratory, unforeseen, etc., 11 per cent.	20,000
License	34,000
Working capital	25,000
Minimum capital	235,000
Total	600,000

The value of the Swedish krone is given in Webster's New International Dictionary as $0.268.

The Most Powerful Ship Yet.

The British Admiralty is still leading the way in naval construction, as is evidenced by the announcement that the new cruiser about to be laid down at Devonport (Eng.) Dockyard will be equipped with turbine engines of no less than 70,000 indicated horsepower! The designed speed of this ship has not yet been made known to the public, but the *Invincible,* the fastest cruiser in the world at present, can make over twenty-six knots with her engines of 41,000 horsepower, so it can safely be assumed that the speed of the new vessel will be phenomenal. It is understood that the armor, armament, displacement and electrical equipment of the new cruiser (the first of a number provided for by the present plans) will be in keeping with the horsepower.

Wireless Opportunity.

An American consul in an Asiatic country reports that a local government official has made inquiries concerning the possibility of installing a wireless-telephone system. A system such as is used on lake steamers in the United States would undoubtedly give satisfaction, and the consul states that if installed by an American would increase American influence in that region very much. He adds that he is willing to give this matter his personal attention and would like to hear from American firms in regard to the same. Further information can be obtained by writing to the Bureau of Manufacturers, Washington, D. C., quoting File No. 4133.

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Cadmium Amalgams and the Weston Normal Cell.[1]

A number of researches have been made within recent years on the electromotive properties of mercurous sulphate, and as a result it is possible to make a standard cell having considerable accuracy. There are still many instances withal of abnormal behavior of such cells both as to constancy of electromotive-force and with respect to change of electromotive-force with varying temperature. The want of constancy has been attributed to slow hydrolysis of the mercurous sulphate, and to a change in the size of the mercurous sulphate crystals. Irregular behavior with changing temperature has been observed by several investigators, all of whom attribute the observed differences to the cadmium amalgam.

While the exact constitution of cadmium amalgams is doubtful, there is no doubt that the electromotive properties of the amalgams depend largely on whether one or two phases are present. When, by increasing the temperature, a solid amalgam is converted into a mixture of liquid and solid phases, there is an immediate change in the electromotive temperature coefficient of the amalgam, and a similar change results when the co-existing phases are changed entirely into the liquid state. If the temperature of an amalgam, containing the mixed phases, is raised, the liquid phase is increased and the solid phase diminished. It is probable, however, that the electromotive-force of an amalgam toward a solution of cadmium sulphate does not depend on the relative amounts of the two phases. Hence, amalgams containing different percentages of cadmium, but possessing the two phases, may have the same electromotive-force toward a cadmium sulphate solution. With amalgams all solid or all liquid, the electromotive force varies with the cadmium content.

The objects of the present investigation were: (1) To trace the cause of the electromotive difference, which sometimes existed, and which was sometimes absent, between ten and twelve-and-one-half per cent amalgams; (2) to determine the limits of temperature between which amalgams of various concentrations could be usefully employed; (3) to explain the abnormal electromotive-forces of cells made by various observers, when the amalgams contained from twelve-and-one-half to fourteen per cent of cadmium; (4) as the recent International Conference on Electrical Units and Standards specifies a twelve-and-one-half per cent amalgam, it was important to decide whether the limits of temperature (zero to forty degrees centigrade) specified, required amending or not.

The author's conclusions are as follows:

1. Cadmium amalgams of such a composition that if homogeneous—the term is used in a relative sense—they would be completely solid below certain temperatures, may not in a Weston normal cell have that electromotive force toward a cadmium sulphate solution corresponding to such a solid. The general result is a lowering of the electromotive force of the cell and is due to lack of homogeneity of the amalgam, the outer skin of which is of low cadmium concentration and the center of the mass of high cadmium concentration. Diffusion tends to restore uniformity, and in consequence the cell is unstable for a very considerable time—the electromotive force rising.

2. When the amalgam is at a temperature near to, but below, the first transition point, the difference of concentration between the inner and outer parts of the amalgam need be only small to enable the outer skin to be a two-phase system. Owing to the small difference of cadmium concentration throughout the mass the diffusion process will be slow and the electromotive force of the cell may remain constant for a very long time. There is, however, in general, a small difference in electromotive force between such a cell and one containing a normal two-phase system.

3. Cadmium amalgams of such a composition that, if homogeneous, they would be all liquid above certain temperatures, may not in a standard cell have that electromotive force toward the solution corresponding to a homogeneous amalgam. In such a case the electromotive force of the cell is higher than usual. The effect is due to the upper part of the amalgam being a two-phase system and the lower part an all liquid system of less cadmium concentration than the upper part. Diffusion quickly equalizes the concentration and the electromotive force falls to a normal value.

4. The twelve-and-one-half per cent cadmium amalgam at present used in the Weston normal cell may be completely solid at temperatures below twelve degrees centigrade, and cells containing it may have a higher electromotive force than normal if used below that temperature. Fortunately, even at temperatures such as zero centigrade, the amalgam is comparatively near to its first transition point, and the conditions are similar to those noted in (2). In consequence, except in rare cases, cells containing the twelve-and-one-half per cent amalgam will behave at zero temperature (centigrade) as though they contained an amalgam which was always in a two-phase system at that temperature.

5. As a ten per-cent amalgam at zero centigrade is above its first transition temperature this may be used in standard cells at low temperatures. Such cells may also be used at temperatures as high as fifty-one degrees. We suggest that the twelve-and-one-half per cent amalgam in the Weston normal cell be replaced by a ten per cent amalgam.

[1] Abstract of a paper by F. E. Smith, presented at the October 23 meeting of the Physical Society of London (Eng.).

New Telephone Line in South America.

The Union Telephone Company, of Buenos Ayres, is about to build a telephone line from that city to its leading seaside resort, Mar del Plata.

An Electromagnetic Friction Coupling.

This coupling, which has been patented in Germany by a machine-building firm of Berlin, is intended chiefly for motors and rolling mills. Its two principal parts are an electromagnet in the form of a pot mounted rigidly on one shaft, and the armature of this magnet mounted on the other shaft in such a way that it can be displaced. Current is transmitted to the coil of the pot-shaped magnet by means of two collector rings and brushes. When the circuit is closed the two parts of the coupling attract each other strongly, but without being able to touch, a direct contact being prevented by friction rings arranged on both sides and consisting of non-magnetic material. The frictional resistance thus produced causes the rotation of the part to be operated. When the circuit is opened the magnetic action ceases immediately and the two parts of the coupling are separated from each other by springs. Switches for operating the couple may be located in different places in order to diminish the danger of accidents. The various parts are easily interchangeable. The current consumption is small, being only one-half to one ampere at 220 volts for models of the size most extensively employed.—*Translated and abstracted from L'Electricien (Paris), October 23.*

A Reversible Turbine.

Consul Frederick I. Bright, of Huddersfield, Eng., quotes a British newspaper statement that an Italian engineer has invented a reversible turbine engine. The advantages claimed for the engine are that "there are no blades or vanes to break or get out of order;" that "it will work with equal power or speed in both directions, forward or reverse," and that "it can be built in all sizes from five horsepower to 50,000 horsepower." It is reported that a large company is to be formed, backed by prominent Italians in London.

The Telechronometer.

A Rochester (N. Y.) man has recently invented a device called the "telechronometer," which is designed to be attached to a telephone instrument to record the length of the conversation by intervals of a quarter of a minute. No record is made when a call is not effective, and furthermore, when a subscriber is called, his meter does not register unless by previous arrangement with "central." Thus the charge is made on the party who is willing to pay for it.

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ELECTRIC TRACTION

A Modern Electric-Railway Substation.

Probably no other city has been handicapped in its growth to such an extent or encountered difficulties, due to traction problems, as has Chicago. Prior to the year 1907, such chaos reigned that a concise account of traction conditions then would be hard to relate. In February of that year, however, the City Council passed ordinances authorizing the Chicago City Railway Company and the Chicago Railways Company, the latter succeeding the Chicago Union Traction Company, to reconstruct, maintain and operate a system of railways according to the specifications contained in the ordinances. This action was the actual beginning of the rehabilitation of the street railways in Chicago.

One of the first problems to be considered was the changing of power on all remaining cable lines to electricity, some few of these lines having been electrically operated prior to the passing of the ordinances. This change required a great expenditure of money for additions to power stations or new plants, and on account of the financial conditions then existing the Chicago City Railway Company found it more advantageous to abolish its few inadequate power stations and to purchase current from the local central-station company. The Chicago Railways Company having more modern power stations found it necessary to purchase only a part of the total current required.

Since that time the traffic of both railways has steadily increased, necessitating the construction of more substations along their lines. As an example of the most modern practice in substations, the Lill Avenue station, known as Substation No. 3 of the Chicago Railways Company, is selected as being typical. This substation is located on Lill Avenue, near Sheffield Avenue, directly south of one of the new car houses of that road. The building, a substantial pressed brick and concrete structure with steel frame construction and tile roof, is ninety-three feet long and forty-nine feet wide.

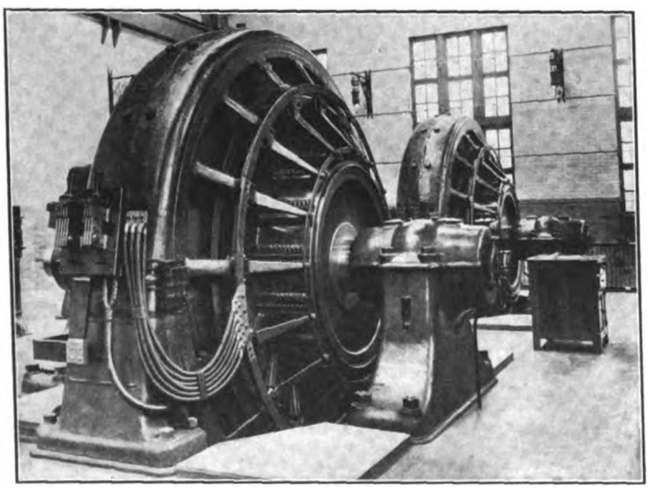
It is divided into a basement of concrete construction and a main or service floor, provision being made for ample space for the operation of the machinery and for light and ventilation.

The entire equipment consists of standard apparatus, including motor-operated oil switches, single-phase air-blast transformers and six-phase compound-wound rotary converters. The substation receives twenty-five-cycle, 9,000-volt, three-phase current from the feeders of the Commonwealth Edison Company, and delivers a 600-volt direct current to the direct-current feeder system of the road.

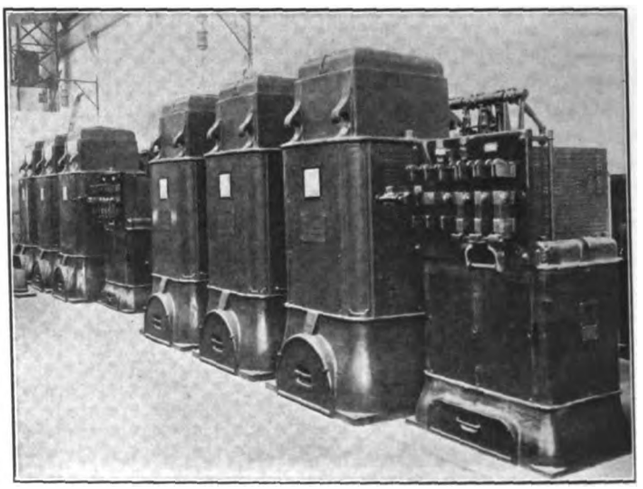
The three-phase current is supplied to the step-down transformers through a separate high-tension underground lead-armored feeder cable. Each transmission line runs through a conduit in the basement to a motor-operated oil switch and is connected through it to a short busbar. To this busbar two other switches are connected, one making connections to the bank of transformers and the other connecting to a transfer busbar which extends through the entire station, but which is divided into three sections through two additional oil switches. An emergency line is connected to the middle section of this busbar. This arrangement provides for great flexibility in the operation of the station.

The apparatus is conveniently arranged in rows. Starting at the west side of the building may be seen the high-tension potential transformers and their detachable fuses, located in small brick structures protected by wood and glass swinging doors. The high-tension oil switches enclosed in brick structures with stone-slab partitions and sliding asbestos doors with glass panels are arranged in a single row in front of the potential transformers. The two banks of 750-kilowatt step-down transformers constitute the next row, the reactance coil for each rotary being placed at the head of each row of transformers. In the next row, with ample space between, are located the two rotary converters; a third one is now being installed. Along the east wall is the main switchboard.

This board contains twenty-four panels of black enameled slate and two auxiliary



VIEW OF 2,000-KILOWATT ROTARY CONVERTERS.



TRANSFORMERS AND REACTANCE COILS.

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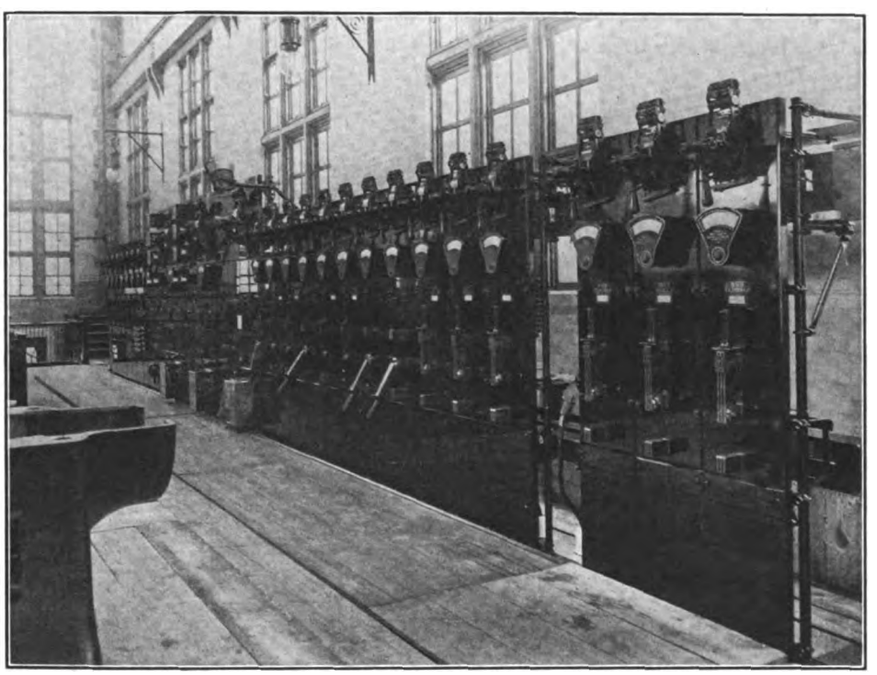
panels. There are three direct-current converter panels, three alternating-current converter panels, three alternating-current line panels, one battery panel and fourteen feeder panels. The direct-current converter panels are equipped with automatic circuit-breakers, direct-current ammeters and direct-current recording wattmeters; the three alternating-current rotary panels are equipped with power-factor indicators, alternating-current voltmeters and ammeters and inverse time-limit relays. The alternating-current line panels are equipped with wattmeters, line meters and relays. The battery panel is equipped with a voltmeter, an ammeter, two circuit-breakers and a relay for ringing the emergency bells. All feeder panels



VIEW OF SWITCHBOARD IN LILL AVENUE SUBSTATION.

are equipped with ammeters and automatic circuit-breakers. The board is also provided with two direct-current voltmeters on swinging brackets located at each end of the board. Each feeder panel and the machine panels are equipped with lightning arresters located on the back of each respective panel. Back of each alternating-current panel is a potential transformer for the power-factor indicators and voltmeters.

Most of the space in the basement is occupied by a large air chamber in which a pressure of one-half an ounce to the square inch is maintained for cooling the transformers and reactance coils. The air is supplied by three fans direct-connected to seven-and-one-half-horsepower induction motors. These motors are controlled from a three-panel switchboard which is so connected that two motors may be used for operating one fan. The incoming lines and high-tension busbars are also located in this air chamber.

In a room just south of the air chamber is an auxiliary storage battery which supplies current for controlling the oil switches and for the signal lamps on the switchboard. This battery consists of fifty-five cells. In the basement there is also located an automatic pump driven by a Roth motor, this pump being used for drainage purposes.

The building is illuminated by ten arc lamps, five connected in series across the 600-volt direct-current circuit, and also by incandescent carbon lamps, five in series. The lighting circuits are controlled from a panel in the north end of the basement. Included in the apparatus in this station is an electric traveling crane manufactured by the Walker Manufacturing Company.

The entire electrical equipment, with the exception of the motor operating the automatic pump, was supplied by the General Electric Company.

New York Subway Profits.

In a synopsis of a report of the Interborough Rapid Transit Company of New York given out by the Public Service Commission, the rather interesting point was brought out that there has been a profit of more than three cents per passenger on the subway. The synopsis shows that 237,451,171 passengers were carried at a total expense of $4,547,620.

THREE-PHASE TRACTION SYSTEMS.

BY FRANK KOESTER.

The practicability of three-phase traction systems has been discussed by our American engineers for a number of years and great efforts have been made to introduce this system here after its having been successfully applied on the Continent of Europe, particularly in Italy and Switzerland. The credit is largely due to Koloman von Kando for applying three-phase current to heavy electric traction. It is probably still fresh in the minds of most readers that in September, 1902, the entire steam locomotives of the sixty-six miles of the Valtellina Railway in upper Italy were supplanted by three-phase locomotives, hauling local and express passenger, as well as heavy freight trains.

The Ganz Company, by whom this installation was carried out, experimented with the three-phase system as early as 1895, and soon thereafter, in 1898, installed a short line at Evians-les-Bains, on Lake Geneva, which was but 0.3 kilometre long, the steepest grade being 10.2 per cent. This was followed later by the introduction of this system for railways in mines in Hungary and France.

These Valtellina Railway locomotives draw three-phase current at 3,000 volts, fifteen cycles, from two overhead conductors, the rails acting as the third phase. The first locomotives were equipped with four 225-horsepower motors, flexible-link-connected to the drivers, having a constant speed of 128 revolutions per minute, and giving a train sped of 18.6 miles per hour. They weighed forty-seven metric tons. The later locomotives, put in operation in 1904, were designed for two normal speeds, namely, one speed 18.5 to 21.5 miles and another thirty-seven to forty-three miles per hour, and weighed sixty-two metric tons. While in the earlier type the motors were mounted on quills surrounding the driven axle, in the later type two motors are mounted between three axles and connected to them by means of cranks and connecting rods, the cranks of the motors being also interconnected. Each motor has a nominal rated capacity of 600 horsepower; hence the locomotive at standard full speed is developing 1,200 horsepower.

In 1906 a similar system was supplied for the Italian State Railway, the locomotive having three speeds instead of two, namely, 15.6, 26.5 and forty miles per hour, the motors having one speed corresponding to eight poles and another to

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twelve poles, and the independent connection of the motors and the cascade connections of both enable the three different speeds to be attained. The rated capacity of the motor with eight poles is 1,500 horsepower, that of the twelve-pole motor is somewhat smaller.

The original equipment of the Valtellina Railway included also ten motor cars for passenger traffic, each having a weight of fifty-three tons and generally hauling five trailing coaches with a total train weight of 150 tons. The speed is forty miles and twenty miles, the latter being used at the stations. Each motor car is equipped with four motors transmitting the power to the spokes of the wheels by means of elastic-link couplings. Two motors are wound for 3,000 volts and two for 300 volts, the former being capable of developing 150 horsepower each at 300 revolutions per minute.

Another prominent three-phase traction system is that of the Simplon Tunnel Railway, a road which has a length of 13.75 miles, of which 11.5 miles is in the tunnel proper. While the average grade is 0.7 per cent, there is a grade, on a short stretch of one per cent. The current is taken at 3,000 volts and sixteen cycles from two overhead conductors by bow collectors, the rails constituting the third phase. The earlier locomotives, which were put in operation in June, 1906, were designed for two different speeds, namely, twenty-one and forty-two miles per hour. The change in speed is accomplished by changing the number of poles in the rotor, sixteen and eight poles being used, respectively, for the speeds mentioned.

The new locomotives[1] for this tunnel railway are designed for four different speeds, the change being accomplished in the same manner, depending upon the number of poles used, namely, sixteen, twelve, eight and six, the speeds produced thereby being 16.5, 21.7, 33.1 and 43.4 miles per hour.

Both types of the Simplon locomotives are driven by motors which are link-connected to the drivers, the motors themselves being interconnected. Each of the motors for the new type of locomotive is rated 650 horsepower, while those of the older type were 450 horsepower.

None of the European locomotives have gear-connected motors, and all use, for drawing the current from the working conductors, collector bows or long contact tubes, the two tubes, for the two conductors, being mounted on a single frame.

Fully seven years after the successful operation of the first prominent three-phase system in Europe we come across the first three-phase system in this country, at the Cascade Tunnel of the Great Northern Railway Company. An exceptionally good paper on this installation was presented by Dr. Cary T. Hutchinson at the last meeting[2] of the American Institute of Electrical Engineers.

In addition to other novel features, we find the locomotives used here to be equipped with four motors, twin-geared to the four driving axles in the ratio of 1:4.26. The synchronous speed of the motor is 375 revolutions per minute, giving a speed of 15.7 miles per hour at no load, dropping to fifteen miles per hour at a load corresponding to the one-hour rating. The trolley voltage is 6,000, twenty-five cycles, and drawn from two overhead lines by two collector wheels. As the motor winding is for 500 volts, the potential is stepped down by means of two three-phase transformers. Taps are also provided to draw 625 volts. The motors have a continuous output of 375 horsepower, at 500 volts with 1,500 cubic feet of air supplied per minute for cooling, and 400 horsepower at 625 volts with similar cooling. For the one-hour rating at 500 volts the output was found to be 475 horsepower. The total weight of the locomotive is 230,000 pounds.

At the time efforts were made to introduce the three-phase traction system into this country, about five years ago, much opposition was met with, particularly among the single-phase enthusiasts. It developed at the discussion of the paper referred to that, after six years of argument, the many advantages of the three-phase system must be acknowledged. It had been claimed that the use of two trolleys instead of one and the constant-sped motors instead of variable-speed motors (single-phase or direct current) were the great disadvantages in three-phase traction. It is admitted that a single conductor may cause half the trouble that might be caused by a double conductor, but this is only a matter of detail. The constant-speed motor, particularly in mountainous districts, has the decided advantage of regenerating current in descending the mountain, cutting down materially the required output of the generating plant. As cited in the examples given of the Valtellina and the Simplon Tunnel railways, both of which are for heavy traction, freight and passenger, provision may be made for securing various speeds by cascade switching, changing the number of poles, and changing the secondary voltage of the step-down transformers on the locomotives.

[1] See the illustrated article describing these locomotives in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 13, 1909, pages 938-940.

[2] See the comprehensive report of this meeting in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 20, pages 981-985.

Device for Preventing Collisions.

A device for preventing collisions of trains was recently given a test before railway officials of the Erie Railroad in New York, and apparently worked successfully.

Two special trains approaching each other at a speed of thirty miles an hour were stopped within a short distance of each other without the assistance of either engineer.

The invention is operated by a third rail, such as is used on electric railroads. A shoe from the locomotive touches the rail and receives power through it both for the operation of the emergency brake and for the telephone. The principle is similar to that of the block-signal system. A length of track is divided into zones, and so long as only one engine is in this zone a green light shines in the locomotive cab. Whenever two trains enter the same zone, however, this light goes out automatically, and when the trains approach within a given distance of each other the air brakes on each are set automatically. It is possible to arrange the mechanism so that the brakes will be applied with great speed, or so they will operate gradually.

Increased Earnings of Wisconsin Railways.

The final assessment of the street railway and light, heat and power companies of Wisconsin, recently made by the state board of assessment, shows an increased valuation of nearly $3,000,000 over that of last year. The taxes which will be received from these companies will amount to $422,015.21. Eighty-five per cent of this tax goes to the towns, cities and villages where the properties taxed are located, and the remaining amount to the state. The state will receive $63,302.32 as its share, while $358,712.89 will go to the municipal corporations and villages. The Milwaukee Electric Railway Company will pay a tax of $249,763.46. The Janesville Street Railway Company will pay only $422.94, the smallest amount. Of the $8,001.59 to be paid by the Southern Wisconsin Railway Company, operating in Madison, Wis., $6,801.35 will be paid to the city. M.

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CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

Notes on Long-Distance Transmissions.[1]

When power-transmission work first began in California, the various companies which harnessed the high-fall mountain streams had no idea of becoming linked together, and so each engineered its proposition in its own way.

The importance of the industry has, however, grown to such an extent that a few years ago some far-sighted engineers and financiers saw the advisability of linking up, so that each station could help the others in emergency and also for the purpose of economizing establishment charges. This has now been done.

The result is that stoppages of power are very seldom heard of, and when even only a few miles of steel-tower line are blown down, a way around is found in a few hours.

California is now practically a huge switchboard, with over 1,000 miles of high-tension busbars criss-crossing it in all directions. For the present the voltage is 60,000, but everything now going in is being erected with a view to changing over to 100,000 volts.

In Canada and in India there are some big transmissions already, and more being erected and proposed.

The development of long-distance power has been the means of enhancing the importance of the occupations of patrol men and extra high-tension line repairers. These men have an adventurous life, for they live most of the time away from their fellows and have to ride many miles a day over rough country and in all weathers. If need be, they must be prepared to camp out where darkness finds them and forage for their food as they go along. They can speak with the power house, but a telephone line running parallel to a transmission line is not a nice thing to talk through, however much the two may be transposed.

When the patrol man has discovered a fault, he rings up the power station or substation, and a gang of extra-high-tension line repairers come out. These men literally take their lives in their hands, for it is becoming the custom to execute all repairs by daylight, when current is on the line. It can be done quicker that way, and there is no loss of revenue due to the line being stopped.

It is with a feeling of relief that one reads that special clamps have been invented to fasten high-tension wires to insulators, so that winding thirty inches of the wire with sticks three feet long will not be necessary.

TABLE SHOWING ELEMENTS OF SEVERAL HIGH-VOLTAGE, LONG-DISTANCE TRANSMISSION LINES.

Power Co. and Year Designed.	Location.	Length of Transmission.	Voltage.	Kilowatts Transmitted.	Phase and No. of Circuits.	Conductor.	Spacing of Conductors.	Height of Standard Tower and Span.	Width of Tower at Right Angle to Line.	Distance Nearest Tower Member to Line.	Type and Number of Insulators.	Highest and Lowest Wires from Ground.	Weight of Complete Tower.	Coating of Metal in Tower.
Great Western Power Company. 1907	Northern Central California	160 miles Big Bend to Oakland	100,000	40,000 with first development	Three-phase Two circuits	No. 000 copper strand cable, 6 wires and hemp core to a strand	10 ft. vertically	76 ft. in height 750-ft. span	17 ft.	6½ ft.	4-50,000 vt. suspended. Lock type for each conductor	66 ft. 46 ft.	3,800 lbs.	Galvanized
Stanislaus Electric Power Co. 1907	Central California	92 miles to Mission San Jose. 140 miles to San Francisco	100,000	5,500 at present. To be increased shortly to 10,000	Three-phase One circuit	No. 00-6 strand copper cable with hemp center	8 ft.	65 ft. in height 800-ft. span	15 ft.	3 ft.	Suspended type—Lock and G. E.	58 ft. 35 ft.	3,400 lbs.	Galvanized
Edison Electric Co Kern River No. 1. 1906	Southern California	117 miles	60,000 now. Intend to raise to 80,000	80,000, including 50% overload at peak	Three-phase Three circuits	No. 0000 hard-drawn copper, 7-strand. Elastic limit 35,000 lbs. Ult. strength 62,400 lbs. 2,500,000 lbs. of cable used in the line	6 ft. between wires	30 ft. to 60 ft. 1,140 towers in 117 miles av. span is $\frac{1175 \times 280}{1140} = 542$ ft.	12 ft.	3 ft.	Pin type, C I. pin, 3 petticoats, 9 to the tower	61 ft. 55 ft.	4,250 lbs. average	Galvanized portions below ground asphalted
Necaxa Light and Power Co. 1906	Mexico	169 miles	60,000	37,500 at peak	Three-phase Four circuits Two tower line	No. 000-⅛ in. diam hemp center copper strand cable, 40,000 lbs. Elastic limit 60,000 lbs. Ultimate strength 168,000 circular mils section	Circuits carried on 6-ft. triangles	58 ft. in height Span not given	14 ft.	2 ft.	Pin type, porcelain petticoats, 14 in. diameter 120.000 vt test	46 ft 40 ft.	.....	Galvanized
Winnipeg Power Co.	Canada	65 miles	60,000	.....	Three-phase Two circuits	No. 00 hemp core cable, No. 7 wires	6 ft.	Span 400-500 ft.	.....	.....	Pin type	60 ft. 40 ft.	2,240 lbs.	.....

The table[2] herewith is interesting, because it gives data of some very large power transmissions. The longest transmission—169 miles—is in Mexico, and no less than 37,500 horsepower passes over it.

Two transmissions in the table work at 100,000 volts, and the tendency is all in that direction, the wires being carried by suspended insulators instead of the upright pin type. Practically all long-distance transmissions have two or more

[1] Abstracted from an article by E. Kilburn Scott in *The Electrical Engineer* (London, Eng.), September 24, 1909.

[2] Acknowledgment for this table is given by Mr. Scott to *Engineering News*.

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circuits, and in some of them the circuits are run over separate rights-of-way, so as to tap more country and give greater safety in case of an accident.

Although aluminum has been used for many transmissions, all those in the table are copper, and now that the price has come down, the tendency is to use the harder metal. The wires are carried on steel towers, this being the most up-to-date construction, and, indeed, practically compulsory in hot countries, where white ants give trouble. The towers run about sixty-five feet high, with the cross-bars about eight feet apart. All the metal of the towers is galvanized.

The tendency at the present time in Canada and the United States is to put all high-tension transformers and switch-work out in the open. A paper read last April by K. C. Randall before the American Institution of Electrical Engineers details the precautions which had to be taken.

Of course, the transformers are very large, say, 1,500 kilowatts, oil-cooled, and the voltages are in the nature of 60,000 down to 6,000, and so on. The oil must be non-freezing, and in very severe weather the transformers not in use are left in the circuit to make sure the oil shall not thicken, and so reduce its insulation.

Also in summer the transformers are kept cooler by a simple fence built high enough to throw a shadow over them during the hottest hours of the day. At night the heat accumulated in the oil during the day is discharged, so that the transformer starts fair with cool oil next morning. Then there are the terminals where the high-tension wires enter the transformer. These are built with layers of tinfoil in the insulation on the lines of a graded high-tension cable, so as to reduce the electric stress. The wires run down vertically into the top of the transformers, and each layer of tinfoil is provided with a water shed; but for particulars of these the reader is referred to another paper read at the same time before the American Institute by A. B. Reynders.

In January of this year about eleven miles of the transmission line of the Great Western Power Company, near Sacramento, were blown down. As the wires were carried on the latest approved manner on steel towers, seventy feet high, spaced 750 feet apart, the failure of this line was serious, especially as the old wooden pole lines weathered the storm.

Two firms of consulting engineers practicing in San Francisco were called in, and their reports, which have recently been published, are interesting reading.

The failure of the towers was due to the foundations under the legs giving way. It appears that when the ninety-two towers which failed were erected, the ground was very hard, due to a dry summer, and most of the holes were opened out by blasting the clay. When the towers were up, this hard, lumpy stuff was hastily shoveled back, and no attempt made properly to compact it. In January there were heavy floods over the country, and the water getting into these holes softened the loose refilled material and destroyed its vertical supporting power as well as its holding-down power. The result was that a heavy windstorm going up to forty-eight miles an hour found out the weak spot and overturned ninety-two of the towers.

Fortunately, comparatively little interruption to the power was caused, because one of the largest customers was the Gas and Electric Corporation, and the tap to its line was merely changed from Oakland to a point—Oroville—between the breakdown and the power house.

The investigation into the foundations was made by Messrs. Duryea, Hachl and Gilman, and their recommendations will no doubt prevent any such accident ever happening again, and fortunately so. A few like that, and long-distance power-transmission practice would receive a severe setback.

One result of the failure of the above transmission was that an investigation was also made by Galloway & Markwart into the design of the steel tower. Two towers which had been firmly anchored down were tested to destruction by pulling on the three cross-arms horizontally and at right angles to the direction of the transmission. The first tower failed with 8,400 pounds, and the second, which had been strengthened, gave way with 11,250 pounds. The experts then assumed wind velocity of seventy-seven miles per hour, which is equal to thirty pounds per square foot, and from the area presented to the wind they worked out the total pressure as follows:

One steel cable.....	527 pounds
Six copper cables.....4,218	pounds
Force on tower.....2,100	pounds
Total 6,845	pounds

This force is not exactly comparable with the test force applied, because in the test there was lacking the weight of the transmission cables which produces a moment that counteracts the moment of the wind. It was estimated that 345 pounds applied at the top of the tower would be equal to this, so that the total wind would be 6,500 pounds.

Therefore, the factor of safety works out at 8,400/6,500 = 1.3 to 1 in first test, and 11,250/6,500 = 1.73 to 1 in second test.

The factors are too small when one considers the immense importance of keeping power on the line. A failure means loss of prestige and standing with power consumers, besides the money loss. In bridges it is common to allow four or five, and in buildings four to one.

It is to be hoped that in future American contractors will be thorough in their work, and the designers more liberal in their factors of safety.

Waterhammer and Steam Explosions.

An interesting pamphlet dealing with waterhammer in steam pipes has been issued by C. F. Stromeyer, chief engineer of the Manchester (Eng.) Steam Users' Association, says *Nature*, of London, Eng.

According to the (British) Board of Trade reports, waterhammer has been the cause of about 120 steam-pipe explosions. Mr. Stromeyer finds that nearly one-half of these have been due to the absence of drain-cocks on steam pipes, or to their injudicious use. A large number, chiefly on steamers, have been produced by admitting steam into pipes containing water. Others have occurred when water was admitted into steam pipes, or when steam condensed in them. Steam being admitted through valves on which water was resting, injudicious opening of valves having steam and water on both sides, and injudicious manipulations of steam valves, whereby plugs of water have been set in motion, have all contributed to swell the total of explosions.

Mr. Stromeyer considers it inadvisable to lay down at present definite rules for the design of pipe arrangements in general, having been led to this conclusion by the fact that draining arrangements, designed to obviate explosions, have caused the majority of accidents, and also because in many cases of complicated pipe arrangements the waterhammer may often be attributed to any of the above-mentioned causes. Mr. Stromeyer complains of the insufficiency of the official reports of explosions having given him much difficulty in arriving at definite conclusions.

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A New Australian Central Station.

An interesting example of Australian central-station practive is afforded by the Balmain (N. S. W.) works of the Electric Light and Power Supply Corporation, which were recently opened by the mayor of that town.

The plant, which is situated on an excellent site possessing a water frontage of 270 feet, is contained in a fine steel-framed building, and comprises two 5,000-volt, three-phase Thomson-Houston generators, direct-coupled to two Bellis & Morcom triple-expansion engines of 1,200 horsepower. The boiler plant includes two Babcock and Wilcox water-tube boilers fitted with superheaters and automatic chain-grate stokers, and a third Babcock & Wilcox boiler connected with a garbage destructor, the latter being more than sufficient to supply the steam necessary for lighting the whole of Balmain. The supply is controlled by a switchboard supplied by the Australian General Electric Company. The plant specifications were prepared by J. E. Donoghue, who is the chief engineer and general manager of the Electric Light and Power Supply Corporation.

Measuring Holes by Electricity.

A novel use for electricity is recorded in a recent issue of the *Scientific American*, as follows:

One of the employes of a Chicago firm dealing in perforated metal to be used in flour mills has devised a simple measuring device for readily matching samples brought in by customers. A tapering needle, which is pushed into one of the perforations as far as it will go, carries a brush that passes a series of electric contact pieces. The latter are connected to a set of solenoids, and when the circuit is closed by pressing a button, one of these solenoids operates to uncover a number indicating the correct size of the hole.

A Prussian Searchlight Rifle.

Vice-Consul-General Charles A. Risdorf, of Frankfort, states that a German publication, *Army and Politics*, has caused a sensation in military circles by describing a new appliance for a gun to enable a soldier to take aim at great distances in complete darkness. The inventor is an engineer of Dortmund, named Issel. A telescopic searchlight containing a small electric lamp is fixed to the barrel below the stock. Military authorities are said to have made successful trials, and all shots took effect.

Waterpower in Iceland.

Iceland is comparatively rich in waterpower which still awaits its exploitation, says *Engineering* (London, Eng.), but a move in this direction is now being made by a limited company formed for that purpose.

The Skjälfandi River Falls are divided into three groups—the Aldeyjar Falls, with an aggregate head of 190 feet; the Goda Falls, with a divided course and respective heads of about ninety feet and eighty-three feet. The aggregate power of the Goda Falls is calculated at 39,200 horsepower, and that of the Aldeyjar Falls at 45,800 horsepower. The Barna Fall, north of the former fall, has a head of fifty-five feet, and an estimated capacity of 17,000 horsepower. The Laxau River Falls can easily be regulated so as to yield between 25,000 and 30,000 horsepower.

In the southern part of the island are the Sog Falls, three in number, which, with minimum water level, can yield 50,000 horsepower, which, however, can by regulation be increased to some 60,000 to 70,000 horsepower. The Guldfoss Fall is in the Hoitaa River before it joins the River Sog. This important fall is calculated to yield some 100,000 horsepower, which, by regulation of the river, can probably be increased to 150,000 horsepower.

It will thus be seen that a considerable amount of waterpower is available in Iceland, particularly adapted for electrochemical installations.

Large Aluminum Contract.

The Hydroelectric Power Commission of Ontario, Can., has recently placed a contract with the Aluminum Company, of America, for 1,500,000 pounds of half-inch aluminum wire, to be delivered as quickly as possible. It is the intention of the commission to transmit power from Niagara Falls through the province of Ontario at the lowest possible rates, thus inducing large plants to locate there.

An International Congress of Radiology and Electricity.

Arrangements have been made for an International Congress of Radiology and Electricity to take place at Brussels in connection with the exhibition to be held there in 1910, says *The Lancet* (London, Eng.). The Congress, which will meet on September 6, 7 and 8, will be held in three sections. In the first section, general questions of terminology and methods of measurement in radio-activity and subjects connected with ions, electrons and corpuscles will be dealt with. The second section will be divided into various sub-sections, dealing respectively with fundamental theories of electricity, the study of radiations (including spectroscopy, chemical effects of radiations, and other allied questions), radio-activity, atomic theory, cosmical phenomena (including atmospheric electricity and atmospheric radio-activity). The third section will be biological and will be devoted to consideration of the effects of radiations on living organisms. The section will deal with purely biological questions as well as with the use of various radiations for medical purposes, both for diagnosis and therapeutics. In order to insure the success of the Congress, committees have been formed in the various countries which will take part in the Congress, and the following scientists have already consented to act as presidents of the committee in each country: Professor Lenard (Germany), Professor Exner (Austria), Professor Oëtvös (Hungary), Professor Castillo (Spain), Professor Barus (United States), Professor Langevin (France), Professor Rutherford (Great Britain), Professor Blaserna (Italy), Professor Birkeland (Norway), Professor Lorentz (Holland), Professor Ferreira da Silva (Portugal), Professor Hurmuzescu (Roumania), Professor Lebedew (Russia), Professor Arrhenius (Sweden), and Professor Guye (Switzerland). Anyone wishing to become a member of the Congress should communicate his intention directly to the general secretary, Dr. J. Daniel, 1 Rue de la Prévôte, Brussels.

London Railways to Replace a Four-Year-Old Turbine Equipment.

The London Underground Railways, which were electrified in 1905, have decided to replace their present double-flow impulse and reaction turbines by Parsons turbines. By this change it is expected to reduce the fuel cost by $150,000 a year. The new turbines will use about 13.4 pounds of steam per kilowatt-hour of current produced, as against about 20.0 pounds required by the old machines.

There has been some talk of a possible further change, in the course of the next few years, to gas engines and producer plants, as some experts consider these would effect a still further economy in coal consumption. In fact, one writer in a recent London trade paper predicts that this may happen even before the new turbines shall have fulfilled their allowance for depreciation.

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TELEGRAPHY—TELEPHONY, and WIRELESS.

Automanual Telephone Exchange at Ashtabula Harbor, Ohio.

In Ashtabula Harbor, Ohio, there has recently been installed the first commercial telephone-exchange equipment of the Clement automanual type. The Ashtabula Harbor board has now been in operation six months, under conditions as severe as any to be met in telephone practice. Daily tests have been made and careful records kept, and based upon these it has been shown that all previous estimates have not only been confirmed but exceeded in the showing actually made.

The city of Ashtabula has a population of about 20,000, and is divided into the main town, situated about four miles from the lake, and the Harbor, situated at the mouth of the Ashtabula River on the lake. The local population of the Harbor is only 5,000, but conditions there are peculiar, partly due to the fact that it is a very busy port; indeed, it is said to be the largest ore port in the world. It goes without saying that it has extensive railroad terminals, which handle practically all the ore for the Pittsburg district.

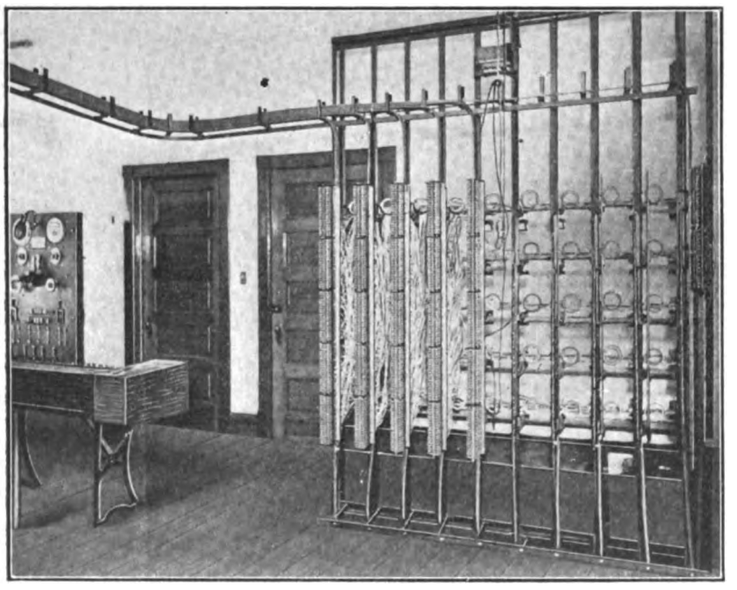
Prior to the present installation, telephone service has been given by two manual switchboards, that at the main exchange in the town being of the common-battery multiple type, with 1,200 lines installed, and that at the Harbor a magneto transfer board with approximately 350 lines. The two boards were connected by open wire leads, there being ten trunks each way. These were destroyed in the sleetstorm of March, 1909, and were replaced just prior to the present installation by aerial cable.

The service at the Harbor required seven operators for a night and day shift, while the main exchange employed thirty to accomplish the same service. The number of subscribers served at the Harbor exchange prior to the cut over to automanual service was 424, and the number at the main exchange was 1,916.

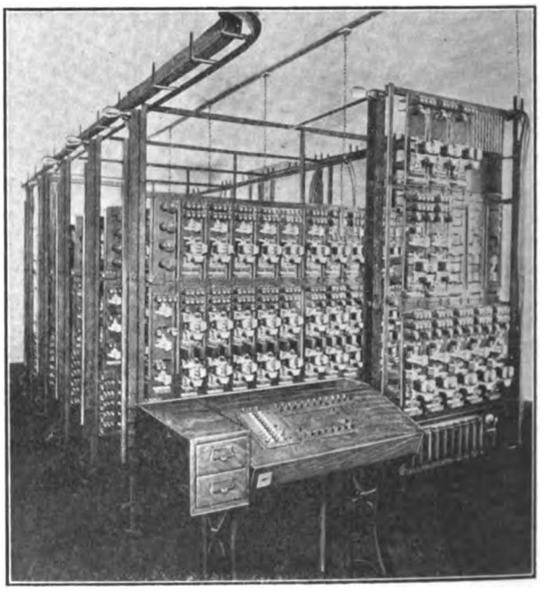
It was considered that the conditions thus stated were quite favorable for a thorough demonstration of the possibilities of the automanual equipment, and the builders of the original boards contracted to re-equip both the main and Harbor exchanges, with the idea of starting first at the Harbor with local operators, and after that exchange was successfully working, equipping the main exchange so as to centralize all the operators therein, leaving the Harbor practically an automatic branch. By following this plan, additional economies will be effected, in that the day load at the Harbor will only call for one additional operator at the main exchange, and the night load will be handled by a single operator at main. A brief statement of the general scheme will make this clear.

The fundamental idea underlying the automanual system is that of providing skilled and efficient service, and the carrying out of this idea results in the practical elimination of all cords, plugs, ringing and listening keys, line lamps, answering and multiple jacks, together with their complicated attendant wiring; the retention at the subscriber's station of the simplest present known form of equipment, namely, a standard common-battery telephone; the elimination of "B" operators entirely; the simplification of the "A" operator's duties to a point whereby efficiency of operation is vastly increased and the service correspondingly improved.

Apart from the means by which the operators are used to the greatest advan-



Power Board and Terminal Rack.



Wire Chief's Desk and Automanual Switches.

AUTOMANUAL TELEPHONE EXCHANGE AT ASHTABULA HARBOR, OHIO.

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tage, a striking economy is rendered possible by the employment of mechanical switching means, in that an exchange system can be subdivided practically without limit into centers and subcenters, served by distributed automatic equipments working on the principle of branch exchanges, all controlled from one main operating point or clearing house. The extent of saving thus effected may be realized when it is recalled that over ninety per cent of the cable and wire plant in local-exchange territory is idle all of the time; and by complete subdivision this percentage can be reduced to twenty-five per cent, or even less, according to traffic conditions in the territory. In other words, instead of having a single large multiple board serving a large number of lines divided arbitrarily among fixed positions, groups of short lines are carried from the subscribers' stations to local automatic centers, interconnected by talking trunks only sufficient in number to take care of the maximum load between these centers, all of these branch automatic equipments being controlled by a single centralized group of operators among whom the total load on all the centers can be uniformly distributed at all times, so that fluctuations in any one center or group of subscribers are distributed, and only the total load need be provided for at any given time. All the operators work at maximum efficiency all of the time, while the cable and wire plant is theoretically at almost one hundred per cent efficiency during the busy hour, as against ten or fifteen per cent in the manual systems.

At the Ashtabula Harbor exchange are installed five units of one hundred lines each, each line adapted for either single or party-line service, thus insuring both flexibility and load capacity without the loss of any group or groups of numbers.

Each unit is complete in itself, requiring the use of no outside apparatus for the completion of a call, having the line and cut-off relays mounted upon angle plates at the bottom, with the necessary trunk switches and relays above. These units are assembled, wired and tested out in the factory, and the only installation required upon the ground is the connecting of the line and trunk cables, together with the battery-supply and ringing-current wires.

The operator's equipment is extremely simple and somewhat resembles the ordinary school desk. Two positions are provided, and each position is equipped with three sets of numbered keys, almost identical in appearance and method of manipulation with those of the ordinary adding machine.

Each set of keys has its own lamp signals, a listening button and a starting button. Each complete key set consists of three vertical rows of numbered buttons, and an additional row of four buttons for selective ringing. Connected to those key sets is a power-driven impulse sending machine, from which groups of impulses are taken corresponding to the numbers of the keys depressed. From each key set an operator's trunk is taken to what is called a secondary selector switch, through which it may be connected to a primary collector trunk and calling line.

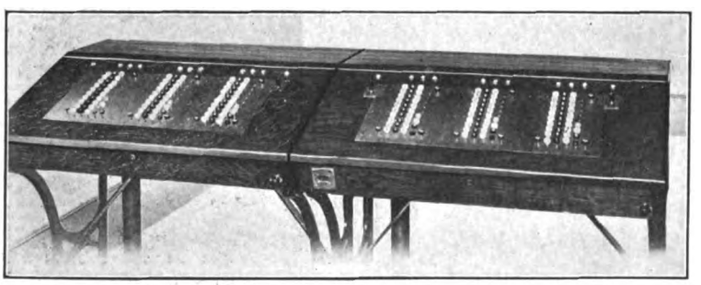
The subscriber's metallic line circuits come in to the exchange building, and after passing through the usual main frame terminals and protectors, are ended upon the usual line and cut-off relays, and the local trunks or link circuits between the primary selector and first selector switches are provided with condensers, and sleeve and tip relays on the main battery, so that the circuit conditions are identical with those in standard common-battery manual boards.

The operation of this equipment is as follows: When a subscriber calls by taking down his receiver, his line relay pulls up and causes a primary selector switch to connect his line with an idle trunk or link circuit, at the same time starting up a secondary selector switch, which immediately connects the primary trunk and the calling line to an operator's idle key set. The key-set lamp then lights, thus indicating the call, the operator comes in on her listening key as usual, gets the number, and depresses the corresponding buttons, thereby determining the number of impulses to be sent to the selector and connector switches to make the desired connection. The operator then repeats this number to the calling subscriber and presses the starting button. The sending machine transmits the predetermined impulses to the switches, which then select, test, and ring the wanted line automatically. As soon as this line is selected, however, the secondary selector or operator's switch is automatically released and restored to normal position, ready for another call.

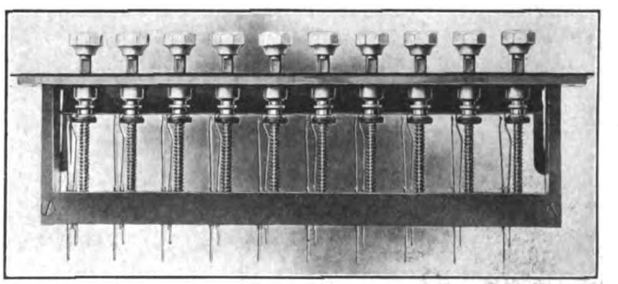
The subscribers have entire control of their own connection, being in this respect situated precisely as in a full automatic exchange, and it will be observed that they are secure from interruption, because it is impossible for any of the operators to cut in or secure access to a line or trunk after a connection is established. To clear-out or make a re-call the subscribers simply hang up their receivers, when switches are automatically restored.

The location of the operating room adjacent to the switches is a matter of choice and not of necessity, because the only wires having direct access to the operators' keys are their own secondary trunk wires which can be made of any length desired. Thus it is possible to carry these trunks from a common point to more than one switching center, so that the operators can be centralized.

Since the operators' trunks are only in use for each call, during the brief time necessary to answer and send the impulses required to make connection, they are at maximum efficiency all the time, and the number required is relatively very small, figuring in large exchanges at less than one per cent. Subscribers' connecting trunks do not necessarily pass to the operating center, but directly between the various switching centers, and are laid out solely with an eye to traffic requirements



FRONT VIEW OF TWO-OPERATORS' POSITION BOARD.



STRIP OF KEYS FROM OPERATOR'S KEYBOARD.

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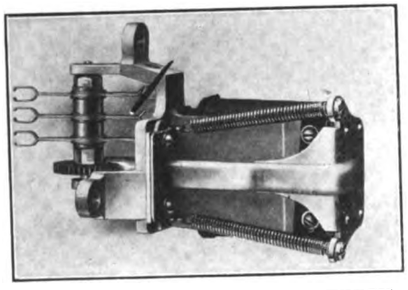
between the centers and the groups of subscribers which they serve. Should the operators, for convenience, be located at a switching center, then their secondary trunks would be distributed along with the main connecting trunks, and may be in the same cable. As they constitute in effect automatic order wires, they can be handled in the ordinary way as stated.

From the foregoing it is clear that when the main exchange in the town of Ashtabula is fully equipped, the present operators' positions at the Harbor can be put out of commission, all calls from the Harbor subscribers going to the operators at the main exchange through their secondary trunks or order wires, and the selective impulses coming back to the Harbor switches by the same route. In any branch as important as this, however, it would be unwise to dispense entirely with local operating means, hence this will probably be kept at the Harbor indefinitely for use in case of emergency, such as would arise, for example, through accident to the trunk cable, or a fire in the main exchange.

There are no rural lines terminating at the Harbor, and no toll lines, as all



AUTOMANUAL DISTRIBUTING SWITCH.

service of this character is handled from the main exchange. When the cut-over is made at the main exchange, the rural lines will be handled in the same manner as local lines, with the added feature of furnishing ten-party selective service through the use of five frequencies, and ringing to ground through condensers on both sides of the line. Toll business will be handled as at present through a local toll board.

The power plant consists of a duplicate set of storage batteries of 120 ampere-hours capacity each, and each set consists of twenty cells, thus the system is a forty-volt system. A direct-current charging set and power switchboard completes this outfit.

Ringing is accomplished through the medium of a duplicate set of synchro-harmonic converters supplying current at the frequencies of thirty, forty-two, fifty-four and sixty-six cycles, and four-party selective service is furnished.

Aside from the standard equipment incident to all common-battery installations, such as power plant, protecting and ringing devices, there are but five different pieces of apparatus required to complete this automanual installation. These are: The impulse or sending machine, the operator's keys, the automanual relay, the 100-point two-motion switch, the twenty-point, one-motion switch.

An examination of the sending machine reveals a simple but well made device consisting of a drum upon which are placed cams arranged to furnish impulses from one to ten in accordance with the keys depressed by the operator. It is driven by a small motor direct from the storage batteries. This sending machine is common to the entire system and performs for the system the same functions that in a full automatic installation are performed by the dial or sending device, located at each subscriber's telephone. Its use means the elimination of the dial investment and its attendant maintenance cost. No sending machines are required at branch exchanges, but only at the point where operators are located.

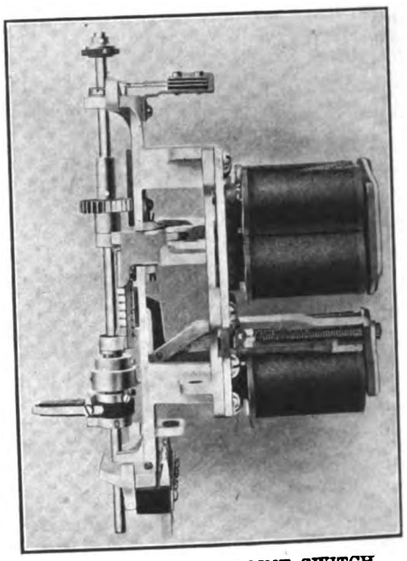
The racks are of open steel construction and each rack carries the line and cut-off relays, together with the necessary trunking apparatus for 100 lines. What may at first appear as unnecessary complication in this, upon analysis resolves itself only to such necessary duplication of but three pieces of apparatus as the number of lines served require. These three pieces of apparatus consist of a 100-point two-motion switch, a twenty-point one-motion switch, and a relay.

The relay consists of a core upon which the wire is wound, a frame, an armature and a spring block which serves the double purpose of carrying the contact springs and retaining the armature in place, at the same time allowing freedom of movement. The armature extension which causes the movement of the springs is in the same direction as the springs themselves, thus permitting the spring movement to be accomplished with but a very little over one one-hundredth of an inch air gap. This construction results in an exceptionally powerful and sensitive relay.

In the 100-point switch the same principles regarding air gaps have been applied that were used in designing the relay. The three switch movements, rotary, vertical, and release, are identical in construction, and interchangeable. The armatures are mounted upon hardened knife-edge bearings extending across the entire length of the armature and held in place by spiral return springs, which then perform a double duty. All adjustments are effected by means of steel blades recessed into the die-molded frames at an angle of fifteen degrees from the opening through the blade, which limits the motion sought to be controlled. This method of adjustment is positive and cannot be shaken loose in service, hence a switch once adjusted is adjusted for all time. The bank contacts are placed vertically to prevent dust accumulation, and thus the rotary motion precedes the vertical.

The one-motion twenty-point switch is very similar in construction to the 100-point switch.

All circuits are balanced, and contain no greater number of talking contacts than



AUTOMANUAL 100-POINT SWITCH.

a standard common-battery cord circuit. There is not a relay in the system having more than one winding or more than one armature, nor a set of spring contacts in which it is necessary to establish one contact before breaking another. Controlling impulses are not required to pass over the varying length of subscribers' lines, but are local to the exchange itself, hence all switch adjustments are alike and all switches once adjusted remain adjusted, as the conditions under which they are called upon to operate are constant and not fluctuating.

Variations in battery voltage have absolutely no effect upon the system, as the apparatus will work with equal facility whether taking current from cells freshly charged or exhausted to as low a point as storage batteries can be carried without injury to themselves. No grounds are used except upon rural lines of more than

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five parties. The action of each piece of mechanism is positive and its function direct.

The operator of the Clement automanual system is not hampered with a multiplicity of interlacing cords and plugs when a load comes on; for it is not necessary to watch for the lamp of a calling subscriber among a distributed group, neither is it necessary to give attention to the waiting call first to secure an idle cord and insert its plug into the answering jack, at the same time throwing into and holding in position the listening key, all of which the manual operator must do before the wants of the subscriber can be ascertained. Many other details must be attended to with manual systems.

On the other hand there is nothing in front of the automanual operator but three simple sets of keys, placed at a convenient angle upon the top of the desk. No reaching in any direction more than ten inches is necessary, and only three sets of lamps must be watched, and these lamps cannot flash.

A call comes in, lighting the lamp upon one key set. The listening key must be pressed, but not held, for the first touch has brought up a relay which locks the operator's head set upon the calling line. On ascertaining the number wanted, the operator sets it up on the keys and touches the starting key, which releases the relay which was brought up by the operation of touching the listening key, thus starting the call through the automatic switches, where it is completed. No matter where the call comes from or where it is going to, the procedure is the same.

There is no possible way for an automanual operator to get in on a call when once the starting key has been pressed, and it is utterly impossible for two sets of subscribers to land upon the same trunk or talking circuit, hence all conversations between subscribers are absolutely private. Where the load requires a number of operators the result is the same, for the incoming call will take the first idle key set in the entire group of operators.

An automatic register, consisting of a Veeder counter operated by a relay, is permanently connected to each key set, hence the management has knowledge of the exact number of calls handled by each operator at all times. The mechanism is impartial and gives every operator exactly the same opportunity. The registers accurately disclose the comparative efficiency of each operator.

Any girl of average intelligence can be converted into an operator in an hour's time, and a few days' practice will bring her efficiency up to the standard. Interesting and successful experiments have been made with blind operators, the only change necessary being to give them an audible signal instead of a lamp.

Each unit frame carrying the automanual apparatus for 100 lines is entirely self-contained and its dimensions are as follows: Six feet three inches long; seven feet four inches high, and eight-and-one-half inches in thickness; weight, 600 pounds, or six pounds per line. The units are placed upon three-feet centers. In cases of limited floor space this could with safety be slightly reduced, and in no event would there ever be any occasion for increasing it.

A vertically mounted terminal rack is carried upon each end of the frame, one for the purpose of connecting the cable to the main distributing board, and the other to unite the interconnecting trunks between units. These units are wired up complete, switches and relays mounted thereon and tested out before shipment from the factory. When packed for shipment each frame, together with its enclosing case, will pass through any standard door and can be placed in permanent position before removing the case, which eliminates any chance for injury in either shipping and handling.

The only work of installation remaining is to solder in the cables above referred to, and the unit or units are ready for operation, provided, of course, that power plant and main distributing board, ringing device, etc., are in place. The equipment for the operating room is so simple and the connecting wires so few that the operator's equipment for a 5,000-line installation can easily be installed in one day by two men.

The Clement automanual telephone exchange at Ashtabula Harbor was made and installed by the North Electric Company, of Cleveland, Ohio.

Neon and Electric Waves.

In a recent letter to the editor of *Science,* W. L. Dudley, of the Vanderbilt University, writes as follows:

"Prof. J. Norman Collie, F. R. S., recently discovered that when perfectly pure neon is enclosed in a glass tube with a globule of mercury and shaken, it glows with a bright orange-red color, and when the globule rolls it appears to be followed by a flame. This phenomenon takes place at ordinary pressure.

"Sir William Ramsay has found that neon is the best conducting of the gases and that it readily becomes luminous under the influence of electric waves. Professor J. A. Fleming, F. R. S., uses a neon tube as a detector for the wavelength of Hertzian waves in his apparatus for measuring them.

"During a recent visit to Sir William Ramsay I had the pleasure of seeing the astonishing quantity of over 500 cubic centimetres of pure neon which he had obtained from about 120 tons of air. While there, Professor Collie very kindly presented to me a tube of neon, under about one-half an atmosphere pressure, containing a globule of mercury which showed the 'Collie effect' very strikingly.

"Returning from Liverpool, July 2, on the steamer *Baltic,* I was given opportunity during the voyage, by Mr. Bates, chief operator of the wireless, to try the neon tube as an instrument for the visual reading of the wireless message. We experimented with it during two nights and found that the neon glowed beautifully in response to the waves sent out, but the waves as received were too weak to visibly affect the neon, although we tried every arrangement of the limited apparatus at our command. The electric wave sent out by the Baltic's apparatus was, according to Mr. Bates, about 800 feet long."

New Ruling on Telephone Installation.

The Nebraska State Railway Commission, in a recent ruling, held that although one of two telephones might give adequate service, in the office of an express company, it could be compelled to install the other.

Chairman Clark stated that, while under the common law, one telephone might be sufficient in the case of the Norfolk Express Company, the ruling must be made, under the Bartos act, which authorizes the railway commission to require the installation of telephones in express and railway offices.

An agreement has been reached between the Panama Government and the United Fruit Company, whereby the latter will establish wireless stations at Colon and Bocas del Toro similar to the one the company maintains at Limon, Costa Rica. Through its new land telegraph facilities, and the proposed wireless system, the Panama Government will be able eventually to route messages from Panama to Bocas del Toro, Limon and other points. Under the agreement with the fruit company, the Panama Government is permitted to fix its own rates for messages.

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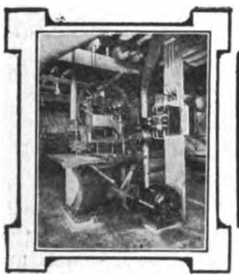
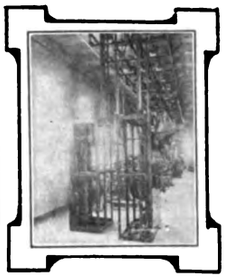


Industrial Power



Speed Control of Electric Motors.

Many people, says Michael Longridge, in his annual report to the British Engine, Boiler and Electrical Insurance Company, seem to think that if a controller containing resistances in series with the armature of a motor will give certain variations of speed at full load, the same controller will give the same variations at light load. A few words on the subject of speed control may be serviceable.

In 1908 the company was asked to inspect some electrical plant for a colliery proprietor, and, among other things, an eighty-five horsepower, compound-wound motor and controller for underground haulage. The motor was to receive current at 450 volts, and was to run with the controller resistance cut out, at speeds varying from 420 revolutions per minute at full load to 450 revolutions at no load. The controller was specified to have six contact studs and resistances capable of reducing the speed from 420 to 210 revolutions per minute at full-load torque, and to carry the full-load current for fifteen minutes with the regulating switch on any contact. Both passed their tests satisfactorily at the makers' works, were certified by the company, sent to the colliery, and erected there, but no sooner was the current switched on than the owner began to complain that the controller was irregular in its action, and at light loads would hardly reduce the speed at all, even when all the resistance was in circuit. In the course of the correspondence which ensued it appeared that he wanted, and had expected to get, a controller not only fulfilling the conditions described at the beginning of this paragraph, but capable of giving any speed, between eighty revolutions per minute and full speed, at any load. The company explained that the controller specified could not possibly give the variations of speed he asked for, even if the resistance were very much increased, and the following table was calculated and sent to him, to show what speed reductions could be made at various percentages of full load, with about eight times the resistance originally supplied. It was at the same time explained that unless a new controller having a greater number of contacts were provided it would not be possible to approach any nearer to his requirements. He eventually decided to have the resistances increased, and to be satisfied with the speed control shown by the table.

This table shows that, although the controller with the increased resistance was able to reduce the speed from 420 revolutions per minute to fifty revolutions per minute when taking the current required to give the full-load torque, it did not effect the same reductions with smaller currents.

For instance, at fifty-eight per cent of the full-load torque, the lowest speed was 210 revolutions per minute. If the switch were moved on to the second contact to reduce the speed still further, the motor would stop altogether, unless at the same time the torque were reduced to 51.6 per cent of the full-load torque, when a speed of ten revolutions would be obtainable. Similarly it shows that with a current of forty amperes, sufficient to give 25.8 per cent of the full-load torque, the lowest possible speed was 230 revolutions per minute, but on reducing the current to thirty amperes the eighty revolutions asked for would be possible.

The effect of the load upon the speeds obtainable with given resistances is explained by Ohm's law. The speed of a shunt-wound motor, except for the effect of armature reaction, which may be neglected, depends exclusively upon the volts across the armature, while the current is determined solely by the torque required to overcome the drag of the load. Thus, so long as the torque remains constant, the volts across the armature, and consequently the speed, vary only with the resistance in the circuit, and therefore can be regulated at will by putting suitable resistances into the circuit. But as soon as the torque, and consequently the current passing, changes, Ohm's law shows that the voltage with any given resistance changes also, and that the series of speeds which were obtained by the series of resistances determined for a certain torque and current will no longer be obtained if the torque and current vary, but will be higher or lower than the required speeds as the torque is greater or less than the torque for which the resistances were calculated. Ohm's law also explains why the effect of moving the controller arm back one contact in certain cases shown by the table is to stop the motor instead of reducing its speed, for in such cases the supply voltage divided by the increased resistance is equal to a current which is less than that which will give the torque required to turn the load.

TABLE.

Per cent of full load torque	6.45	12.9	19.3	25.8	32.3	38.7	45.2	51.6	58	64.5	71	77.4	84	90	96.7	100
Amperes...	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	155
Position of Controller. Contact.	Revolutions per Minute															
1st	333	208	80	0	..	..	..	..	..	..	..	..	..	..	..	..
2d	403	346	290	230	175	115	60	10	0	..	..	..	..	..	..	..
3d	433	407	380	354	328	300	270	240	210	190	170	142	116	90	60	50
4th	443	427	410	454	377	360	345	328	312	295	280	262	245	230	215	205
5th	450	444	435	428	420	412	404	396	388	380	372	364	356	350	340	335
6th	450	448	446	444	442	440	438	436	434	432	430	428	426	424	422	420

The speed of a compound-wound motor is further modified by the effect of the series windings. This effect in the case here referred to is shown by the figures in the last line of the table, which gives the speed with the controller switch on the sixth contact and all the resistance cut out.

Of course, the difficulty of speed regulation by resistance in series with the armature could be overcome by increasing the number of contacts, but this would mean a considerable increase in cost of the controller. The ideal controller from this point of view is no doubt one with a liquid resistance, for it will give an even graduation of speed, but the prac-

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tical difficulties as regards dimensions, generation of gas, etc., in many cases counterbalance its advantages.

It may also be mentioned that all forms of speed control by resistance in series with the armature are wasteful. If the speed of a motor be reduced to half its full speed in this way, the power absorbed is the same as if it were running at full speed, but the power given out is only one-half; the other half is wasted in heating the resistance coils. Control by resistance in the shunt circuit has, on the other hand, a high efficiency, and can be used with modern motors with interpoles for a speed variation of one to six. But this efficiency is only obtainable at a high first cost. For as the effect of putting resistance in series with the shunt is to increase the speed by weakening the field, the motor must be large enough to give the torque required to overcome the resistance of the full load with the weakest field. Thus, a motor with speed control by resistance in series with the shunt, capable of giving eighty-five horsepower at 420 revolutions per minute with all the controlling resistance in, and the same torque at eighty revolutions per minute with all the resistance out, would have to be large enough to give 450 horsepower at 420 revolutions per minute with no resistance in series with the shunt. In other words, to get the efficiency due to shunt-sped control a 450-horsepower motor must be put down instead of an eighty-five-horsepower motor.

There are, of course, other combinations by which wide variations of speed can be obtained, combinations of series and shunt resistances in conjunction with a single armature or with two armatures workable in series or in parallel, but none of these is of universal application. Each case must be considered on its merits, having regard to first cost, working cost, and graduation of speeds required.—*From the Mechanical Engineer (Manchester, England), September 10.*

Cincinnati Proposes to Build Municipal Subway.

Plans for the construction of a subway to connect the business part with the outlying districts of Cincinnati are now before the City Council. The plans are said to have the indorsement of the city administration. The expenditure of from $10,000,000 to $15,000,000 would be involved in the project, which contemplates municipal ownership of the subway, city and interurban terminals.

Electric Development in Birmingham, England.

Consul Albert Halstead reports as follows concerning the increased use of electrical motive power in Birmingham since that English municipality bought out the Birmingham Electrical Supply Company in 1901:

In the year ended March 31, 1901, the total units sold for lighting and power purposes amounted to 3,040,822, while for the year ended March 31, 1909, the units aggregated 12,623,818. This does not include 11,782,409 units sold to the city tramways for traction purposes. Including these, the total for the year ended March 31, 1909, was 24,406,227 units, or eight times the amount supplied when the city undertook control. A particular point has been made of pushing the sale of electricity for motive purposes, with good results. In 1901, 750 horsepower of electric motors were connected with the city supply, and in 1909 this had grown to 14,365 horsepower.

In the year 1907 the management of the city electrical department concluded to institute a plan of renting out electric motors for motive purposes. In that year motors aggregating 992 horsepower were rented out, while in 1909 the total horsepower rented had increased to 2,549. Special attention had been paid to supplying power to large manufacturing works. A three-phase, high-tension, alternating current, at a pressure of 5,000 volts, is distributed for this purpose. Quite recently Birmingham firms engaged in the rolling-mill industry, of which there are many, chiefly engaged in rolling brass and copper or drawing brass and copper tubes, or drawing copper and silver wire, have been encouraged to rent motors and substitute electrical for steam power.

The rolling mills that have substituted electrical for steam power are reported to have found the results most satisfactory. Among the advantages obtained has been a great saving of space, that which hitherto was required for engines and boilers being now utilized for factory purposes, while in one case a pit has been built in which the motor is placed, so that the whole building can be used for manufacturing. In two instances, with an electrical motor of the same horsepower as the previous steam engine, an increased output has followed, aggregating in one case twenty per cent and in another fifteen per cent. This increased output is due to greater economy in the use of power from the non-stalling of the machinery. The cost of power has also been found, in many cases, to be cheaper than steam. In one case a firm has found that the saving it has made by the new arrangement will enable it to pay off in five years the capital expenditure necessary to install the new motor. The steady drive and economy have also tended to prove electric power to be more suitable than steam engines.

For current the prices now in force are as follows:

For lighting, maximum charge four pence (eight cents) per unit, with a sliding scale down to two pence (four cents) per unit, five per cent discount being allowed for prompt payment.

For low-tension power and heating supply, maximum charge 1.35 pence (2.7 cents) per unit, with a sliding scale down to 1.1 pence (2.2 cents) per unit, subject to five per cent discount for prompt payment.

High-tension power supply, maximum charge one penny (two cents) per unit, with a sliding scale down to 0.7 of a penny (1.4 cents) per unit, subject to five per cent discount for prompt payment, and to a minimum guarantee of $1,217 per annum. In some cases where the cost of the supply mains is heavy an increased guaranteed sum per annum is required.

The city charges for service lines laid through private property, quotations being made before the contract is signed, and for conveying and installing motors are not high. The rental charges for the different sizes of motors run from $12 per annum for a one-half horsepower to $127 for a fifty-horsepower motor. These terms are attractive to the small power user, because an efficient and reliable motor can be obtained at a reasonable rental, which includes fair wear and tear and periodical inspection. The consumers can obtain hire-purchase terms, by which the motors become their private property at the end of three years.

The advantages of taking a motor on hire, as given by the city electrical department, are: Manufacturers can deal with a sudden increase of the volume of business without going to heavy expense in installing additional power; the existing motor may be changed for one of a larger or smaller size at any time, to meet the requirements of business; experiments can be made in the extension of a manufacturer's business without involving heavy initial expenditure, and if the venture is found to be unsatisfactory another method may be substituted without serious financial loss.

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BOOK REVIEWS.

"Webster's New International Dictionary." Editor-in-chief, Dr. W. T. Harris. General editor, F. Sturges Allen. G. & C. Merriam Company, Springfield, Mass. In various bindings, 2,700 pages (8¾ by 12 inches); 6,000 illustrations. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $12 (sheep, marble edge, indexed) or more, according to style of binding.

This latest, biggest and best of the Webster series of dictionaries, is not a rehashed edition of the well-known "International," but an entirely new work, built on the skeleton outlines and well-proved traditions of its predecessors. The New International includes over 400,000 entries, more than double the number in the International, besides the separate geographical and biographical lists, which are inserted as appendices. A first glance reveals some novel features, chief of which are the systematic definitions and the arrangement of the type. The systematic definitions may be best described and exemplified by a particular case. For instance, the mechanical definition of the word *file,* on page 814, gives first the general meaning of term, this being followed by a differentiation from the similar term *rasp.* The different "cuts" of file are then explained, after which is the grading of files according to fineness. Classification according to cross-section follows, including terse and accurate definitions of such terms as *flat, round, square, triangular, three-square, half-round, cant, canted (five-canted, six-canted, etc.), lightning, knife, cross, crossing, double half-round, great American, pippin, auriform, lozenge, onglette, oval,* etc. The next division is into general classes, the nomenclature being given in this as in all the other divisions, and finally a list of variously named files is appended in alphabetical order, designated according to peculiarities of shape, methods of manufacture, purposes for which used, etc. The definition of file is typical of many hundreds of definitions which lend themselves to systematic treatment. The advantage of this is obvious. A person looking up a definition of *tumbler file,* for example, in its vocabularly place in the book is referred directly to the main definition of *file.* Here a *tumbler file* is defined as "a thick, taper, double-cut, oval file, for shaping gunlock tumblers." This may not seem very informing, as the terms *taper, double-cut* and *oval* are all technical as applied to files, but the definitions of all these terms are to be found under the main entry *file,* so that no further turning over of the pages of the book is necessary. The type arrangement has been carefully thought out and designed so as to economize space to the utmost while allowing readiness and convenience for reference. Three principal sizes of type are used, the largest for the main entries, the intermediate size for such matter as is arranged under these entries, or for two or more word phrases, and the smallest for cross-references and terms of minor importance which are put at the bottom of the page separate from the main vocabulary. Space saving, to accommodate the enormous number of new words which have been added to the language in the last decade or so, as well as a large number of old terms not previously recorded, has been reduced to a fine art in the compilation of the New International, in order to keep it within the confines of a single volume. The book is the result of many years' work of a large staff of experts under the general supervision of the late Dr. W. T. Harris, a scholar and metaphysician of the first rank, and who was for many years United States Commissioner of Education. The office force was under the direct control of F. Sturges Allen, who combines with his lexicographical knowledge a large executive ability. The effect of Mr. Allen's highly analytical and constructive mind is plainly discernible by the splendid coordination of the various departments. The stamp of his legal training is directly noticeable in such definitions as *motor cycle, motor car, tool,* etc., and less directly, but none the less certainly, in the principal mechanical definition of *machine* (def. 5, p. 1291) and other terms. These definitions, of course, were handled in their proper department, but Mr. Allen's criticisms and suggestions were responsible, as in many similar cases, for their correct legal aspect. Such supervision gives the International a unique legal value. No less attention has been paid to the scholarliness of the work, want of space alone preventing a review of this feature. The department of electricity was handled by Dr. Frederick Bedell, professor of applied electricity in Cornell University, and the allied department of physics by Dr. Edward L. Nichols, formerly professor of physics at Cornell and now principal of Dartmouth University. These names are a sure indication of the value of the electrical definitions. In this department many hundreds of new terms have been included, and many of the older terms have for the first time been given a correct and sufficient treatment. The definitions of *induction* and *phase,* picked at random in the book, are veritable little treatises, these terms having been handled systematically, as explained at length above. In fact, it may be said that the New International, taken as a whole, is the newest, most complete and scholarly, in fine, the largest and best, of modern English dictionaries (excluding the mammoth New Oxford Dictionary, which is still in course of publication). Engineers will want it for its mechanical and electrical definitions. A word of praise is due to the many excellent illustrations, while the printing and binding are indeed worthy of the contents and a credit to the Riverside Press, of Cambridge, Mass., which was responsible for these features.

"Natural Sources of Power." By Robert S. Ball. D. Van Nostrand Company, New York, N. Y. Cloth, 348 pages (5¾x8 inches), illustrated. Supplied by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for $2.

This book covers two departments of engineering and their applications to industry. While the subject of waterpower would be conceded to be more important than that of windpower, the latter has a wider application at the present time than is popularly assigned to it, for the advancement for windmills was never so great as it is today, nor the trade of the manufacturer of such motors never so brisk, but there are unmistakable signs of abnormal expansion in the direction of their useful application in the great agricultural countries of the world. No attempt is made to appraise the relative value and the industrial worth of two natural sources of power so widely different in distribution and reliability; moreover, in a given place the choice rarely lies between the two, as local conditions determine the preference should an alternative, perchance, exist. It may, however, be said that the use of power of either kind in small installations renders such comparisons more likely to be effective, for, at present large windmill installations do not exist, with which waterpower plants of great power might be compared. The various chapters cover in detail the applications of both water and wind, various industries, together with the types of machines and appliances best fitted for the particular service. The text is exemplified throughout with diagrams and illustrations, making the book one which should be of great benefit to students in this branch of engineering. The book is made available to a larger number of readers than would be otherwise, by the fact that the author has made use of only the simpler mathematics.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

NORTH SHORE ELECTRIC COMPANY.

The North Shore Electric Company, of Chicago, Ill., has issued a financial report for the fiscal year ending September 30, 1909, from which the following data are taken:

To provide funds for the acquisition of additional electric light and power properties for the construction of substations and for the enlargement of the distributing system, the capital stock was increased $220,000 and the outstanding mortgage bonds $285,000.

The earnings and expenses were as follows:

Gross earnings	$1,005,432.49
Expenses (including taxes and rentals)	600,994.56
Earnings for the year	$ 404,437.93
Charges against earnings:	
Interest on bonds	$ 190,354.88
Balance	$ 214,083.05

From this balance must be deducted a special depreciation reserve of $75,600 and dividends of $103,552.69, leaving a surplus of $34,930.36, which, added to the $119,969.99 surplus of 1908, makes a present surplus of $154,900.35. The balance sheet of the company is given below:

ASSETS.

Plant, real estate, franchises and construction		$7,864,232.81
Open accounts		19,385.11
CURRENT ASSETS.		
Inventory of material	$104,884.35	
Bills receivable	153,855.85	
Accounts receivable	218,152.43	
Cash	249,196.86	
Capital stock subscriptions (Not yet due.)	25,637.50	
		751,726.99
		$8,635,344.91

LIABILITIES.

Capital stock outstanding and subscribed		$4,000,000.00
Five per cent first mortgage gold bonds		4,000,000.00
Depreciation reserve (Under the terms of the company's general mortgage.)		267,640.00
CURRENT LIABILITIES.		
Accounts payable	$112,804.56	
Bond interest accrued, matured and unpaid	100,000.00	
		212,804.56
Surplus, September 30, 1909		154,900.35
		$8,635,344.91

Note.—In addition to the liabilities given above, the company has taken over certain properties which are subject to outstanding bonds and mortgage loans thereon, as follows:

Evanston Heating Company	$125,000.00
La Grange Service Company bonds	254,000.00
Real estate mortgages	4,000.00
	$383,000.00

The interest on these bonds and mortgage loans has been treated as Rental of Property and has been included in the item of Expenses.

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of October compares as follows:

	1909.	1908.
October gross	$354,007	$328,608
Expenses and taxes	178,734	168,124
October net	$175,272	$160,484
Charges	27,079	27,480
October surplus	$148,192	$133,004

TOLEDO RAILWAY AND LIGHT.

The report of the Toledo Railway and Light Company for the month of October and ten months ended October 31 compares as follows:

	1909.	1908.
October gross	$ 239,374	$ 218,074
Expenses	129,719	119,982
October net	$ 109,655	$ 98,092
Other income	245	187
Total income	$ 109,900	$ 98,279
Charges and taxes	75,615	71,953
October surplus	$ 34,285	$ 26,326
Ten months gross	2,220,810	2,082,897
Expenses	1,263,769	1,139,806
Ten months net	$ 957,041	$ 943,091
Other income	2,444	3,259
Total income	$ 959,485	$ 946,350
Charges and taxes	727,818	707,696
Ten months surplus	$ 231,667	$ 238,654

HUDSON & MANHATTAN RAILROAD COMPANY.

The New York Public Service Commission has issued a report covering operations of the Hudson & Manhattan Railroad Company for the year ended June 30, 1909, as follows:

Revenue from transportation		$709,618
Advertising and news privileges		33,945
Miscellaneous		138
Total operating revenue		$743,701
Maintenance of way and structure		100,577
Maintenance of equipment		42,669
Operation of power plant		23,486
Hired power		159,195
Operation of cars		146,028
General expenses		58,392
Total operating expenses		$530,347
Net operating revenue		213,354
Net revenue from outside operation		560,994
Total net revenue		$774,348
Taxes accrued		68,319
Operating income		$706,029
Non-operating income		18,235
Gross income		$724,264
Interest on funded debt	$632,967	
Other deductions	26,927	
		659,894
Net corporate income		$ 64,370
Deficit June 30, 1908		116,820
Deficit June 30, 1909		$ 52,450

SECOND AVENUE RAILROAD.

The New York Public Service Commission has issued a report covering the operations of the Second Avenue Railroad Company in the city of New York, receiver, for the period from November 13, 1908, to June 30, 1909, as follows:

Revenue from transportation	$491,439
Advertising privileges	14,833
Rent of track and ducts	3,232
Total operating revenue	$509,503
Maintenance of way and structure	33,918
Maintenance of equipment	131,263
Hired power	113,274
Operating of cars	185,489
General expenses	33,562
Total operating expenses	$497,506
Net operating revenue	11,997
Taxes accrued	11,283
Operating income	$ 714
Interest on bank balances	312
Sale of scrap	5,084
Total income	$ 6,111
Interest and rents	44,729
Net deficit for period	$ 38,618
Expenses prior period	671
Interest on funded debt accrued prior to receivership	34,133
Deficit June 30, 1909	$ 73,422

NEW YORK TRACTION.

The New York Public Service Commission for the First District has issued the following statistics in connection with passengers carried and revenues derived from operation in traction lines of New York during the month of August, 1909, as follows:

	Fare Passengers, Aug., 1909.	Total Rev. from St. Ry. Oper.
Interboro Rapid Transit	38,677,838	$1,995,307
B. R. T. System:		
Brooklyn Union L	13,933,266	727,145
Sea Beach	386,200	20,125
South Brooklyn	1,182,067	63,598
Total L service	15,501,553	$ 810,868
Brooklyn Heights	12,040,249	611,231
Brooklyn Q County Sub	2,151,123	111,890
Coney Island & Graves	252,495	12,883
Nassau Electric	7,569,515	389,363
Total Brooklyn Rapid Transit system	37,514,935	$1,936,287

LONDON UNDERGROUND.

The associated companies of the London Underground Electric Railways Company report for the month of October compared as follows:

	1909.	1908.
Metropolitan Street Railway:		
Gross receipts	£ 53,990	£ 52,337
Working expenses	27,444	28,691
Net receipts	£ 26,546	£ 23,646
Baker Street & Waterloo Company Railway:		
Gross receipts	£ 15,851	£ 15,511
Working expenses	7,708	7,508
Net receipts	£ 8,143	£ 7,913
Great Northern, Piccadilly & Brompton Railway:		
Gross receipts	£ 26,733	£ 24,798
Working expenses	14,200	14,752
Net receipts	£ 12,443	£ 10,046
Charing Cross, Easton & Hampstead Railway:		
Gross receipts	£ 17,640	£ 16,167
Working expenses	10,017	9,772
Net receipts	£ 7,623	£ 6,395
London United Tramways, Limited:		
Gross receipts	£ 26,151	£ 30,126
Working expenses	18,270	16,585
Net receipts	£ 7,881	£ 13,541
Total, all companies:		
Gross receipts	£140,365	£138,939
Working expenses	77,729	77,398
Net receipts	£ 62,636	£ 61,541

PHILADELPHIA COMPANY GAINS.

The gross receipts of the Philadelphia Company and affiliated corporations for October were $1,641,004, an increase of $344,574, or seventeen-and-one-half per cent over the same month last year. For seven months ended October 31, the gross was $10,365,007, an increase of $1,230,394. The surplus over charges was $1,232,693, an increase of $323,179.

ORANGE COUNTY TRACTION.

The Orange County Traction Company, of Newburgh, N. Y., reports for the quarter ended September 30, 1909, gross earnings of $67,801, against $62,155 last year; net earnings, after expenses and taxes, amounted to $26,438, against $33,480 last year, and there remained a surplus, after charges of $18,481, against $24,364 last year.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Installation of an Intercommunicating Telephone System in a Jewelry Manufacturing Plant.

The application of telephone intercommunication in a plant which has factory and offices adjoining is well illustrated in a recent installation of an intercommunicating telephone system at the plant of Charles M. Robbins & Company, wholesale jewelers, located at Attleboro, Mass. This company does a large jewelry business, including the making of fraternity badges and college emblems, as well as other articles of a more common nature. Due to the conditions under which the material must be handled at this plant, the different departments are somewhat separated and distributed over a considerable space. The telephone instruments, therefore, connected to this system are scattered throughout the factory and the various branches of the general offices, so that the whole plant is interconnected for information of any sort.

The photographs which are here shown illustrate the type of instruments which have been installed, and the general use of the different types to each of the locations.

The type of instrument used in the manager's office is a convenient hand set, which can be used at the desk where a long-distance telephone is required and where two desk sets would occupy considerable space. This set consists of a receiver and transmitter mounted together in such a way as to be operated while held in one hand. When not in use it may be suspended from a hook at any convenient place.

The organization of Charles M. Robbins & Company is such that each department is in itself a separate organization, with a manager. Each of these department managers reports to a general management, so that it is here that the advantages of intercommunication are readily seen.

The intercommunicating system installed at the above plant is so arranged that each station is interconnected with every other one. Waste of time is eliminated, and the whole organization brought together as a co-operative unit.

The operation of a system of the nature installed is one of the features which has received considerable attention by the designers and engineers of the Western Electric Company, the manufacturers, and has been made as simple as possible. Each of the types shown in the illustrations is used for the same service and is operated exactly the same. To secure telephone connection with the different stations to which these instruments are connected, it is only necessary to press the proper buttons. One button is mounted on the face of each of the key boxes, shown for each of the stations connected to the system, and a nameplate is provided with space opposite each button for designating the name or location of the station associated with the button. To make a call, therefore, all that is necessary is to press the button opposite the name of the station desired. The act of pressing the button rings and connects the party, and you talk as with the ordinary telephone instrument. The system is always available for use, since, as already seen above, no operator is required.

The illustrations show only hand and desk sets. There is, however, installed at the other stations, wherever these sets are not deemed the most convenient, a wall type of instrument. These sets are self-contained and operate similar to the desk and hand sets shown. The transmitter and key connections are mounted in the same case, so that when attached to the wall the instrument is operated from a standing position. Telephone instruments of the character shown are made of such a capacity as to accommodate either eleven, twenty-one, or thirty-one stations, and in three different styles—one for wall mounting, one for desk use similar to the long-distance set, and a special hand set, which is very convenient in many cases where room for the desk set is not available.

In connection with the wiring of the equipments of this system, the conductors both for ringing and talking extend throughout in cable, the conductors being provided with double-silk and single-cotton insulation, colored for identification. In damp interior locations, when not made fireproof by protecting conduits, the cable has a lead cover.

TELEPHONE IN STOCK ROOM.

TELEPHONE IN MANAGER'S OFFICE.

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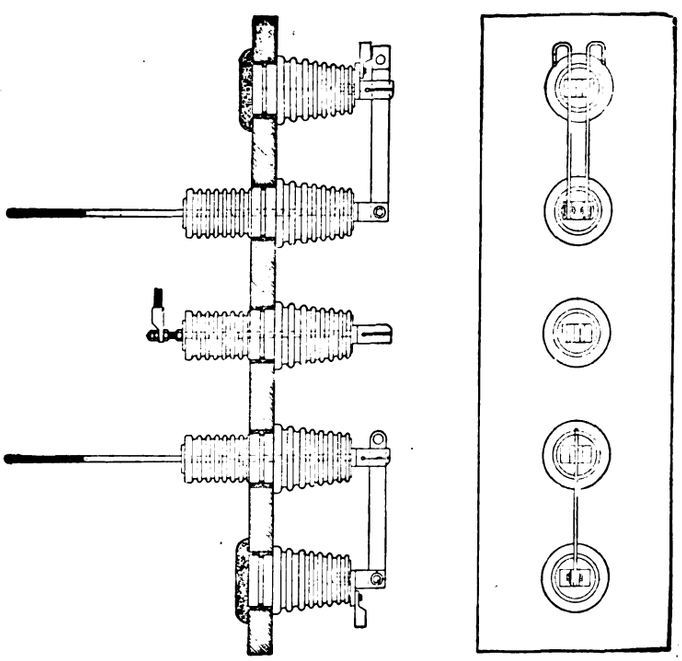
For ringing purposes, when the maximum distance between any two stations is 1,300 feet or less, the battery used is sufficient to give a potential of about seven volts with a talking battery of about four volts. With 1,600 feet as a maximum distance, a nine-volt ringing battery is used and a four-volt talking battery. It is, therefore, seen that since no operator is required, the expense connected with this system is largely maintenance, consisting of battery supply. This expense, when standard telephone batteries are used, is very low.

Combined Disconnecting and Transfer Switch.

The requirements of modern distributing systems necessitates more flexible and better selective control than is afforded by the usual system of circuit-breakers or switches; a need which has resulted in the development of many special forms of switching devices. In many cases it is important that these auxiliary devices not only possess the desired flexibility, but that they are of such dimensions that they will not interfere with existing apparatus, which might be difficult or impossible to change.



COMBINED DISCONNECTING AND TRANSFER SWITCH.

A recent requirement for combined disconnecting and transfer switches was met by the design illustrated herewith. The lower switch is of the single-pole, single-throw type, and arranged to be connected in series with the lightning arresters, thus permitting the arrester circuit to be opened for inspection and replacement of arrester units. The upper element of the device consists of a double-blade, single-pole, double-throw transfer switch, enabling connection to be made to either the upper or lower contacts, as desired.

By use of a double set of lever blades and contacts it is possible to transfer the circuit without interrupting it or subjecting the switch to destructive arcing. It will be noticed that the switch is a combined front and back-connected device and the lever blades are provided with offset extensions, thus permitting them to be operated in the usual manner by means of an insulated pole, or hook. This combined device, developed by the Central Electric Company, of Chicago, Ill., has a carrying capacity of 300 amperes at 13,200 volts.

A Fire and a Quick Installation.

Not all telephone companies can yet enjoy that sense of security that comes with the housing of their equipment in a fireproof telephone building. In spite of precautions taken, a number of exchanges are burned out every year, and there is scarcely a manager in the country who has not worried more or less over this possible interruption to his service, with its attendant loss both of revenue and prestige.

One of the difficulties looming before the average manager in connection with a possible fire is that of securing a suitable switchboard with any reasonable degree of promptness. However, the promptness with which the Kellogg Switchboard and Supply Company, of Chicago, replaced a board destroyed by fire recently would seem to indicate that the cause for worry in this respect should be lessened.

Immediately following the total destruction of its central office by fire, the Lamar & Barton County Telephone Company, of Lamar, Mo., placed an order with the Kellogg Switchboard and Supply Company for a new 300-line, two-position magneto switchboard, a main frame and No. 10 protector equipment, and a Kellogg pulsating and alternating-current, pole-changer ringing equipment. This order was received at Chicago the afternoon of Thursday, November 11. On Saturday afternoon, November 13, the entire equipment was shipped by express, forty-eight hours after receipt of the order. The express company made delivery of the equipment at Lamar, Mo., late Sunday evening. The Kellogg company was advised of the arrival of the equipment, and two of its installers, stationed at Kansas City, left for Lamar Monday morning. Before midnight of the same day the equipment had been installed ready for operation by the telephone company.

The building, shipping and installation of this equipment in three working days becomes the more interesting when it is learned that the board was not in stock, but was assembled and wired complete and built to the telephone company's specifications. The board is fitted with the Kellogg company's double supervisory non-interfering cord circuits throughout. All cord circuits are provided with two ring-off drops and two cord-circuit condensers, while ten of them contain, in addition, four-section repeating coils for the proper and efficient connection of grounded and metallic lines.

Each position of the board is provided with master keys for ringing four party selective telephones to ground. In this connection a special circuit was provided whereby this selective ringing feature does not require the grounding of the alternating current, and the latter is left free from ground for the proper ringing of metallic toll lines and "phantom circuits." Each position of the board is furthermore equipped with line and supervisory pilot lamps.

The Detroit United Railway has acceded conditionally to the city's demand for $300 per day for the use of streets upon which franchises are said to have expired. The company specifies that it waives no rights and that the city waives none as regards an ultimate readjustment.

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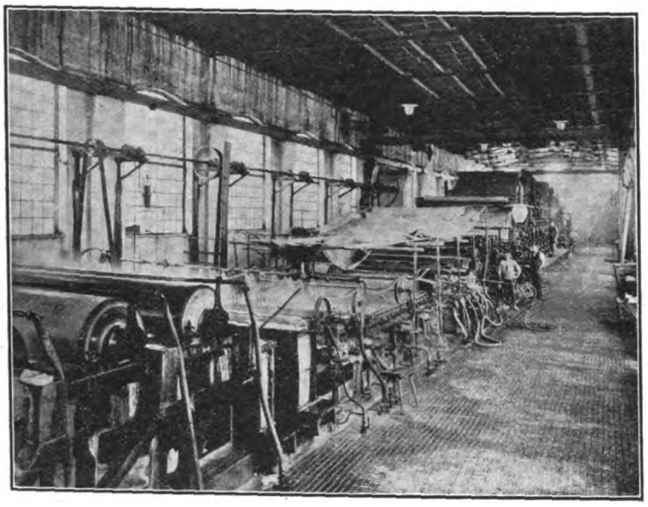
Arc Lamps for Various Phases of Illumination.

The accompanying illustrations show a number of widely varying conditions of illumination which have been successfully met by the installation of flaming arc lamps.

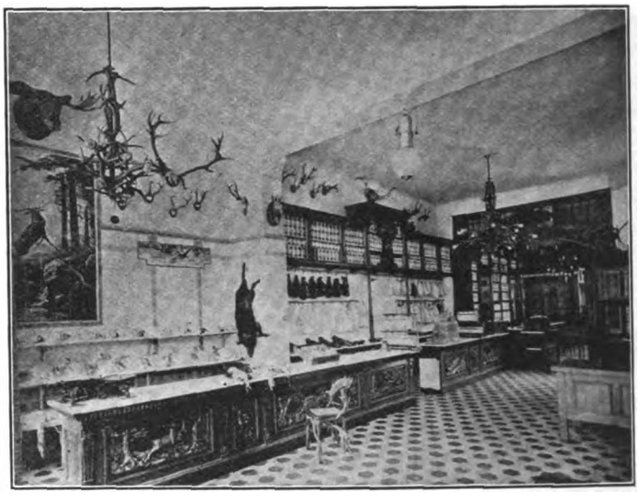
Probably the most unique of these installations are those shown in the two upper illustrations, which demonstrate, respectively, the interior illumination of a paper-making plant and a retail store for the distribution and sale of game.

In the case of the paper-making plant some of the architectural features of two prominent points in the city of Milwaukee, Wis. In the one instance the Aurola lamps are used for general illumination at a point just where Wisconsin Street crosses the bridge over the river. In the other, Aurola lamps are used for illumination in front of a popular restaurant, and in this case the cable carrying the lamp from an ornamental standard is passed over sheaves to a reel placed at a convenient height on the front of the building.

Another illustration shows a very effective installation of Alba lamps in Berlin, Germany, where the lamp is placed at a great height upon an iron standard for general park illumination.

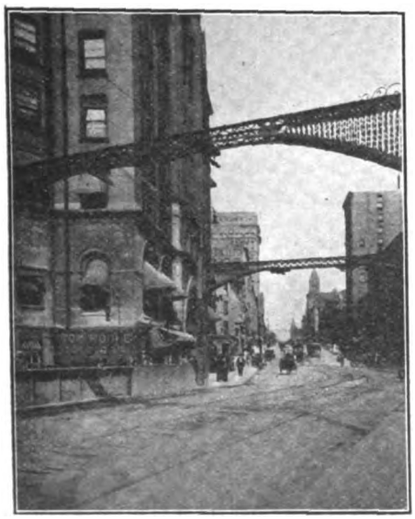


Paper-Making Plant.

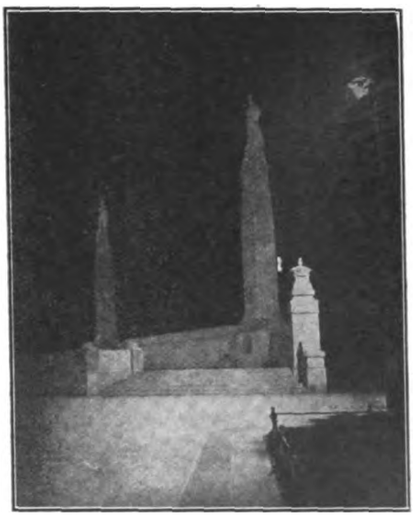


Fowl and Game Market.

INDUSTRIAL INSTALLATIONS OF ALBA FLAMING ARC LAMPS.



Wisconsin Street Bridge, Milwaukee.



Park Illumination in Berlin.

A Well-Known Milwaukee Restaurant.

TYPICAL INSTALLATIONS OF AUROLA AND ALBA FLAMING ARC LAMPS.

Alba lamps are used, and it may be pointed out that so necessary is a high degree of illumination that the powerful arc lamp is brought down very close to the work.

The lamp in the retail store is a ten-hour Alba, and in this service it is working with a high degree of satisfaction.

Two of the other illustrations show

Allis-Chalmers Sales of Pumping Machinery.

The sales of the pumping-engine department of the Allis-Chalmers Company, of Milwaukee, Wis., for the past month are interesting as an indication of the various types of pumps now going into service. Most of the smaller capacity units are of the centrifugal type, while the high-duty pumps are of the direct-connected engine type.

Among a long list of recent sales, Chicago has ordered two 25,000,000-gallon (daily) vertical expansion pumping engines for its Roseland pumping station and Wheeling (W. Va.) a 20,000,000-gallon triple-expansion pumping engine to reinforce its municipal supply.

Niagara Falls, N. Y., has ordered three 6,000,000-gallon single-stage and six 6,000,000-gallon two-stage centrifugal pumps with electrical drive, to be used in the new muncipal waterworks. The Paine Lumber Company, of Oshkosh, Wis., is getting two two-stage electrically driven centrifugal pumps for use in connection with its condensing system.

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WHAT CONSTITUTES A GOOD LUBRICANT?

BY ORRIN E. DUNLAP.

In the issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 25 there appeared a most interesting article entitled, "What Constitutes a Good Lubricant?" The headline of itself arouses great interest, because the question it asks is one which many have for years been trying to solve, each one anxious for knowledge of the best lubricant suitable for various fields. Had this question been asked sixty years ago it would have met with a different answer from that it receives today.

It is well known the past generation used animal fat for lubrication, the present generation is using petroleum oil. We are told by those who seek to conserve our natural resources that the supply of lubricating oils will barely last another fifty years. This is, indeed, a comparatively short period, and it is none too early to take into earnest consideration and proceed to adopt a lubricant which will replace all others in appreciation and service. That the lubrication of the present day, as supplied by many of the oil and grease lubricants in use, is quite imperfect, is told in the article to which reference is made, which says, "Melted grease stays in the bearings no better than oil. It leaks away and must be constantly replaced by a fresh supply." The question is asked, "Where shall we find a lubricant which both offers a low and constant coefficient of friction and does not tend to leave the bearings before it has done its work?" This question is easily answered. The solution is given in the paragraphs proceeding that from which I quote, where it is stated that graphite has a tendency to remain in the bearing while the fatty constituents melt and run away. This brings us to a realization that unctuous, pure graphite is the lubricant on which we must depend for highest efficiency and best results.

Graphite lubrication has been retarded in its popularity by the impurity always found associated in natural graphite, but the objections developed by this inferior graphite are more easily overcome than are the objections to inferior oils or greases. It is true that here in Niagara Falls man has developed a process which has given to the world a very soft, pure, unctuous graphite that has a guaranteed purity of at least ninety-nine per cent. This very high and remarkable purity is assurance to all that a practically pure graphite is available for use in the field of lubrication. Furthermore, the makers of this graphite have advanced still further in making it possible for industry to avail itself of the lubricating qualities of this graphite by combining it with a high-grade grease which acts as a carrier for the graphite and makes it possible to carry it into bearings requiring lubrication. The inventor has also discovered a process whereby this unctuous graphite is deflocculated and made to remain in suspension in oil or water, in which form it is easily fed through any of the present-day oiling devices.

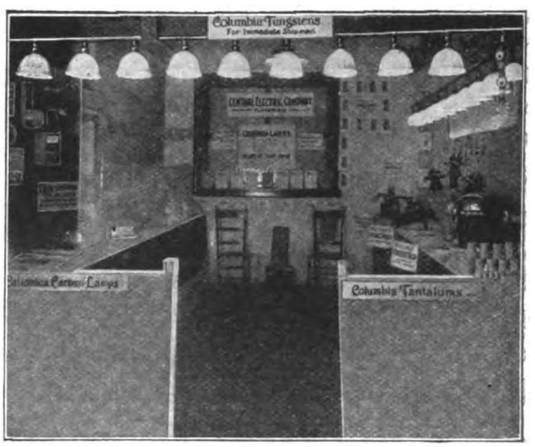
"What is to insure maintaining a sufficient film?" is another question asked in the most interesting article. The answer is, "The use of unctuous graphite will insure a film or coating that will afford perfect lubrication. This is particularly true if the graphite used be unctuous, pure and soft, not crystalline nor hard, for it will with great ease adjust itself to the microscopical irregularities of the surface, filling up the hollows and burying the points, thereby producing a mirror-like surface of great density quite capable of withstanding continued wear and affording the highest form of lubrication. Under pressure the graphite will move within itself like a film of oil, making it quite impossible for bearings so lubricated to seize or cut. Those familiar with oils as lubricants are aware that an oil on examination may seem to possess all the essential qualities, but that those qualities when in use become wholly changed.

Unctuous graphite, on the other hand, is a lubricant that will not deteriorate, emulsify, oxidize or burn up, factors of importance which make unctuous graphite a dependable lubricant, sure to render efficient service on heavy or light machines, on large or small bearings, as required.

It is also true that a large percentage of fires in cereal, textile and other mills come from overheated bearings. In all such establishments unctuous graphite will tend to conserve the element of safety in fire risks, for it should be understood that unctuous graphite is made in Niagara Falls in a temperature of over 7,000 degrees Fahrenheit, and that its lubricating properties cannot be impaired by any degree of heat likely to develop in hot bearings, due to extraneous heat or other causes.

Central Electric Exhibit at Illinois State Convention.

One of the most artistically decorated booths at the last convention of the Illinois State Electric Association that was held at Alton, Ill., on October 26 to 28, was that of the Central Electric Company, of Chicago. By the use of tungsten lamps and Opalux reflectors a soft, uniform illumination was secured which materially added to the attractiveness of the booth. As shown in the accompanying picture, the display of Opalux glassware formed a striking feature of the exhibit. Opalux is a new type of reflector, having its diffusing surface on the reflecting side. Opalux glass is perceptibly translucent, but a new method of manufacture has been devised which produces a diffusing surface entirely different from that produced by the ordinary etching, sand-blasting or enameling. While the glaze of the glass has been entirely removed, the surface is of such a high degree of smoothness that it can be cleaned as readily as other glass and at the same time does not give sufficient direct reflection to produce perceptible glare. The absence of glare in connection with this particular display was especially noticeable.



CENTRAL ELECTRIC EXHIBIT AT ALTON.

Large Wire Plant for the South.

The American Steel and Wire Company has been authorized by the directors of the Steel Corporation to construct wire mills at a point near Ensley, Ala., having a capacity of 400 tons per day. The appropriation is $3,000,000. This new plant has been considered for some time, on account of the large demand for wire in this section. New orders and specifications for the first half of November averaged 7,500 tons per day, or 500 tons per day in excess of the total output of all the mills of the company.

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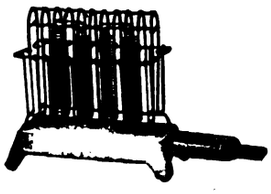
Electrically-Heated Devices for Holiday Trade.

Electrically-heated devices have passed the experimental stage and are now well established as part of the equipment of a modern household. There is no disputing their superiority as to cleanliness, convenience and attractiveness.

An impetus has been given the sale of the popular household devices, such as percolators, chafing-dishes, tea-kettles. etc., owing to the fact that a large choice of designs is now available. Hitherto manufacturers have taken one or two styles of heating devices and equipped them electrically. Arrangements have now been made with a large manufacturer to equip his most popular and attractive designs with General Electric units, and a choice of thirty designs and finishes of electric percolators tea-kettles and chafing-dishes will be ready for the holiday trade.

There are a number of novelties in the electric heating line, prominent among which is the new radiant toaster. This is a fascinating device. Toast may be made on the dining table, at the bedside or wherever electricity is available, and the whole operation is visible. On turning on the switch the wire heats up to a white heat instantly. The toasting process is at all times under control.



RADIANT TOASTER.

CIGAR LIGHTER.

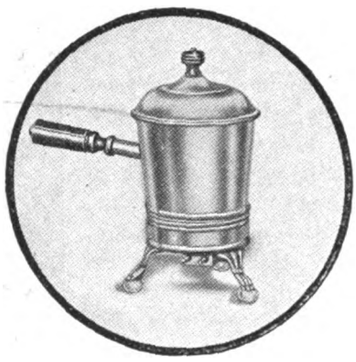
The electric cigar lighter is a very attractive device. The continuous pendant type is intended for continuous service in cigar stands and similar places and operates an entire day at a cost of less than two cents.

The new design of General Electric water heater, shown in the accompanying illustration, will be found of great usefulness in a thousand different ways. It may be used as a milk warmer, egg boiler or for heating liquids generally. It is made of copper, heavily riveted and is available in pint and quart sizes. A larger size of heater for two, four or six quarts is suitable for preparing an entire dinner. A range of three heats allows satisfactory regulation of the thermal effect.

Disk stoves are rapidly being adopted for small households. These stoves are remarkably quick and efficient, being of the encased disk unit type. These new stoves are able to operate at a much greater activity (watts per square inch) for a given size than electric stoves have formerly been. This is due not only to radical improvements in the design or application of the heating elements, but also to the material and construction of the heating element itself.

Underground Transformers.

The Oerlikon Company constructed some time ago a new type of transformer intended for installation underground. These transformers are easily accessible, and do not interfere with the traffic and disfigure the appearance of the street like those installed above ground. An oil-filled case of riveted sheet iron with a tightly fitting cover contains the transformer proper, which is of the core type. The cables are led in through two diametrically opposite openings sealed by an insulating mass, in the upper part of the case. Up to these openings the transformer is surrounded by gravel, which readily takes up the rainwater flowing from the curved cover. The entire apparatus is installed in a cement manhole with four flow-off channels in the bottom for removing water. A more or less strong cover, according to whether the transformer is installed under the street or sidewalk, closes the manhole. Oil vapors can escape through a suitable valve. Switches and fuses may be installed in other oil cases alongside of the transformer, or else such accessories for all the transformers of a zone may be united in a central station, whence the high-tension current is then conducted to the transformers. The high-tension conductor is a single cable with two concentric conductors; for the low-tension, two separate cables are provided.—*Abstracted from Journal fuer Gasbeleuchtung (Munich), October 16.*



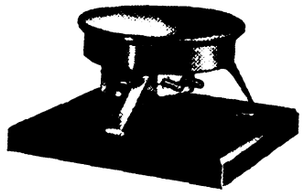
WATER HEATER.

Electrical Equipment for a Large Shop.

Among the orders received recently by Allis-Chalmers Company, of Milwaukee, Wis., is one from the Starr Manufacturing Company, of Carpentersville, Ill., which is one of the well-known manufacturers of steel shapes, and is arranging to install electric shop drive by induction motors.

This order includes a 300-kilovolt-ampere, 480-volt, three-phase, sixty-cycle alternating-current generator, direct-connected to a 380-horsepower twin vertical open-flume hydraulic turbine. The turbine will operate under a seven-foot head, and will be regulated by an oil-pressure governor. Excitation for this hydroelectric unit will be by means of a 22.5-kilowatt motor-generator set.

The order also covers a similar generator of the engine type, which is to be driven by a steam engine now installed in the plant. This generator will be excited by a thirteen-kilowatt, 120-volt exciter driven by a belt from the generator shaft.



DISK STOVE.

COFFEE PERCOLATOR.

A total of fifty-two 440-volt induction motors will be installed about the plant, and a nine-panel switchboard of blue Vermont marble, with complete equipment of the latest design, will hold the control and recording apparatus. All of the machinery and auxiliary equipment named above will be of Allis-Chalmers make.

The British Electrical Industry.

About 31.5 per cent of the heavy electrical plant manufactured in Great Britain is exported, while 16.0 or 17.0 per cent of the total home consumption is imported from foreign countries. One-half of the electrical fittings, and more than half of the metal-filament lamps, used in Great Britain, are also imported, while in other lines of electrical industry the British manufacturer is not able to monopolize his own home market. These facts were given by R. K. Morcom in an address to the Birmingham (Eng.) Section of the Institution of Electrical Engineers.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, NOVEMBER 20.—The traffic receipts on the District Railway and on the affiliated "tubes" are rapidly increasing. On the District line in October there was an increase of $10,000 compared with October last year, and the corresponding increases in the receipts from the tube railways for the same month were $12,000, $1,150 and $6,500. No doubt the facilities for through booking, which have been brought to a high state of perfection, are mainly responsible for this result.

The Olympia Motor Car Exhibition, which is just about to close, once again demonstrates that no headway is being made in the manufacture of electric motor cars. Indeed, one firm at the show, with an electrical name, does not show an electric car at all. There are only two stands on which electric cars are exhibited. Considerable progress has, however, been made in the electric lighting of cars, and in one case a dynamo is mounted on the shaft of the gasoline engine which draws the car. Other systems involve the use of belt-driven dynamos, while in others accumulators are employed. Electric horns are also becoming popular, and electric headlights are being used to a very large extent. But the field for electric cars still remains undeveloped, although a great many may be seen running about the streets of London.

A marble bust of the late Dr. John Hopkinson was presented last week to the Institution of Electrical Engineers by Mrs. Hopkinson. The new president, Dr. Gisbert Kapp, delivered his opening address at this meeting.

It is announced that the Nobel prize for physics for the past year has been divided between William Marconi and Professor Braun of Strasburg.

The two aluminum companies of Great Britain are being gradually brought to a satisfactory position. A scheme of rearrangement has been passed by the creditors and shareholders of the British Aluminum Company, under which a new company will be formed and the majority of the creditors will take shares in liquidation of their claims. In the case of the aluminum corporation negotiations for reorganizing the undertaking presents such a satisfactory outlook, that two petitioning creditors for a compulsory winding up have agreed to allow their petitions to stand over until the next legal sittings.

A new bridge, to carry tramways and to have one carriageway, is to be built across the Thames, close to St. Paul's Cathedral. The cost is estimated at $8,250,000.

A good deal has been heard at various times regarding the application of wind power for dynamo driving, but not a great deal has been done in this direction in this country. One famous instance, some fifteen years ago, was in London, where a well-known miller erected a windmill of American manufacture upon the roof of his premises. This mill drove a dynamo which supplied current for lighting and for operating an electric elevator. But the London County Council succeeded in bringing the structure within the Sky Signs Act and down it had to come. Since then a few installations of a similar character have been erected for country house lighting. An installation of this kind has just been completed in Worcestershire where a twenty-four-foot wheel on a seventy-five-foot steel tower drives a small dynamo. The house is some 500 yards away, and the energy is conveyed from the dynamo room, in the foot of the tower, to the house by means of overhead mains. Metal-filament, twenty-five-volt lamps have been installed. There is a twenty-eight-cell battery used with this installation.

The Royal Society, in its annual distribution of medals, has awarded Dr. R. T. Glazebrook a Hughes medal for his work on electrical standards, and Sir James Dewar a Davy medal for his work on low temperatures.

In spite of the refusal of the London County Council a short while ago to grant the Marylebone Council a loan for converting a large number of street gas lamps to electric lamps, the work has been carried out and is being paid for out of revenue. Further, it has been demonstrated that the cost is cheaper than gas, with a better light. Emboldened by the success of the experiment, the Marylebone Council proposes to go further and lay mains for lighting all the remaining streets of the Borough by electricity, and a loan of $125,000 is to be asked for for this purpose.

A British Association of Medical and Electromedical Instrument Manufacturers has been formed in London.

Conciliation Boards have been formed by the London County Council to deal with any grievances which the tramway employes may have. The Council and the men nominate an equal number of representatives. Boards will be formed to deal with traffic, rolling stock, electrical work, permanent way and buildings. There will also be a Central Board.

I have just heard of a big scheme for amalgamating the Yerkes group of tube railways in London, in order to bring them under one management instead of having three separate companies as at present. The proposal will be submitted to Parliament next session.

G.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., NOVEMBER 27.—The earnings of the Mexican Light and Power Company for the year to date are some $350,000 short of the $543,400 necessary to meet common stock dividends. The company, by the end of the year, will have paid out considerably more than it has earned.

There is not likely to be any interference by the federal government with the Ontario government's hydroelectric legislation. The refusal of the Dominion government to yield to the demands of the electric interests is due probably to the popularity of the hydroelectric scheme.

The Canadian Pacific Railway will shortly take an important step toward the abatement of the smoke nuisance in the city of Montreal, so far as it may be caused by railway trains drawn into the city. The means proposed is to transfer the motive power from steam to electricity, at Montreal Junction, so that all trains entering the city will be brought in by high-power electric engines. It is felt that the time is near when all railway lines will be compelled to adopt electric power in drawing their trains into terminals.

The Street Railway company of the city of Kingston, Ont., has stopped operations because the City Council refused to give the company the terms it wanted for the use of electric power. The city offered to provide power at 1.20 cents per kilowatt-hour for five years, with the privilege of terminating the contract at the end of three years if the necessities of the city lighting and power plant required it. The company wanted a contract for five years with the privilege of dissolving it at any time on six months' notice.

Dissatisfied with the change of schedule from twenty minutes to one hour, for the trip between Niagara Falls View and Montrose station, the Stampford Township Council has ordered the Niagara & St. Catherines Street Railway company to restore the former service or tear up its rails and ties. The railway company has been served with notice to this effect, and a fight between the company and the Council, which fought the hydroelectric commission so determinedly, is awaited with much interest.

The demand for Canadian mica is on the increase, and the mica properties in eastern Ontario are nearly all in operation again. In spite of the fact that the recent tariff legislation in the United States has raised the tax on the Canadian article going into the United States, the market there has become large, and it is confidently expected, among the Canadian mica men, that there will be an opening in the United States, in the future, for nearly all the mica that can be produced in this country.

The city of St. Catherines, Ont., has finally succeeded in getting the Canadian branch of the Crocker-Wheeler Manufacturing Company, of Ampere, N. J., located in St. Catherines. This concern manufactures all kinds of electrical machinery and does a very large business in Canada. One large Canadian contract the company has now in hand is for the manufacture of machinery for the big power works at Winnipeg, Man. The contract price is stated to be $250,000 and the machinery will be made at St. Catherines. The company has agreed to start with 100 first-class mechanics, but says that it will be employing at least 1,000 at the St. Catharines works in a few years' time.

President J. E. Aldred, of the Shawinigan Water and Power Company, states that the report that his company is acquiring shares in the Montreal Light, Heat and Power Company, for the purpose of control, is absolutely unfounded. It is true, however, that the Shawinigan company has acquired a substantial interest in the shares of the Montreal concern. The president remarks that it is hardly necessary to comment on the strength of the position of the Montreal company, backed by the Shawinigan company, which still has at its disposal 75,000 horsepower of the capacity of its waterpower, known to be the most perfect and economical waterpower in the world. The harmonious operation of these two companies guarantees to the city of Montreal electric energy for many years, under conditions not excelled in any city on this continent.

That in the Ottawa and the Gatineau valleys there is much undeveloped waterpower, and that there are iron ore deposits,

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which could be treated profitably by the new electric furnace method, are two conclusions arrived at by Fritz Cirkel, who has been investigating for the department of mines at Ottawa. In his report, the mining engineer says that pig-iron can be economically produced at a price to compete with the blast furnace product when electrical energy can be produced at less than $7 per horsepower. In this connection, it has been learned that the waterpower at the Chats Falls, on the Ottawa River, near this city, can be developed at a cost of only $4.50 per horsepower per year. In addition to these there are other splendid falls, near deposits of iron ore, such as the falls between Kirks Ferry and Ironsides, on the Gatineau River, within a few miles of Ottawa on the Quebec side. These can develop about 200,000 horsepower and are only two miles distant from large iron mines. The amount of water available for use along the Ottawa and Gatineau rivers has been shown, and steps necessary to harness it have been indicated. A summary of the investigations, with the name of the falls and the horsepower available, shows on the Ottawa River, within a comparatively short distance from the city, eighteen rapids and falls, yielding an estimated total of 306,020 horsepower, and, on the Gatineau, fifteen waterpowers, giving 216,325 horsepower, or a grand total of 522,345 horsepower. W.

LIGHTING AND POWER.

(Special Correspondence.)

ASH GROVE, MO.—This city is planning to install an electric-light plant. P.

CHESAW, WASH.—The Apex Mining Company will purchase a power plant for its mine here. A.

ARLINGTON, S. D.—The Council is figuring on the installation of an electric-light plant to cost from $2,500 to $3,000. C.

LOS ANGELES, CAL.—An ordinance has been passed providing for ornamental lighting of Pico from Main to Vermont Street.

WOODSTOCK, VT.—The Woodstock Electric Company has filed a statement of an increase of its stock from $18,000 to $40,000.

RED BLUFF, CAL.—The Sacramento Valley Power Company has been awarded a franchise to use the public highway for its poles and wires. A.

SALINAS, CAL.—The Monterey County Gas and Electric Company has been granted a franchise for a power line between Salinas and Monterey. A.

DENVER, COLO.—The Champa Power Company has been incorporated, with a capital of $15,000, by H. C. Briggs, William I. Spratt and Huse Taylor, of this city.

PHILADELPHIA, PA.—The Philadelphia Electric Company has secured the contract for lighting the city for the coming year. The city has appropriated $1,182,000 for this purpose.

LONG BEACH, CAL.—The Southern California Edison Company will build a substation in the Belmont Heights district to care for the electricity that will be used in that section of the city for lighting.

VISALIA, CAL.—The Mount Whitney Power and Electric Company has been incorporated, with a capital stock of $5,000,000, by J. C. Hays, T. J. Broidrick, F. G. Hamilton, H. T. Hays and A. C. Chickering. A.

LEADVILLE, COLO.—The Leadville Light and Power Company is building a power house to the Sugar Loaf mining district. It is expected that much of the steam power plants will be replaced by electric installations.

EDGERTON, WIS.—A rural telephone company, which will build a line to connect several homes in the village of Albion with Edgerton, has been organized. William McCarthy has been elected president of the company. M.

NEW YORK, N. Y.—The Ambato Electric Light Company of New York, has been incorporated to deal in electric light, heat and power in Ecuador, South America, with a capital of $50,000. The incorporators are: F. J. Torpey, J. A. Caras, A. Manly, New York city.

LOS ANGELES, CAL.—The Mexican Light and Power Company, which has a monopoly in Mexico City and supplies the El Oro mining district, has decided to build a branch transmission line to Pachuca and deliver current to the mines in that district. A.

PINEBUR, MISS.—The Walworth & Neville Manufacturing Company wishes to buy at once a second-hand direct-current dynamo that is guaranteed to burn 250 bright sixteen-candlepower lights. Machine to be given a test on the work before final acceptance. B.

NEW BRIGHTON, PA.—At the annual meeting of stockholders of the Beaver Valley Traction Company directors were elected as follows: James D. Callery, J. H. Reed, S. L. Tone, W. B. Carson, C. S. Mitchell, J. L. Foster, Theodore P. Simpson, M. D., W. G. Whitlinger, A. M. Stevenson. Expenditures were authorized for $10,000 on the power-house and storage-battery equipment.

HILTON, N. Y.—The Public Service Commission, Second District, has authorized the Hilton Electric Light, Power and Heat Company to issue its capital stock to the amount of $5,000, and has authorized this company to construct a plant and exercise franchises in this village.

STAUNTON, IND.—The Town Board has granted a franchise to the Terre Haute, Indianapolis & Eastern Traction Company to light the town and furnish current for commercial lighting. The company will construct a pole line from the supply wires to the town, a distance of six miles. S.

SAN BERNARDINO, CAL.—The City Council has passed an ordinance granting to the Southern California Edison Company a franchise to construct and maintain piers, masts and poles, and to lay and operate cables, etc., for the transmission of electricity along the public highways of this county. A.

GOLDFIELD, NEV.—Work will soon begin on large power plants in Mono County, which are to suuply power for an electric railroad from Coaldale to Bodie, to connect with the Tonapah & Goldfield Railroad. The water for the plants will be taken from Silver Lake and will furnish about 33,000 horsepower. A.

LEWISTOWN, ME.—President John L. Bright, of the Citizens' Electric Company, has just organized the Spring Creek Power and Electric Company, which will take over some valuable power sites on Spring Creek, one of which, just purchased, was sold for $21,000. The new concern has a capital of $250,000.

OAKLAND, CAL.—D. U. Toffelmire, representing the United Power Company, has applied for a franchise to erect poles and install a system for the distribution of electric light and power in Alameda County. The purpose of this company is to engage in competition with the Oakland Gas Light and Heat Company. A.

TERRE HAUTE, IND.—The Indiana Electric Transmission Company, has given the Secretary of State notice of an increase of directors from five to seven, and an enlargement of field to enable the corporation, which is building a mammoth power plant in the coal fields, to operate or transmit electricity into any county of the State. S.

FRANKFORT, IND.—It has been decided in a recent ruling, that the municipal plant here, has no right to sell incandescent lamp bulbs to its customers. While the case has never come up for trial, Judge Vestal has overruled a demurrer to John S. Kelly's injunction against the city, and the City Council has let the matter drop.

GREENVILLE, S. C.—Transmission lines of the Southern Power Company to the new distributing station bringing current from the Great Falls plant, which were expected to be completed two months ago, on account of delays will hardly start before December 1. Power will be furnished the Monaghan and Woodside cotton mills. L.

ANAMOSA, IOWA—Harry and Frank Zinn, Park Chamberlain and Geo. L. Schoonover sold the electric-light plant, waterpower and all franchises and equipment to A. E. Anderson, of Chicago. Mr. Anderson has also bought the water franchise at Oxford Mills, the electric-light plant at Oxford Junction, which includes the systems at Wyoming and Olin. C.

BRISTOL, TENN.—A company has been formed to construct a hydroelectric power house near this city at a cost of $250,000. Power is to be delivered by this company to the Bristol Gas and Electric Company and distributed by them. The power company is under bond to deliver power to the Bristol Gas and Electric Company not later than July 1.

HICKORY, N. C.—Following announcements of surveys to this point by the Southern Power Company for transmission lines, it is stated that the company is considering extensive developments on the upper Catawaba, near Hickory, and that another transmission line will be surveyed. The company has, however, already contracted to deliver power in Hickory. L.

MISSOULA, MONT.—It is reported that State Senator Ed Donlon of Missoula, candidate for governor on the Republican ticket last year, intends to erect a million-dollar electric-power plant at Thompson Falls in competition with the Washington Water Power Company. Water rights and a site have been acquired and the territory of the Washington Company will be invaded in Idaho, Washington and Montana.

COSHOCTON, O.—The Coshocton Light, Heat and Power Company is placing contracts for over 1,200 horsepower addition to its plant for power purposes and next spring will start work on a hydroelectric plant of over 1,000 initial horsepower, the waterpower being obtained from the state dam in the Walhonding River. Mr. Heimbaugh, president of the company, says that contracts have been made for practically all of the power which will be developed by the new plant.

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ELECTRIC RAILWAYS.

(Special Correspondence.)

WATERTOWN, S. D.—An electric line to Fargo, via Sisseton, Hankinson and Wahpeton is projected. C.

SCOTTSBURG, IND.—Preliminary surveys have been made of the Cincinnati, Madison & Western traction line from Scottsburg to Madison.

FRESNO, CAL.—An ordinance has been passed granting a franchise to the Fresno Traction Company to construct and maintain a street railroad. A.

SAN JOSE, CAL.—The Peninsula Railroad Company has sold its fifty-year franchise on the First Street line and auxiliaries for $16,000 to L. E. Hanchett. A.

ANOKA, MINN.—An ordinance has been passed granting a franchise for a street railway to the Anoka-Minneapolis Suburban Railway Promotion Company. C.

CHARLES CITY, IOWA—Arthur Dennis, secretary Commercial Club, is trying to interest capital in the construction of a street railway to Greene, Iowa. C.

PETALUMA, CAL.—The Highland Pacific Electric Railroad is procuring rights-of-way to operate an electric line from Lakeport to Santa Rosa via Cloverdale. A.

JACKSONVILLE, ILL.—Work on the Jacksonville-Springfield railway has begun. The stockholders are O. J. Lucas, D. H. Sims, S. H. Cummins and T. S. Davy.

SAN FRANCISCO, CAL.—The Stockton Street Railway franchise granting a right-of-way from Market Street to the Presidio has been awarded to Frank D. Stringham. A.

WINNECONNE, WIS.—The business men propose to raise $5,000 for the immediate construction of an electric line to Oshkosh, to be later continued to Waupaca. C.

BERKELEY, CAL.—The Key Route Company will begin work at once on its new Sacramento Street line. The line will be double tracked and will cost about $3,000,000. A.

VIRGINIA, MINN.—W. M. Prindel, of Duluth, and J. D. Chapman, of Chicago, have applied to the Council for a franchise to build an electric line to Gilbert and Eveleth. C.

PRINEVILLE, ORE.—Arrangements have been made for the survey of an electric railway between here and Opal City, a new townsite between Trail Crossing and Culver Road. A.

ONTARIO, ORE.—D. G. Sutherland, of this city, has applied for a franchise to build an electric railway in this city. The franchise will be offered for sale on December 14. A.

LOS ANGELES, CAL.—W. M. Bowen has purchased from the county an electric-railway franchise to extend from city limits on W. Adams Street to Washington Street in this city. A.

FRESNO, CAL.—F. S. Granger has been granted the franchise recently applied for by him for terminals in this city for his proposed interurban line between Fresno and Hanford. A.

SAN DIEGO, CAL.—The San Diego Electric Railway Company has petitioned the Council to advertise for bids for a street-railway franchise on Thirteenth Street from K to L streets. A.

WINONA, MINN.—The La Crosse and Winona Traction Company has petitioned the Council for a fifty-year franchise to build and operate an interurban electric railway to La Crosse, via Galesville. C.

BLUFFTON, IND.—The directors of the Bluffton, Geneva & Celina Traction Company have abandoned the idea of using motor cars and will install an overhead trolley system on its new road. S.

LAUREL, MONT.—W. R. Westbrook and L. A. Nutting, of Laurel, and others, have incorporated a company to construct an electric line to Billings and up Clark Fork and Rock Creek. C.

MINNEAPOLIS, MINN.—The Twin City Rapid Transit Company is considering the erection of a new barn and repair shops at Layman Avenue and Lake Street, to cost $400,000 to $500,000. C.

SIOUX CITY, IOWA—The survey for the proposed electric road to the Bijou Hills, S. D., has been completed as far as Parkston, S. D., which town subscribed $50,000 toward the enterprise. C.

WILMINGTON, DEL.—The Ohio, Kentucky & Atlantic Railroad Company has been incorporated by J. F. Varcoe, Brooklyn, N. Y.; W. N. Akers, W. J. Maloney, Wilmington, Del. The capital is $50,000.

ELKHART, IND.—The Indiana and Michigan Electric Company is now furnishing current, on a contract for fifteen years, to the Chicago and South Bend and Northern Indiana Railway Company to operate their interurban cars. The power is generated at the Hen Island plant, on the St. Joseph River, and is now moving all of the interurban cars of the traction company from Michigan City to Goshen, and all of the local cars in Goshen, Elkhart, Mishawaka and South Bend. This service was begun November 19. S.

WABASH, IND.—Wabash County has voted $50,000 subsidy to aid the Wabash & Northern Indiana Traction Company in building its road from Wabash to North Manchester and Warsaw. Kosciusko County voted $7,500 to the same end.

LA CROSSE, WIS.—W. J. Ferris, president of the La Crosse Water Power Company, states that construction on the interurban line to Winona will be started in the spring, there already being $1,000,000 available for that purpose. C.

TOLEDO, OHIO—The new Fremont & Fostoria Electric Railway has acquired the Fremont Street Railway lines, for entrance into the city of Fremont, Ohio. Grading will soon be under way and the bulk of the work will be done this winter. H.

BRISTOL, VA.—An electric line is to be built through Lee and Wise counties, in southwest Virginia, by Canadian capitalists. Engineers have been employed and it is reported that work on the interurban electric line will be begun in a short time.

MUSCATINE, IOWA—The final survey of the new line of the Muscatine North and South Railway extension from Elrick Junction to Burlington is now being made. A party of surveyors left Muscatine early last week and are now working out of Oakville.

NEW CASTLE, IND.—The engines and other equipment for the power house of the Indianapolis, New Castle & Toledo Traction Company have arrived and are being installed rapidly. The company's road-bed is being ballasted and plans are to open the line by Christmas. S.

SALT LAKE CITY, UTAH—Officials of the Salt Lake & Los Angeles Railway Company have announced their intention of electrifying the line to Saltair during the coming summer. A franchise permitting the use of electric cars on the present steam road has been asked.

WABASH, IND.—W. L. Moyer, who is promoting the Wabash & Northern Traction Company, to run between Wabash and Warsaw, announces that contracts have been let for all the material, supplies, etc., except the overhead work and equipment. Work on the road will begin January 1. S.

KINGMAN, IND.—A generator and other power-house equipment have arrived and the work of installing them in the new power house will begin at once. J. J. Barnes, president of the Covington & Southwestern Traction Company, says that he hopes to complete the road in a few months. S.

HOUSTON, TEX.—M. M. Phinney, manager for the Stone & Webster syndicate here, recently announced that the construction of the Houston-Galveston interurban line will be commenced by January 1, and that the line will be in operation by the time the Galveston causeway is completed.

LA CROSSE, WIS.—The $3,000,000 electric interurban between Winona, La Crosse and Sparta will be completed and in operation by next fall, according to a statement issued by W. J. Ferris, president and general manager of the La Crosse Waterpower Company, which is behind the project.

JERSEY CITY, N. J.—The Ottoman-American Development Company has been incorporated to construct railways, electric lighting, telephones, sewers, etc., with a capital of $100,000. The incorporators are: D. E. Peck, A. T. Chester, L. G. Billings, Jr., G. E. Schultze and R. S. Wolfe, Jersey City, N. J.

CHATTANOOGA, TENN.—The Chattanooga Railway and Light Company has filed a mortgage for $15,000,000 in favor of the Fidelity Trust Company, of Philadelphia. Of this amount $10,610,000 will be used for extensions and new equipment and the remainder in retiring the bonded indebtedness.

LAUREL, MONT.—The Eastern Montana Electric Railway Company is asking for a franchise to build a street-car line in the city. It is proposed to build a line to Billings and extend it west to Red Lodge, crossing the hill to Bearcreek and returning to Laurel by a loop, embracing the entire Clark Fork Valley. C.

PENDLETON, IND.—The Indiana Union Traction Company is purchasing an additional thirty feet of land along its right-of-way and will soon enter upon the work of building a double track between Anderson and Indianapolis in order to accommodate the increasing number of through trains that center on the main line at Anderson. S.

KENOSHA, WIS.—Thomas B. Jeffry has been awarded damages to the amount of $133,000 against the Chicago & Milwaukee Electric Railway Company and the receivers of the company by the Circuit Court of Kenosha County. Jeffry had demanded $2,000,000 as the value of land taken from him by the company as its right of way. In the previous trial, $135,000 of damages were awarded, but the State Supreme Court returned the case for a new trial, holding that the verdict was excessive. The Chicago & Milwaukee Electric

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Railway Company's representative, Louis Quarles of Quarles, Spence & Quarles of Milwaukee, moved to have the verdict set aside as excessive. The case will likely be appealed to the Supreme Court. M.

REXBURG, IDAHO—The Idaho Power and Transportation Company, of Idaho Falls, has recently acquired the property of the St. Anthony Light and Power Company, which supplies Sugar City, Rexburg, St. Anthony and Teton. The deal involves $150,000, and the Idaho Power and Transportation Company is to take possession on December 1.

COLUMBIA, WASH.—Plans for branch lines in the Rainier Valley involving approximately $50,000 have been completed by the Seattle, Renton & Southern, and part of the work is now under way. President W. R. Crawford has announced that all of the plans for extensions and branch lines made during the summer will be rushed toward completion.

MEMPHIS, TENN.—The Tennessee Traction Company has been incorporated, with a capital of $50,000, for the purpose of building a line from this city to Nashville by way of Jackson. Officers were chosen as follows: W. K. Burton, president; W. R. Gilbert, vice-president; Horace N. Smith, secretary and treasurer; George E. Bushnell, general manager.

CATSKILL, N. Y.—In pursuance of a judgment of foreclosure and sale granted at a special term of the Supreme Court, John W. Collory, referee, will sell on behalf of the Hamilton Trust Company as trustee the premises and property in the village of Catskill known as the Catskill Electric Railway Company, at the front door of the courthouse, at Catskill, on the 22d day of December, 1909.

HERRIN, ILL.—Work is soon to begin on an electric interurban line from Murphysboro to Carbondale, with good prospect of extending the line through the coal belt and to the Ohio River, ending at Shawneetown. The line is built by Southern Illinois capital, incorporated as the Murphysboro & Southern Illinois Railroad, which has just put a street-railway system into operation in Murphysboro.

EUREKA, CAL.—George Henderson, who has arrived from San Francisco, has asked the City Council for an electric-railway franchise from the water front through the city, and has asked that the proposed franchise shall require a forfeit of $25,000 and shall provide for the use of the sixty-pound steel rails. He states that the people he represents will erect a power plant for the operation of the road. A.

SALEM, ORE.—The Portland, Eugene & Eastern Railway Company, A. Welch, president and general manager, has a crew of men at work in this city to-day building the first of the two miles of a city system for which it has a franchise, and also the first of an extensive interurban system which is planned to include Salem, Albany, Stayon, Eugene and various other towns and cities in the Willamette Valley.

OGDEN CITY, UTAH—The Salt Lake and Ogden Railway has begun the construction of a power plant at Lagoon, for the electrification of the railway between here and Salt Lake City. The plant at Lagoon will cost $200,000 and substations will be erected at Lagoon, Stockdale, Clearfield and Ogden at a cost of about $25,000 each. Work on the plant is being pushed and cars will be in operation in a short time.

PITTSBURG, PA.—It is stated on good authority that the Baltimore & Ohio Railroad is negotiating for the purchase of the lines of the Grafton Traction Company, a report admitted by some of the representatives of the company. The railroad is credited with owning a controlling interest in the Fairmont, Clarksburg and Elkins lines which, with the Grafton lines, would give it control of the traction situaton in eastern West Virginia.

CINCINNATI, O.—Articles of incorporation have been drawn up for the Cincinnati-Big Bone Interurban Railway Company, which plans to build a road through Covington, Erlanger, Florence, Union and Big Bone Springs, a distance of twenty-one miles. The incorporators are: Dr. M. J. Crouch, A. W. Koch, J. J. Weaver, J. W. Kennedy, Orlando P. Schmidt, Robert Holmes, Louis Fritz William Riedlin and Joseph Feltman.

CANTON, O.—There is a report to the effect that a merger of the Northern Ohio Traction, Stark Electric and Youngstown & Ohio Electric lines will be brought about shortly and that lines between Salem and Youngstown will be built. A merger of all the traction lines to this section of the state is said to be under way. Traction stockholders and officials of this city are interested in the Canton deal as well as in the purchase and control of other lines near by.

FREMONT, O.—The Fremont-Fostoria Electric Railway Company has acquired possession of the Fremont street-railway line, which connects the city with the village of Ballville on the south. The Fremont-Fostoria line will use the local line for an entrance to the city, enabling the cars of the interurban line to get down to the very heart of the business section. It is expected that the grading of the road will be completed before the first of the year.

ALAMEDA, CAL.—F. P. Fisher has been awarded the contract for finishing the power house of the Southern Pacific Company, now being erected between Park Street and Fruitvale Avenue, Alameda. His bid to finish the plant was $127,000. The power house will supply current for the operation of the passenger system, which is to be made by the Southern Pacific Company by converting its present steam roads in the east bay cities into electric lines.

GUTHRIE, OKLA.—The Citizens' Traction Company of Oklahoma City, which consolidation of the Patterson and Hurst interurban interests, was recently chartered, with $300,000 capital. Lines are proposed from Oklahoma City to Shawnee and Oklahoma City to Sulphur, with a possible extension to Fort Smith, Ark. The directors include Alfred Hare of Shawnee, principal owner of the Shawnee-Tecumseh Interurban; John F. Winans, L. E. Patterson and W. F. Harn of Oklahoma City and H. S. Hurst of Holdenville.

INDIANAPOLIS, IND.—An order has been entered by Judge Vincent Carter in the Superior Court, authorizing the issuance of $460,000 in receiver's certificates for the completion of the Indianapolis, New Castle & Toledo Interurban line from Indianapolis to New Castle. Practically all of those who held claims against the company when the Union Trust Company was appointed receiver have agreed to have the receiver's certificates issued, and it is announced that the work of construction will begin at once.

WALLA WALLA, WASH.—The Northwestern corporation has asked for an extension to its franchise covering electric power, lighting, electric railways and gas. The extension is asked to correspond with the new $5,000,000 bond issue. A. Welsh, general manager of the Northwestern corporation, states that he is considering the construction of electric roads to Wallowa, Ore., and Dayton, Wash. There is a report that the Northwestern corporation is planning to combine with the Washington Traction Company.

CINCINNATI, O.—The Cincinnati, Harrison & Indianapolis Traction Company has been incorporated at the nominal capitalization of $10,000 to construct a traction road over the present tracks of the old Westwood steam railway, through Westwood and Cheviot, and on to Harrison, and eventually through to Indianapolis. A survey had been made as far as Harrison, and preliminary steps have been found favorable to the completion of the project. A. K. Nippert, Chas. E. Roth and Will L. Finch are among those interested in the proposed road.

GREENSBORO, N. C.—Parties identified with the Southern Power Company are reported to be occupied with surveys and obtaining rights-of-way for an interurban trolley system extending from Greensboro, N. C., by way of Salisbury and Charlotte, to Spartansburg and Greenville, S. C. The routes parallel the lines which the Southern Power Company has built for the distribution of its hydroelectric power from its 200,000-horsepower plant. The names of W. S. Lee, Jr., vice-president of the Southern Power Company, of Charlotte, N. C., and of J. B. and B. N. Duke, of the American Tobacco Company, are associated with the project.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

ELGIN, TEX.—K. F. Leggett is about to establish an electric-light plant here. P.

CASH, ARK.—The Farmers' Mutual Telephone Company will extend its line to Jonesboro. P.

BUTTE, MONT.—The Montana Independent Telephone Company has been incorporated. P.

CAMP CREEK, S. D.—The Belle-Fourche Telephone Company will install a local exchange. P.

KAUKAUNA, WIS.—The Kaukauna Telephone Company has been incorporated, with a capital stock of $5,000. P.

ST. JOSEPH, MO.—The Home Telephone Company has been incorporated, with a capital stock of $1,200,000. P.

PORT ARTHUR, TEXAS—A new exchange equipped with the latest telephone apparatus has just been completed.

LYONS, NEB.—The Burt County Telephone Company has been incorporated, with a capital stock of $100,000. P.

LEWISVILLE, TEX.—The Lewisville Light and Power Company has been incorporated, with a capital of $2,000. P.

KENNEBECK, S. D.—The Kennebeck Telephone Company has been incorporated, with a capital stock of $5,000. P.

PAXTON, NEB.—The Paxton and Sutherland Telephone Company has been incorporated, with a capital stock of $5,000. P.

CHECOTAH, OKLA.—The Checotah-Texanna Telephone Company has been incorporated, with a capital stock of $4,000. P.

SAN FRANCISCO, CAL.—R. P. Schwerin, general manager of the Pacific Mail Steamship Company, states that the entire

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Pacific fleet of the company will be equipped with wireless telegraph apparatus.

SAN ANTONIO, TEX.—The Farmers' Independent Telephone Company is beginning the construction of rural lines. P.

MADISON, WIS.—The Timber Conlee Co-operative Telephone Company, of Westby, with a capital stock of $680, has filed articles of incorporation. M.

DALLAS, ORE.—The Dallas Telephone Company has been incorporated, with a capital of $25,000, by C. B. Sunderberg, Henry Berning and J. J. Keber.

ROSCOE, TEX.—The Roscoe, Snyder & Pacific Railway Company has let the contract for fifty miles of telephone and telegraph line to Balsh Bros., of Hermleigh, Tex. P.

SANTA ROSA, CAL.—The Petaluma Rural Telephone was recently incorporated, with a capital of $50,000. The lines are to cover the rural districts outside of Petaluma.

PORTLAND, ORE.—The Home Telephone Company will erect three new exchanges on the East Side and will extend its system largely. The cost of the exchanges will be $100,000.

FORSYTH, MONT.—The local telephone company will install important improvements. The central office will be moved to the old Journal building and a new switchboard installed. C.

BUTTE, MONT.—Acting for the Interstate Consolidated Telephone Company, Thaddeus S. Lane bought outright the long-distance lines of the J. S. Haley Telephone Company, of Bozeman. C.

SHERWOOD, N. D.—A company has been organized by farmers in Winlay, Elmors and Workman townships, all in Canada, to build fifty-seven miles of telephone line to connect with the central office here. C.

BUTTE, MONT.—The Independent Telephone lines between Livingstone and Gardner, Bozeman and Salesville, Bozeman and Chimney Rock, and others, have been purchased by the Interstate Consolidated Telephone Company.

LEWISTOWN, ME.—At a recent meeting of the stockholders of the Monroe & Brooks Telephone Company the following officers were elected: President, Fred L. Palmer; vice-president, John Nealley; secretary, Harry Littlefield; treasurer, Joseph Littlefield.

HARRISONBURG, VA.—At a recent meeting of the New Valley Telephone Company the following officers were elected: President, Abram Sanger, Mount Solon; vice-president, Dr. B. H. Beydler, Bridgewater; secretary, L. Z. Miller, Bridgewater; treasurer, George A. Snell, Bridgewater.

HUME, FAUQUIER COUNTY, VA.—The Morven Telephone Company has been chartered by the state, the capital being $500 to $5,000. The incorporators are: James R. Green, president, Markham, Va.; E. Marshall Newton, secretary and treasurer, Hume, Va.; C. H. Corder, Edward Ambler, C. J. Yates, Hume, Va. I.

PORT LAVACA, TEX.—The Port Lavaca Telephone Company, which is owned by W. T. Best and H. C. Ennis, of this place, has selected a route for a new line, which it will build from Port Lavaca to O'Connorport, a distance of twenty-five miles. The line will run by way of Alamo Beach. It is planned to begin the construction work soon. D.

TACOMA, WASH.—The City Council of Tacoma will bring action against the Pacific Telephone and Telegraph Company to ascertain whether the company has a franchise to operate in this city. The franchise of the old Sunset Telephone Company has expired, but the company claims that it was given an extension of franchise until 1915 when it laid wires underground several years ago.

SAN ANTONIO, TEX.—The board of county commissioners of Bexar County has granted the petition of the Farmers' Independent Telephone Company for right-of-way and privilege to construct a rural telephone line through certain parts of this county. John M. Melcher is president of the company; August G. Bippert, secretary, and Emil F. Bippert, treasurer. Its principal office is in San Antonio. D.

AUSTIN, TEX.—At a meeting of the stockholders of the South Texas Telephone Company held here November 1 the following directors were elected: J. A. Quisenberry, of Danville, Ky.; John H. Robinson, Jr., of Austin; J. B. Earle, of Waco, Tex.; S. J. Brooks, of San Antonio, and James W. McClendon, of Austin. The new board elected the following officers: J. A. Quisenberry, president; James H. Robinson, Jr., vice-president; James W. McClendon, secretary; Robert E. Carrington, of Austin, auditor and treasurer, and Robert E. Shelley, of Austin, general manager. This company operates in many counties in South Texas and is doing a profitable business. Important improvements and extensions are under consideration. D.

ELECTRICAL SECURITIES.

Advance rumors of President Taft's message have had a rather disquieting effect upon the stock market during the past week, although the rumors touch on nothing that has not been publicly expressed by the president. This break in prices is, however, to be expected at the beginning of a new administration. The copper combine is as yet uncertain. Three times the prices have broken, and after the third time Boston, the headquarters of the copper industry, declared that if there had ever been such a thing as a copper combine contemplated the idea had been discouraged by the Standard Oil decision. Nevertheless, there was a rumor in Wall Street that J. P. Morgan & Company is at the head of a combine and believes it can succeed where H. H. Rogers failed. While it is generally believed that if this company is formed it will be so carefully organized as not to conflict with the anti-trust laws, there is no doubt that production will be curtailed to uphold prices. The effect that this will have on the electrical industries is quite apparent.

At the annual meeting of the Continental Telegraph Company directors were re-elected, and subsequently the officers were re-elected.

The November earnings of the Chicago Railways Company show a daily gain of $5,000, with the estimated gross for ten months $10,375,000, or an increase of $1,250,000.

New York Public Service Commissioner Maltbie conducted a hearing last week on the application of the Kings County Electric Light and Power Company for the issuance of $5,000,000 of convertible debenture bonds. Very little was accomplished, as Counsel Searing for the company objected to the statement that was to be filed on the ground that he had not corrected it; but he promised to have everything in presentable shape shortly. The proceedings were adjourned until December 13.

For the year to end with December the New York Telephone Company is expected to earn close to eleven-and-one-half per cent on its $85,672,800 outstanding capital stock, out of which dividends at the rate of six per cent are now being paid. This leaves a balance of rising $4,500,000 to devote to property extensions. It is not at all unlikely that the dividend rate may be increased from six to seven per cent, giving the American Telephone Company, which owns the entire capital stock, an increased return of nearly $900,000. The constituent properties forming the present New York Telephone Company had total assets as of June 30 last of $125,869,014, of which $108,068,087 included real estate and construction.

DIVIDENDS.

Mackay Companies; quarterly dividend of one-and-one-fourth per cent on the $41,380,400 outstanding common stock, putting this issue on a five per cent annual basis. (The common has been paying four per cent annually since 1906.) The regular one per cent quarterly dividend was also declared on the preferred stock. Both dividends are payable January 3 to stockholders of record December 11.

Massachusetts Electric Companies; semi-annual dividend of one-and-three-fourths per cent, payable January 1.

West End Street Railway Company; regular semi-annual dividend of $2 per share, as rental, payable January 1.

NEW YORK.

	Nov. 29.	Nov. 22.
Allis-Chalmers common	15	15½
Allis-Chalmers preferred	54¼	55
Amalgamated Copper	86¾	99⅜
American Tel. & Cable	*80	*80
American Tel. & Tel.	141¼	143⅞
Brooklyn Rapid Transit	77⅝	78¼
General Electric	161	163
Interborough-Metropolitan common	22⅞	23⅜
Interborough-Metropolitan preferred	55⅛	55½
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	92	93
Mackay Companies (Postal Telegraph and Cables) preferred	75¾	76
Manhattan Elevated	138	140
Metropolitan Street Railway	21	20
New York & New Jersey Telephone	123½	123½
U. S. Steel common	88⅛	89¾
U. S. Steel preferred	124	125¾
Western Union	78	79½
Westinghouse common	84¾	85¾
Westinghouse preferred	134	135

*Last price quoted.

BOSTON.

	Nov. 29.	Nov. 22.
American Tel. & Tel.	141¼	143⅞
Edison Elec. Illuminating	.....	250
General Electric	161	163
Massachusetts Electric common	15¾	16
Massachusetts Electric preferred	78½	80
New England Telephone	134	134
Western Tel. & Tel. common	12	12¼
Western Tel. & Tel. preferred	89	.....

PHILADELPHIA.

	Nov. 29.	Nov. 22.
American Railways	45	45
Electric Company of America	12¼	12½
Electric Storage Battery common	58¼	58½
Electric Storage Battery preferred	58¼	58½
Philadelphia Electric	12⅞	12¾
Philadelphia Rapid Transit	26	26¼
Philadelphia Traction	89	89
Union Traction	52	52½

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CHICAGO.

	Nov. 29.	Nov. 22.
Chicago Railways, Series 1	95	98
Chicago Railways, Series 2	32	33
Chicago Subway	5½	6
Chicago Telephone	135	136
Commonwealth Edison	118½	119
Metropolitan Elevated common	16½	16
Metropolitan Elevated preferred	52	52
National Carbon common	96½	96½
National Carbon preferred	123	123

PERSONAL MENTION.

FRANK CORDTS was recently elected president of the Citizens' Light, Heat and Power Company, of Jersey City, N. J., taking the place of A. J. Volk, who recently resigned.

OLIVER L. TURGEON, well known for a number of years as representative of the Eastern Carbon Company, has left this company to become connected with the sales force of the Stackpole Battery Company, of St. Mary's, Pa.

F. F. ESPENSCHIED has resigned his position with the West Penn Railways Company to assume the management of the Interstate Light and Power Company, at Galena, Ill. Mr. Espenschied has for a number of years been connected with the railway company as consulting engineer to the operating manager, W. E. Moore.

T. COMMERFORD MARTIN, executive secretary of the National Electric Light Association, will be the guest of honor at the next meeting and dinner of the League of Electrical Interests of St. Louis, to be held at the Mercantile Club, December 7. The league membership is made up of men representing all of the different electrical industries of the city.

HARRY SCHLEY SANDERSON, supervisor of city lighting, presented his resignation to the Board of Public Improvements on November 26. It was accepted to take effect on October 31. His successor has not yet been appointed. Mr. Sanderson, who is a grandnephew of Admiral Winfield Scott Schley, has been supervisor of city lighting for the last two years.

CHARLES ROBBINS, who has for many years been connected with the Westinghouse Electric and Manufacturing Company in the industrial and power sales department in connection with the sale of industrial motors, has recently been appointed manager of this department. Mr. Robbins has been with the company since 1899, in which time he has been in the manufacturing department, the New York district office sales department, and for the past three years in the industrial and power sales department at East Pittsburg. His headquarters will continue to be at East Pittsburg.

SAMUEL A. CHASE, who for the past few years has been with the Westinghouse Electric and Manufacturing Company in the New York sales office as a special detail and supply salesman, has recently resigned to accept a position with the White Investing Company, of New York city, a financial investment company handling stock of many different organizations. Previous to Mr. Chase's employment with the Westinghouse Electric and Manufacturing Company he was a salesman for the Western Electric Company, where he was highly successful. Mr. Chase will, after January 1, be in charge of the Chicago office of the White Investing Company, having exclusive territorial rights in North and South Dakota, Minneapolis, Iowa, Illinois and northern Indiana.

OBITUARY.

ALBERT V. PORTER, who was for many years the consulting architect for the New York City Street Railway Company, died at his home, 267 Madison Street, Brooklyn, last week. He was born in Gloversville, N. Y., fifty-three years ago, and is said to have drawn the plans for the first electric power house built in this country. He was a fellow of the American Institute of Architects. His wife, two sons and two daughters survive him.

HON. FRANCIS H. RAYMOND, treasurer and general manager of the Cambridge Electric Light Company, and formerly representative, senator and member of the governor's council, died recently at his home in Somerville, Mass. Mr. Raymond was operated on last February, and although the operation was successful, the shock proved too great for him. The end came suddenly. Mr. Raymond had attended to business within three weeks of his death, and had been confined to his room only four days. He leaves a widow and a daughter, Miss Alice Raymond, of Somerville, and one son, Edward B. Raymond, general superintendent of the General Electric Company, at Schenectady, N. Y.

JOHN CALDWELL, treasurer of the Westinghouse Airbrake Company, vice-president of the Bank of Pittsburg and a leading financier of Pittsburg, was found dead in his office at Wilmerding shortly before noon on November 23. He had been stricken by heart disease while signing some letters, and fell dead in an effort to reach the door to summon help. Mr. Caldwell was seventy years of age and he had been treasurer of the Westinghouse Airbrake Company for thirty years. He became a director and stockholder of the Merchants and Manufacturers' Bank, Pittsburg, and when this institution was absorbed some years ago by the Bank of Pittsburg, Mr. Caldwell became a director and vice-president in the Bank of Pittsburg.

ROBERT M. VAN ARSDALE, proprietor of *The American Engineering and Railroad Journal*, died suddenly at his home, 276 West Seventy-first Street, on November 23. Apoplexy was given as the cause of death. Mr. Van Arsdale had been working hard for months past, and it is believed that overwork was indirectly the cause of his sudden death. Hardly had he reached his home and taken off his overcoat when he complained of feeling ill. His wife telephoned immediately for a doctor, but before he arrived Mr. Van Arsdale was dead. He is survived only by his widow.

NEW INDUSTRIAL COMPANIES.

ST. LOUIS, MO.—The Gleeson-Brokaw Electric Company has been incorporated to handle electrical fixtures, etc. P.

ST. LOUIS, MO.—The American Electric Machine and Elevator Company has been incorporated, with a capital of $10,000. P.

PLAINFIELD, N. J.—The United States Electric Smelters, of Newark, N. J., has been incorporated; capital, $150,000. Incorporators: James H. Reid, Edward A. Filkins and Frank E. Gollier.

CLEVELAND, OHIO—The Cleveland Vibrator and Electrical Company has been incorporated, with the following as incorporators: R. Brown, V. G. Murphy, N. A. Quilling, W. H. McJury, B. A. Scott.

FORT WAYNE, IND.—The Electric Supply and Fixtures Company has been incorporated, with a capital of $25,000. The company will manufacture all kinds of electrical supplies, equipment, fixtuhes, etc. S. M. Foster, H. L. Sayler and F. H. McCulloch, directors. S.

ALBANY, N. Y.—The Hooker Electro Chemical Company of Niagara Falls, has been incorporated with a capital of $3,750,000. The directors include: Franklin Remington, Michael Gavin, Percy K. Hilton of New York city; George E. Velie and Albert H. Hoower, of Niagara Falls.

CANTON, OHIO—The United Electric Company, of Canton, has been incorporated to take over the holdings of the Power Electric Company, and to enlarge the business of the concern. The new company is backed by the Berger interests with $200,000 capital. The incorporators are Edward A. Langenbach, W. W. Irwin, Harry R. Jones, Charles A. Dillon and Charles L. Goughnour.

LEGAL NOTES.

REQUIREMENTS IN MAINTAINING TELEPHONE LINES OVER NAVIGABLE STREAMS—The case of Heiberger vs. Missouri & Kansas Telephone Company, 113 Southwestern Reporter, 730, was brought to recover damages for injuries sustained by the plaintiff through a gasoline launch in which she was riding on the Missouri River colliding with a sagging telephone wire. Recognizing such river as a navigable stream, a public highway, which no person or corporation had the right to obstruct, and conceding, for argument, that the telephone company, in maintaining a telephone line which crossed over the highway, was in the exercise of a lawful right, the Kansas Court of Appeals says that the enjoyment of the right carried with it certain duties and responsibilities. Both in the construction and maintenance of its line the defendant was bound to take into consideration the right of the public to navigate the river, and was required by the plainest principles of law, first, to build the line at a height above the water sufficient to permit the free passage under it of river boats, and then to exercise at least reasonable care to prevent it from becoming an obstruction and menace to navigation. Though not an insurer of travelers on the highway against danger of injury from fallen wires, the company owed them the duty above stated, and a negligent breach of such duty would afford a person injured thereby an action for the damages sustained. The presumption of negligence might be overcome by showing that the falling of the wire was not the result of negligence in the construction and maintenance of the line, and that the defendant had neither actual nor implied notice of the fact that it had fallen in time to have removed the obstruction by the exercise of reasonable care.

CONTRACT FOR EXCLUSIVE SERVICE UPHELD—In measuring the effect of an agreement such as one for the installation of a telephone system in a hotel, with a provision that no instruments or wires other than those furnished by the company were to be placed or maintained in said hotel or connected with or maintained in connection with the switchboard apparatus, etc., the Fourth Appellate Division of the Supreme Court of New York says, Central New York Telephone and Telegraph Company vs. Averill and another, that the court is not alone to consider the public, which may be interested only in a theoretical way, but the rights of the parties to the agreement must not be overlooked. The residents of a street or of a village may get

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telephone service at a low rate if the use is confined to one company. If there are two or three competing lines, each supplying the residences on the same street and with the same general connections, the added original cost and the expense of operation and maintenance with the division of revenues must eventually increase the charge to the patrons if the companies continue to do business. The customers are the sufferers in the end. The term public is a variable one, and these customers may comprise the public so far as that locality is concerned. The people at large or of the whole village may not be interested in the agreement with the citizens of this street to the extent of securing its abrogation. So far as appeared in this hotel case, only the parties to the agreement were affected by it, and yet, on the pretense that the rights of the public were endangered, the courts were asked to allow the defendants to disclaim liability for their further performance and evade the payment of obligations already incurred in furnishing the service which it entailed. The court thinks there was no necessity for making the public the scapegoat of this plan.

EVIDENCE AND DAMAGES IN SUIT FOR FAILURE TO FURNISH AGREED POWER—The case of Kimball Brothers Company vs. Citizens' Gas and Electric Company, 118 Northwestern Reporter, 891, was brought to recover damages alleged to have been sustained by a failure of the defendant to furnish as agreed an adequate and sufficient electrical current to run an elevator and motor in a certain building. The contract was alleged to have been made while the building was being erected and the installation proceeded with in consequence thereof. But at that time the defendant was furnishing monocyclic current and when it later attached its wires to a motor designed for three-phase operation it was found that it could not start the motor when the elevator was loaded to capacity, and that without the use of a clutch or other device it could not furnish the amount of power required to operate the elevator successfully when fully loaded. Many attempts were made to correct the difficulty, but the defendant did not succeed in making the elevator work until the plant from which it got its current was changed entirely from the monocyclic to the three-phase system. During the time the parties were trying to make the motor work, it was taken to a power plant and given a brake test. This disclosed that the motor was not at fault, and that, when a current of from 200 to 230 volts was supplied to each of its circuits, it would do the work and furnish the necessary power. Bearing in mind that the defendant was claiming that the trouble was with the motor, in that it was not adapted to the monocyclic current, the Supreme Court of Iowa holds that there was no error in giving the results of this test in evidence to the jury. At the same time in view of the issues tendered and of the claimed result of the test, the court thinks that the defendant ought to have been permitted to prove by an electrical engineer the difficulty of using a monocyclic system in connection with a regular three-phase motor to carry a load of 6,000 pounds. Assuming that the defendant did not furnish the kind of current that it agreed to, the court thinks that it was error to instruct the jury that it might allow the plaintiff the difference in the rental value of the building with and without the current agreed upon during the entire time of something like three years until the defendant changed its system. The plaintiff was entitled to this difference only for the time that the defendant was endeavoring to comply with its contract, and for such reasonable time thereafter as would have enabled the plaintiff to have substituted some other known and approved motive power for the running of its elevator. This was the most it would be entitled to under any circumstances. Whether or not it should have supplied the motor with the clutch or other device to enable it to be started before that time was a fair question for a jury. If, in the exercise of reasonable care and prudence at moderate or small expense, it could have remedied the difficulty, it should have taken that course, and, if a jury should find that this was the proper course to have been pursued, the plaintiff would not have been entitled to the rental value of the building after it became its duty to remedy the defect.

COMPANY NOT LIABLE FOR INJURY FROM PULLING APART OF TWO-CLAMP SPLICE OF MESSENGER WIRE BETWEEN POLES—A lineman engaged in attaching the loops or hooks to a messenger wire in the construction of a new telephone line was injured by the cable, on which he was suspended in midair, parting at a splice about halfway between the poles. The only claim of negligence appeared to be that the company had changed the method of splicing from a three-clamp splice to a two-clamp splice, and that it had permitted its foreman to direct that the splice should be made between the poles, instead of at or near a pole, it being claimed that the strain would be greater at the intermediate point than at or near one of the poles. But there was no evidence that the company had provided for making the splice at the particular point. It was engaged in the work of constructing a telephone line. It was necessary, and an incidental part of such construction, that the cable should be spliced at the end of each length of cable, and this lineman himself had helped in making such splices on the very day of the accident, besides the one where he was injured. This work the company had intrusted to a competent foreman, with competent helpers. The fact that the foreman may have erred in judgment in directing the splice to be made midway between the poles, instead of at or near one of the poles, in the absence of evidence that experience had demonstrated the unsafety of such construction, so that the company should have made regulations about it, the Supreme Court of New York, Appellate Division, Second Department, holds, Tweed vs. Hudson River Telephone Company, 114 New York Supplement, 607, did not constitute actionable negligence as against the company. This left the only question of negligence to depend upon the question of whether the company disregarded any duty in changing from the three-clamp splice to the two-clamp splice, and in this regard the evidence failed, the court says, to show that a two-clamp splice, properly made, was not a proper and safe splice, or that it was any less safe than the other one. The jury, however, apparently concluded that the fact that this splice pulled apart and injured the lineman entitled him to recover damages, for there was clearly no point at which the company was shown to have neglected any duty which it owed to him. The law does not make an employer an insurer. It calls upon an employe to use his own intelligence in carrying out the details of the work in which he is engaged; and where the master has supplied all necessary materials and has provided a reasonably safe place in which to perform the duties, there is no liability for the mere error of judgment on the part of a foreman in making suggestions as to a detail of the work, unless the case is brought within the provisions of the employer's liability act. And a safe place in which to perform the services does not require the master to superintend each step of the work of construction, to see that at all times the employe has preserved the conditions of safety.

INDUSTRIAL ITEMS.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., announces a change in management of its southern sales office. H. H. Seaman, the former manager, having resigned, A. N. Bentley has been appointed to take charge of this office. Mr. Bentley has had a comprehensive storage-battery experience as the engineer of the Cleveland office.

THE POWER EQUIPMENT COMPANY, Fisher Building, Chicago, Ill., has in stock a number of arc lamps, covering a wide range of selections, which it is offering for sale at very low prices. The company will be pleased to send its bargain sheet on alternating and direct-current arc lamps, and also its list of used steam and electrical machinery upon request.

THE ALUMINUM COMPANY OF AMERICA, Pittsburg, Pa., has recently received an order from the Hydroelectric Commission of Ontario for 1,500,000 pounds of aluminum wire. This company has recently declared a 500 per cent dividend on its capital stock of $3,200,000. In 1908 the entire production of the American Aluminum Company, which controls the bauxite beds of Arkansas, Georgia and Alabama, was 8,200,000 pounds.

THE DUPLEX METALS COMPANY, Singer Building, New York, N. Y., is distributing a unique folder entitled, "How to put conductivity on poles out of harm's way." This circular gives a number of good arguments in favor of copper-clad steel trolley wires, claiming that this wire gives the necessary strength and will outwear a much larger copper wire. Actual figures are given to demonstrate the difference in cost between the two.

THE FLINT & WALLING MANUFACTURING CO., of Kendallville, Ind., has recently placed an order with the Allis-Chalmers Company for additional electrical generating unit to take care of the increased demands of its plant. It consists of an 18 and 30 by 42-inch cross-compound heavy-duty non-condensing engine, operating at 150 pounds steam pressure, direct-connected to a 500-kilovolt-ampere, 480-volt, two-phase, sixty-cycle alternator, with exciter and switchboard.

THE PACIFIC ELECTRIC HEATING COMPANY, Ontario, Cal., has distributed the November number of "Hot Points," which is particularly devoted to holiday goods. The cover design of this publication shows the electric flat-iron manufactured by the company wrapped in an attractive package, the latter being supplied to dealers without additional cost. Numerous other suggestions for the Christmas trade are made, which makes this issue of "Hot Points" very valuable at this time.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., is distributing important information relative to revised navy specifications. These new specifications are known as 17M1 and 17M2 and are for use in all departments of navy yards and stations. 17M1 covers specifications for direct-current electric motors for operating navy yard machinery and supersedes specifications 2M1 issued by the Navy Department, June 1, 1908. 17M2 covers specifications for induction motors for operating navy yard machinery, and supersedes specifications 17M2 issued by the Navy Department October 9, 1908. All 220-volt, direct-current motors and controlling devices for installation in navy yards, and certain 120-volt apparatus for use on shipboard must

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conform to new specifications 17M1. All alternating-current motors and controllers for installation in navy yards must conform to new specifications 17M2. Copies of this circular may be had upon request to the company.

THE HOSKINS MANUFACTURING COMPANY, of Detroit, Mich., well-known manufacturer of electric furnaces and pyrom eters, has developed an electric toaster as the first of a new line of domestic heating appliances. In an interesting circular on "The Cheerie Toastove," as this toaster is called, the company describes, in an unusually cheerful manner for a booklet of this type, the many uses and advantages of this device, which should aid it materially in finding a ready market in a great many homes.

THE MINNEAPOLIS STEEL AND MACHINERY COMPANY has recently received an order for a Muenzel gas-engine and gas-producer plant from the Dakota Gas, Electric Light and Power Company, of Scotland, S. D. This makes five orders received by the Minneapolis Steel and Machinery Company for these gas engines in the last two weeks, the others being the electric-light plant at Milbank, S. D.; the electric light and power plant at Ipswich, S. D.; the electric-light plant at Carthage, S. D., and the electric-light plant at Tyler, Minn.

THE DUNCAN ELECTRIC MANUFACTURING COMPANY, La Fayette, Ind., reports that the past two weeks are the banner ones of the entire year in the sale of its Model E direct-current watt-hour meters. The sales include a number of the new astatic switchboard meters with removable armature, as well as many of the new portable test meters with fly-back pointers. This company is forging ahead in excellent shape, not only in the way of greatly increasing its sales and patronage, but in the quality and standard of its apparatus.

THE ALLIS-CHALMERS COMPANY has received an order from the Lackawanna Bridge Company for twenty-five 220-volt direct-current type "K" motors, for its Buffalo plant. This follows an order given in August for a 200-kilowatt direct-current engine-type generator and twenty-one motors. Those motors were compound-wound constant speed, and with one exception, geared directly to shears and punches manufactured by the Cleveland Punch and Shear Works. Part of the last order of motors is compound wound and part shunt wound, and most of these will also be geared directly to the machines.

THE CHARLES L. KIEWERT COMPANY, Milwaukee, Wis., has recently published two interesting pamphlets devoted respectively to the Alba flaming arc lamps and the Economy pure carbon arc lamps. The Alba lamp works with alternating current of sixty and twenty-five cycles, and direct current in any voltage. The distinctive feature of the Alba arc lamp is the vertical arrangement of the carbons with a large, highly efficient chemical core. The maximum intensity is within thirty degrees from the horizontal, and the distribution makes the lamp desirable for economical and uniform illumination of large spaces. The Economy lamp operates on direct current and is recommended particularly for small and medium-sized spaces. The high efficiency is obtained principally by the use of a very thin cored carbon which produces a long arc and a high current intensity on the carbon tips. Full information concerning these lamps will be furnished upon request.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a new circular descriptive of Pittsburg transformers and illustrating the various types from 0.6 kilowatt to 1,000 kilowatts capacity. This circular shows the various methods of winding employed and calls particular attention to the new type of porcelain bushings and insulation used on the primary leads. The company also has ready for distribution copies of its December price and discount list. This has grown to be a sixty-four-page pamphlet, thus showing the great variety of electrical products handled by this well-known company.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., has recently distributed Bulletin No. 1181, devoted to portable direct-current ammeters and voltmeters. These meters, known as type R, include ammeters and voltmeters operating on the D'Arsonval principle with the permanent magnet and moving coil construction. A unique feature of the type R meter is the single air-gap construction. The moving coil is pivoted so that it swings about one side. The other side swings in a semi-circular air gap of the magnetic circuit. The bulletin describes these meters at length and also contains tables of useful data.

THE ELECTRIC CONTROLLER AND MANUFACTURING COMPANY, Cleveland, O., has recently distributed the November issue of its regular monthly publication, entitled "Common Sense." In addition to the regular entertaining reading matter contained in these publications, this number contains a description of its type "Q" magnetic friction brake for use in connection with electrically-driven machinery, such as hoists, cranes, ore and coal handling machinery, and similar apparatus. This type of brake is particularly adapted in cases where frequent stops and reversals are required and where the safety of the crane or other machinery depends upon the brake employed. A circular showing the various applications of this brake is being sent out in connection with "Common Sense."

DATES AHEAD.

International Independent Telephone Association. Annual convention, Chicago, December 7, 8 and 9.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

Wisconsin Electrical Association. Annual convention, Milwaukee, Wis., January 19 and 20, 1910.

Toledo Electrical Show, Coliseum, Toledo, Ohio, January 31 February 5, 1910.

San Francisco Electrical Exposition, January 29-February 5, 1910.

Philadelphia Electrical Exposition, Philadelphia, Pa., February 14-26, 1910.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) November 23, 1909.

940,654. ART OF NULLIFYING INDUCTIVE DISTURBANCES. William E. Athearn, New York, N. Y., assignor to American Telephone and Telegraph Company. Filed April 29, 1908. The method of arranging for communication, lines employed in inducing neutralizing electromotive-forces in other lines of communication, consists in rendering each of the neutralizing lines electrically continuous independently of its associated neutralizing lines, and providing for the inducing currents a path separate from the neutralizing lines, such path excluding operating currents.

940,655. ELECTRICAL CONDUCTING SYSTEM. William E. Athearn, New York, N. Y., assignor to American Telephone and Telegraph Company. Filed April 29, 1908. The system comprises groups of lines, an induction coil having a primary winding connected to the lines of one group and secondary windings joined to the lines of a second group, and means for preserving the electrical continuity of each line of the primary group independently of the associated lines.

940,658. SYSTEM FOR NULLIFYING INDUCTIVE DISTURBANCES. John A. Barrett, New York, N. Y., assignor to American Telephone and Telegraph Company. Filed April 29, 1908. Signaling conductors are arranged in groups each comprising a number of conductors, and an induction coil having primary and secondary windings is included in different groups and continues the circuit of each conductor independently of the associated conductors.

940,673. TELEPHONE-KEY AND MEANS FOR ACTUATING THE SAME. William Christensen, Belmont, Mass., assignor to American Telephone and Telegraph Company, Boston, Mass. Filed August 26, 1907. In combination with a number of listening keys are means for temporarily locking each key in the listening position. An electromagnetic releasing mechanism is provided for each key, and a contact device is in circuit with all the releasing mechanisms and under the control of the operator.

940,692. TIME-CONTROLLED ALARM MECHANISM. Hilbert W. Howard, Scranton, Pa. Filed January 27, 1906. One of the hands makes successive electrical contacts around the face of the clock.

940,693. TELEPHONE SYSTEM. David S. Hulfish, Chicago, Ill., assignor to McMeen & Miller, Chicago, Ill. Filed December 28, 1906. Each of the call-seeking devices has moving parts adapted to detect a calling line and to stop in registry with the calling line and to identify the calling line to the operator.

940,698. DYNAMO-ELECTRIC MACHINE. Benjamin G. Lamme and Russell S. Feicht, Pittsburg, and George H. Garcelon, Wilkinsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. Filed September 13, 1905. Comprises a primary core member, windings therefor having different time constants, a relatively rotatable secondary core member, a winding therefor and a resistance in circuit therewith, and an automatically operated means serving to cut one of the primary windings out of circuit and also to remove the resistance from the secondary circuit.

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940,734. ELECTROLYTE FOR USE IN ELECTRIC BATTERIES. Wallace J. L. Sandy, London, England. Filed August 22, 1908. The electrolyte is produced by adding to thirty-six fluid ounces of a mixture containing two volumes sulphuric acid, two volumes of hydrochloric acid and one volume of water the following: Thirty-two ounces of bichromate of sodium dissolved in 128 ounces of water and six fluid ounces of a saturated solution of caustic soda.

940,736. VAPOR ELECTRICAL APPARATUS. Harold M. Scheibe, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed January 21, 1909. A starting or tilting magnet for vapor electric apparatus comprises an actuating coil or coils and an opposing coil which is effective when the apparatus is tilted.

940,746. TELEPHONE SYSTEM. Henry B. Stone, Providence, R. I. Filed April 16, 1909. Means are provided for regulating the inductive effect between the windings of a transformer.

940,747. PHASE ADJUSTMENT. William E. Sumpner, Moseley, near Birmingham, England. Filed December 4, 1907. A condenser is included in the circuit of one of the transformer windings.

940,774. APPARATUS FOR TREATING MOLTEN METALS. Francis S. Adams, Leetonia, Ohio. Filed July 22, 1909. Describes a form of electrode furnace.

940,786. AUTOMATICALLY-OPERATED GATE FOR RAILWAY CROSSINGS. William J. Cook, Denver, Colo. Filed May 4, 1908. A gate is operated by an electric motor the circuit of which is closed and opened by a passing train.

940,787. RAILWAY SIGNALING APPARATUS. William J. Cook, Denver, Colo. Filed August 17, 1908. Describes an automatic electric-lamp signaling system.

940,810. COASTING-RECORD DEVICE. Frank Hedley and James S. Doyle, New York, N. Y. Filed January 18, 1909. A coasting record apparatus for cars, trains or the like, includes recording mechanism, a motor controller and a brake controller, and means controlled conjointly by the controllers for controlling the recording mechanism.

940,821. PROCESS OF TREATING ORES. John R. Parks, Spokane, Wash. Filed November 23, 1906. The process of treating ores consists in intermixing pulverized ore with a sufficient quantity of liquid to make a mobile mixture, passing such mixture through a series of electrolytic pans in tandem, excluding any one of said pans from the series while the other pans continue with the operation.

940,831. ASEPTIC LAMP FOR DENTAL, MEDICAL, OR SURGICAL PURPOSES. David Stern, Cincinnati, Ohio. Filed June 1, 1909. An electric lamp is provided with a suitable casing and extension piece, etc.

940,847. ILLUMINATED SIGN. Frederick Ward, Chicago, Ill. Filed January 7, 1909. A sign-moving mechanism is electrically lighted.

940,850. APPARATUS FOR TESTING FLUIDS. Howard B. Bishop, New York, N. Y., assignor to General Chemical Company, New York, N. Y. Original application filed September 5, 1907. Divided and this application filed July 29, 1909. The apparatus described is used to compare the electrical conductivity of a test specimen of gas with that of a standard specimen.

940,881. AUTOMATIC CIRCUIT-BREAKER. William H. Lawrence and Philip Torchio, New York, N. Y. Filed February 9, 1909. In combination with alternating-current generators operating in parallel and equipped with an external reactance coil on each generator lead, is an overload relay on each lead calibrated to operate at a current in excess of the maximum instantaneous short-circuit current of each generator and its external reactance coil in series and arranged to control automatically a circuit-breaker.

940,910. SAFETY ELECTRICAL CIRCUIT-BREAKER. William F. Wocher, Robert L. Lemon and Louis H. Mortsolf, Indianapolis, Ind. Filed April 25, 1908. Has a grounded wire extending into the housing.

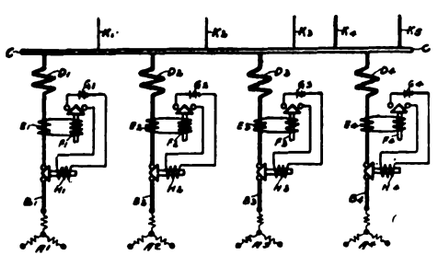
940,972. PROCESS OF MAKING SALTS OF AMMONIA, ESPECIALLY SULPHATE OF AMMONIA. Oliver P. Hurford, Chicago, Ill. Filed December 12, 1908. The process consists in causing nitrogen gas and hydrogen gas to unite under the influence of electric discharges to form ammonia gas in the presence of sulphuric acid, which combines with the ammonia gas to form sulphate of ammonia.

940,994. TELEPHONE SYSTEM. John N. Wallace, La Crosse, Wis., assignor to Vote-Berger Company, La Crosse, Wis. Filed March 22, 1909. A metal-filament lamp is included in the line circuit.

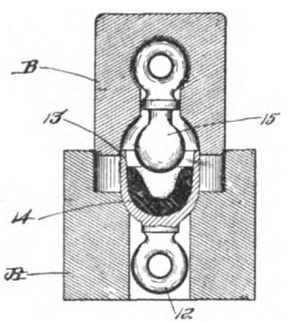
941,002. SAFETY ELECTRICAL CIRCUIT-BREAKER. William F. Wocher, Robert L. Lemon and Louis H. Mortsolf, Indianapolis, Ind. Filed November 30, 1908. Includes an electrical current-conducting circuit, a movable electrical conducting connector for forming the normal circuit, and a movable locking device acting directly with the connector to ground the circuit and also to prevent restoration of the normal circuit when grounded.

941,020. FUSE. Frank G. Jones, Muskegon, Mich. Filed March 11, 1908. The fuse support has near its end an enlargement over which is spun or crimped a ferrule. The fuse wires are connected to the ferrule and are contained in longitudinal channels through the support.

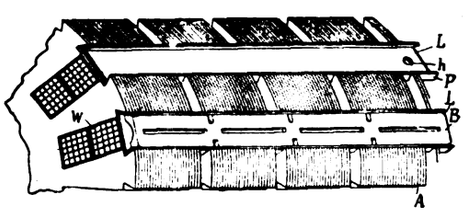
941,032. PROCESS OF MANUFACTURING INSULATORS. Louis McCarthy, Boston, Mass., assignor to the Macallen Company, Boston, Mass. Filed March 6, 1909. The process comprises placing insulating material in plastic state between male and female members and then subjecting the female member to pressure sufficient to shape it while the insulating material is still in plastic state.



940,881.—AUTOMATIC CIRCUIT-BREAKER.



941,032.—PROCESS OF MANUFACTURING INSULATORS.



941,181.—LINING FOR SLOTS OF DYNAMO-ELECTRIC-MACHINE ELEMENTS.

941,086. TELEPHONE ATTACHMENT. Charles B. Mitchell, Franklin, Tex., assignor of one-fourth to Hammet B. Hurt and one-fourth to James W. McCrary, Franklin, Tex. Filed February 19, 1909. Two conducting strips are connected to the two sides of a divided line to constitute the terminals thereof; a contact common to and normally bridging the strips is electrically connected to the speaking circuit; other contacts individual to the strips are electrically connected to the same side of the signal in the signal circuit; and means are provided for moving either strip from the common contact into engagement with its individual contact.

941,113. ELECTRICAL SYSTEM OF DISTRIBUTION. William A. Turbayne, Lancaster, N. Y., assignor to Gould Coupler Company. Filed February 13, 1909. A dynamo-electric machine has an armature core structure provided with two sets of windings, one set being motor windings and the other set being generator windings, and independent field windings are operatively arranged with respect to each of the sets.

941,114. TELEPHONIC SYSTEM FOR AUDITORIUMS. Kelley M. Turner, New York, N. Y. Filed June 1, 1908. Transmitters are distributed at fixed points with reference to each other throughout a given area; receivers are distributed throughout this area and connected in a single circuit; and a switching station is located in a position which commands a view of the entire area, this station being provided with manually-operated means for connecting any one or more of the transmitters with the circuit containing the receivers.

941,124. IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINES. Charles B. Askew, Chicago, Ill. Filed November 14, 1907. The engine governor varies the number of battery cells required.

941,144. SIGNAL. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. Filed December 29, 1908. Comprises a differential gear, a signal controlled by

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one member of the gear, a pair of electromagnets, and operative connections between the other two members of the gear and the two magnets respectively.

941,151. THIRD-RAIL ELECTRIC-RAILWAY SYSTEM. Charles Kozesnik, New York, N. Y. Original application filed October 30, 1906. Divided and this application filed April 18, 1908. Describes the contact-shoe details.

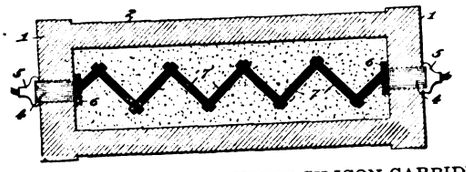
941,157. SPARK-PLUG. Charles A. Martin, Racine, Wis. Filed March 21, 1908. A guard or deflector for a spark plug has an open side and an end piece and is provided with attaching projections, the end piece being in the form of an outwardly extending cone having the apex thereof pointing toward the plug and being planed or cut off to form both a spark orifice and a spark terminal having a thin bordering edge.

941,165. ELECTRIC CUT-OUT. Thomas E. Murray, New York, N. Y. Filed June 18, 1909. A removable circuit-closing plug is adapted to enter between a contact plate and one member of a pair of clip arms.

941,173. ANTISEPTIC MOUTHPIECE FOR TELEPHONES. George Rowlands, Schenectady, N. Y., assignor of one-half to Walter S. Wood, Schenectady, N. Y. Filed June 1, 1909. Has a hygroscopic guard.

941,175. INSULATED RAIL-JOINT. George W. Whiteman, Philadelphia, Pa., assignor to Christian J. Buck, Gallitzin, Pa. Filed March 2, 1909. The walls of the filler bars and splice-bars are recessed and curved to receive insulation between them and the curves of the filler bars.

941,180. BRIDGING-BLOCK FOR DYNAMO-ELECTRIC MACHINES. Frederick W. Young, East Orange, N. J., assignor to Crocker-Wheeler Company, Ampere, N. J. Filed June 2, 1909. An elongated slot-closing bridging block is provided with a forked end.



941,339.—PROCESS OF PRODUCING SILICON CARBIDE.

941,181. LINING FOR SLOTS OF DYNAMO-ELECTRIC-MACHINE ELEMENTS. Frederick W. Young, East Orange, and Edward Heitmann, Montclair, N. J., assignors to Crocker-Wheeler Company, Ampere, N. J. Filed June 5, 1909. An exteriorly insulated metallic trough of high electrical resistance has its sides inclined toward each other, whereby it is constructed to serve as a lining interposed between the walls of a coil-containing slot of a dynamo-electric machine element and a slot-closing bridging-block.

941,182. BRIDGING-BLOCK FOR DYNAMO-ELECTRIC MACHINES. Frederick W. Young, East Orange, N. J., assignor to Crocker-Wheeler Company, Ampere, N. J. Filed July 19, 1909. A slot-closing bridging-block consists of a sheet metal trough and an iron core cast therein.

941,211. APPARATUS FOR PRODUCING AUDIBLE MOVING PICTURES, PIECES OF MUSIC AND OTHER PERFORMANCES. Franz E. Thormeyer, Hamburg, Germany. Filed March 1, 1909. Apparatus for securing synchronous working of two apparatus for producing performances, comprises a driving means for each apparatus, a special independent driving device adapted to control the working of one apparatus and also adapted to be brought into connection with the driving members of the other apparatus.

941,233. AUTOMATIC SAFETY APPLIANCE FOR RAILWAYS. William G. Daring, Pittsburg, Pa., assignor of one-third to Charles B. Henry and one-third to Samuel D. Daniels, Pittsburg, Pa. Filed April 27, 1909. Describes an electric safety signal system for railways.

941,263. RAILWAY SIGNALING SYSTEM. Thomas MacDougal and James M. Chambers, Boulder, Colo., assignors to the Teletopograph Signal Company, Boulder, Colo. Filed June 16, 1908. The signal device is electrically actuated.

941,266. ELECTRIC SWITCH. Waters A. Morse, Westport, N. Y. Filed December 28, 1908. Describes a form of telegraph switch.

941,276. ELECTRICAL RECEPTACLE. Frank J. Russell, New York, N. Y. Filed September 25, 1908. The body has a plug receiving socket, and a wire plug holder having a single spiral holding loop.

941,336. TELEPHONE-CABINET. Charles E. Oxford, Fayetteville, Ark. Filed January 29, 1909. The electrical contacts engage frictionally.

941,339. PROCESS OF PRODUCING SILICON CARBIDE. Frank J. Tone, Niagara Falls, N. Y. Filed June 14, 1907. The process consists in embedding in a charge of silicious and carbonaceous materials a resistance-conductor consisting of a series of separate shaped resistance-pieces of predetermined cross-section and resistance arranged longitudinally in direct electrical contact and supported by the charge, and passing an electric current through the conductor.

941,342. ELECTRICAL SAD-IRON. William A. Braun, Fort Wayne, Ind., assignor of one-half to Fremont L. Jones, Fort Wayne, Ind. Filed January 20, 1908. An expanding member attached to the iron has a movable electric contact in connection with the heating member, with a view to prevent excessive temperature rise.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 29, 1909:

486,888. ELECTRICAL TRANSMITTING APPARATUS. Albert D. Neal, Boston, and Howard F. Eaton, Cambridge, Mass.

486,902. GALVANIC BODY BATTERY. John W. Shults, Wichita, Kan.

486,909. AUTOMATIC TELEPHONE OR OTHER ELECTRICAL EXCHANGE. Almon B. Strowger, Chicago, Ill.

486,916. ELECTRICAL TRANSFORMER. Elihu Thomson, Swampscott, Mass.

486,926. COIL FOR ELECTRICAL APPARATUS. Henry C. Buck, Somerville, Mass.

486,958. ELECTRIC ARC LAMP. Charles E. Scribner, Chicago, Ill.

486,987. ELECTRIC SWITCH. Wm. J. Schultz, Detroit, Mich.

487,002. SAFETY DEVICE FOR ELECTRIC CIRCUITS. George Cutter, Chicago, Ill.

487,022. ADJUSTABLE ELECTRIC-LIGHT HOLDER. Leroy S. Pfouts, Canton, Ohio.

487,046. ELECTRIC-LIGHT CARBON. James Clegg, London, England.

487,049. INCANDESCENT LAMP. Johannes H. F. Gorges, Berlin, Germany.

487,069. DEVICE FOR TRANSMITTING MOTION FOR ELECTRIC STREET-CAR MOTORS. Walter E. Harrington, Atlantic City, N. J.

487,070. ELECTROMAGNETIC PULLEY. Walter E. Harrington, Atlantic City, N. J.

487,092. ELECTRIC SWITCH. John J. Nate, Chicago, Ill.

487,093. ELECTRIC CURRENT INDICATOR. Chas. P. L. Noxon, Syracuse, N. Y.

487,095. AUXILIARY FIRE-ALARM-SIGNAL APPARATUS. Chas. E. Scribner, Chicago, Ill.

487,096. MULTIPLE-SWITCHBOARD SYSTEM. Chas. E. Scribner, Chicago, Ill.

487,097. TELEPHONE-EXCHANGE SYSTEM. Chas. E. Scribner, Chicago, Ill.

487,098. TELEPHONE-SWITCHBOARD APPARATUS. Chas. E. Scribner, Chicago, Ill.

487,102. DEVELOPMENT AND DISTRIBUTION OF ELECTRICITY. John S. Stone, Boston, Mass.

487,109. AUTOMATIC ELECTRIC-LIGHTING APPARATUS. Leonidas G. Woolley, Grand Rapids, Mich.

487,114. ELECTRIC LOCOMOTIVE. Conrad M. Conradson, Madison, Wis.

487,128. BURGLAR ALARM. Harry W. Reynolds, Long Branch, N. J.

487,154. TELEGRAPHIC APPARATUS. Josiah A. Parker, St. Louis, Mo.

487,176. PROCESS OF ELECTRODEPOSITING ALLOYS. Sherard O. Cowper-Coles, London, England.

487,185. ELECTRIC BELT. John H. Johnson, Dodgeville, Wis.

487,219. TELEPHONE. Hammond V. Hayes, Cambridge, and Wilton L. Richards, Malden, Mass.

487,220. ELECTRODE FOR ARC LAMPS. Chas. W. Hazeltine, St. Louis, Mo.

487,227. ELECTRICAL TYPEWRITER. Albert D. Neal, Boston, and Howard F. Eaton, Quincy, Mass.

487,228. ELECTRIC TYPEWRITER. Albert D. Neal, Boston, and Howard F. Eaton, Quincy, Mass.

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CONTENTS.

EDITORIAL:
Minimum Charge Decisions by the Massachusetts Commission...1115
The Propulsion of Steamships 1117
Marconi's Work in Wireless Telegraphy Rewarded by Nobel Prize...1118
Lectures at the Stevens Institute....1118
Denver Electric Club Organizes....1118
New York Public Service Commission Seeks Large Appropriation....1118
A New Long Distance Transmitter....1118
International Independent Telephone Association—Annual Convention at Chicago 1119
Telephone Inquiry in New York....1119
Telephoning en Tour 1119
November Meeting, Pittsburg Electric Boosters' Club....1120
Chicago Electric Club 1120
Methods and Costs of Underground Conduit Construction....1121
Compound Voltmeters for Indicating the Tension at the Distant End of Feeders 1124
The New Congressional Heating, Lighting and Power Plant at Washington 1125
Important Telephone Merger....1127
ELECTRICAL NOTES FROM GREAT BRITAIN....1128
The Melville and Macalpine Reduction Gear....1130
CENTRAL STATION PRACTICE:
A Rational Method of Installing Service Meters....1131
New York Interior Wiring Rules....1132
Some Remarks on District Steam Heating....1133
Development of Electrical Undertakings....1134
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
The New Down Town Street-Lighting System of St. Louis....1136
November Meeting of the New York Electrical Society....1138
The Methods of Comparing Our Various Sources of Artificial Light 1138
Determining the Degree of Vacuum of Incandescent Lamps....1140
INDUSTRIAL POWER:
The Electric Propulsion of Ships....1141
Increasing Farm Production by Electricity....1142
A Remarkable 7000 Horsepower Electric Rolling-Mill Motor Equipment 1144
An English Wired Turbo-Electric Plant....1145
ELECTRICAL ADVERTISING AND SELLING:
Getting After Unwired Houses....1146
The "Electric Shop" Brochure....1149
Some Effective Booklets of Central Stations....1150
Growth of Easton Gas and Electric Company....1150
QUESTIONS AND ANSWERS....1151
FINANCIAL REPORTS OF ELECTRICAL COMPANIES....1152
INDUSTRIAL SECTION:
The Electric Drive for Printing Establishments....1154
The Wesel-Westinghouse Electric Matrix Drying Table....1155
New Type of Electric Toaster....1155
An All-Porcelain Pothead 1156
New Type of Tailor's Goose....1156
A Department Store Pneumatic Cash System and Motor Equipment 1157
The Federal Vacuum Cleaner....1158
CURRENT ELECTRICAL NEWS....1159
DIRECTORY OF ELECTRICAL AND ALLIED ENGINEERING AND SCIENTIFIC SOCIETIES 1166
RECORD OF ELECTRICAL PATENTS....1168

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MINIMUM CHARGE DECISIONS BY THE MASSACHUSETTS COMMISSION.

An important decision respecting the minimum monthly meter charge of the Edison Electric Illuminating Company of Boston has been handed down by the Massachusetts Gas and Electric Light Commissioners, acting under an appeal of Joseph J. Leonard and others, and following several hearings on the matter which developed considerable information of technical interest. The petitioners are customers of this company, with offices scattered through one of the larger buildings of the city, and they claimed that the minimum meter charge of $1.00 per month per meter is excessive, and should be reduced or abolished. The petitioners conceded during the hearings, however, that some, though lesser, minimum charge was reasonable.

The Commissioners state that the charge is, strictly speaking, one imposed upon all customers whose actual consumption falls below a certain amount. It appears to be as much for the purpose of raising revenue as the price per kilowatt-hour in force for energy consumed. As a revenue producer, however, the minimum monthly charge is almost a negligible factor. In the case of the Boston company, the receipts from this charge in 1908 were only $20,000 out of $4,000,000 total revenue.

Regarding the company's arguments, the Board summarizes them under two headings, first, that the minimum charge was essential to return the actual expense due to the maintenance of a meter, and second, that it saves the company from a costly and substantial increase in dead investment. The company figured that the annual expense of maintaining a meter for a customer paying a minimum monthly charge was $7.25, to which should be added forty kilowatt-hours at the prevailing maximum net rate, or $4.80 worth of energy per year, making the total cost of meter maintenance, including fixed charges, testing, repairs, reading, depreciation and loss of lamps, accounting and billing, postage and stationery, $12.05 per annum. This consumption of forty kilowatt-hours per year arises from the excitation of the shunt coil of the meter so long as the instrument is connected to the company's lines, and the company argued that it was fair to charge for this, not the cost of the energy at the busbar of the generating station, or even at the consumer's terminals, but the revenue which the company might have derived from its sale, since all current which was thus diverted to excite the meter field was then and

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there forever lost as a source of income to the system. The Commissioners emphasize, however, the great difficulty of accurately determining the average expense of maintaining a meter on the premises of a consumer who uses little electricity, quite apart from the possibility of getting an average figure for the maintenance of the meters on the system as a whole.

The Board says, in regard to the effect of the minimum charge in preventing the accumulation of dead investment, that there is a real and important purpose of the charge. Nevertheless, it holds that the company is bound to supply even small and occasional users without imposing a minimum charge unreasonable and prohibitive in amount. The Commissioners regard the minimum charge, especially on a large and well-established central-station system, as of more consequence to the general body of the consumers than to the company itself; for, if there should be a too rapid growth of a company's business where under present conditions no substantial demand exists, the promotion of electrical applications and use may be hampered. Respecting the present charge the Board states that no increase in the amount should be allowed, and that a smaller amount might be desirable. Whatever hardship arises comes mainly because the charge is imposed in certain months without regard to the fact that the same customer may use considerable electricity in other months and throughout the year on an average of more than the monthly minimum.

Again, the Commission points out that there has been a law on the Massachusetts statute books for about twenty years permitting the imposition of a minimum charge of $7.00 per year for a gas meter. The law states that "no charge for the use of a meter during any portion of any twelve consecutive months shall be made if the consumer during said time uses gas to the value of seven dollars." There has been no serious demand for the repeal or modification of this law since its enactment.

The Commissioners show that the reasons for permitting a charge in the gas business have even greater force in electrical supply. Certain elements of cost are relatively greater in electrical service. Hence the Board recommends that if the company shall continue to impose a minimum monthly charge upon its customers who pay the maximum prevailing net price, such charge shall not exceed $1.00 per month per meter; and that, if on any June 30th it shall appear that a customer has, by reason of the minimum charge, paid or become liable to pay during the year immediately preceding an amount exceeding the minimum monthly charge multiplied by the number of months in which he has been a customer of the company and an average price for metered electricity exceeding the prevailing maximum net price per kilowatt-hour, the company shall refund all such excess.

It may be noted in conclusion that the Board states that nothing in its recommendation is to be construed to require the company to render its service at an average price per month less than the minimum monthly charge or at an average price per kilowatt-hour less than the prevailing maximum net rate.

The Gas and Electric Light Commissioners of Massachusetts have also rendered an important decision on another phase of the same subject, this being a case involving the minimum electric rates in use in the town of Leominster. Both the facts and the conclusion of the Commissioners are sufficiently stated in the following quotations from their opinion:

"On May 29, 1909, * * * the Board recommended that on and after the first day of June, 1909, the net price charged by the Leominster Electric Light and Power Company for electricity shall not exceed sixteen cents per kilowatt-hour. * * *

"It appeared that on June 1, 1909, the company discontinued the schedule of prices for commercial lighting * * * and adopted, in place thereof, a gross price of eighteen cents per kilowatt-hour, with a discount of two cents per kilowatt-hour for prompt payment and a minimum monthly charge of $1.00. No change was made in the power rates, which are set out in detail in the Board's decision, and include a monthly service charge based upon the horsepower of the customer's motor, independent of and in addition to the charge for the current consumed. * * *

"In illustration of the effect of this method of charging, it appeared that for the month of June the town was charged $1.00 for a school-house to which no electricity was supplied, $1.00 for a stable to which three kilowatt-hours of current were supplied for light, $5.54 for another school-house to which eight kilowatt-hours were supplied for power, and $5.77 for the same school-house to which thirty-four kilowatt-hours of energy were supplied for power through another meter. * * * The important question is whether or not the company is now fairly complying with the recommendation of the Board.

"During the hearings in the original case there was no complaint of the minimum monthly charge of $1.00 made to the lighting customers. A charge of this character is a common feature of electric light schedules. It is not a service charge or meter rent imposed in addition to the actual charge for current. * * * The monthly service charge made to power customers is of a different character. It is plain that this charge may, indeed has in two cases already described, compelled a small user of power to pay much more than sixteen cents per kilowatt-hour for electricity supplied by the company. Complaint was made of this charge at the hearings in the original case and was met by the company, to some extent at least, by raising a question as to the Board's jurisdiction over rates for this kind of supply.

"This question was considered and discussed in the decision of the original case. The Board pointed out that its duty under the statutes seemed to be to determine 'the fair price at which the company is bound to supply electricity to

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any one who may apply for whatever use,' and that if there are to be differentials in rates, 'they must be upon the initiative of the company rather than the Board.' * * * In view of these facts any scheme of rates which, otherwise than through the monthly minimum charge of $1.00, may in its operation cause the price of electricity for any use to exceed sixteen cents a kilowatt-hour, is not, in the opinion of the Board, a fair compliance with its recommendation. * * * The Board therefore recommends, in furtherance of its decision of May 29, 1909, that the company immediately offer to sell electricity for any use at a net price not to exceed sixteen cents per kilowatt-hour, with such minimum monthly charge not exceeding $1.00 per month as it is now employing with respect to its lighting customers; that the company adjust with its customers, who elect to be served at the rate fixed by the Board, any excess actually charged them over and above the amount which they would have been charged had the foregoing recommendation been put in force on June 1, 1909; that, if a customer elects to be served under such other schedules for light or power as are now or may hereafter be in force, whenever the charges for such service for any year thereunder aggregate more than sixteen cents per kilowatt-hour for the electricity so supplied to him, the company shall restore to him such excess; and that the company shall, as promptly as is consistent with the fulfillment of current contracts, if any exist, discontinue giving or offering any advantage to one customer not open to all who enjoy or seek the company's service under like conditions."

THE PROPULSION OF STEAMSHIPS.

Much has been written of late on the subject of steamship propulsion, and many excellent papers have recently been read before the various engineering societies showing forth the possible advantages of systems involving more or less radical changes from existing practice. The remarkable performances of some recent ships fitted with steam turbines, have elicited a great deal of praise from the advocates of the steam turbine, and much criticism from some others who are not so enthusiastic.

Two noteworthy contributions to the controversy appear on other pages of this issue,—one an article by Engineer Vice-Admiral H. J. Oram, of the British Navy, on "The Electric Propulsion of Ships," extracted from his presidential address, "Propelling Machinery of Warships," delivered at the recent inaugural meeting of the Junior Institution of Engineers, in England,—and the other an article entitled "The Melville and Macalpine Reduction Gear," the material for which was obtained mostly from a pamphlet written by Mr. George Westinghouse, head of the Westinghouse companies in America. Both of these men are unquestionably of the highest authority.

Vice-Admiral Oram, while elucidating no new features in the problem of the electrical propulsion of ships, presents a remarkably dispassionate and critical review of the situation, and his observations will be read with much interest.

Mr. George Westinghouse also speaks with the weight of much authority, although some of his observations on the performances of steam turbines already installed in large steamships, are not quite in accord with the facts of the case. For instance, in the pamphlet referred to above, Mr. Westinghouse says: "From the best information obtainable, it is believed that the steam consumption of the *Mauretania* and *Lusitania* cannot be less than 14.5 pounds per shaft horsepower per hour, while it has been demonstrated beyond question that in turbines of similar capacity operating at speeds which the reduction gear makes possible for marine service, the steam consumption does not exceed 11.0 pounds per shaft horsepower per hour."

This would seem to infer that the best type of steamship turbine was not capable of working at an efficiency greater than 14.5 pounds of steam per shaft horsepower per hour, whereas Vice-Admiral Oram, in another part of his presidential address to the Junior Institution of Engineers, states that in the three British warships of the *Indomitable* class, an efficiency of 12.0 pounds of steam per shaft horsepower per hour is attained with the engines working at full power. This would not, however, invalidate Mr. Westinghouse's claim that the reduction gear would not effect a considerable economy, although it would appear that the economy would not be quite so great as he supposes. Of course the real problem, with warships having turbine engines, is the present apparent necessity for separate cruising turbines, which, if the reduction gear were employed, would not be needed.

Although the results attained by the Melville and Macalpine reduction gear are undoubtedly phenomenal, it is impossible to state definitely at this time whether or not the gear would be successful in a prolonged test under actual working conditions as obtain at sea. Until such a test has been carried out for many months on a sea-going vessel of great power, it is questionable whether existing and projected shipbuilding plans will be much disturbed.

The same remarks also apply to the various electrical methods of ship propulsion that have been proposed, although much is expected of designs employing producer plants and internal-combustion reciprocating or turbine engines coupled by electrical generators and motors to the propellers. However, there is no means of knowing how any of these things will work until they are tried.

Mr. Westinghouse's performance in proposing and financing the proposition of evolving a workable reduction gear, is much to be commended, and it is to be hoped that his efforts and those of the clever inventors he has sponsored, will ultimately be crowned with the success they deserve. Even if the gear should not be an unqualified success at sea, there seem to be plenty of opportunities for it in machine shops and factories on land.

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Marconi's Work in Wireless Telegraphy Rewarded by Nobel Prize.

The Nobel prize for physics has this year been awarded to William Marconi for his extended researches and developments of wireless telegraphy, and also to Professor F. K. Braun of Strasburg University, Germany, for his researches in radio-activity. The Swedish Academy of Science, to which is given the duty of annually selecting the scientists and great public leaders whose work has been of the greatest value to the human race, was unable to decide in regard to the prize for physics between these two men, and therefore decided to award the honors between them.

This prize amounts annually to about $40,000. Since it was divided this year, each of the two recipients will receive $20,000. The prize will be awarded formally on December 11 at Stockholm, Sweden.

The honor that has come to Mr. Marconi is a peculiarly appropriate recognition of his very effective work in developing wireless telegraphy. The main facts connected with his career are common knowledge.

William (Guglielmo) Marconi was born April 25, 1874, near Bologna, Italy. Before he had reached the age of twenty he was already something of an inventor, as he had devised an apparatus by which he sent signals through the walls of his father's house without the use of any connecting wires. In the few years following 1894 he lent himself entirely to his experiments on wireless telegraphy, and when he went to England in 1897 he was already prepared to send messages five miles. Since that time the extension of the distance that could be covered has been progressing steadily with improvements in his apparatus. October 17, 1907, was marked by the beginning of regular transatlantic communication by means of wireless telegraphy between the Marconi stations at Clifden, in Ireland, and at Glace Bay, Nova Scotia. The work of Marconi and the importance of wireless telegraphy attracted considerable attention when the steamer *Republic* was saved through the aid of wireless telegraphy after a collision last winter. This showed the immense value of the radio-graphic equipments for all maritime vessels. Although many have taken prominent parts in the rapid progress of wireless telegraphy, to Marconi doubtless belongs the greatest credit for making it a commercial success.

Lectures at the Stevens Institute.

The Stevens Institute of Technology, Hoboken, N. J., possesses an enterprising engineering society which is affiliated with the American Society of Mechanical Engineers. This society has recently issued a neat little pamphlet containing a programme of lectures announced for the session of 1909-1910. This list of lectures is so good that the dates ahead are given in full below, and it will be noticed that the speakers are nearly all men of national prominence in the engineering industries:

December 14, "Essentials of Naval Efficiency in an Age of Engineering," by Rear-Admiral G. W. Melville.—January 4, "Engineering Efficiency," by Henry G. Stott.—January 11, "Warfare of the Future," by Hudson Maxim.—January 18, "Features of Electrical Development," by T. Commerford Martin.—February 8, "Pavements for City Streets," Samuel Whinery.—February 15, "Power Plant Economies," by David S. Jacobus.—February 21, "The Engineer as a Manager," by Henry L. Gantt.—March 1, Lecture by John F. O'Rourke.—March 8, "Automobiles," by Herman F. Cuntz.—March 15, Lecture by W. J. Hammer.—March 22, "Arts and Industries of the Orient," by Charles R. Richards.—March 31, "The Gyrostat and Its Applications," by George V. Wendell.—April 5, "The Theory of Gyroscopic Motion," by Louis A. Martin.—April 12, "Methods and Systems in Relation to Handling Concrete Work," by Frank B. Gilbreth.—April 19, "Notable Examples in Modern Construction," by John C. Ostrup.—April 26, "Development of the New Navy," by Naval-Constructor David Watson Taylor, U. S. N.—May 3, "Immortality," by Charles F. Kroeh.—May 10, "The Contributions of Photography to Our Knowledge of the Stellar Universe," by John A. Brashear.

Each lecture is timed to begin at 4:10 p. m., and it will be noticed that all the above dates are on Tuesday.

Denver Electric Club Organizes.

Following the excellent practice of the electrical men in our large centers to organize into clubs for weekly meetings of a social and business character, the leaders of the electrical fraternity in Denver have started a movement for the organization of the Denver Electric Club. The originators of the idea were C. F. Oehlman, of the Denver Gas and Electric Company, and J. B. Griffith, of the Nernst Lamp Company's Denver office. At a luncheon held at the Chateau Lafayette in Denver, on December 1st, the project took definite shape and was enthusiastically received by an aggregation of nearly thirty prominent representatives of the Denver electrical interests who were present. It was decided to hold the first regular meeting on December 8 in connection with a luncheon to be given at the Kaiserhof Hotel. At this meeting the organization will be perfected and the officers elected.

New York Public Service Commission Appropriation.

To carry on its work next year and perform the duties prescribed under the law of 1907, the New York Public Service Commission, First District, has laid before the Board of Estimate and Apportionment of New York city a requisition for $1,093,274. The letter in which this sum is asked for details the chief classes of expenditure by the commission. For special purposes the sum of $58,300 is asked, and $25,000 for contingencies, but apart from the regular maintenance charges the great bulk of the total, amounting to $931,994, is to be apportioned to the class which includes executive, engineering, statistics, franchises, gas and electricity, legal and transportation bureaus, salaries and disbursements, including stationery, library supplies, printing, maps, plans and engineering supplies.

The grand total to be provided by the Board of Estimate does not, however, cover the entire cost of the commission, as the salaries of the members of he commission, their counsel and secretary are paid by the State of New York. The commission further states that no estimate can be made now and additional requisition will be necessary hereafter for the expenses of legal proceedings in getting consents for rapid transit routes and other incidental charges.

A New Long-Distance Transmitter.

The London *Electrician*, quoting the *Austrialian Mining Standard*, states that M. Moloney, of the staff of the Auckland (N. Z.) telegraph office, has invented, in conjunction with John Ross, of the Christchurch (N. Z.) office, a long-distance telephone transmitter known as the "tandem looseback," which he proposes to place before telephone experts in England. The transmitter is a device constructed on the principle of the human ear, and it is claimed for it that by means of it long-distance telephoning is greatly facilitated, and for ordinary use conversations can be carried on in whispers by persons using the telephone in crowded rooms where others are talking. It is Mr. Moloney's intention when in England to ascertain whether or not his invention has been forestalled, and, if not, to place it on the market. It is also stated that Mr. Ross intends visiting the United States in order to place the invention before the telephone companies in this country.

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INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION.

ANNUAL CONVENTION AT CHICAGO, DECEMBER 7, 8 AND 9.—FIRST DAY'S PROCEEDINGS.

In view of the recent mergers and rumors of combinations that have aroused the independent telephone interests throughout the country, the annual meeting of the International Independent Telephone Association, which began on December 7 at the Auditorium Hotel, Chicago, Ill., has attracted an unusual amount of interest.

The meeting, at which about 200 members were present, was opened by Vice-President P. C. Holdoegel, who introduced B. J. Mullaney, secretary to Mayor F. A. Busse of Chicago. Mr. Mullaney's short address of welcome to the association was responded to by Hon. E. B. Fisher of Grand Rapids, Mich., who has for many years been associated with the development of the telephone business.

Owing to the death of his business partner, President E. H. Moulton, of Minneapolis, Minn., was unable to be present, and therefore the secretary was called on to read the presidential address, which was a report of the progress made in the past year. The figures presented were in part obtained from the United States census and showed that the year 1909 was the most important in telephone development of any during the past twelve years.

It was an unexpected pleasure to hear Herbert H. Houston, vice-president of the Doubleday-Page Company, on the subject of advertising the telephone business. After giving some figures on the amount of advertising the Bell Telephone companies have been carrying, he gave estimates on the probable cost of an advertising campaign which could be carried out by the independent association.

The afternoon session was set apart as a technical and operating conference. Gansey R. Johnson read an outline programme of the session and mentioned a few papers which would be presented. The programme proper was opened by a talk on "Scientific Business Methods," by Harry N. Tolles of the Sheldon School of Chicago, in which he mentioned various ways of increasing the efficiency of the personnel of a company through salesmanship education.

The subject of education was discussed further by Prof. Arthur Bessey Smith, of Purdue University, in a paper on "The Telephone and the School." Professor Smith deplored the fact that the independent companies did not secure enough technically educated men, who could doubtless aid the company to a considerable extent.

Professor Volney D. Cousins, also of Purdue, read a paper on "Telephone Problems and Suggestions," in which he impressed the value of practice as a necessary addition to the technical training of an apprentice. Some telephone companies already offer such apprenticeship courses.

Following along the educational line Kempster B. Miller dealt with the "Economy of Proper Engineering," showing how such engineering could he carried out by properly trained men. When the properties of a telephone company are not showing proper dividends, it is the duty of the engineer to gradually bring about operating conditions which will allow of a better profit. Forecasts of the service expected in five or in twenty years must be made, and the equipment must be such as to meet this service demand with the least alteration.

After a brief discussion of Mr. Miller's paper the meeting was adjourned until Wednesday morning.

The report of the Wednesday and Thursday sessions of the convention will be given in the next issue.

Telephone Inquiry in New York.

An investigation of the companies doing business in the city of New York is now in progress, and, from the amount of work mapped, will probably last six weeks longer. The committee, composed of Senator George A. Davis of Buffalo, Senator James Frawley of New York city, and a number of others has been appointed to examine conditions carefully and to decide whether telegraph and telephone companies should be subject to the Public Service Commission.

Any officials of the various companies can, by act of Legislatue, be compelled to appear before the committee and must on request allow inspection of the company's books. Furthermore, any subscriber who has a real or imaginary grievance is invited to explain it.

The recent telephone merger, which involved a $50,000,000 bond issue, is also to be investigated with respect to the possibility of over-capitalization and the benefits to be derived by the public from the combine. Should it be found that the Western Union and the Postal Telegraph companies are working under a secret rate agreement the committee is at liberty to recommend steps toward the breaking up of the combine.

Telephoning En Tour.

Something new in telephone work during an automobile run was developed the other day in Texas. One of the numerous reliability runs was conducted between San Antonio and Dallas. Among the entrants was D. A. Walker, the president of a telephone company, with a big Rambler car carrying a portable telephone.

By means of a long fishing pole with a hook at the end Mr. Walker was enabled at any time to ring up any connecting point along the lines without getting out of his car.

The usefulness of this member of the touring party can be appreciated by some of the things which Mr. Walker did for the party en route. One day, while many miles from any station, he made arrangements for the Governor of Texas to be entertained by the auto men at dinner where the night stop was made. If the car broke down the wire along the roadside was tapped and messages for relief were promptly sent. Points ahead were kept well informed of the progress of the cars, from time to time, and the usefulness of the plan was demonstrated many times.

Manhattan Bridge Opening.

It is announced that the roadway of the new Manhattan Bridge connecting the boroughs of Manhattan and Brooklyn, New York city, will be opened on December 24. No elaborate celebration in connection with the event has been planned. The mayor and several city officials will be driven across the roadway, and it will then be thrown open for vehicle traffic. Neither the footpath nor the railroad tracks will be ready for some time.

The work of changing the grade of the Second Avenue Elevated road so as to permit the bridge to cross over the tracks in Division Street has been completed.

Nothing has been done regarding railroad transportation across the new span. The plans provide for eight tracks, two on each side of the roadway.

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November Meeting Pittsburg Electric Boosters' Club.

A brief mention of the meeting of the Pittsburg Electric Boosters' Club that was held on November 29, was made in these columns last week. Further details regarding this meeting and about this unique club have been received and from these the following has been prepared:

The Pittsburg Electric Boosters' Club includes in its membership representatives of all of the electrical interests in Greater Pittsburg. It is organized on the lines of similar clubs in other cities, and yet embodies in its essentials distinctive points among which may prove of interest the designations given to its officers, who are as follows: L. J. Kiefer, master controller; A. H. Harris, auxiliary master controller; Ludwig Hommel, recording wattmeter; C. B. Cushing, master electrotype.

The club has monthly meetings, usually spoken of as "short-circuits," and a weekly dining club. About 150 members were present at the meeting, which was held at the Hotel Duquesne in Pittsburg.

A. P. Munning, the general sales agent of the Cutler-Hammer Manufacturing Company, addressed the club on this occasion on the subject of "Seventeen Years of Development in the Controller Industry." In introducing Mr. Munning, President Kiefer referred to his long connection with this phase of the art, dating from 1892.

The speaker first touched on the fact that with the development of power-saving appliances when used with electric motors, the question of proper controllers had become so important as to practically dominate to a large extent the use of motor appliances, comparing it in this respect with conditions existing seventeen years ago, when the controller was looked upon as purely a necessary evil in connection with the motor, and was designed essentially by rule of thumb. For instance, in 1892 a one-horsepower, 220-volt starting rheostat, without any automatic features, sold for approximately $20 to $25, its dimensions were 24 by 24 by 18 inches, and its weight about sixty pounds; today the same device with automatic features sells for approximately $3, its size is 9 by 9 by 4 inches, and its weight 11 pounds.

Mr. Munning referred at some length to the development period occurring between 1892 and 1896, and beginning with a very simple automatic release, he outlined the various steps which had taken place since that time in the design and manufacture of controllers up to, for example, the intricate and massive controllers at present employed in steel-mill service at Gary, Ind., and at Aliquippa. As an instance, he spoke of the 1,500-horsepower, 220-volt, multiple-lever type speed regulators used at the Edgar Thomson works of the Carnegie Steel Company, where the final contacts on the controller are arranged to carry 10,000 amperes, and the resistances for each controller consist of approximately 5,000 feet of culm T rails. He also referred to the extensive use of self-starters in connection with compressors, valve-control systems, etc.

In reference to the subject of printing-press control, Mr. Munning described in a general way the types of controllers used for this purpose, beginning with the Hoe sextuple and octuple presses down to the simplest form of controllers for presswork used with the ordinary cylinder or flat-bed types.

In the use of larger motors for steel-mill work, attention was called to the application of the series-relay type of controller, and the speaker stated that before the advent of this construction, mill tables were not as successfully operated, since the drum-type control previously employed involved a much greater strain on the machinery, required harder service on the part of the operatives, and involved the use of a larger amount of time than with the new types. It was pointed out that the motors on mill tables are often required to be reversed from full speed in one direction to full speed in the opposite direction under full-load conditions in from three to four seconds, approximately seven times per minute, for twenty-four hours per day and six days per week, all of which required the most rugged types of controller construction that could be designed.

Mr. Munning also spoke of such uses of controllers as those in operation for ringing the chimes in the Metropolitan Tower of New York, operating the lighting circuits at the New York Hippodrome, and operating the turret-turning gears for the newer battleships of the United States Navy, and pointing out that practically the only limit to the use of controllers was the application of motors. Emphasis was placed on the fact that the controller industry has now become so distinctly specialized that one manufacturer alone in this field has now listed in his catalogue 3,000 standard types of controllers, and was manufacturing from 4,500 to 6,000 special controllers per annum.

When the large number of companies manufacturing controllers as a specialty is considered, some idea of the volume of this business can be gained. The manufacture of controllers and their specialization had become the crux of the motor situation, for in order to make new applications of motors, and have present applications perform their functions correctly, the controller is the vital point in most operations where predetermined cycles must be obtained.

Chicago Electric Club.

The meeting of the Chicago Electric Club on Wednesday, December 1, was a departure from the regular schedule, it being devoted to a business session. The reports of the secretary, treasurer, membership committee, speakers' committee and civic committee were read and adopted.

In the order of new business a motion was made and carried that the club hold an entertainment in the near future, the details of which are to be arranged by the entertainment committee. This committee is to report the result of its work to the club at its next weekly meeting. Much discussion ensued regarding the financial end of the entertainment, some members desiring the club to stand the expenses while others contended that tickets should be sold to defray expenses. The question was finally settled by a motion, which was subsequently passed, to the effect that the club guarantee fifty dollars to apply towards the expense of the entertainment, the balance to be provided by the sale of tickets.

C. S. Howlett, formerly president of the club, was present and following the business session delivered a brief address in which he compared similar electric clubs in the East with the Chicago Electric Club and drew the conclusion that he has visited no other club which could claim the same congenial membership as the Chicago Electric Club.

Late newspaper reports state that the Chicago & Milwaukee Telegraph Company has been bought by the Continental Telephone and Telegraph Company, thus affording an entrance into Chicago for independent telephone and telegraph lines.

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METHODS AND COSTS OF UNDERGROUND CIRCUIT CONSTRUCTION.

BY CLARENCE MAYER.

As the purpose of this article is to compare methods and cost of constructing underground conduits for electric transmission lines and railway signal lines, the construction of manholes, while strictly a part of underground conduit work, will not be treated because the great variety of designs, materials and methods really requires a separate article for their description. Besides, no true comparison of manhole construction methods and cost could be made, as manholes of different designs and sizes are required for street railway, electric light and power, telephone, telegraph, and railway signal conduits.

FIG 1—USE OF IRON PIPE CONDUIT ON A BRIDGE.

This does not hold true of conduits itself; for a conduit which is free from deterioration, proof against electrolysis and fire, has a smooth bore, and is quickly and cheaply laid, is practical for all classes of underground electrical transmission. These are fundamental axioms, and will readily be accepted without question.

In this article the writer will give his conclusions from the result of his experience in the actual construction of several million duct feet of underground conduit. In this work careful cost data were collected on the installation of more than 600,000 trench feet of city and country conduit work, involving both large and small jobs and many kinds of conduit construction under many sorts of conditions.

For the information of those who have never given underground conduit work much thought, a brief description of the most prominent kinds of duct now installed may be pertinent. These may be roughly divided into three classes: First, conduits of metal material; second, conduits of vegetable material; third, conduits of silicious material.

In the first class are wrought-iron pipe and cement lined wrought-iron pipe.

In the second class are paper or fibre conduit and creosoted pump log.

In the third class are cement or stone conduit, single and multiple vitrified clay conduit, and monolithic concrete or cement conduit.

Conduit of metal material is rarely used except for continuing conduit over a bridge or trestle, for terminating a lateral, or for short subsidiary conduit. Its cost and corrosiveness makes its use almost prohibitive. (See Fig. 1.)

Although several types of monolithic conduit have been installed in recent years, mostly in St. Louis, this kind of conduit has some disadvantages. These are the length of time required for its installation, the difficulty of breaking into it without injuring cable where repairs are to be made due to a bad burnout or where an additional manhole or service box is required, the difficulty in securing the experienced labor required in monolithic construction, the expense of such labor and the liability of heterogeneous and defective construction incident to all molded concrete and cement work which must be done quickly and underground.

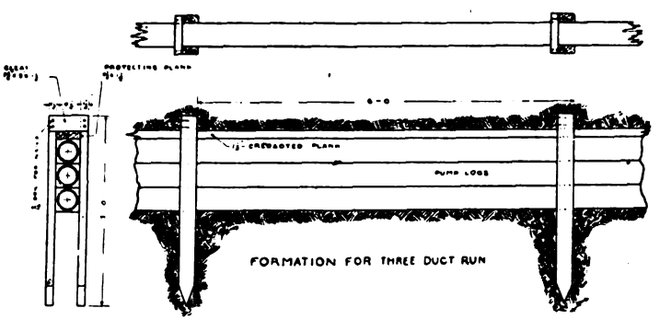

FIG. 2—VARIOUS SECTIONAL VIEWS OF PUMP LOG CONSTRUCTION.

The length of time required to install conduit is important not only from a standpoint of cost and utility, but also because work in city streets must be quickly completed to avoid interruption of traffic and complaint of property owners. In practical conduit work it rarely happens that the cement or concrete work is without defects, except, perhaps, where the work is very carefully done by experienced and skilled men which means additional time and cost.

It has been found that different batches of concrete are not always uniform in composition or consistency. It is therefore obvious that any conduit which is built entirely of this material is liable to be defective. Another negative feature of monolithic concrete conduit is that it is not entirely electrolysis-proof.

This latter objection is also made against cement or stone conduit and it is a very important objection, for the great damage done to underground cables by the ravages of electrolysis amounts annually to a large sum of money, irrespective of the losses through interruption of service incident to such cable injury.

Concrete is generally porous enough to allow saturation of the mass by the acid and alkali solutions constantly present under streets. And though the mass itself may not be materially weakened by this process, the eroding solutions are allowed to seep quite freely through to attack the cable sheath. The concrete surface lying next to the cable becomes softened, scales off and distributes its debris through the duct so that in time the duct is of no more use for exchange and repulling of cables than the disqualified iron pipe.

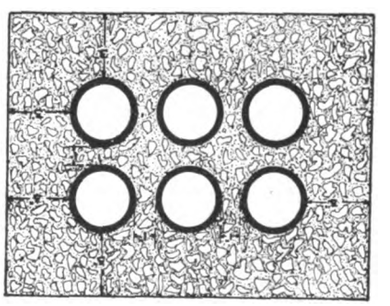

FIG. 3—FIBER CONDUIT WITH USUAL CONCRETE ENCASEMENT.

Another detrimental feature of cement or stone conduit is its brittleness. It is rarely a load is hauled from cars or storehouse to the work with a breakage of less than six or seven per cent.

Cement or stone conduit is of circular shape and usually made in three or six-foot lengths with slip joints on either end. It is usually laid in an envelope of concrete three inches in thickness: the lengths are butted together within the alining collar of iron which

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fits over the slip joints. In multiple conduit construction the ducts are built up in tiers, the formation being retained in place by clamps or by stakes driven into the bottom of the trench and removed upon completion of the side walls. Cement or concrete is placed and flushed between the layers of ducts so as to make a solid construction. Where two or more ducts are laid side by side all joints are staggered.

Most of the underground conduits installed today are either single or multiple clay duct, fiber or creosoted wood. The preference is often caused by the market price of conduit materials and freight from factory to point of installation. In too many instances the first cost is the main item of consideration. There are, however, some conditions besides cost of material and installation that should dictate the kind of conduit to be laid.

For example, in localities where much water has to be contended with or where conduit is subject to constant and severe shocks, as in the yards of great steel plants and the like, creosoted pump log is most practical. In streets crowded with underground pipes or where it is desired that ducts be isolated from each other in order that ground currents may be equally distributed over the greatest possible area of cable sheath, to minimize the local electrolysis, such as in street-railway conduits, single-duct tile should be laid.

Creosoted pump log, though most practical under certain conditions, cannot be said to compare for general conduit construction with either fiber or vitrified clay conduits in durability or insulating qualities, and its cost is greater than either fiber conduit or vitrified clay conduit, as the ducts cost more and the creosoted stakes, cleats and protecting plank cost more than concrete and labor in mixing and placing.

Creosoted pump log is generally laid without any special foundation. Where two or more ducts are required they are laid so as to break joints. Each duct is provided with mortise and tenon which simplifies alinement. When the pump log is laid and settled in position, a creosoted plank usually one and one-half inches thick and of the width of the conduit is laid on top of the ducts. Stakes are then driven, one on either side, three inches by one and one-half inches by three feet, of creosoted lumber. These stakes are driven at intervals of six feet, are sharpened to a point and are driven with the three-inch face parallel to the line of conduit. The tops of the stakes are bound together by a cleat, of the same size lumber as the stakes. The methods of installing pump log is shown by Fig. 2. There are other and cheaper methods of installing permanent and solid construction. Were either stakes or creosoted plank to be omitted, the formation would have no protection from foreign excavations which experience has shown to be imperative.

Fiber conduit is usually laid in a three-inch envelope of concrete. Where two or more ducts are required the ducts are laid so as to leave an interstice between the ducts of one inch. Ducts are alined by means of male and female slip joints with which each length is provided, and in laying, the joints of each length are dipped in a liquid compound which seals the joint. Where the conduit cross-section is large it is built up in tiers and the formation is held in place by stakes driven into the bottom of the trench or by removable guide racks at intervals of six feet. As each tier is laid, concrete is flushed into the interstices between ducts and to a thickness of one inch on top of the ducts. The next tier is then laid and similarly concreted. (Fig. 3.) Where, as in railway signal conduit construction, ducts are laid between rails or tracks, and it is desired to concrete the entire formation in a single operation in order not to impede traffic or in order to cheapen construction cost, one-inch duct supports or guide racks are placed at intervals between tiers of ducts both horizontally and vertically, and the whole formation is held in place by stakes driven into the bottom of the trench on either side of the conduit formation. (See Figs. 4 and 5.)

A vitrified clay conduit line when composed of a single duct is laid in a matrix of three inches of concrete. Where multiple-duct tile is laid, the trench is prepared with a foundation of three inches of concrete. (Figs. 6 and 7.) Upon this the tile is laid, and if multiple ducts are used, the ducts are centered by means of dowel pins which preserve alinement. The top

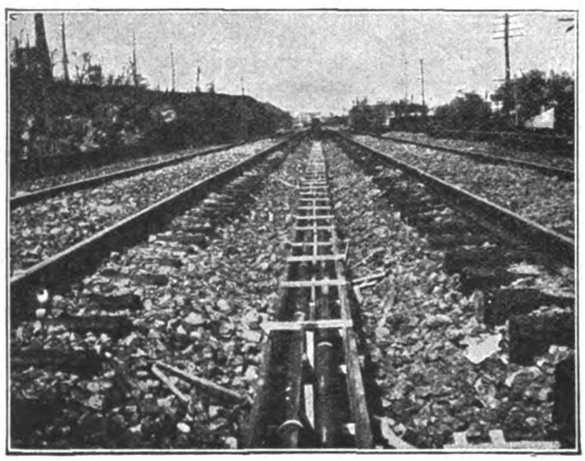

FIG. 4—WOODEN RACKS FOR FIBER CONDUIT LINE, SHOWING HOLDING STAKES.

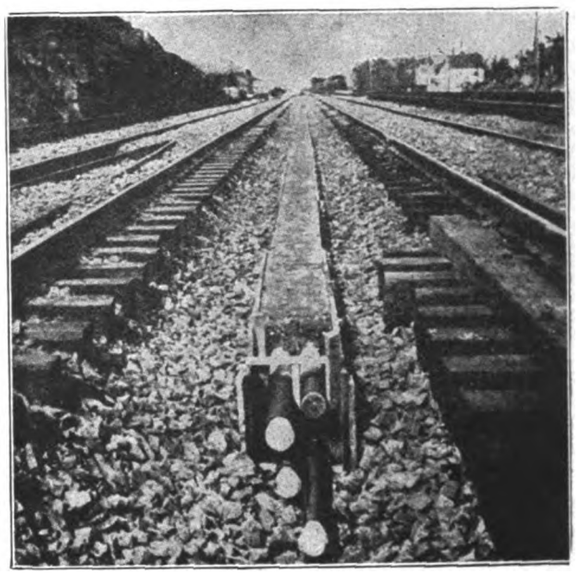

FIG. 5—WOODEN RACKS AND CONCRETE ENCASEMENT FOR FIBER CONDUIT LINE.

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and sides of each tile joint are covered with a strip of burlap six inches wide to prevent the entrance of concrete, and all joints are staggered. The formation is then enclosed at the sides and top with a wall of concrete three inches thick. Another and more economical method of installing vitrified clay tile which, after a series of experiments covering several years, has been adopted by the Chicago Telephone Company and by other large companies in most of their work, except in congested districts, is to lay the tile on a four-inch concrete foundation which is wide enough to extend three inches beyond the outer walls of the conduit formation. On this foundation the tile is laid as already described, except that the tile joints are protected by dampened strips of muslin or burlap, dipped in neat cement paste extending smoothly over the end of each section of conduit at least three inches on each side of the joints. After the joint has been made, the entire surface of the muslin or burlap is covered with a three-eighths-inch layer of one to one mortar. The sides of the trench are then filled with earth to a height level with the top of the ducts and a layer of concrete three inches in thickness is placed over the ducts, extending three inches on each side beyond the outside line of the ducts. This method of construction is shown by Fig. 8.

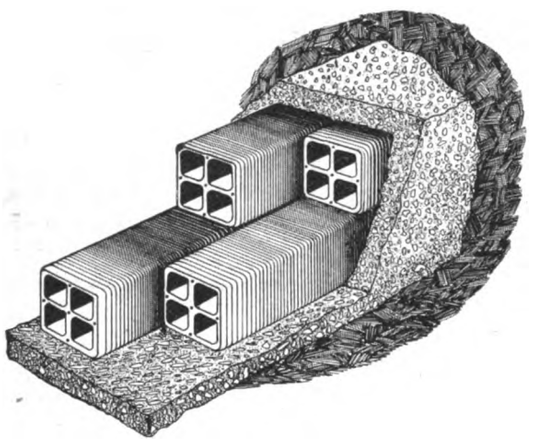

FIG. 6—STANDARD MULTIPLE-DUCT, CLAY CONDUIT CONSTRUCTION WITH COMPLETE CONCRETE ENCASEMENT.

FIG. 7—SINGLE-DUCT CLAY CONDUIT CONSTRUCTION WITH COMPLETE ENCASEMENT.

The cost of underground conduit construction while variable and depending on the location of work, size of job, rates of wages, price of material and competence of foremen, may still be figured with accuracy provided the data used are based on average cost of work done under average conditions.

It is often assumed that cost data to be of any value for comparative purposes must be based on work done under approximately similar conditions. Of course, to secure such data is obviously improbable, as it does not often occur that two conduit lines are built under similar conditions, of the two kinds of duct which it is desired to compare. However, this is by no means necessary, for where distance of haul, character of soil and pavement, rates of wages and price of material are known and the cost data are carefully and systematically collected, they may serve as accurate bases for comparing or estimating. This is now generally recognized by cost statisticians and the writer's personal experience has proven this beyond question.

As an instance of this, the writer, when cost statistician for the Chicago Telephone Company, estimated the cost of installing a multiple duct conduit from Forty-eighth Avenue in the city of Chicago to La Grange, Ill. (a distance of approximately 38,000 feet), and he came within less than $100 of the actual cost. This is not an isolated instance. Similarly close estimates have been made by others where based on actual cost records.

The accompanying cost table is based on average costs collected by specially trained men using an identical system. They are not averaged from timing a few feet of work but from complete jobs, small and large, done in both city and country districts. On one job alone 824,862 duct feet of conduit was installed. This work was done by the Chicago Telephone Company in combination with the American Telephone and Telegraph Company to extend their conduits from Chicago, Ill., to Kenosha, Wis., and is one of the longest underground conduit lines ever built. The writer personally superintended the collection of cost data on this work and daily detail records of cost were kept.[1] These data together with those collected on many other conduit jobs are used as a basis for averaging the costs given in the following table:

COST OF FOUR-DUCT VITRIFIED CLAY CONDUIT.

	Single-duct tile enclosed in concrete	Multiple-duct tile enclosed in concrete	Multiple duct tile, concrete top and bottom
Costs of ducts at factory.	.1600	.1600	.1600
Concrete	.1522	.1463	.0915
Burlaps for joints (no burlaps used for single tiles)	.....	.0043	.0043
Mortar for joints	.....	.....	.0051
Breakage	.0040	.0040	.0040
Trenching	.1291	.1252	.1252
Backfilling	.0384	.0376	.0269
Unloading and distributing conduit	.0096	.0091	.0091
Laying ducts	.0111	.0093	.0093
Placing concrete	.0107	.0068	.0042
Mixing concrete	.0239	.0222	.0076
Disposal of surplus earth.	.0336	.0321	.0167
Supervision 5% of total...	.0286	.0279	.0232
Total cost per trench foot	.6012	.5848	.4871
Total cost per duct foot.	.1503	.1462	.1218

Rate of Wages.—The following were the rates of wages paid for a nine-hour day:

Foreman	$3.50 to $4.00
Assistant foremen	2.50 to 3.00
Timekeepers	2.00 to 2.50
Watchmen	2.00
Waterboys	1.00
Laborers	2.00
Teams and drivers	5.00

Concrete.—Concrete is based on cement $1.65 per barrel, sand and gravel $1.90 per yard delivered on the ground, mixed in proportion of one part cement, four parts sand and eight parts stone. Concrete was mixed by machine where possible. A considerable section of trench was excavated and graded and then the mixer was drawn along the side of the trench and an entire section of trench bottomed. The ducts were then laid and concreted on sides and top in one operation.

Laying Conduit.—Conduit was laid by unskilled labor. Two men were used in the trench and one handing conduit, dowel pins and preparing burlap or compound for joints as the case might be. The conduit layers were usually picked men and kept continually on this work.

Resurfacing.—All pavements except in unimproved and macadamized streets and roads were repaired by con-

1 For fuller details of this work the reader is referred to the writer's book on "Telephone Construction: Methods and Cost," Chapter VI; Myron C. Clark Publishing Company, Chicago.

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tractors. In the cost table the resurfacing is not shown because there are many kinds of pavements, varying in cost in different localities, and whether the trench is a few inches wider for one construction than another makes no difference in cost of resurfacing, as paving contractors generally charge the same yardage.

Trenching.—The cost of trenching is based on average clay soil, which is the most usual soil encountered in this country. In trenching, any conduit requiring less than a fifteen-inch trench costs practically the same to excavate as a fifteen-inch trench. The reason for this is that a trench less than this width impedes the free working of the men, where a trench is deep enough to permit the top of the conduit formation to be two feet below street level as is generally required. Then, again, experience has shown that it is almost impossible to get men to dig a trench less than this width unless a foreman is placed over each man.

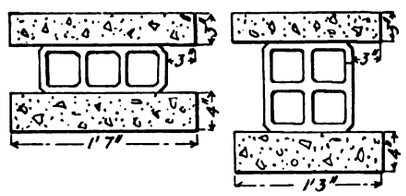


FIG. 8—MULTIPLE-DUCT, CLAY CONDUIT WITH PARTIAL CONCRETE ENCASEMENT.

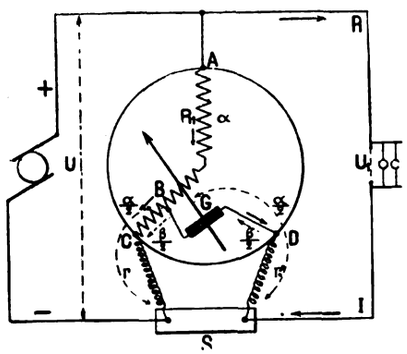
Unloading and Distributing.—Unloading and distributing conduit is based on an average load over average distances and road conditions being $.0023 per duct foot for vitrified clay conduit, with two-horse trucks costing $5.00 per day with driver, carrying five loads per day.

There are many points which lead one inexperienced to believe the cost of laying vitrified clay conduit is higher than it actually is. For example, it is often thought that a mandrel is required in laying multiple tile and that skilled men are needed to lay the tile. Of course a mandrel may be used, as may skilled men, but neither are necessary and neither are used by competent conduit men. If vitrified clay tile be laid as described in this article, it would be only necessary to run a cleaner through the ducts when rodding to remove any concrete which may have entered through joints, and this operation would add nothing to the cost of rodding.

Vitrified clay tile ducts are superior to many other kinds of ducts because they form a solid and permanent conduit, irrespective of the concrete envelope which only adds a secure foundation and protection from foreign excavations. Concrete on the sides of vitrified clay tile is more or less superfluous.

Compound Voltmeters for Indicating the Tension at the Distant End of Feeders.

In most electrical distribution systems the center of consumption is at a distance from the generating station and the tension must be maintained constant at these distant points. The original method of indicating the tension at the extreme end of feeders to the central station by means of pilot wires was costly and unreliable, and the indications of compound voltmeters with movable soft-



COMPOUND VOLTMETER FOR FEEDER LINES.

iron armature now extensively employed are not very exact. Chauvin and Arnoux have recently found a solution of the problem, which is applicable to movable-frame as well as hot-wire instruments. As shown diagrammatically in the accompanying illustration, their compound voltmeter is an instrument with three terminals, *A C D*. The circuit *A B D* represents the ordinary voltmeter circuit comprising the frame *G*, movable in a magnetic field. A resistance *B C* joints the third terminal to the movable frame, and terminals *C D* are connected to a shunt traversed by the feeder current. If *I* be the current intensity in a feeder of resistance *R*, *U* the tension at point of origin and U_1 the tension at the point of utilization, then according to Ohm's law: $U_1 = U - RI$.

The resistances *BC*, *BB* being made equal by construction, the current in the coil of circuit R_1 is divided in half at *B* and is therefore of equal value in frame *G* and the auxiliary resistance *BC*, and the deviation of the movable frame is consequently proportional to the tension U_1 at the extreme end of the feeder. It is sufficient to indicate to the manufacturer the resistance of the feeder and intensity of the current it will carry. In accordance with these data he establishes the shut and adjusts the constants C_1 C_2, so that the voltmeter will directly indicate the tension U_1. With thermal voltmeters the arrangement is the same, the expanding wire being inserted between points *B* and *D*. In order to transfer the instrument to another feeder carrying the same current, but having a different resistance, it is only necessary to modify suitably and simultaneously the resistances *r r'*.—*From L' Electricien (Paris), November 6.*

Enjoins Two-Cent Trolley Rate.

Following up his Missouri decision adjudging the two-cent fare law unconstitutional where it can be shown that a railroad is unable to earn a reasonable profit, Federal Judge Smith McPherson granted a temporary injunction which forbids the Cedar Rapids & Iowa City Railway and Light Company from complying with the Iowa two-cent fare law. The hearing was set for December 15.

The action was based on a petition by Mrs. Elizabeth D. McClintock, of Haverford, Pa., a stockholder of the company. She declares the corporation is no longer paying dividends, and that the stockholders have been forced into the action to protect their interests. The injunction restrains Attorney-General Byers, the State Railroad Commissioners and two county attorneys from bringing action against the company to compel it to follow the law.

Conservation Course for Engineers.

Conservation engineering is a new course to be offered at the University of Michigan. Six years and a summer session will be required to complete the course for the degree of Master of Conservation Engineering.

The new course is an outgrowth of the impetus given interest in national resources by the Roosevelt conservation congress two years ago.

No new branches will be taught, as the course is a combination of courses in the literary, law, and engineering departments. Its aim is to fit students to appreciate the natural resources of the country, to equip them for a better utilization of the same, and to enable them to give scientific attention to waste regions.

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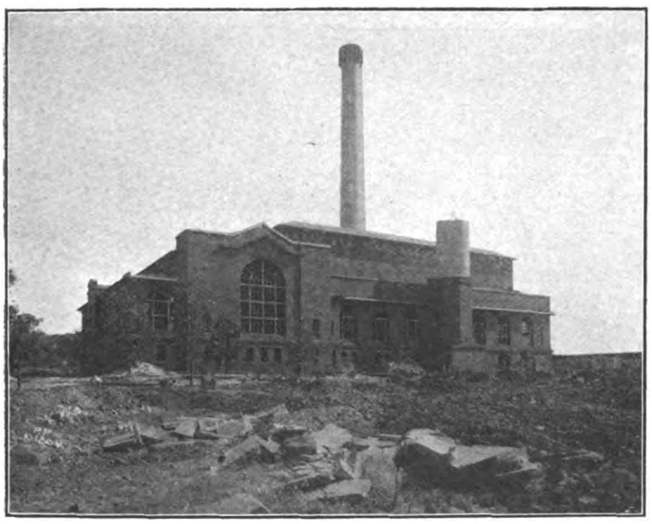
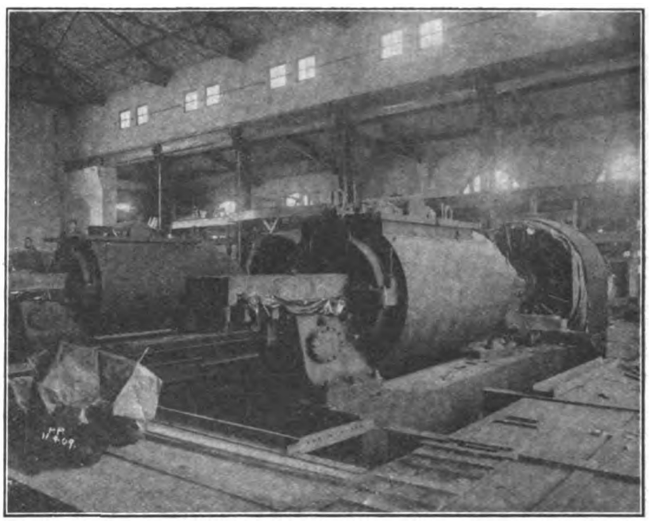
THE NEW CONGRESSIONAL HEATING, LIGHTING AND POWER PLANT AT WASHINGTON.

BY GEORGE H. DRAPER.

Within a short period there will be completed in the city of Washington, D. C., one of the largest and most complete power plants of its character in the country. A preliminary description of this plant appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 18 last. For some years the Congress of the United States has had under consideration the erection of a central power plant for furnishing heat, light and power to the group of costly government buildings known as the "Congressional Buildings," which include the United States Capitol, the House Office Building, the Senate Office Building, the new Congressional Library, and the proposed new structure which is to house the United States Supreme Court and some of the minor courts. This entire aggregation of buildings is embraced in an area of probably not more than four acres, and is approximately 3,500 feet distant from the central power station, which is located on a government reservation known as Garfield Park, just south of the United States Capitol grounds.



NEW CONGRESSIONAL HEATING, LIGHTING AND POWER PLANT AT WASHINGTON, D. C.



TURBINE ROOM, SHOWING TURBINES AND TURBO-GENERATORS IN PROCESS OF ERECTION.

The heating, lighting and power plant for the Congressional Buildings is a three-story modern steel-frame structure built of red brick and cement after the old mission style, with gracefully sloping tile-covered roof and twin ornamental buff brick stacks. The building is eighty feet in height. Reinforced concrete has been used throughout for all supports, floors and roofing, and the entire structure rests on a concrete pile foundation.

In connection with the plant there is a pumping station located on the river front, about 4,400 feet distant from the main station, for furnishing water for condensing purposes, and it is also the outlet for the overflow flume.

For the present there are to be four substations, one in each of the buildings forming the congressional group, and each is connected to the main station by a comprehensive system of concrete tunnels.

It has been uppermost in the minds of the engineers in charge of the construction of this plant that the buildings shall at no time be without proper service. To this end it has been arranged that all machinery and apparatus be in duplicate in so far as is consistent with expense, so that in case of a breakdown, from any cause, in any part of the system the other part is immediately available. There are checks and counter checks throughout the entire system so as to make it almost a certainty that it will never be necessary to suspend operation of the entire plant.

Foundation and Floors.—The foundation of the building consists of 750 concrete piles of Simplex construction, or about 15,000 lineal feet, covered with a concrete surface to the depth of several feet. The building is shaped like the letter T, the vertical stem, running north and south, being the boiler-room section, and the top of the T, abuting on the north, the turbine-room section. The boiler section is 160 by 87 feet, and the turbine section 112 by 85 feet. The boilers are on the second floor, fourteen feet above street grade, and immediately above the boilers on the third floor is the coal-storage loft. The ash-handling apparatus is directly under the boilers on the basement floor. The basement of the turbine section is occupied by a storage battery and the feed pumps; on the second floor of this section are the turbines and turbo-generators; on the mezzanine floor, running the entire length of the turbine room, is the switchboard gallery and the visitors' gallery. The bottom portion of this gallery is for the high-tension equipment, and immediately above this the marble switchboard, and then the visitors' gallery. A fifty-ton Shaw electric crane spans the upper portion of the turbine room.

Stacks.—The two stacks were constructed by the Alphonse Custodis Chimney Company and are each 212 feet in height by eighteen feet diameter at the base and eleven feet at the top, inside measurement. They have outlet doors on the outside of the plant for removing accumulations of soot. The stacks have each a red brick octagon-shaped pedestal or base forty-eight feet in height, and above this they are cylindrical in shape and built of buff-colored radial chimney brick. The stacks are lined inside with fire brick in fire clay from a point four feet below the flue entrance for a distance upward of twenty-eight feet, and from that point upward with Custodis radial brick. Between the inside wall of the chimney

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and the fire-brick lining there is a two-inch air space for a distance of seventy-five feet from the flue openings, which are thirty-three feet above the street grade. The usual inside and outside ladders are provided and each chimney is surmounted with a twelve-section iron cap. Somewhat of a departure in brick stack building has been incorporated in these stacks, i. e., a smooth rolling bell-top head as an ornamental and graceful trimming to each chimney.

Boilers, Condensers and Pumps.—There are sixteen water-tube boilers of the Atlas make, comprising eight batteries. Each boiler is rated at 550 horsepower and has an evaporating capacity of 21,000 pounds of water per hour, at 212 degrees Fahrenheit and 175 pounds gauge pressure. The boilers are provided with mechanical stokers.

There are four barometric injector condensers, comprising two sets of two condensers each, and these are connected by a forty-two-inch cross and provided with a twenty-four-inch inclosed automatic exhaust relief valve, having hydraulic lifting cylinders.

Metropolitan injectors with Hancock swing check valves are used as a reserve precaution in case the boiler-feed pumps fail to operate from any cause, or if the load is such that they would be more economical to operate than the pumps.

In the basement of the boiler section are installed three feed pumps for the boilers, which are connected to the hot well and city pressure mains, any one of which is capable of supplying one-half of the plant, the third one being held in reserve. These pumps are of the balanced piston type, and equipped for outside adjustment.

Two eighteen-inch vertical centrifugal circulating pumps are installed at the pump house, coupled direct to a 200-horsepower vertical induction motor. They have twenty-inch water openings, and each pump is capable of supplying sufficient condensing water for the above-mentioned condensers, delivering 150 gallons of water per minute and maintaining a head equal to fifty pounds pressure per square inch.

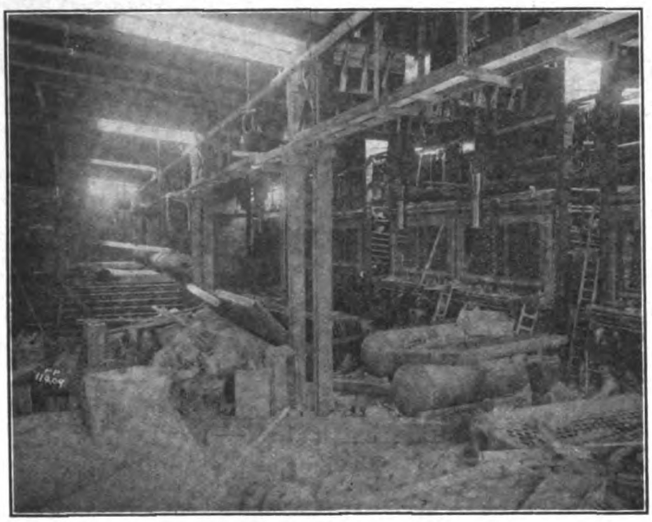
Water from the hot well is taken by gravity through a forty-eight-inch, inside diameter, concrete overflow flume to the river. Running parallel with this flume is the condensing water-pipe line. The latter is of extra heavy cast-iron thirty-six-inch pipe for about half the distance from the river end and of standard cast-iron pipe of the same size for the remainder of the distance to the condensers.

Coal and Ash-Handling Apparatus.—In connection with the boilers Roney steam-actuated mechanical stokers are used, automatically feeding coal to each of the sixteen boilers from chutes connected with the coal bunkers immediately above. Coal is delivered to these bunkers by means of belt conveyors. The coal is first dropped directly from the railroad cars, on a siding at the rear entrance of the plant, into a hopper, and then mechanically conveyed to and through coal crushers and thence to the loft conveyors. The ashes are automatically dropped into ash hoppers under each boiler and then in turn dropped into hand dump cars. These hand cars are rolled to an ashpit in the rear of the plant and from there are conveyed by means of ash skips to the top of the building and dumped into chutes suspended over railroad cars to be hauled away.

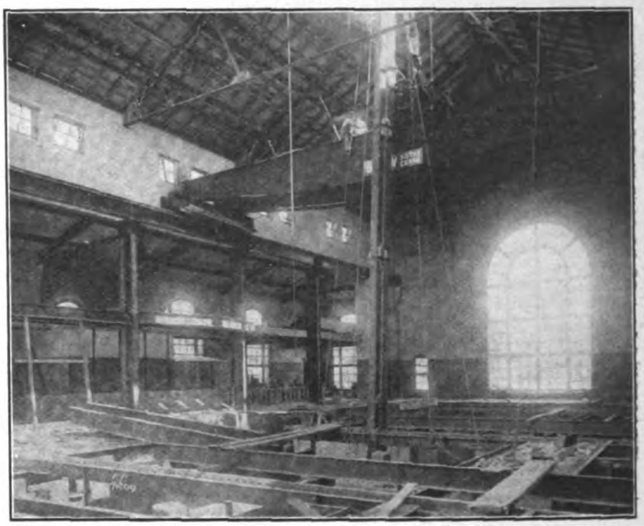
Generators and Turbines.—The generating equipment consists of four 2,000-kilowatt, 6,600-volt Westinghouse three-phase turbo-generators, direct driven by four 2,700-horsepower Westinghouse-Parsons steam turbines. The machines run at a speed of 1,500 revolutions per minute. There are four 37.5-kilowatt exciters connected at the ends of the turbine shafts. The turbines are equipped with an equalizing stop valve placed in the steam line and operated from a separate safety governor which automatically closes the valve when the turbine speed exceeds the safe limit; this safety stop can also be tripped by hand. The governor is so designed that it can be operated either by hand and has also an approved electric attachment so that the speed control may be effected from the switchboard if desired.

Transformers and Motors.—There are installed in the station two sets of transformers, each set consisting of three 125-kilowatt, single-phase, twenty-five-cycle, oil-cooled transformers, for lighting the power station and furnishing power for the auxiliary apparatus; these transformers are Y-connected on the four-wire system and step down from 6,600 volts to 200 volts for motor circuits and to the standard pressure of 125 volts for lighting circuits, respectively.

In the pump house at the river front there are two 6,600-volt, 250-horsepower vertical-shaft induction motors which are so connected electrically as to be started either at the pump house or direct from the switchboard in the main



VIEW OF BOILER ROOM.



TURBINE ROOM SHOWING ELECTRIC CRANE.

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station. Three starting compensators are located in the basement of the power house under the high-tension section, and there is an emergency starting apparatus in the pump house.

Booster Set and Storage Battery.—The booster set consists of a 125-horsepower motor, direct-connected to a booster generator having a capacity of 845 amperes at sixty-five volts.

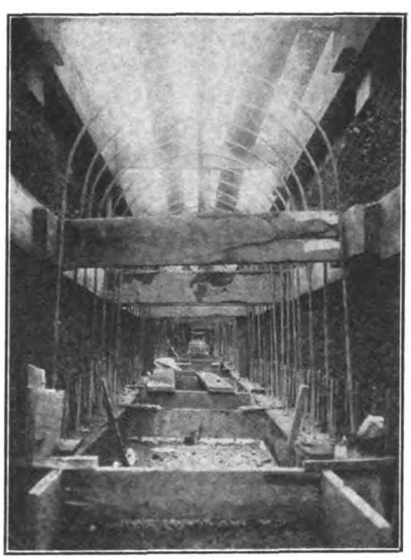
There is a seventy-four-cell storage battery of standard type, furnished by the Electric Storage Battery Company, of Philadelphia, Pa., which is used in connection with the exciter system; also for operation of the crane and for emergency lighting of the plant and substations in case of a breakdown or failure of the alternating current for any cause. The battery has a normal discharge rate of 200 amperes and of 800 amperes for one hour.

Switchboard, and High-Tension Structure.—The lower portion of the switchboard gallery is occupied by the high-tension structure, which is of concrete construction containing twenty, type E, electrically operated oil switches, with disconnecting switches on both sides thereof in order that they may be cut off for inspection. The high-tension busbars are of bare copper tubing, separated in the center by sectionalizing knife switches, thus enabling the system to be divided into two parts and operated separately. The structure is eighty-seven feet long and twelve feet high. It also contains the transformers for operating the instruments on the switchboard above.

The switchboard proper is constructed of white marble and is composed of nineteen panels, comprising four generator panels, five feeder panels controlling the feeders to the various substations, two panels for the storage battery, two for the exciters, one for the booster set, one for the pump motors, one for the station lighting transformers and three for station power service and substation lighting.

There is a somewhat new departure in the manner of the installation of emergency provisions. First duplication is used where it has been practicable and consistent with a reasonable cost. There are two sets of busbars, duplicate feeders, duplicate busbars for the storage battery, etc. There is an emergency panel for lighting the power house and all substations from the storage battery. Ordinarily these are lighted through the transformers in the basement, but it has been so arranged that, in case the alternating current is cut off for any cause, this circuit is automatically thrown on the storage battery, thus giving light immediately in the power house and substations.

Steam Tunnels.—The system whereby heat as well as lighting and power current are transmitted to the various buildings is no less interesting than the plant itself. Reinforced concrete tunnels, having an aggregate length of about 6,000 feet, built up on Blaw collapsible steel forms, have been constructed. These tunnels are seven feet high by four and a half feet wide, and are provided with suitable entrance manholes at various points of convenience. Steam is conveyed through wrought-steel piping with welded



VIEW OF TUNNEL CONSTRUCTION.

flanges. High-pressure steam is sent through this piping and reduced in pressure on reaching each of the buildings. From the plant to the nearest building a fourteen-inch pipe is used, from which point it diminishes in diameter to twelve inches and ten inches, with branches to the various buildings of nine inches and seven inches. These tunnels are electrically lighted and are so wired that an operator can turn on or off any series of lamps before and behind him as he goes. The steam pipes are arranged along one side of the tunnels and there is ample room for a good sidewalk. Electric current is transmitted through cables in vitrified conduits running parallel with the steam tunnels.

Cost of Construction and Maintenance.—The construction of this plant has cost the government approximately $1,500,000, and when completed it is estimated that the operating expenses will be between $20,000 and $25,000 annually. Owing to the very stringent smoke law in the District of Columbia hard coal has hitherfore been used exclusively in these buildings. The present plant, however, being located at a considerable distance from the buildings, together with up-to-date apparatus, will enable the use of soft coal at approximately one-half the cost. The Capitol at present uses from 7,000 to 10,000 tons of hard coal each year; the new Library from 4,000 to 5,000 tons; the office buildings are somewhat of a problem since they have not been in operation long. However, it can be seen at a glance what an enormous saving in coal alone is to be had, to say nothing of concentration of these various old plants in the one new central station.

The government supervision of the entire plant comes under Elliott Woods, superintendent of the United States Capitol building and grounds, and Christian P. Gliem, chief electrical engineer Westinghouse, Church, Kerr & Company, were the consulting engineers, and of this firm F. E. Caldwell, constructing engineer, had immediate supervision of the construction.

Important Telephone Merger.

Announcement was made recently at Harrisburg, Pa., that the American Union Telephone Company, which controls practically all of the independent telephone business in the state of Pennsylvania outside of Philadelphia and the territory of the Pittsburg & Allegheny company, of Pittsburg, had been purchased by the new Continental Telephone & Telegraph Company, of New York.

The transaction is said to give the new company immediate control, and will enable it to unite the American Union territory with that of the company in Delaware, Maryland, New York, West Virginia, Virginia, and New Jersey, where the company acquired the Inter-State company recently.

The American Union was formed several years ago to take over the business of various Pennsylvania independent lines, and had an authorized capital of $25,000,000.

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Electrical Notes From Great Britain.

By Our British Correspondent.

The affairs of several English electrical undertakings which are operating in different parts of South America, have recently been receiving attention in London. One of these—the Rosario Electric Company, Limited—has experienced a thirty-two per cent advance in electric current sold during the past year; one-fourth of the whole was for motor power. The gross receipts advanced by $91,000, to $456,500. W. T. Western, chairman of the company, who recently returned from a study of the position in Rosario, records a remarkable general development of the town. While he was there, C. H. Merz, who was visiting the Argentine on other business, made a report upon the electric plant, and advised as to the best course to pursue in preparing for continuous development. At the present station there is room for more plant, and here by means of alterations and additions they could provide for a normal increase in demand for two or three, or even five, years ahead. It is thought, however, wiser to look forward for a longer period in view of the development alluded to, so land has been purchased at Sorrento, just outside the municipal boundary, where a turbo-electric generating station, capable of extension for many years, is to be erected. The cost of the station and equipment, with turbine and condensing plants, will be $500,000 or $600,000, with $1,000,000 as the total outlay, including cables and transformers. This expenditure will be spread over the next three or four years, according to present plans, and it will enable the company to double its present effective capacity.

Cordoba is another city in Argentina whose population is increasing with a great rapidity, and the Cordoba Light, Power and Traction Company, Limited, is engaged on important development works. The original concession for the use of the waterpower of the River Primero would expire in 1912, but this has now been replaced by one extending to 1948. To supplement the existing hydroelectric generating station during the periods of heavy load or shortage of water, a steam plant of 900 horsepower has been installed, and a further 1,000 horsepower from England will have arrived there by the time these lines appear in print. It has become urgently necessary to develop a further section of the river. The English company has acquired more holdings in the American company, so that it now holds ninety per cent of its capital stock, and important electric tramway interests have also been negotiated. J. G. White and Company are now preparing designs and specifications for the new hydraulic installation. Until the completion of this new plant, the 1,000-horsepower steam plant now being added, and a further 800 horsepower which is on order, will endeavor to keep pace with the demand. Tramway construction operations, in extension of the few miles opened last August, are proceeding.

Electrical engineers have had their attention turned back to discussions and experiments of fifteen years ago by the publication, before a Glasgow engineering society, of a few particulars of the Reid-Ramsay steam-turbine electric locomotive, which is now in course of construction at the works of the North British Locomotive Company. The Heilmann steam-electric locomotive of 1894 will be remembered by many. Hugh Reid, the managing director of the company named, says that the present locomotive is a new development of the Heilmann idea, only on a different and more practical basis. As cost of conversion is the great obstacle in the way of electrifying many railroads, the merit of any independent self-generating unit that would operate over existing railway systems without necessitating any electrical equipment of the railways themselves, was obvious. In the Reid-Ramsay locomotive an ordinary locomotive boiler fitted with a superheater carries coal and water supplies in bunkers and tanks on both sides. Steam is led to an impulse turbine (3,000 revolutions per minute) to which is directly coupled a continuous-current variable-voltage generator. The dynamo supplies energy at 200 to 600 volts to four series-wound traction motors, the armatures of which are built on the four main or driving axles of the locomotive. The exhaust steam from the turbine passes into an ejector condenser and to the hot well, from whence it is returned to the boiler by a feed pump, and the supply of water carried in the tanks is actually circulating water for condensation purposes. It is circulated by a small centrifugal pump driven by auxiliary steam turbines alongside the main turbine and dynamo. The cooler is in front of the locomotive. The small switchboard and instruments, the controller for grouping the four motors in series, series-parallel, and parallel, according to the drawbar pull to be exerted, and the regulator for controlling the voltage in the electrical circuit, and consequently the train speed, are all placed within easy reach on the driver's platform. The strong underframe is carried upon two eight-wheeled compound bogies. Each bogie carries two of the four motors. Mr. Reid says that the engine is intended for express passenger main line work, and he hopes to obtain actual working performance data for comparison with reciprocating steam locomotives.

Before the Institution of Mechanical Engineers in London, on November 19, Herbert A. Humphrey, in a paper on "An Internal Combustion Pump, and Other Applications of a New Principle," described the construction of a pump of great simplicity and strength of construction, in which the explosive force is exerted directly upon the water, and in which no rotating flywheel, solid piston, connecting rod, crank, bearings, or glands of any sort are required. He said that as the result of his experiments, several very successful types of pumps had been devised and set to work on a scale sufficiently large to demonstrate their utility and economy. By allowing the movements of liquid to control the pump, and by causing the mass of liquid moved to be sufficiently large, the velocities are never excessive. The mass of water forms a pendulum which swings between the high and low level, and by its movement alone, serves to draw in fresh water, to exhaust the burnt products, to draw in a fresh combustible charge, and to compress the charge previous to ignition. Curves were given to indicate the possibility that internal-combustion pumps might be substituted for gas engines in central electric-power stations. If the water pumped is passed through an ordinary water turbine driving an elec-

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tric generator, and the water is then returned to the pump to be used over and over again, "we arrive at a gas-power electric system with the water forming a hydraulic coupling." The author looked into future possibilities to see what a central station on the new lines might be like. In the diagram a section of such a station is shown, so as to exhibit one unit of plant, the other units being arranged side by side. The pump discharges through the valve box situated in the suction tank, the latter also serving as an insolating tank.

The discharge pipe conveys the water into a large air-vessel placed outside the building. This air vessel is connected with other similar air vessels by a common air pipe at the top, which maintains the air pressure the same in all the vessels, and a common water main at the bottom. The water is fed to the turbine by a pipe, and the turbine discharges into a longitudinal canal which has a connection to each of the suction tanks. The turbine is direct-coupled to the electric generator, and the current may be taken to the switchboard, which is conveniently placed for overlooking the machinery. The necessary isolating valves appear in the diagram, and it will be seen that the working parts of the pump, as also the turbine and generator, are so situated as to be supervised from a common platform. The gas main runs longitudinally outside the building. The absence of noise and shock and exceedingly low cost of upkeep were named as the advantages of the arrangement, and Mr. Humphrey further remarked as follows: "In gas-engine stations using cheap producer gas or blast-furnace gas, the cost of lubricants and stores frequently exceeds the cost of the fuel, but in the present instance there is practically no lubrication required, and the author has worked one of his pumps for a week at a time with absolutely no lubrication whatever. Of course, one has to face the loss due to the conversion of the waterpower into mechanical energy, but the efficiency of a well-designed turbine is not less than eighty per cent at full load, and there is no need to work any of the pumps at less than full load. The ease with which they can be started and stopped from the switchboard gives the electrician complete control of his station, and the ability to start up one or more pumps at a moment's notice. In fact, even this arrangement can be simplified, because the governing of the pumps can be so arranged that a steady pressure is kept on the air vessels irrespective of the demands, and a slight rise in this pressure may automatically cut out one pump and its attached dynamo after another, and restart them again as the pressure falls. Based on the efficiencies so far obtained, a Board of Trade unit can be generated for two pounds of anthracite coal, and with the large units of plant required in central stations this figure should be much reduced. Even if the fuel economy should not prove to be higher in such a station, yet its other advantages may more than compensate for this defect. . . . If the contour of the district is such as to permit the construction of a high-level reservoir of considerable capacity in proximity to the pump house, water can be pumped into this reservoir and be drawn upon as required. This would enable the pumps to work steadily day and night on a 100 per cent load factor, and would reduce the quantity of plant, in so far as the gas producers and pumps are concerned, to the minimum possible." It was stated that Allen Nicholls, who had had charge of the electrical ignition devices, had produced a sparking plug which was absolutely reliable when washed by water at each stroke.

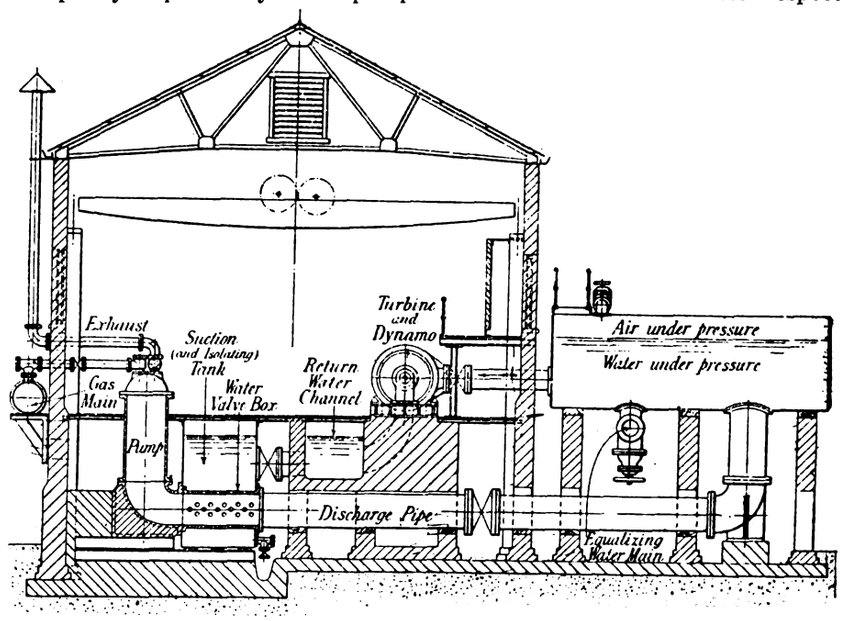

DIAGRAM OF SUGGESTED CENTRAL STATION, SHOWING HYDRAULIC COUPLING BETWEEN THE GAS POWER AND ELECTRIC POWER.

The inaugural address of the president and local section chairmen of the Institution of Electrical Engineers have now been delivered. Dr. Gisbert Kapp, the president, in taking the chair at the first London meeting for the session, reviewed the state of electrical engineering, drawing attention to a few of the novel features in design of electrical apparatus, and to a few among the many applications of electricity to industrial processes. The enormous field of useful work lying open to the electrical engineer in connection with the industries was referred to by the president, and the reasons why British electrical engineering is not as prosperous as it might be were inquired into. A number of appendices to Doctor Kapp's address showed in useful form the particulars of the various large power distribution companies, their systems of generation, transmission, and distribution, the greatest distances to which they deliver power, and the nature of the industries to be served in their respective districts. Other appendices related to electrically driven rolling mills in English works, and electrically driven winding engines in some English pits.

On the same night a marble bust of a renowned former president, the late Dr. John Hopkinson, was presented to the Institution on behalf of Mrs. Hopkinson.

The address delivered at the Birmingham Section by R. K. Morcom was one of the best investigations that has yet been made regarding the trials through which British electrical industry has been passing in recent years.

Albert H. Bridge.

London, November 27, 1909.

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The Melville and Macalpine Reduction Gear.

In spite of the present development of the marine steam turbine it is nevertheless true that the greatest possible advantage is not made of this prime mover in present-day marine practice. The reason of this lies in the fact that the steam turbine operates at its best efficiency only when running at a high speed, whereas the propeller that it has to drive must be operated at a much lower speed in order to obtain the best results. The consequence is that neither of these component units can be worked at its maximum efficiency, for a compromise speed, too low for the one and too high for the other, must be employed, inasmuch as hitherto it has been impossible to employ a speed-reduction gear which is capable of withstanding the enormous stresses to which it must be subjected in the transmission of a great horsepower and at the same time have of itself an efficiency which would not more than offset its other advantages.

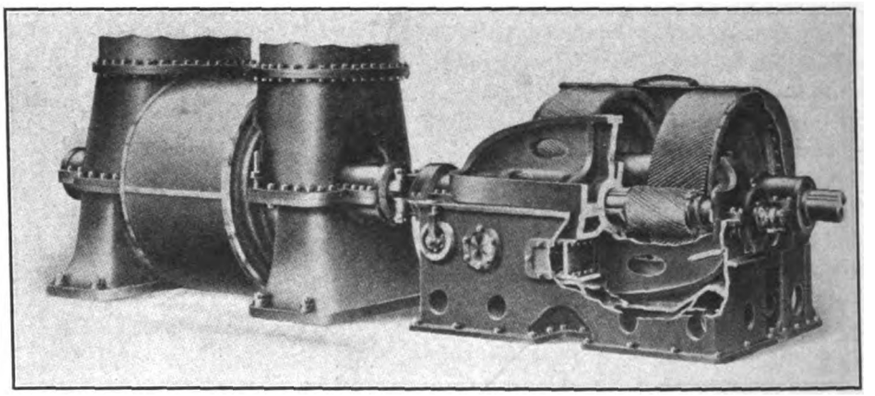
A solution of this problem has now been offered through the instrumentality of George Westinghouse, the head of the great mechanical and electrical companies that bear his name.

At Mr. Westinghouse's suggestion, and with the immense resources of the Westinghouse works at their disposal, Rear-Admiral George W. Melville, ex-Engineer in Chief of the United States Navy, and John H. Macalpine, a well-known consulting engineer, have invented and constructed a speed-reduction gear by which it is possible to couple together the turbine and propeller shafts so that each may revolve at its critical speed of maximum efficiency. This gear has been tested by a specially designed 6,000-horsepower hydraulic absorption dynamometer at the Westinghouse works for a period of forty hours of continuous running, and the remarkable efficiency of over 98.5 per cent was attained, this while the driving turbine was running at 1,500 revolutions a minute with a reduction to 300 revolutions at the dynamometer end (representing the ship's propeller).

When this performance is compared with a statement made by President Denny in his inaugural address to the Institution of Marine Engineers in Great Britain on October 5, 1908, it will be apparent that a revolution in the design of steamship machinery is imminent. Mr. Denny said in this address: "It has frequently been suggested that if some inspired engineer would evolve a system of gearing that would be lasting and reliable, not too noisy, and would not absorb in friction more than, say, ten per cent of the power, turbine engines would be capable of application to any speed of vessel, and to any size of propeller; you would then have a high-speed turbine and a low-speed propeller, which is the ideal condition for marine propulsion."

The Melville and Macalpine reduction gear absorbs but one-seventh of the power proposed by Mr. Denny as a loss reconcilable with efficient working conditions.

The accompanying illustration of the reduction gear connected to a Westinghouse turbine, gives a good idea of the device, part of the frame and casing being broken away in the view to expose the interior.



MELVILLE AND MACALPINE REDUCTION GEAR CONNECTED TO A WESTINGHOUSE TURBINE.

The teeth of the gears are helical to permit of noiseless running, and end thrust is eliminated by reversing the pitch of the gear wheels of the opposite halves of the mechanism. In order to reduce pressure on the teeth to the minimum required by good engineering practice, and at the same time keep down the size of the teeth to insure the best possible running conditions, the width of the gears had to be made very large, as can be seen from the illustration. Wear on the teeth is equalized by introducing an additional cog, technically called a "hunting cog," in each of the larger gears; that is, one more cog than is necessary for an absolutely integral speed reduction is used, which, while hardly affecting the velocity rates to an appreciable degree, insures that each cog of one wheel will come in contact at definitely recurring intervals with each and every cog of the gearing wheel.

The smaller gear or pinion is mounted in what the inventors call a "floating frame," and this is the real feature of the invention, that makes possible the remarkable efficiency and durability attained in the test.

This floating frame is a heavy steel casting supported only at a single point midway between the bearings. The support is flexible so that the frame is free to oscillate in a vertical plane passing through the axis of the pinion, but is held securely against motion in any other direction. Furthermore, the pinion is free to move endwise in its bearings. Any tendency of the teeth to bear harder at one end of the gear than the other would tend to unbalance the respective end thrusts due to the right and left hand spirals of the teeth; but as the pinion cannot present any resistance to unbalanced end thrust, it constantly adjusts itself in the direction of its axis to the position corresponding to equilibrium between the opposing forces. This means that the tooth contact pressures are always automatically equalized.

Mr. Westinghouse states in a letter over his own signature, that the machinery described and illustrated herewith, "while costing less and weighing only about one-half as much as the turbine machinery successfully used on British vessels, will effect not only a great economy in fuel but will also permit of much higher speeds in cases of emergencies. Were the United States Government," he says, "to apply this type of marine turbine to the large 26,000-ton battleships for which contracts have only just been let, we could have the fastest battleships yet projected by any nation."

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A RATIONAL METHOD OF INSTALLING SERVICE METERS.

BY H. W. YOUNG.

The average meter installation by central-station managements represents one of the strange inconsistencies of human nature, as frequently the same manager who permits an admittedly poor system of meter installation to exist will prove to be most insistent upon good power-house design and high station economies.

The present loose methods of meter installation are to a certain extent an outgrowth of the early days when wiring was poorly put in and scant attention paid to permanent work. While the wiring practices of the past have been largely eliminated the fact remains that meters which are absolutely under the control of the lighting company are frequently installed in a primitive manner.

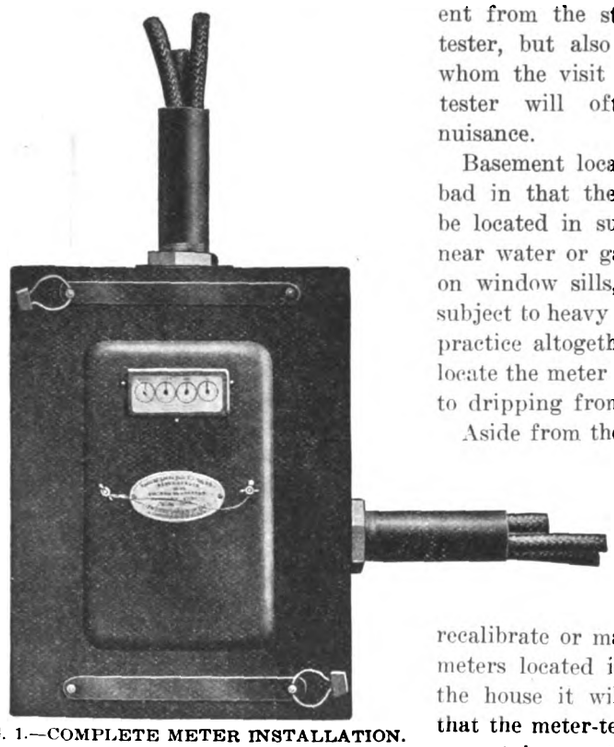

FIG. 1.—COMPLETE METER INSTALLATION.

In some cases the contractor is obliged to place the meter boards in a more or less inconvenient place, or to leave the loops in such a condition that all the meters can be easily installed. This practice is good as far as it goes, but a location which from a contractor's standpoint may be a convenient place to install the meter, is frequently most inconvenient from the standpoint of the central station or consumer. For instance, it is not an uncommon practice to find meters installed in garrets, back under low partitions, in bathrooms, in dark halls, behind the refrigerator, or other equally inaccessible places. It will readily be appreciated that such locations as cited are not only inconvenient from the standpoint of the meter tester, but also to the householder to whom the visit of the meter reader or tester will often prove a positive nuisance.

Basement locations are often equally bad in that the meter will frequently be located in such places as coal bins, near water or gas pipes, near furnaces, on window sills, or on light partitions subject to heavy vibration. Another bad practice altogether too common is to so locate the meter that it will be subjected to dripping from leaky water pipes.

Aside from the inconvenience of reading improperly located meters the most serious objection is the difficulty experienced when it becomes necessary to recalibrate or make adjustments. With meters located in any of the rooms of the house it will frequently be found that the meter-tester's visit will come at a most inopportune moment and much time will be lost in awaiting the convenience of the householder, or in preparation for the meter test. The same objection applies to improper basement locations, for if the meter is not conveniently located it will be found that a great deal of time will be wasted in preparing for the test, all of which could be avoided by a better method of installation.

Again, the present methods of meter installation using open main and branch blocks present a constant temptation to unscrupulous persons in that theft of current is very readily accomplished. It is a well-known and admitted fact that central stations, especially in larger cities, are losing a vast amount of revenue through the practice of stealing current.

Central-station managers are therefore fast beginning to realize that the meter is really an important element of the electrical equipment, for if the meters register incorrectly a large percentage of the economy secured in the generating or distributing systems is quickly dissipated by under-registration of the meters. Aside from this phase of the situation it should be remembered that meters form a very considerable part of the plant investment per kilowatt and come within the scope of valuable assets which should be properly taken care of.

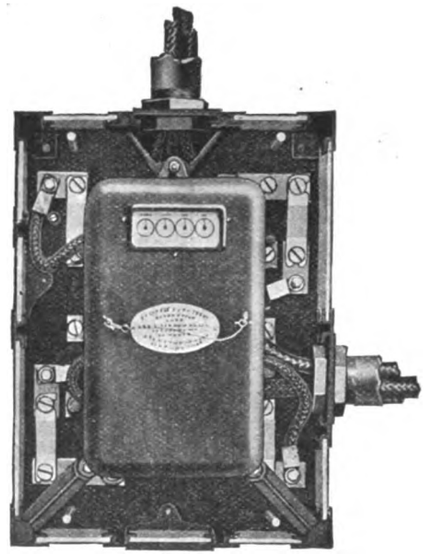

FIG. 2.—METER CONNECTION BOX WITH COVER REMOVED.

After a careful analysis of the situation extending over a period of years it was decided that central-station managers could be made to realize the importance of proper meter installations. As a result of this decision the installation and testing system described herein was

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developed and is now in successful commercial use.

The essential element of this new system is a specially designed meter connection box provided with suitable means for installing meters in such a manner that installations are made safe, accessible and of such a nature that all necessary tests can be quickly and

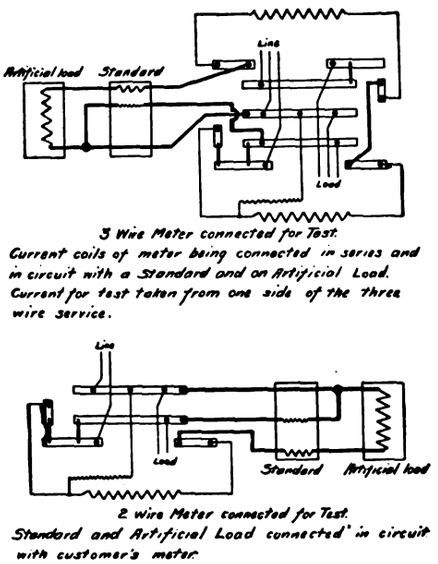

FIG. 3.—TESTING CONNECTIONS.

cheaply made. For small-capacity meters the connection blocks are made of porcelain and in larger capacities they are made of slate and busbar copper.

A method of installing large-capacity meters is shown in Figs. 1 and 2. This type of installation is particularly well-adapted for use on the premises of power consumers where it is advisable to test frequently, owing to the fact that a comparatively slight error in the meter's registration would involve a very considerable monetary loss. This method of connection not only permits of a systematic method of terminal arrangement, but also eliminates the danger of stray field effect upon the measuring coils of the meter.

The terminals on the block to which the meter leads are attached are so arranged that their relative position is always the same irrespective of the direction from which the line and load wires approach the meter. This being the case, the standard meter leads may be directly attached to their proper connection points, thus obviating all confusion and making it possible to trace the direction of the meter loop at a glance. The sides of the box consist of metal stampings which form the corners and conduit entrances, the spaces between these stampings being filled with asbestos lumber strips, that are readily removable, to facilitate connecting up or testing the meter.

The meter itself is supported by studs attached to the slate base in such a manner that it is possible to set up and connect any make or type of meter within the capacity of the block without making any changes other than can be affected by a moment's use of a screwdriver. Metal covers are provided that entirely enclose the meter and connection wires may be sealed in a closed position as shown in Fig. 1. Special covers are provided for different types of meters so that it is possible to replace a meter of one make or size with another by arranging the meter supports and substituting the proper sized meter-cover.

Fig. 2 shows the method of mounting the meter, the connection box cover being removed. The location of fuses, method of conduit entrance and arrangement of asbestos lumber side pieces are clearly shown. Fig. 3 illustrates one of the many methods of conducting tests on heavy-capacity service meters by use of artificial loads and by tracing the connections the circuit through the series coils of the meter may be readily it is only necessary to insert two fuses across readily accessible points, and then by removing four fuses, entirely disconnect the meter without interrupting the customer's use of current.

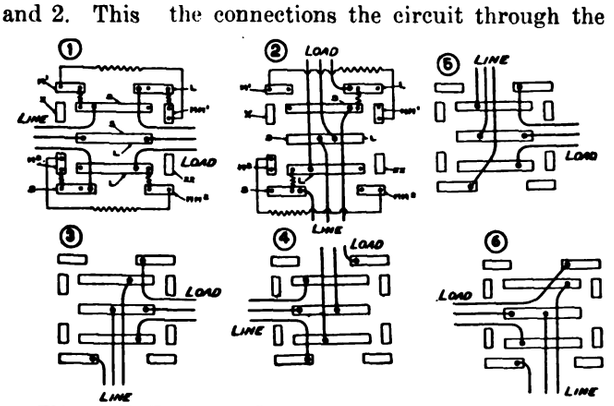

FIG. 4.—METHOD OF TERMINATING HEAVY SERVICES.

Another feature of this meter connection system is that it affords a ready method of terminating heavy-service and load wires. Fig. 4 illustrates six terminal or connection blocks with different arrangement of line and load wires entering and leaving the connection box without crossing. The advantage of this management is obvious when installing meters of different makes having line or load wires entering and leaving from the top, bottom or sides, as the case may be.

New York Interior Wiring Rules.

Commissioner J. H. O'Brien, of the department of water supply, gas and electricity, New York city, has announced the withdrawal, on December 1st, of the interior wiring rules of the city, comprising Classes A and C, included on pages 32 to 42, and 48 to 85 inclusive, of the city's rules and regulations, and the substitution thereof of the interior wiring rules of the National Electrical Code, edition of 1909, as included in Class A—Stations and Dynamo Rooms, and Class C—Inside Work, with the following modifications, which are rendered necessary by local conditions.

8-6. Omit the third paragraph, relating to motor leads.

14-b. Change the first sentence, to read as follows: "If tie wires are used they must have an insulation of the same type as that of the conductors they confine and must be of such a size as to afford ample mechanical security."

21-a and 22-a. Add the following sentence to the end of the first paragraph: "Departure from this rule may be authorized only under special permission in writing, given in advance."

21-d. Omit the fifth paragraph, relating to link fuse rosettes.

24-g. Omit the note under this rule, and add the following sentence as a second sentence of the rule: "Slow-burning insulation may be used only under special permission in writing, given in advance."

24-h. Omit the third paragraph, relating to the neutral of an Edison system.

24-q to u inclusive. Omit these rules, which relate to concealed "knob and tube" work.

24-A-b and 25-d. After "plate" add the words "or other approved device."

25-b. Add to the end of the second paragraph the following sentence: "Departure from this rule may be authorized only under special permission in writing, given in advance."

25-A-b. In the second paragraph omit the first clause and begin the paragraph "where the mechanical strength," etc.

27-b. For the words "'waterproof' sockets" substitute the words "weatherproof sockets especially approved for the location."

31-A. Omit from the general note the words "which is capable of seating at least 400 persons."

31-A-a. Omit the notes under paragraphs 1 and 2 and add the following sentence at the end of paragraph 1: "Departure from this rule may be authorized only under special permission in writing, given in advance."

31-B-l. Insert after the word "wires" the following words: "Connected to open terminal receptacles not enclosed in outlet boxes."

36-c. Omit the words "thoroughly insulated from the ground, or."

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SOME REMARKS ON DISTRICT STEAM HEATING.[1]

BY W. J. KLINE.[2]

The development of operating methods has, in a measure, paralleled the advancement of construction details. Mechanical soundness is a vital factor, but without rational business principles in the operation of a district heating system, mediocre results will be obtained.

Boiler room efficiency is a problem too often neglected, or indifferently studied. Here is the source of heat to be distributed whether in live or exhaust steam, and the expenditure of man's best resources will be amply rewarded. With the vast fund of information available, it is a reflection on any operator who only secures fifty per cent of the heat units in coal when he should get sixty per cent, or sixty per cent when he should get seventy per cent, etc. Records, tests and comparisons stop many leaks.

The operation of a combination steam heating plant, one using both exhaust and live steam, presents a further problem in the engine room, which will influence the degree of profit to a considerable extent.

It must be conceded that back pressure on engines increases the amount of steam required to develop a horsepower, but this back pressure has been aptly described as "the most profitable load an engine carries" when the exhaust steam is sold for heating. It will also be conceded that a unit quantity of steam contains a certain quantity of energy, a greater or less proportion of which may be developed according to the construction and efficiency of what might be termed the "transformer."

A third postulate will also be conceded—that there exists in every community a definite demand for heat, varying according to the changes of temperature, etc., and uninfluenced by other necessities, such as water and light.

Since there is a demand for heat, which is distributed from the central station in the form of steam, it follows that there exists a certain amount of mechanical energy in the total quantity of steam demanded for heating. Therefore, an ideal engine room condition would be the development of the greatest amount of energy possible from the steam needed to supply the heating demand, and with the engine which will use the least amount of steam per horsepower against the necessary back pressure. Then when the exhaust steam has been sold for heating, the greatest possible heat efficiency of steam will be realized.

It is not profitable to run two engines under back pressure, when one will supply the exhaust steam needed. Therefore a considerable expense is justified to provide station piping so arranged that the best co-ordination of electric and heating loads possible may be realized. This arrangement is indispensible for the further reason of the fluctuation in the amount of heat required in various months, which ranges from five to six per cent of the season's demand in the warmer to several times greater in the coldest months.

Each individual case will vary somewhat, depending upon station equipment and heat demand, but in the main, a scheme of operation can be worked out in any plant, which will assist toward economy of operation without much expense.

Aside from the generating station and a properly constructed underground distributing system, the district steam heating problem becomes largely one of dealing with the individual consumer, and since steam heating companies seldom have an interruption of service, the commercial feature is one of the principal factors to be considered.

The invisibility of heat is its most important distinguishing characteristic. Heat may therefore be used and wasted without being particularly noticed by the consumer except so far as his comfort is concerned. This furnishes the key to the problem, which is measured service.

About the first method of selling heat was that of charging a fixed amount for the heating season, equal to the average coal bill. In another method a fixed sum per square foot radiation installed was charged, which was manifestly unfair, since the ratio of heating surface to space is seldom alike for buildings of the same size, type of construction, glass and wall exposure, etc.

Probably the most equitable of the flat-rate methods is that of a fixed charge per unit of space heated, but since the quantity of heat consumed is influenced by the construction and use of the building, temperament of the individual, etc., even this method cannot fail to work injustice in a majority of cases. Tabulated records show a variation of over 100 per cent in heat used per unit of space in the same cities.

The velocity or live-steam meter was the first forward step in the selling of the heat of steam, and many of these meters are in use today. Their moral effect has been helpful to plants using them, besides furnishing a fairly accurate record of consumption under the proper conditions. Pressure and volume variations which affect the calibration of the meter, have been the principal handicaps of this style of meter.

The need of an accurate device to measure the quantity of heat consumed, resulted in the invention of the condensation meter and its subsequent development. The scientific principle upon which it is based is too well known to require discussion, but it should be noted that its accuracy is practically uninfluenced by variations of pressure of the steam entering a building, and for the following reasons: Based on the temperature of steam at zero pressure gauge, the increase in temperature at twenty-five pounds pressure is about twenty-four degrees Fahrenheit, but the total heat of steam at twenty-five pounds pressure is less than one and one-half times greater than the total heat at zero pressure. Therefore, for all practical purposes, each customer receives an equal heat value for each pound of steam condensed. Reference to standard tables of the properties of steam will show the exact variations in quantities.

The condensation meter is now in general use by district steam heating companies and no company will realize its proper success unless it is adopted as a medium for determining charges.

A proper rate is of vital importance to a heating company and should fulfill two conditions: (1) It should allow the company a fair profit over manufacturing costs. (2) It should not be burdensome or prohibitive to the consumer, but it should be high enough to discourage extravagance.

Manufacturing costs are made up of two items, generating and fixed charges.

Generating charges vary according to the cost of coal, water and labor, and the evaporative efficiency of the fuel and may average from twenty to thirty per cent per 1,000 pounds of steam manufactured, according to locality.

Fixed charges are based on salaries,

[1] Abstract of a paper presented at the first annual convention of The National District Heating Association, Columbus, Ohio, November 11, 1909.

[2] Of the American District Steam Company, Lockport, N. Y.

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office expenses, investment, etc., and the amount per 1,000 pounds will vary inversely as the total quantity manufactured during the season. The sum of the foregoing items plus a fair profit should determine the net average rate charged.

For a particular community local conditions should be taken into account in determining what the company must charge, and what the customer can afford to pay. In this latter connection it may be said that a customer can afford to pay, per 1,000 pounds of steam, at least one-tenth of the local cost per ton of anthracite coal, and for this reason: Fuel burned in small quantities will not produce a high evaporative efficiency, and therefore, on the basis of five to one, 10,000 pounds of steam will be made from a ton of coal, which, I believe, is conservative. This fundamental handicap in individual plants has a further tendency to compel the average individual toward insufficient heating or at least to regulate the supply more nearly to necessity, which he often fails to do when using heat from a district system, unless the rate charged is high enough to furnish a motive for economy. Heating companies are often confronted with the statement that their service costs more than the expense when the individual "used to do it himself." The statement would be quite harmless, if qualified by the fact that the customer has used a proportionally greater amount of heat.

A sliding scale of charges varying according to quantities consumed seems to be the most desirable, for the larger the consumer, the proportionally less his generating expense, and as a matter of business the operating company can afford to take a less profit per 1,000 pounds when large quantities of steam are sold.

Rates should always be based on the manufacturing cost of live steam independent of the benefits a company derive through utilizing its exhaust steam. It is true that the profits of exhaust heating are larger than of strictly live-steam heating, but the economic principle of demand for heat, and its commercial value, remain unchanged, and the contingency of furnishing live steam should be anticipated.

An operating company should uphold a proper rate and educate the individuals to economy, rather than make concessions in cases of excessive consumption due to carelessness or to fundamental causes, for example, poor construction of building, business of occupant, or mechanical defects of the piping system.

Every well conducted heating system should have a system of accurate records of all departments of the business arranged in convenient form for comparison. Without such records and unless used when kept, progress will remain largely a matter of chance.

Among the items of station records will be included: Pounds of fuel burned; pounds of water evaporated; average daily temperature; average daily wind; average daily relative humidity; average temperature of feed water; daily kilowatt output (if combination plant), etc.

Office records will include: Monthly condensation of each customer; an accurate measurement of the space heated; amount of radiating surface; economy coil; size of trap; size of meter, etc.

A graphic representation of some of the information of this character oftentimes reveals facts which might otherwise be overlooked.

The heating business in general has been considered too easy. This is true of selling as well as of operating. Within a short time, a manager said to me, "We never solicit heating business; it comes to us." It seems to me that if the heating business is at all worth while, every possible customer should be secured, for the more space heated per foot of mains installed, the greater the net profit of operation as the fixed charges are spread over a greater volume.

However, such conditions are rapidly passing away. A great deal of information has been compiled, and with standard construction, reliable meters, equitable rates, the success of district steam heating is assured, as has been demonstrated by the many companies now operating.

Electrical Opportunities in Australia.

The Bureau of Manufactures is in receipt of a communication from an Australian organization requesting the names of firms that can supply machinery and appliances for the following: The utilization of water, wind, steam, and the generation of electric power for the manufacture of calcium carbide and metal sheets and foil; also aluminum in bulk and in manufactured form, and appliances for aerial wire transport and ground railways. Further particulars may be obtained by writing to the Bureau of Manufactures, Washington, D. C., quoting File No. 4178.

DEVELOPMENT OF ELECTRICAL UNDERTAKINGS.[1]—II.

BY S. J. WATSON.[2]

There is no doubt that the reciprocating engine has a very high thermal efficiency with moderate steam pressures, and it has been suggested that to obtain the highest possible efficiency from the use of highly superheated high-pressure steam in large units of plant, a combination might be used consisting of a one-stage or two-stage impulse turbine at the high-pressure end, a reciprocating engine for the intermediate pressure, and an exhaust turbine at the vacuum end. Such an arrangement possesses certain theoretical and practical advantages. There is apparently no difficulty in designing impulse machines to run with steam of the highest superheat and pressure, and the superheat and pressure can be very considerably reduced in one or two stages, whereas under similar conditions trouble is likely to arise in the cylinders or valves of reciprocating engines through distortion owing to changes of temperature in providing efficient internal lubrication, or in the suitable maintenance of the steam glands.

At intermediate pressures the reciprocating engine is undoubtedly very economical and satisfactory. The equivalent of the large low-pressure cylinders theoretically required for the reciprocating engine working on high vacuum can be much better provided in a turbine. As two-thirds of such a combination would, however, consist of turbines, there would have to be a very considerable advantage in the economy of the reciprocating engine at the intermediate pressures compared with the corresponding portion of a turbine to warrant the additional cost and complication of such a combination, and as yet no figures are available to show that such a marked improvement would be forthcoming.

So much has been written and said recently concerning large gas engines for power stations that I hesitate to say very much on the matter. The whole question is really one of load factor, and, unfortunately, the load factor of the most public supply undertakings is so low, it is impossible to say or to estimate with any degree of certainty

[1] Chairman's address at opening meeting, Institution of Electrical Engineers, Manchester (Eng.) Section, October 22.
[2] Borough Electrical Engineer, Bury, Eng.
Note.—The English money values have been changed in all cases to approximate American figures.

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that the extra cost of the gas engine plant will be counterbalanced by the reduced fuel costs. Inasmuch as the load factor, however, is slowly but surely improving, it is not unlikely that in the near future it will be found economical to install gas engines to deal with at least that portion of the load having the highest load factor.

For a direct-current station situated in a good position for obtaining coal supplies a combination of gas engines as the prime movers with large storage-battery capacity appears to be an excellent arrangement. The higher capital cost of gas engines as compared with steam plant is only warranted when the running load factor is high, and the cost of storage batteries as compared with steam plant only appears advantageous when the output capacity is taken at the one-hour discharge rate. If, therefore, the capital cost of a gas engine with battery station is compared with a steam station without batteries not on the basis of the capacity per kilowatt of generating plant installed, but on the maximum demand it is possible to supply, there is very little difference between the two. Exception has often been taken to comparing the capital cost per kilowatt of batteries at their one-hour rate with generating plant capable of giving the rated output continuously for twenty-four hours because the one is strictly speaking unproductive, while the other is productive plant, but so long as peak loads are obtained which only necessitate the employment of plant for about one hour per day, the comparison is quite fair, as the additional twenty-three hours capacity of the steam plant is quite useless, and yet has had to be provided and paid for as part of the equipment. The combination, then, of gas engines with batteries would not much exceed in cost the steam plant capable of dealing with the same maximum demand, and as the working load factor of the gas engine would probably reach, if not exceed, sixty per cent, there is little doubt that the fuel costs and the working expenses generally would be lower than the steam station.

Before leaving the subject of gas engines, it may be as well to note, in passing, that the coming of the gas turbine still seems a long way off. In conversation with a gas engine manufacturer a short time ago, I was assured that gas turbines can be designed; they cannot, however, be constructed, because at the present time there is not a metal on the market suitable to meet the difficult conditions in regard to high temperatures and high pressures under which turbines must work successfully when internal combustion is employed.

Power-station engineers are evidently appreciating the many advantages incident to the use of storage batteries on a comprehensive scale. The load can be leveled out so as to improve the load factor of the main plant, the supply pressure can be kept constant even with sudden and violent changes of load and greater security is provided against a total shutdown. During the last few years batteries many sizes larger than previously contemplated have been put into use, and the ideal conditions of supply of our gas and water undertakings in regard to storage may even be realized in the near future.

Much less attention is given nowadays to the old idea of grading the size of plant so that whatever the demand it should be possible to work with approximately full load on each set. The best all-round results are now obtained from large plants, although they do sometimes have to be worked on light loads. The subdivision of plant reminds me that the original contract for one of our supply undertakings provided for the erection of two thirty-five kilowatt and eight sixty-six kilowatt sets, and before they were all set to work it was decided to sell two of the sixty-six kilowatt sets and obtain one or more of 250 kilowatt size, which in turn have since been superseded by plants of still larger capacity. To a less extent, perhaps, the same course has already been, or will eventually have to be, taken by all undertakings, and for this reason, if for no other, those responsible for the management should use every opportunity to provide funds, whether under the heading of reserve or depreciation, to enable the value of such obsolescent plant to be entirely written off from time to time, so that the net capital expenditure shall only represent the value of the plant capable of being usefully and economically employed under modern conditions. *(To be continued.)*

The Cunard liner Caronia has been equipped with what is claimed to be the most powerful wireless apparatus on any steamship afloat. The radius is 1,200 miles.

Vacuum Lightning Arrester for Telegraph and Telephone Lines.

The toothed-plate lightning arresters generally employed for telegraph and telephone lines, while efficacious in the case of atmospheric discharges, are not sensitive enough to protect apparatus and cables, if the circuit contains any, against the effects of static discharges which may take place in the lines. By means of the vacuum lightning arrester it is possible to insure the conduction to the ground of all charges having a tension of 300 volts and over. For this reason the arrester is particularly useful in protecting two-wire circuits, in which the formation of static charges is generally pronounced. The device consists of a vacuum tube containing the toothed electrodes. The rarefaction of the air facilitates the passage of the discharges, and the electrodes are placed at a sufficient distance to insure good working. As this lightning arrester is protected from humidity and dust, its operation is more reliable than that of the ordinary instruments. The device is constructed in the form of a cartridge, similar to enclosed fuses, and can be connected in the circuit by placing it between flat springs. Pointed lightning arresters and fuses may be used in connection with the same in order to protect it against very violent discharges and excessive currents.—*From L'Electricien (Paris), October 16.*

Manchester (Eng.) Machinery Show for 1910.

The proprietors of *The Engineering Review*, an English technical monthly magazine, are promoting an Engineering and Machinery Exhibition to be held at Manchester, England, from October 14 to November 5, 1910. The head office of the exhibition is at 16 John Dalton Street, Manchester, England. Inquiries may also be directed to The Exhibition Department, *The Engineering Review*, 104 High Holborn, London, W. C., England.

Electrical Openings in Russia.

Consul-General John H. Snodgrass, of Moscow, Russia, states in a recent report that electrical engineers have chances to exploit their ability in the Baku District, as electrical power is being instituted in the immense oil fields of that district. Oil-well supplies, such as casing, drilling tools, rig and engineering machinery and irrigation outfits are in demand.

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ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

THE NEW DOWN TOWN STREET-LIGHTING SYSTEM OF ST. LOUIS.

BY JOHN E. TIEDEMAN[1].

Before the beginning of the new year, St. Louis will have completed and in operation what the writer believes to be the most extensive, most up-to-date, and most effective street-lighting system of any American city.

The work of arousing sentiment in favor of a new lighting system in the business district of St. Louis and carrying the project to successful completion was placed in the hands of the officers of a voluntary organization composed of merchants and property owners within the district and known as the Down Town Lighting Association.

It had been realized by the merchants and property owners that a new lighting system was badly needed in the business district, and it was finally agreed that some steps should be taken looking to the improvement of conditions.

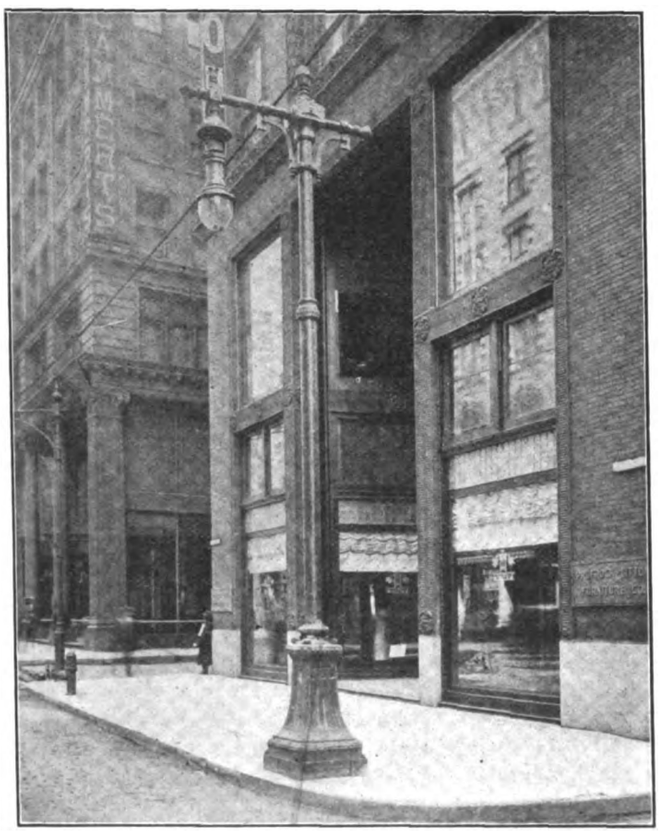
The new organization began work immediately after the beginning of the present year. Committees were appointed, to which were delegated the duties of making a thorough investigation of all existing forms of street illumination, and of devising the proper system adapted to conditions in St. Louis.

After more than eight months of labor, it was decided to install an improved form of arc-lamp lighting, and by process of elimination the new General Electric magnetite arc lamp was fixed upon as the unit of illumination.

This having been established, a committee was appointed to design a suitable lamp standard which could be manufactured and erected at moderate cost, and which would eliminate the unsightly service loops which had heretofore been a feature of the arc-lamp standards. The new lamp standard called for the fixation of the lamp.

These points having been settled, the entire plans were laid before the Board of Public Improvements of the City of St. Louis for its approval and adoption, so that the maintenance charge would be paid by the city under its street-lighting contracts with the Union Electric Light and Power Company. The plans were also placed before the executive committee of the Union Electric Light and Power Company, since it was to undertake the installation.

The association made a contract with



TYPE OF SINGLE-LAMP STANDARD USED ON ALL STREETS IN ST. LOUIS BUSINESS DISTRICT EXCEPT BROADWAY.

TYPE OF THREE-LAMP STANDARDS USED ON BROADWAY IN ST. LOUIS BUSINESS DISTRICT.

[1] Secretary Down Town Lighting Association, of St. Louis, Mo.

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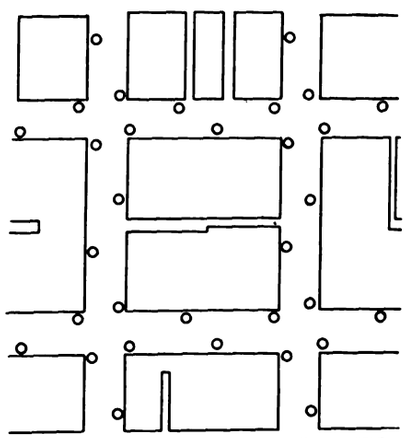
the Union Electric Light and Power Company for the manufacture and installation of the standards at a fixed price for each. The company then contracted with the St. Louis Car Wheel Company for the actual manufacture of the standards. It was found that in this



TYPICAL BLOCK IN ST. LOUIS BUSINESS DISTRICT SHOWING PLACING OF SINGLE LAMP STANDARDS.

way they could be obtained at the least cost and at the same time the business given to a local foundry. The fact that they were "made in St. Louis" made a "hit" with the newspapers and the contributors to the lighting fund.

As soon as these details were determined upon, the question of cost was taken up, and it was estimated that the new lamp standards could be manufactured and installed on the streets at a total cost to the property owners and merchants of $30,000. In order to obtain this sum, the officers of the Lighting Association made an assessment of $1.00 per front foot against all of the property fronting on the streets to be illuminated. The response received from the property owners to the calls for the funds, was more than gratifying, showing that the movement for a new street-lighting system in the business district of St. Louis was a popular one.

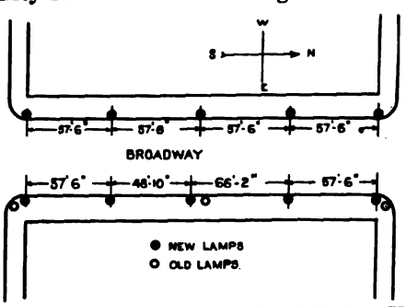
Actual construction work on the new system was begun in August last, and every effort was made by the Union Electric Light and Power Company to have as many streets as possible completed in time for the Centennial Celebration, which began October 4. On that date, enough streets were completed to show what the entire system would be like when completed.

The district illuminated by the new system is bounded by Fourth Street on the east, Twelfth street on the west, Washington Avenue on the north, and Market Street on the south, comprising a total of forty-eight square blocks.

Prior to the installation of the new system there were in this district only 138 arc lamps of the old inclosed type, which had been installed ten years ago. Under the plan of the Down Town Lighting Association there are being installed within this district 427 arc lamps. These are all 6.8-ampere General Electric magnetite arcs. They are placed in a uniform manner on all the streets in the district, with the exception of Broadway. This street was not included in the general lighting scheme, but was left to the City Improvement Association, composed of property owners and merchants on Broadway. The latter association installed on Broadway 240 four-ampere General Electric magnetite lamps, the maintenance of which is paid for by this enterprising association.

The plan of the Down Town Lighting Association calls for four lamps at each street intersection, one on each corner and so arranged that two will line up with those on the north and south streets and two with those on the east and west streets. In addition, there are placed two lamps in the middle of the block, so arranged that they are approximately eighty feet between centers. This gives a total of six lamps per block.

On Broadway the lamp standards are designed to carry three four-ampere magnetite lamps; the standards are placed opposite each other on both sides of the street and with approximately sixty-foot centers. This gives a total

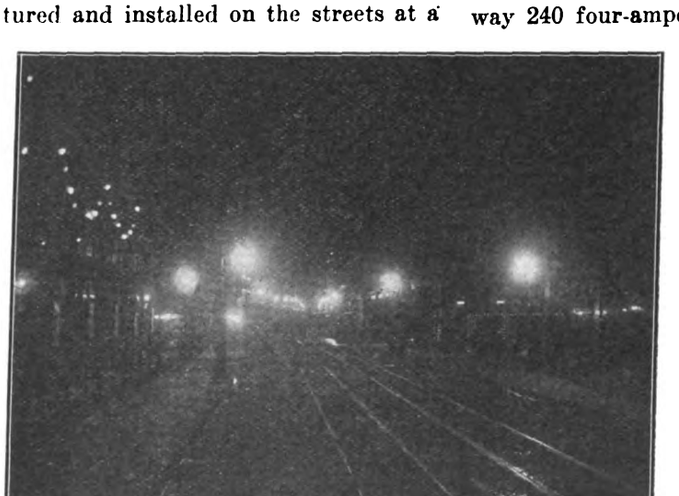


TYPICAL BLOCK ON BROADWAY, ST. LOUIS, SHOWING PLACING OF THREE-LAMP STANDARDS.

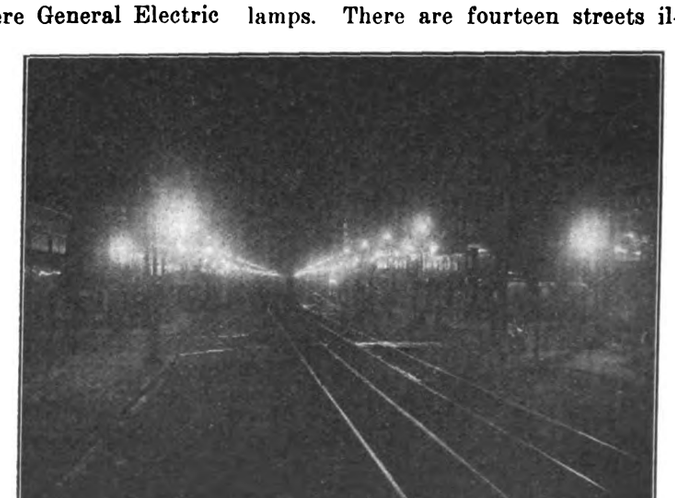
of ten standards, or thirty arc lamps per block. The effect of this illumination is exceedingly brilliant, and has transformed the dark Broadway of old days into the most brilliantly lighted thoroughfare in America, if not in the world.

To indicate the magnitude of the new system, it might be mentioned that in the down town business district there will be installed, when the system is completed, a total of 667 magnetite lamps. There are fourteen streets illuminated by the single-lamp standards and one by the triple-lamp standards. In all, there are five miles of streets illuminated by the new system.

The cost to the property owners in the district, outside of Broadway, was $30,000, and the installation on Broadway amounted to $10,000. The city having agreed to maintain all of the lights, excepting those on Broadway, the additional cost to it will be $30,000



SIXTH STREET, ST. LOUIS, SOUTH FROM WASHINGTON AVENUE.



BROADWAY, ST. LOUIS, SOUTH FROM WASHINGTON AVENUE.

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per year, to be paid out of the general funds of the city, while on Broadway, where the maintenance is borne by the merchants, the cost is approximately $9,000 per year.

In order to supply the current for the new magnetite lamps, the Union Electric Light and Power Company has installed in its station at Tenth and St. Charles streets, three seventy-five-light, four-ampere General Electric mercury rectifiers and regulators, and seven seventy-five-light, 6.8-ampere rectifiers. In addition to this, it has installed additional generators. The company has also, at its own cost, done all of the work of installation of the new system and has furnished all of the new lamps, the only thing paid for by the property owners in the district being the new ornamental lamp standards. When finally completed the total cost of new equipment and construction, it is estimated by S. B. Way, superintendent of the electrical department of the Union Company, will be fully $100,000, thus making the total cost of the system to the property owners and the company, in the neighborhood of $140,000.

This new system is permanent and will be in charge of Harry S. Sanderson, supervisor of city lighting.

The November Meeting of the New York Electrical Society.

At the 289th meeting of the New York Electrical Society, held on November 30, A. J. Marshall delivered an illustrated lecture on "The Significance of Public Decorative Lighting," using over sixty slides of night views taken in various cities of the country, including many views of the illumination during the Hudson-Fulton celebration. Mr. Marshall described various features of spectacular and display lighting, such as lampposts, arches, building outlining, and the use of searchlights.

Chairman Dickinson in opening the discussion, remarked that the subject was particularly interesting to him as he had just returned from Europe where this feature of the electrical business was notable for its absence.

T. I. Jones, of the Edison Illuminating Company of Brooklyn, stated that the local electrical companies had attempted to obtain contracts for building outline lighting, but owing to the large quantity of current which is required in order to make a satisfactory appearance the amount involved was greater than the merchants were willing to pay. He stated, however, that since the Hudson-Fulton Celebration three contracts have been closed for this kind of work.

During the lecture Mr. Marshall had shown a night photograph of the flaming arc installation in Newark, as described in the issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 20 last, and had criticized the lamps on Market Street as being too close to the ground. This brought up the question of the use of flaming arc lamps and Mr. Jones stated that the excavation for the Fourth Avenue subway would be lighted by means of these lamps, and he considered that their use was limited to this kind of work.

H. T. Owens stated that the flaming arc lamp had greater possibilities than given by Mr. Jones, but that they should be used intelligently. He said that the inclined-carbon type of lamps was used in Newark. The first lamps installed in Newark were only seventeen feet above sidewalk level, the later ones were placed twenty-five feet high, whereas in London the same type of lamp was hung thirty-five feet high and also over the center of the roadway.

The flame lamps which were giving the best results in Germany are to be used on the main squares and plazas in the city of New York and these are the Blondel or Alba vertical-carbon lamps taking either ten or twelve amperes. These lamps are not only steadier but they give a white light and the distribution is far superior to that of the inclined-carbon arc. Mr. Owens agreed with the chairman that there were few electrical spectacular displays in Europe, but at Lucerne they poured barrels of burning tar from the top of Mount Pilatus on Saturday nights for the edification of the American tourists.

Franklin Institute.

At the section meeting of the Franklin Institute, announced to be held in Philadelphia on the evening of December 9, Prof. Robert W. Wood, of Johns Hopkins University, Baltimore, was expected to deliver an illustrated lecture on the "Infra-Red and Ultra-Violet, a New Departure in Photography." On account of Professor Wood's well-known researches in this line exceptional interest in this lecture was anticipated.

THE METHODS OF COMPARING OUR VARIOUS SOURCES OF ARTIFICIAL LIGHT.

BY W. E. BARROWS, JR.

The merits of the different sources of artificial illumination in use in this country and throughout the civilized world are based on several important considerations, among which are the following: The candlepower, which may refer to the mean horizontal, the mean hemispherical, or the mean spherical candlepowers as the case may be; the distribution of the light flux, i. e., the intensity of the light in various radial directions; the color of the light; the efficiency of the source; the initial cost of the lamp; its life and cost of maintenance; and its adaptability to the various classes of service. This paper will deal mainly with the problems of determining the photometrical basis of those comparisons involving the values of the candlepower.

The fact that the intensity of light varies inversely as the square of the distance from the source is familiar even to the layman, and the simple methods of photometry are elements of common knowledge. However, the development of new illuminants with color values so radically different and the remarkable progress in illuminating engineering which demands results of greater accuracy, together with the competition in the commercial realm, makes it imperative that photometric results should possess a percentage of accuracy comparable with measurements of the other engineering professions.

The troublesome element in obtaining satisfactory and consistent results in photometry is what is known as the Purkinje or color effect. Without disputing the law of inverse squares it appears that the normal eye can distinguish detail better when the subject is illuminated by a light emitting many green or blue rays than when the light is of a yellow or reddish hue, if the intensity of illumination is low, while the converse is true if the illumination is of greater intensity. An explanation for this phenomenon is that there are in the eye two sets of optical nerves known as the "rods" and the "cones." The cones are the predominating organs when the illumination is intense and they are more sensitive to light of a red or yellow hue, while

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if the illumination is of a low order the iris opens up and the sensations are received by the rods which are partial to light of a bluish or greenish hue.

Let us consider the effect of these physiological peculiarities on the results of photometric measurements. Suppose we were to photometer a tungsten lamp consuming 1.25 watts per candle against a carbon-filament lamp as a standard which requires perhaps 3.5 watts per candle. The tungsten filament being at a much higher temperature will give a light much whiter than that of the carbon lamp. In other words there are comparatively more blue rays in tungsten light and more yellow rays in the light from the carbon lamp. If the photometer screen is brightly illuminated, the cones will be the predominating organs and the photometrical setting will favor the carbon-filament lamp, while, on the other hand, if the lamps are at a considerable distance from the screen and the intensity on the screen is consequently low, the setting, because of the Purkinje effect, will favor the tungsten lamp and the results obtained in the two cases may differ by as much as ten or fifteen per cent.

Thus it will be seen that results taken by one observer may not check with those taken by another especially if different apparatus is used in the two cases. Fortunately there is considerable symmetry in the prevailing apparatus for the most accurate photometrical measurements. The photometer bench is usually about three metres in length so that the source of light may be considered as at a point. The standard in most cases is a carbon filament lamp of about sixteen candlepower and the photometric devices most widely used show no appreciable difference in the results, so that measurements of candlepower hitherto performed may not show any great discrepancies. But the life characteristics of tungsten and osmium lamps are far superior to those of the carbon-filament lamp and the color of the light is more desirable for a standard. These advantages indicate an early adoption of one or both of these lamps as a standard and when this occurs conflicting data from different sources are likely to be found. Moreover, more attention is being paid to the illuminating value of a lamp and less to the candlepower values, i. e., to the color and distribution of light relative to producing a pleasing effect and the desired illumination, rather than the mean horizontal or mean spherical candlepowers. The illuminating value includes as an element the color value of light which seem to agree with values obtained by the ordinary photometer and vary in accordance with the Purkinje effect.

Also the type of instrument used for measurements of illumination is of a portable form and far different from the bench and dark room, and the results obtained by means of the former will conform with those calculated from measurements in the dark room only when the candlepower measurements are based on the illuminating value of the light itself.

There are four types of photometrical devices in commercial use in this country and abroad for comparing the candlepower of luminous sources or for measuring illumination. The Bunsen or "grease spot" photometer, also known as the contrast photometer, is the oldest and most simple in construction and principle. It consists in effect of a sheet of paper in which a certain part with its edges sharply defined has been made translucent by an application of paraffine. Light falling on one side of this screen is reflected from the opaque part while part is reflected and part transmitted by the translucent section. Light falling on the other side is reflected or transmitted in the same way. The percentage of light absorbed by the treated and untreated parts are the same. When the illumination is the same on both sides of the screen the amount of light transmitted in both directions through the translucent part is equal and if the lights are of the same colors the treated and untreated portions will appear identical as viewed through the eye piece and the forty-five degree mirrors.

The "comparison of brightness" or Lummer-Brodhun type possesses greater sensibility than the Bunsen. By means of an optical train the two illuminated sides of the screen are viewed in adjacent fields and the photometrical setting consists in judging equality of brightness of the illminated areas.

Another type is known as the flicker photometer and was designed for the purpose of comparing luminous sources emitting different colored lights—to eliminate the possibility of errors due to the Purkinje effect. Its principle consists in presenting to the eye of the observer by means of rotating disks, rotating beveled surfaces or oscillating lenses, areas illuminated first by one source, then by the other in rapid succession. It was claimed that in this way the eye would be worked at its greatest sensitiveness and the photometrical balance would represent the comparative illuminating values of the luminous sources.

Instruments of another type are known as illuminometers. They were designed as a convenient means for measuring illumination and in this way can be used to compare candlepower values as well. They consist in principle upon the distance from a lamp at which a certain size of print can be read, or the proportional part of the light from a source by which it is possible to discern certain details of drawings or print. In other words, the results obtained by the use of these instruments depend entirely upon visual acuity and without doubt represent the true illuminating values of light sources where a low intensity of illumination is desired, but they do not represent the true illuminating value for higher intensities as met in interior lighting.

Experiments with these types of photometrical devices show that the flicker photometer possesses the greatest consistency in respect to obtaining a photometrical balance and that with reasonable care successive readings will check within one per cent. Moreover, candlepower measurements taken throughout a wide range of different intensities upon the screen agree very closely, thus apparently eliminating the Purkinje effect.

The results of tests by Mr. Wild[1] show a discrepancy of six per cent in the results obtained by photometering a tungsten-filament lamp consuming 1.5 watts per candle against a carbon-filament lamp of 4.5 watts per candle as a standard by means of the flicker, Lummer Brodhun, and Bunsen types of photometers. The flicker photometer, of which three different types were used, gave lower values for the tungsten lamp and differed by less than one per cent from each other. The average results obtained from the contrast and from the equality of brightness types compare very favorably with each other, although the different settings varied by several per cent.

These results show the Purkinje ef-

1 *The Electrician*, London, July 16, 1909.

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fect and doubtless if the lamps were placed at a greater distance apart so that the intensity of the light at the photometrical device was less the difference between the values obtained by the flicker photometer and those obtained by the other instruments would be still greater.

Without further thought on the subject it would appear that the solution of the problem of comparing luminous sources differing in color would be by means of the flicker photometer. But in this method the eye is not working in its normal condition when determining the photometrical balance and it seems reasonable that results obtained when the eye is working in its normal condition should be of more practical value and represent the merits of the two sources in a way more comparable with their illuminating properties, than if the measurements are made with the eye excited to conditions entirely unnatural.

The results obtained by using the illuminometer show the illuminating value of a luminous source with respect to distinguishing detail and would seem to be the proper instrument for making photometrical measurements since the objects of light is usually for the purpose of distinguishing objects or outlines. But the illuminometer is of low sensibility, the illumination which it measures is of low intensity, and the normal eye soon becomes fatigued and will give different results under different physical conditions.

The Bunsen and the Lummer-Brodhun types remain, with the Purkinje effect for the disturbing element. Nevertheless, these devices possess certain advantages. The illumination on the screen may be almost any desired intensity so that the eye may, in its normal condition, compare illuminations made to conform to those met in practice. The screens viewed through the eye piece may have a certain size type so as to obtain a better idea of the illuminating values of the sources. The results of photometrical settings for various intensities on the screen seem to conform with the physiological conceptions of illumination obtained in practice. To make this point clear we will refer to the peculiarity of the human eye referred to at the beginning of this paper, viz., that it can distinguish detail better when the object is illuminated by a white light than when illuminated by a yellow light if the intensity is low. In practice we use light for discerning objects, we see things by contrast in color; dark or black objects are not changed in appearance when viewed by lights of different colors, while light shades are changed in appearance. Thus in a white light colored objects of light shade will appear with their daylight color, but if they are viewed in a yellow light their color will be distorted by the yellow.

This characteristic shows up the light to an advantage and the same thing occurs in the photometer due to the Purkinje effect.

From the above reasoning and from similar reasonings along the same line for higher illumination intensities it would seem that the results obtained by using either the Bunsen or the Lummer-Brodhun photometric device would indicate the true illuminating value of the source although difficulty may be encountered in determining the exact candlepower values of the lamp. Moreover, in portable photometers used for illumination measurements entirely, there is little question but that the above devices give the illuminating values of the source and their greater sensibility and less liability to optical errors, as well as the range of illumination intensities for which the ordinary portable photometer is adapted, make them preferable to the illuminometer.

In the preceding paragraphs are set forth some of the practical complexities of modern photometry. Although the differences may be small in most cases, still there is a broad field for improvement before illumination or candlepower measurements may possess an accuracy or reproducibility comparable with the measurements in the other branches of science.

With the photometrical apparatus which is at the present time commercially available for the comparison of the illuminating powers of various sources of light, it is the opinion of the writer, based upon his experience in the dark room and a study of the results obtained by others, that the Lummer-Brodhun photometrical device possesses the greater merit as a means of comparing luminous sources. The Bunsen photometer has been supported by some as the most desirable on the ground that, if the lights from the two sources differ in color, they can be compared against the white field instead of directly with each other as in the Lummer-Brodhun type, but the higher sensibility of the latter appears to more than offset whatever merit there may be in this claim for the Bunsen photometer. It is suggested that the lamps be placed at such a distance from the photometrical device that the intensity of illumination thereon be approximately the same as the illumination intensities obtained from commercial installations and the report of all tests giving the candlepower of a lamp should include the distances at which the lamps are placed from the screen. As an additional means of reducing the Purkinje effect, it is suggested that the commercial photometrist employ the tungsten lamp as a standard and have it calibrated at the Bureau of Standards, for different specific consumptions of energy as, for instance, 1.25, 2.0, 2.5, 3.1 and 3.5 watts per candlepower. In this way one could approximately match the color of any of the incandescent filament lamps, and when operating at 1.25 watts per candle would furnish a far more satisfactory standard with respect to color, for photometering other classes of lamps than the carbon-filament lamp or flame standards which are commonly used.

Determining the Degree of Vacuum of Incandescent Lamps.

The usual method of ascertaining if incandescent lamps are sufficiently evacuated is to subject them to an alternating field of high tension or bring them in contact with the pole of an induction coil. The nature of the luminous phenomena then appearing in the lamps indicates the degree of the vacuum. This method involves danger to the operators, especially when the spark of the induction coil perforates the lamp-being examined. The process of A. Pfeiffer, of Wetzlar, Germany, in which a Tesla field is utilized, does not involve any risks. A small Tesla transformer is enclosed in a box, and one of its poles is connected to the board which carries the entire series of lamps to be examined in one operation. The other pole, consisting of a metallic ring, is attached to an insulating handle and passed over the lamps at a sufficient height to prevent the formation of sparks. The tension is so chosen that even imperfectly vacuumed lamps become luminous. As is well known, the high-frequency Tesla discharges are harmless, and the operators are therefore not exposed to any danger.—*From L'Electricien (Paris), October 30.*

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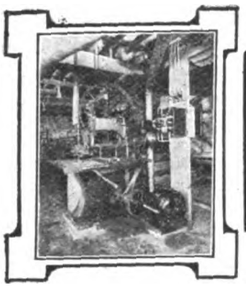

Industrial Power

THE ELECTRIC PROPULSION OF SHIPS.[1]

BY H. J. ORAM.[2]

An electrical drive has already been adopted in some ships of small power where the prime mover is an internal-combustion engine, in order to overcome difficulties in starting, and to avoid complicating these engines with reversing-gear. In one system an electrical drive is adopted for reversing or slow speeds only; at other speeds, though the dynamo and motor are coupled to the engine-shaft, no electricity is generated, and the internal-combustion engine is working directly on the propeller. In this design the capacity of the dynamo and motor is limited to about one-half the power of of the engine in order to save weight. Since the introduction of turbine machinery in warships, proposals to supersede turbines directly coupled to the propeller shafting, by designs where electrical machinery is interposed between the turbines and the propellers, have been made several times.

The system, as proposed, consisted of the employment of economical turbines, at very high revolutions, similar to those in use on land electric-light stations, with a dynamo and motor interposed between the turbine and shaft to reduce the speed of the latter to that which is most suitable from the propeller efficiency point of view. The turbines are always run in one direction, and reversing can be effected by the change of the direction of the current at the motor.

The claims made for this system are that the loss due to the interposition of the dynamo and motor between the turbine and propeller-shaft is more than counterbalanced by the gain due to the more economical steam consumption of high-speed turbines, and that due to a higher propeller efficiency when working at more moderate speeds than is usual in ship turbine machinery.

It is also claimed that the radius of action of the ship will be increased due to an economy when working at low powers, dynamo-machines being shut off altogether, as required, and the remainder worked at, or near, their economical power, and that although the high-speed turbines and electrical machines are together heavier than the direct-coupled turbines this is more than compensated for by the lesser boiler power required, consequent on the higher efficiency of the fast-running turbines and slower-running propellers, so that a complete installation for the same speed of vessel is not only more economical, but no heavier. Further, that there would be an increased economy from working the auxiliary machinery by motors driven from the main generators.

These are the main features of the system; there are various other claims made, but they are not important compared with the preceding.

The actual figures are the subject of considerable doubt and controversy, and would require much time for an adequate examination. I shall only refer generally to some of the important features.

As regards economy at full power, it must be remembered that the claims are based on figures obtained from trials of electric-light stations on shore, and it is somewhat doubtful of the same results will be obtainable when similar units are worked as a battery on board ship with the engines and boilers placed in from five to seven or even more separate watertight compartments.

It appears that the loss which results at the dynamo and motor is not less than twelve per cent, so that not more than eighty-eight per cent of the shaft horsepower given out by the turbine would be available as horsepower at the propeller-shaft.

The actual steam consumption in pounds per shaft horsepower for the propelling turbines in the three ships of the Indomitable class is only twelve pounds at full power, and this without superheating. The figures guaranteed for the steam consumption of the electrical combination from experience in short electric-light installations were given in one case worked out in detail as 12.9 pounds per brake horsepower at the propeller shaft without superheat, and 10.9 pounds with 100 degrees superheat, the vacuum being twenty-eight inches. It will be seen, therefore, that in the particular case of the cruisers mentioned there is little margin of superiority at full power available for reduction of boiler power, even allowing for the probable improvement in economy of the electrical installation due to the larger units in these ships.

The claim to increased economy at low powers should be realized, as the generators then in use could be worked nearer their maximum output, but it must be remembered that the efficiency of the motor falls off with reduced powers, but the actual amount is doubtful. This feature of the system is the important one as regards machinery of warships. The claim as regards increased power for going astern is also justified.

As regards increased propeller efficiency, it must be remembered that the efficiency now obtained with the slower-running propellers has been the result of many years' experience. The early turbine propellers had low efficiencies; experience has enabled these to be increased, but they do not yet reach the figures obtained with the slower running reciprocating engines. There is no doubt that as more experience with small fast-running propellers for such large powers as have only been recently introduced is obtained, the efficiency of the latter will be still further improved. In particular cases, such as in the large cruisers of the Invincible class, there has been no falling off in propeller efficiency of the faster running screws

1 Abstracted from the presidential address, entitled "Propelling Machinery by Warships," delivered at the inaugural meeting (November 16, 1909) of the Junior Institution of Engineers, England.

2 Engineer Vice-Admiral, and Engineer-in-Chief, of the British Navy.

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from efficiencies obtained in the slow-revolution screws of older cruisers.

No doubt a large-diameter propeller assists the maneuvering power of a ship, but the diameter is frequently limited by hull considerations; and electrically driven ships with the same number of propellers, driven slower, would in some cases be limited to practically the same dimensions as in direct-driven installations.

In one design, in which the weights of the turbo-generator and motor were quoted, it was found that the increase of engine-room weights would be considerable, and that the total increase of machinery weights would be about fifteen to twenty per cent. The gain at low powers would require to be very substantial to balance such material increases.

The substitution of electromotors for auxiliary steam-engines would also add to weight, and such auxiliary machinery as steering engines and distilling plant would for the present require to be steam-driven.

The electrical pressure proposed in the various plans has varied from 1,000 volts in the lowest to 2,750 volts in the highest, and these are all very high, from the point of view of safety, for use in the British navy. Also, before any system could be adopted many necessary details would require to be carefully considered, such as freedom from danger of failure due to access of water to the electrical machines or to particular parts of them, and the ventilation of the machines, as considerable heat is generated.

With the interposition of two electrical drives between the turbines and the propeller, in addition to special dynamos as exciters, it is not probable that the wear and tear would be less or that less staff would be required, but rather the reverse.

In the designs submitted to the British Admiralty there has been no gain in the space occupied, but in some cases an increase.

It is essential for warship purposes that the small variations of speed required from the propellers when keeping station in a fleet should be readily obtained, and in this respect the electrical systems which have been proposed to the Admiralty are far from satisfactory. The various firms have only proposed to provide for three electrical speeds—full, half, and quarter—and have suggested that if anything further were required that the speed of the generators should be regulated. This latter would detract from the economy of the system. It is recognized that further attempts are being made to meet this condition, which is absolutely necessary as far as warships are concerned, provision for station keeping or the power of making gradual changes of speed throughout the whole range, both ahead and astern, being essential.

Finally there appears to be considerable doubt as to the efficiencies of the various systems proposed, and the figures on which they are based; but, speaking generally, the conclusion seems to be that the interposition of a dynamo and motor between the engine and its work, involving when on board ship considerable liability to accident and derangement of the electrical machines, in addition to present risks, has disadvantages such that the practicability of the details should be beyond question, and the gain by its adoption must be shown to be substantial before the system could be fitted in any important vessel. This has not, I think, been done at present. We must recognize, however, the skill and ingenuity with which this problem has been dealt with, and any further developments will naturally receive careful consideration, especially the actual results from installations which are about to be fitted on a small scale. The good work done by electrical engineers on board warships at present in respect to auxiliary machinery of all kinds is too well known to need any comment from me, and we should welcome their co-operation as regards the main engines, if the resulting combination is likely to be beneficial.

Increasing Farm Production by Electricity.

In his presidential address to the Institution of Electrical Engineers, in London, England, on November 11 last, Dr. Gisbert Kapp made the following interesting observations on the application of electricity in stimulating plant growth:

"The discovery that electrification of the atmosphere immediately above the plant stimulates in certain cases its growth, is already thirty years old, but only recently has this idea been practically developed—first by Professor Lemström in Sweden, and more recently still by Sir Oliver Lodge, in collaboration with J. E. Newman and R. Bomford, on an experimental farm at Bitton, Gloucestershire, England, and on a farm of about forty acres at Evesham, near Birmingham, and at other places.

"A network of galvanized iron wires is stretched over the field to be treated and suspended eighteen feet from the ground from wooden posts and oil insulators. The posts are placed seventy yards apart, so that about one post per acre is required. The network consists of No. 11 S. W. G. wire placed over the posts in parallel rows 100 yards apart, and No. 20 S. W. G. wire cross-connecting the stouter wires every ten yards. The attachment of the latter to the insulators is not direct, but by means of short links and tension insulators to reduce the electrical stress on the insulator itself.

"The network is positively electrified to from 60,000 to 100,000 volts by means of an induction-coil mercury gas break and Lodge rectifying vacuum valves. The induction coil is worked on the primary side by continuous current obtained from an ordinary dynamo. Lionel Lodge, who is the electrical expert for the various installations, informs me that there is no difficulty in keeping the potential in the network up to the figures given except in misty weather or during rain, when it may fall as low as 200,000 volts; also that the amount of primary power required per acre is very small, namely, from ten to twenty watts.

"The installation is run for five or six months during eight to ten hours each day, and the total expenditure of energy is only about twenty Board-of-Trade units per annum per acre. Under this treatment the increase in the yield per acre is about thirty per cent, but under certain conditions it may be even more. The system is in use on several farms in England, on six farms in Germany, and on one farm in Holland."

Electric Distillation of Turpentine.

Replying to a Philadelphia inquiry requesting more specific information in regard to the electrical distillation of turpentine than was contained in a recent consular report of his, Consul-General George N. West, of Vancouver, B. C., states that specific questions submitted to an electric turpentine company there elicited the following:

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"The number of gallons that we have obtained from selected mill refuse has averaged six to eight per cord treated. We have, however, secured a much larger return from wood obtained from other sources, such as very resinous woods, that are not fit for mercantile lumber—much of the Douglas fir grown in this Province is cut leaving a stumpage of six to ten or more feet on account of the base of tree being very resinous. Then, too, trees growing at higher altitudes or those that have been wind twisted have very resinous bases; in fact, are unfit for mercantile use as lumber.

"Our turpentine has been pronounced by leading authorities in the world as chemically pure and is superior to the article generally sold, which we have found by analysis to be largely adulterated.

"We estimate the cost of erecting a mill at $1,500 per cord to be treated, after making liberal allowances for contingencies. We estimate that it would take twelve men to operate a ten-cord mill, consisting of four North Americans and eight Orientals. The pay of the former labor averages from $2 to $3 per day and the Oriental about twenty cents per hour. At present there is only one mill in operation in the world under our methods.

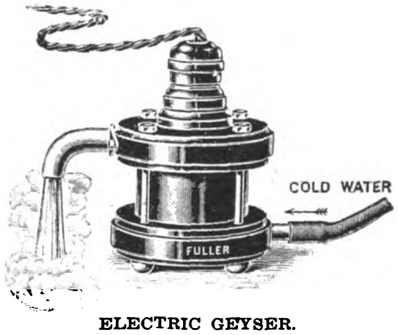
"The present wholesale price of turpentine in Vancouver is $8.10 per cask, but consumers are willing and anxious to pay us a little more than the market price. The by-products, tar, oil, rosin, pitch, and charcoal, all find a ready market, the rosin especially being in great demand for use in the manufacturer of cheap soap."

Three-Phase Motors with Speed Control.

At a recent meeting of the Glasgow (Scot.) University Engineering Society, Parker Haigh read a paper on "Three-Phase Motors with Speed Control," in which he stated that motors with pole-changing types of windings possessed marked advantages over other types of motors when variable speed was desired. A 100-horsepower motor, he said, used as an ordinary single-speed motor, gave eighty-five horsepower when used as a two-speed motor with the same upper speed, this with an efficiency of over ninety per cent, as against a forty-five per cent efficiency for the single-speed motor slowed down to half-speed by the use of resistances.

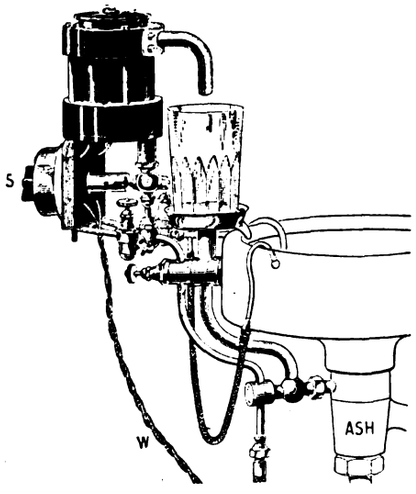
Electric Geysers.

The electric geyser shown in the accompanying illustrations works on an entirely different principle from the various electric water-heating devices now in use. The electric geyser is attached to an ordinary water tap by a rubber hose and the cold water entering the geyser through this inlet pipe passes through a series of chambers which are in direct connection with the electric supply.



ELECTRIC GEYSER.

The water instantly becomes heated and issues in a hot stream from the discharge pipe of the geyser, the time elapsing between the turning on of the tap and the flow of hot water through the geyser being only a few seconds. It is stated that there are no wires or resistances employed in this electric geyser and the apparatus is practically proof against short-circuit. The small geyser is especially adapted for use in



GEYSER FOR DENTAL USE.

the bed chamber or for the dental fountain. A supply of one pint of hot water per minute takes one kilowatt of electricity per hour. The geyser is designed for alternating or direct-current of 100 volts or 200 volts.

The dental electric geyser is four inches deep and three and one-half inches in diameter, the total height from the bottom of the switchplate to the top being seven inches. The body of the geyser is made of hard rubber, and the supply of water may be regulated by means of the tap to any temperature up to the boiling point. In the 100-volt geyser there are a larger number of platinum plates used than in the 200-volt geyser and they are placed closer together, and for this reason the cost of the lower voltage is greater.

This electric geyser is of English design and is being adopted to a considerable extent in British countries.

Electric Smelting in Sweden.

A resent English report states that the Jernkontoret, a national union of Swedish iron works, has decided to make a commercial experiment in the manufacture of pig iron by an electrical process.

The new works will be located at Trollhatten, at a cost of about $125,000. The rights of the process to be employed are owned by the Elektrometall Company, of Ludvika, and was devised by Messrs. Gronvall, Lindblad, and Stalhane, well-known Swedish engineers.

The electric "shaft furnace" has a total height of about twenty-five feet, the height of the shaft itself being eighteen feet. The melting chamber containing the electrodes is about seven feet high, and the furnace attains its maximum diameter at this point. It is the isolation of the descending charge from the lining at the point the electrode enters the furnace that is said to constitute the particular economic advantage of the construction, since it prevents the destruction of the lining.

A recent experiment showed that there had been produced during 903 hours' running twenty-eight tons of iron containing from 0.95 to 3.09 per cent of carbon. In the manufacture there were used the following: Ore, 422 tons; lime, 24 tons; coke, 41 tons; charcoal, 58 tons; electrodes, 6.5 tons, and the current consumed was 891,623 kilowatt-hours.

Electric Pumps for London Docks.

The governing body known as the Port of London Authority has decided to install electrically driven pumps at the Royal Victoria and Royal Albert Docks in London (England), to raise the present level of the docks by about two feet six inches.

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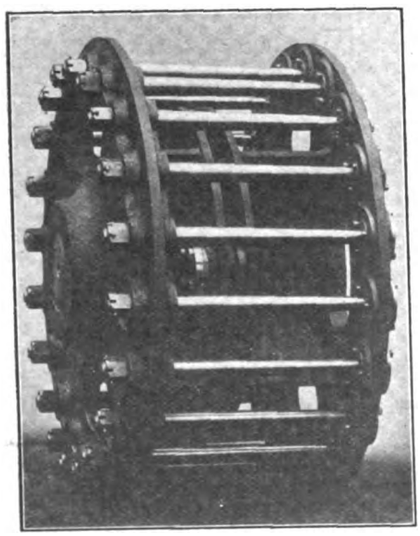
A REMARKABLE 7,000-HORSE-POWER ELECTRIC ROLLING-MILL MOTOR EQUIPMENT.

BY FRANK C. PERKINS.

At the iron and steel works of the Georgs-Marien-Bergkerksund Hutten Verein there is in operation a most successfully electrically driven rolling mill. The details of construction and operation of this plant may be noted in the accompanying illustrations. The electric power for operating the rolling mill is supplied from a large gas-engine electric generating plant using waste gases as a fuel. The electric energy is distributed about the rolling mill to the various motors as a direct current of 500 volts' pressure.

It may be stated that the main rolling mill which is electrically driven was constructed at Mulheim by Thyssen and Company and consists of rolls 900 millimetres in diameter and 225



6,000-HORSEPOWER COUPLING BETWEEN FLYWHEEL AND FOUR MACHINES OF MOTOR-GENERATOR SET.

millimetres in length. The live rolls conveying the steel to the mill are operated by two electric motors of forty-horsepower capacity having a speed of 510 revolutions per minute.

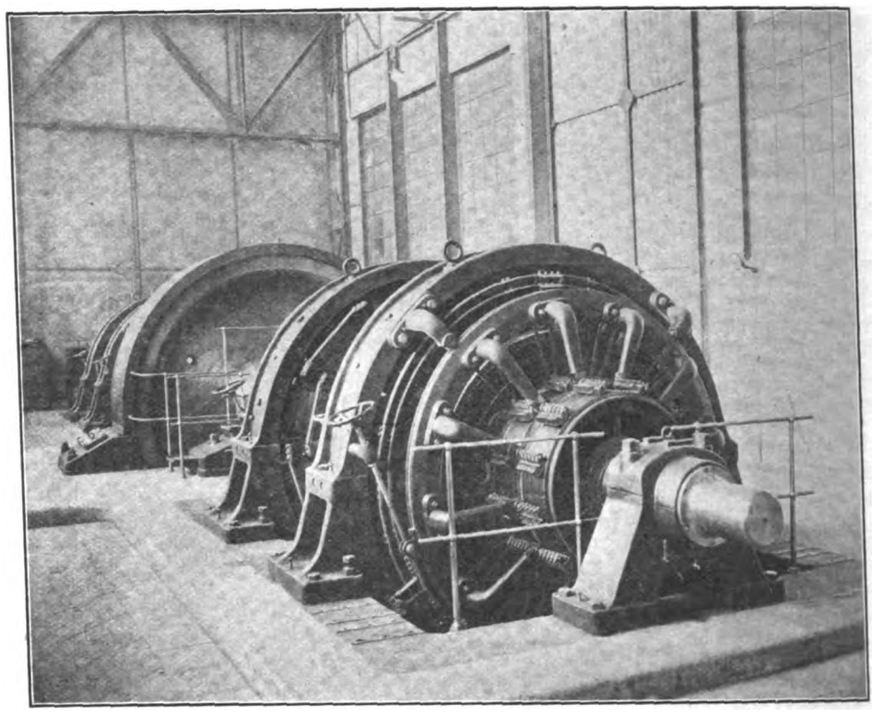
A large, direct-current, shunt-wound, double motor is used for driving the rolling mill proper. It has two armatures and two fields mounted on one base and has a capacity of 7,000 horsepower. The torque is said to be 85,000 metre-kilogrammes, and the motor operates at a speed of sixty revolutions per minute.

For producing this enormous torque and for regulation in driving the mill without overloading the generating equipment there is employed a large flywheel motor-generator set on the Ilgner system which was developed initially for use with mining-shaft hoists.

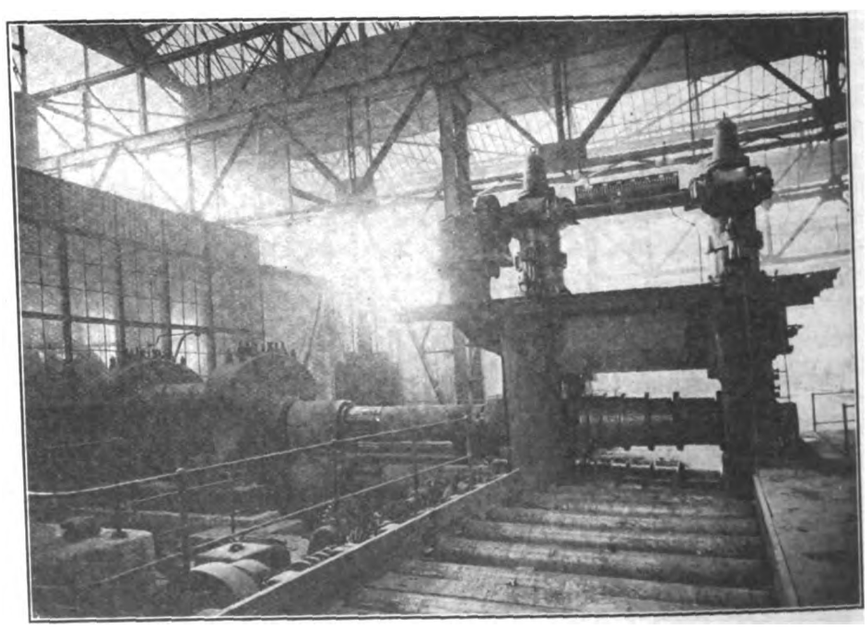
The motor-generator set includes four direct-current machines, each of which has a capacity of 1,300 horsepower and operates at a speed of 350 to 450 revolutions per minute. An enormous flywheel is mounted on the common shaft of these machines in the center and gives up its energy to the dynamos when needed at the time of maximum torque of the rolling-mill motors as the steel passes between the rolls.

One of the 1,300-horsepower machines acts as a motor in the operation of this Ilgner motor-generator set while the other three are driven as dynamos by the motor and the momentum of the flywheel. These are connected in series, each supplying a pressure of 500 volts, so that the highest pressure received by the rolling-mill double motor is 1,500 volts, or 750 volts for each armature.

The flywheel weighs thirty-five tons



ILGNER MOTOR-GENERATOR SET WITH THIRTY-FIVE TON FLYWHEEL IN CENTER



GERMAN ELECTRICALLY DRIVER ROLLING MILL.

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and has a peripheral speed of ninety metres per second. A special coupling is provided for connecting the flywheel with the four machines. The couplings were designed and constructed by the Siemens-Schuckertwerke of Berlin, for a capacity for 6,000 horsepower.

At the instant when the steel ingots weighing 2,200 kilograms to 2,675 kilograms pass through the rolls, an enormous amount of power is required, and the thirty-five-ton flywheel gives up a part of its energy to the direct-current machines so that the latter may supply the necessary current to the rolling-mill motors. It is stated that this electric rolling mill has given excellent and economical service since it was installed, the regulating system and control working perfectly.

A Portable Electro-Hydraulic Riveter.

A new application of electricity is evinced in a portable electro-hydraulic riveter which is being put on the market by a prominent Swiss engineering firm. The machine is very compact, all the working parts being mounted on the upper part of the steel frame, just above the gap. A motor of from four to six horsepower, and designed to run normally at a speed of 1,420 revolutions a minute, drives a differential piston-type pump through a worm reducing-gear and a pair of pitmans. The length of the piston stroke is one and one-half inches, and the pump makes 170 strokes a minute. The motor is provided with a starting resistance, and the water for the pump is mixed with from forty to forty-five per cent of glycerine to prevent freezing in cold weather. The riveting cylinder has a piston of 6.3 inches in diameter and a stroke of 2.75 inches, the cylinder being capable of withstanding pressures up to 90,000 pounds per square inch. The piston has a quick-return movement, its (downward) working strike being made at a speed of 16.5 inches per minute, and its return non-working stroke at a speed of seventy inches a minute. Full control is effected by means of a hand lever. It is stated that the 2,750-pound machine, which is designed for rivets up to seven-eighths of an inch in diameter, has accomplished, under normal conditions, the task of heading 1,000 rivets of three-quarters of an inch in diameter, in a working day of ten hours, with three men in attendance. Larger types of these machines are also made.

An English Wind Turbo-Electric Plant.

The following interesting description of a wind turbo-electric installation on a private estate at Bromyard, in Worcestershire, England, is taken from a recent issue of *The Electrician*, of London, England.

The plant is one of J. G. Childs and Company's standard wind turbines for electric driving, the wheel being twenty-four feet in diameter, and mounted upon a steel tower seventy-five feet high. It is placed 435 yards away from the house on some ground perhaps ninety feet above the level of the latter. The generator is placed in a small house at the foot of the tower, and the battery and switchboard are placed in one of the outbuildings of the house.

The current is conveyed from the generator at the foot of the tower to the battery by means of bare solid overhead copper cables, carried on porcelain insulators mounted on poles, in connection with which lightning arresters are fixed. The poles and the cross-arms are placed about thirty feet apart, the wood used in them being supplied from the plantation on the estate.

The governor is of a special design, with a speed variation of 400 to 1,600 revolutions per minute, and runs with its armature in a vertical position. It is carried on ball bearings and is driven by a five-inch belt from the vertical shaft of the wind turbine, the belt being on its edge. The generator is of four-kilowatt capacity, with a normal voltage of about seventy volts.

As it was desirable to have the whole of the control arrangements in the battery room, where the switchboard is placed, a separate field wire was placed on the transmission line along with the other conductors. This, also, is a bare copper wire carried on insulators.

The battery consists of twenty-eight cells having a discharge capacity of forty-six amperes for ten hours. The battery is divided into equal groups either of which can be used for supplying the lighting. The pressure on the lamps is twenty-five volts, Osram lamps being used. Arrangements are made for using fifty volts for power, as the plant, in addition to running the lights in the house (about 100 in all), also drives a fifty-volt motor for running a chaff-cutter, circular saw and root-pulping machine. This motor is placed in a shed about eighty yards from the house and is connected to the battery by means of an armored lead-covered cable laid in the ground. The chaff-cutting required for the homestead is easily dealt with by this machine, and also a considerable amount of firewood, etc., is sawn. The motor is belted direct to the various machines and only runs one at a time.

The plant is entirely automatic, being fitted with a patent tail gear, which gives very accurate adjustment to the wind. This arrangement consists of three tails, two of which stand out at about twenty degrees with the wheel. Two of these are connected together, so that when the wheel is required to stop they have only to be pulled down into a horizontal position, and the wheel immediately comes up into the wind and stops running. In the same way the tails are so balanced that when the wind reached a predetermined velocity, the tails tend to take the horizontal position, and so bring the wheel more or less out of the wind as the strength of the wind varies. In the recent gales which swept over the Midland counties this plant had a very good test of its stability, and though a very large tree was blown down close to it, the wind turbine suffered not the slightest harm.

In practice, it is found that the supply from the wind turbine is so reliable that it is almost the same as a supply laid on from the public mains, as the attention required by the plant is so small. All the main bearings carrying load are ball bearings, and the gear is enclosed in a cast-iron oil bath, so that if the plant were left for twelve months no harm would result from want of lubrication.

As the wind turbine is placed on ground somewhat higher than the house, and out of sight behind a wood, there is often a good wind blowing at the turbine when none is felt down at the house. The plant is guaranteed to produce 3,000 units a year, but in practice it produces at a much faster rate than this. In twelve hours a few days ago it produced fourteen units, with wind averaging fifteen miles an hour.

A New Electric Cure.

A new system of electro-therapeutics has been invented by K. Mueller, of Zurich, who is said to employ the effects of the electromagnetic field upon the body instead of the direct application of electric current. His invention is based upon observation of the superior health of men working in a strong magnetic field at St. Gothard Tunnel.

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ELECTRICAL Advertising *and* Selling

GETTING AFTER UNWIRED HOUSES.[1]

AN ADVERTISING PROBLEM WITH "KINKS."

BY CHARLES A. PARKER.

"Going after unwired houses nowadays is about as pleasant as trying to satisfy a craving for food on what was left of the meal of a hungry tramp." This rather epigrammatic remark emanated one day from a very much disgruntled solicitor who was discussing with the manager an exceedingly barren day's work on the outskirts of town.

As far as the pleasure of going after unwired houses is concerned, his point was very well taken. It is, most decidedly, not a languid pastime suitable for whiling away a summer's afternoon. No more is it a work calculated to inspire one, by easy successes, to heights of enthusiasm. It is a selling problem, complicated by a generous assortment of "kinks."

Without a clear recognition of just what these kinks are, where they are, and how they may be straightened out, advertising, as well as soliciting, intended to "get" unwired houses will fall short of its purpose. No matter how complete one's knowledge of the subject is, hard, steady plugging and considerable patience are essential. Without that knowledge, complete success is impossible.

There is, however, an ample reward for the central station when it is finally successful in obtaining a wiring contract from the hard prospect, for it ultimately results in large revenues.

There can be no doubt about it—"going after" and "getting" unwired houses as an advertising problem is full of "kinks." But there is this consolation about it. When successfully figured out the solution is just as full of profits as the problem is of difficulties. And just because the problem is a hard one and the solution is profitable, it is all the more urgent that we get down to the essential points from the very first.

In this connection it must be understood perfectly that we are dealing chiefly with dwellings that have been erected for a number of years. Not with new homes of the better sort, in most of which electric wiring is installed as a matter of course.

This problem, like many others, offers its own solution. By a careful survey of the whole matter, we are able to determine all the elements that must necessarily enter into one's advertising if it is to be effective. With this in view, let us ask ourselves "what manner of men are they" to whom our advertising must go? By a process of elimination we can soon mark out the class of people we must attack.

From the very first we can ignore the homes of the rich. Their houses will be wired for electric light whether they represent the skill of modern architecture or date back to the Civil War. So, also, we need not bother ourselves a great deal over new homes that can scarcely be called mansions and still belong to the better class of dwellings. Their owners, too, will "see the light" without much effort on the part of the central station advertiser. It is pretty safe to figure that any man with four thousand dollars or upwards to put into a home will be wise enough to include electric wiring.

This does not mean that the central station advertiser can ignore this class of business, because he can't. If he does he will lose out. He can scarcely expect to have people come crowding into the office to hand his company their money. He must remember that there are other people in the field. He is apt to find the gas people or somebody with some one of the many "private" illuminating plants schemes, stepping in.

It pays to remember that all of these people can put up a mighty strong line of talk. And they often succeed because of the neglect of the central station advertiser. That gentleman tacitly recognizes the fact that we have been stating—namely, that in the natural course of events, houses of the better sort are wired for electricity. And he lets it go at that.

What we do mean by saying that the class of homes mentioned can be eliminated from our problem is simply that this phase of the matter presents no "kinks." Reasonable and ordinary effort is bound to swing this business to the central station. So, for present purposes, we need not consider them.

So far we have found that this advertising problem does not lie with mansions, old or new. Neither does it concern new houses that may be rated as "upper middle class." This brings us to "upper middle class" dwellings that were erected prior to the common use of electricity. When we reach this point in our scrutiny of conditions, we begin to get into our subject-matter proper. Houses of this sort are not always wired for electricity at the first opportunity, not upon the first suggestion. Some effort is required to get action. But even yet we have not placed our fingers upon the real "kinks." This class of house would never give a solicitor just cause for perpetrating pessimistic epigrams. Indeed, when we do arrive at the very source of the difficulty, we can drop consideration of them entirely. The solution of the real problem will be the answer to this as well.

Where, then, is the difficulty? To come at once to the point, "going out" and "getting" unwired houses is difficult for the central station advertiser because the great field of endeavor lies with the cheaper houses. Houses that, even when built today, are not wired for electricity unless won over by strenuous advertising effort. It is made up of the everyday homes of everyday, self-respecting American workmen.

Possibly our claim that this is a "kinky" advertising problem may be challenged as a superficial assertion. It will only be necessary, however, to point out the kinks themselves to demonstrate that all this is something more than mere "airy vaporings."

In the first place, our advertising must go to people who are so accustomed to other forms of illumination that they don't know what they are missing by not having electricity; people who are fairly well satisfied with gas and oil, and fear that, by changing,

1 The second of the series of articles on "Central-Station Advertising" appearing in the second issue of every month.

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they may be flying "to evils that they know not of." Of still more importance is the fact that all of them are not educated to highest possible standard of living. A scientific explanation of the manner in which electricity does away with the exhaustion of the vital elements of the air would be beyond a good many. Few would appreciate a bare statement of the value of electricity as a decorative factor in "The Home Beautiful." The central station advertiser must also bump up against the ever prevalent fear of legal entanglements, and the common distrust of a public service corporation. Add to these things the fact that wiring up a home means a financial burden by no means as light as it is justifiable and you have the story complete. The "kinks" in our advertising problem will, we believe, stand out clearly. This, then, is the class of unwired houses which the central station advertiser must "go out" and "get." These are the people who must be won over to the great army of current users.

STRAIGHTENING OUT THE "KINKS."

There was a day when successful advertising in general was regarded as a sort of a mysterious process depending largely on good luck. To advertise electricity successfully was considered a job of even more subtle character than advertising in general. It was believed that the commodity offered for sale presented peculiar phases that called for a treatment altogether different from that given the ordinary commercial article. That day has gone by. The "kinks" of our unwired house problem that we have been enumerating can be straightened out by careful application of the rules that govern successful advertising in general.

In the first place, we must find the man we are after. That much has already been done. Next we must find out along what lines he thinks, what his attitude toward various phases of modern life is, what moves him to action, and what sets him more firmly than ever in his wonted path. But to do this much is not enough. The central-station advertiser must not only know these things but he must sympathize with his man's attitude. In short, he must look at the world with the other man's eyes. Only when he is able to do this, will he be able to advertise effectively to the man in "the unwired house."

At the very outset, we must recognize that life for the people we are after is a serious struggle. Work is the keynote of their existence. The man must toil to build up his little home, to guard against disaster, and to keep from slipping down a notch in his scale of living. So must the women work. The success of their homes does not depend upon the assiduity with which they attend mothers' meetings, or read women's magazines. It rests upon their ability to scrub floors, get meals on time, keep the children clothed and in school, and all without allowing their health to break down under the strain. Don't mistake our meaning—we are not referring to the class of people which is ground down to the very lowest extremity of life by a bitter struggle with poverty. That class is of little interest to us. The people with whom we are concerned, compose the great middle class — the people who must toil but who do so with steady hand, resolute eye and who cheerfully face whatever the future may have in store for them.

Looking at life as this class of people must necessarily do, we will see that they are peculiarly open to three lines of influence. They are interested in anything that will lessen the labor about the home, cut down expense, or give the home builders more time to devote to themselves, their children, and their pleasures. It will need no argument here to show that these very things are made possible by a "wired" home.

This, then, is the essence of the message that central-station advertising must bear to the man who is not yet a consumer of current. Later in this article, we will come back to message in detail. For the present, let us leave the matter here and take up another general step.

Of equal importance with the content of your advertising is the manner in which it is presented. Borrowing once more "the eyes" with which "our man" looks upon the world, we must realize that he is not a man satiated with all the sensations that are possible in life. His emotions are by no means jaded. He is not blasé. It does not take the most subtle of humor to make him laugh. Neither is his mental attitude so highly developed and so philosophical, that he is unaffected by the sentiment and pathos of everyday life. He has not yet reached the stage where he can rise superior to preconceived prejudices and notions. The man preparing central-station advertising to go to owners of "unwired houses" must bear these facts in mind. He must appeal to this man's sentiments, emotions and prejudices rather than to cold-blooded and unadulterated reason.

If he does the latter he is almost certain to fall short. So also if he fails to get right down to the particulars of everyday life. His appeals to humor and sentiment must not be placed on so lofty a plane, either in form or content as to miss the people he is after.

This does not mean that this class of advertising should be cheap and coarse. Not by any means. If there is anything worse than shooting over a man's head, it is insulting him with the matter beneath his notice. Advertising that arouses a man's resentment accomplishes nothing. Worse than that, it sets the advertiser back several notches.

Before getting deeper into our subject, it may be well to go back a little and sum up the points already made. We have, so to speak, isolated the man we are after. He is the man whose home is of the humbler sort and who, if left to his own devices, would cling to illuminating methods less modern than the electrical. We have also seen that our central-station advertising must emphasize the fact that it does away with drudgery in the home, that its economical features more than make up for its cost, and that it gives "time for better things."

THE MESSAGE IN DETAIL.

Be specific. Generalization, such as is permissible in an article, will not do in an advertisement. The central-station advertiser cannot tell his story all at once. But he can make a good point and drive it home. Its effect will be heightened by the next point he makes at some later date.

To enumerate the different arguments at the central-station advertiser's command is quite impossible in the space available even if it were necessary.

The point we are making here is just this. Instead of saying, as we have said in this article, "Electric light means less work," say, "Electric light means that you no longer have to fill lamps, trim wicks, etc." Instead of saying, "The cost of electric light is more than made up in the savings it makes possible," say, "You can more than pay for electric light with the

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money you save in doctors' bills and decorating." Instead of saying, "Electricity gives the housewife more time to herself," say, "Electricity will give you more time for your children, your social obligations and your pleasures." Of course, these are very crudely put here; but we are only trying to make the point clear.

Avoid saying "We will," but rather "You can." Hammer away steadily at specific points. Show how electricity means purer air to breathe; how it saves eyesight; how it tends by making the home cheerful and bright, to keep boys off the street. Point out the fear burglars and tramps have of a light that can be switched on suddenly; tell the people how much safer it is to have children alone with electricity than with an open flame light.

Of course, the first aim is to arouse interest. To this end, try to make each advertisement not only as bright, cheerful and different in tone as possible, but make it appear as if each were an "event" to you. If people get the idea that you are advertising merely as a routine part of your business they are going to give you but little attention.

After your advertising has aroused interest, it must keep the mind of the reader moving along rapidly to the point where the proposition is finally put. The psychology of the situation is something like this. If you get the reader mentally saying, "Yes" to the various statements you make, he will find it hard to say "No," when it comes to a final proposition, which is the logical conclusion from what precedes.

The converse is equally true. If your man may and is likely to say "No" to your initial statements, he is going to say "No" to your final proposition.

There is another phase of the matter which is often neglected and rather obscure at best. That is the attitude the kind of people we are dealing with take toward advertising matter in general.

It would be asking too much to expect them to keep in close touch with the science of modern advertising, to appreciate it more as "business news" and salesmanship rather than as "only advertising." To the man who is strictly in touch with progress along these lines, the fact that advertising is advertising makes little difference. If good, it gets attention. In fact, he is apt to resent matter that gets his attention under a pretense of being something that it is not. The man in the "unwired house" is apt to look at things differently. If he spots a thing at the outset as "just advertising," he is more apt to disregard it than if it gets to him as "a special offer," a "bulletin" or a "letter." Not that good straight-away advertising loses out entirely; but the other stands a better chance of getting favorable attention.

For these reasons, as well as for the reason that you are advertising not to the general public, but to a well-defined class of persons, mail advertising is the most effective form possible.

One of the best forms of advertising has been found to be the monthly house organ. Probably there is no point we have touched upon in this article that does not act as an argument for the little monthly magazine. It is an easy means of appealing to every side of the reader's nature, his emotions, his sentiments, and his reason. Its real advertising character is more or less concealed. At least, it is not so evident as to be objectionable. Coming every month it carries interest in it from one issue to another.

In addition to these points, it has the added advantage of being more or less in the nature of "something for nothing." Is it not a magazine? Does it not contain attractive views and reading matter? This "something for nothing" feature can be played to advantage just as strongly as the central-station advertiser's appropriation will permit. Not only is it a guarantee of attention, but it conveys the impression that the company is not a "grasping monster" but a "public service corporation" with emphasis on the word "service."

Let us suppose that our advertising is right up to the mark in every one of the essentials we have mentioned. Now we must add something else—persistence.

As we said in the beginning, this is an advertising problem full of "kinks." We are not going to get our man at once. We may have to educate him to a somewhat higher standard of living. We must show him that it is not the purpose of the central station to entrap him into a pitfall. We must prove to him that electricity is valuable enough to justify the outlay of money that is necessary. All this takes time and must be done before we "get action."

But this alone will not always produce results. As a matter of fact, while it is quite possible to get a man to agree with you that your proposition is everything that could be claimed for it, it is another thing to make him act.

HOW TO GET ACTION.

The central-station advertiser whose matter leaves "the man in the unwired house" hanging in the air after each ad is not going to get "quick action." Neither will it do to always wind up with a general request to "wire up the house."

Have some definite proposition to make. Outline a course of action to be taken. As often as not, action is delayed simply because the man you are after does not know quite what to do. The least you can do is to ask him to drop a card and have your representative call.

Be sure and impress him with the fact that, while you are perfectly ready to give him your time, and all the information he desires, you are not asking him to obligate himself in any way.

But this is not going far enough. Have some definite and generous proposition to make. How would it be to agree to put an electric light in his living room and let him try your services on that small scale for a definite period? This would certainly "get" the man who was hesitating in the score of expense alone. Here is another alternative, agree to wire up the house, and if at the end of a certain time your services are not wanted, take the wiring out free of charge. This of course could not very well be promised by companies not doing the active work of wiring. Here is another scheme that would not only bring business, but would increase current consumption. Agree to give every woman whose home was wired within thirty days, an electric flatiron free of charge. This would certainly be worth while and would be generous enough to attract everybody's attention.

Another way of arousing interest and getting action would be to institute contests among school-children. This has been tried in more than one case with remarkable success. One contest might offer a generous prize to the pupil writing the best essay on "Why Our Home Should Be Lighted by Electricity."

Another might be for soliciting. It would of course be asking pretty much of school boys and girls to require them to close a contract for wiring.

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But they could stir up prospects. The contest should be decided on points, say ten points for each name brought into the office and fifty for each one that the solicitor turned into a contract. Small blanks should be furnished the contestants which their prospects would be required to fill out, answering the questions asked and requesting the solicitor to call.

This would get a hearing for the representative from practically every unwired house owner in the town. The fifty points for actual contracts would make each contestant realize that prize was to be won, not on names alone, but on business done. Now if the prize be valuable enough and be placed on exhibition in the company's office, it will further the good work by bringing a good many prospects right into the home of the company.

Any variety of plans to get action may be devised, but the principle underlying all of them must be this. Have something definite to offer, and outline simple steps for the people to take. An advertising campaign built up along these lines by a clever central-station advertiser is certain to be productive of results and will do much to eliminate "barren days" from the solicitor's history.

WHAT ABOUT PEOPLE WITH HOUSES TO RENT?

So far we have apparently neglected people in rented houses. But there is "method in our madness." Before he induces the landlord to "wire up," the central-station advertiser must of necessity do much to educate the people who pay the rent to want electricity.

A campaign going to owners of the class of homes we have been dealing with so far, if successful, is going to help in this educational work. When renters see friends of theirs in homes no better than their own using electricity, they are going to want it too. What's more, they will be willing to pay more to get it.

Of course a campaign directed right to these people will help a great deal. But it must be handled diplomatically. Otherwise it will antagonize the landlords. When it comes right down to actual work, however, the last named gentlemen must be the objects of your attack. With them the matter is largely one of dollars and cents. But there are, nevertheless, plenty of reasons why landlords should prefer to have their property lighted by electricity. Not only do their houses rent and sell easier, but they bring more money in either case.

There are still other reasons for wiring up. Renters are notoriously careless about the house. Match scratches on the wall, smoky ceiling and sooty decorations are bad enough when people are cautious. But when renters occupy a dwelling, it is necessary to redecorate after almost every change of tenants. Add to this the fact that electricity removes one of the greatest sources of fire, and you have a case which should make even the most selfish landlord come around.

ADVERTISING IS ESSENTIAL.

It is only necessary to remark, by way of conclusion, that the field of unwired houses is one where the central station that does not advertise loses out. Only by advertising will the amount of business be secured that should be secured. People will wire up their homes who otherwise would never have thought of it. The solicitor will find new prospects being suggested all the time. He will be enabled to cover much more ground than formerly, close more contracts, and come into the office after his day's work with but little reason for hurling sarcastic epigrams at the manager.

The "Electric Shop" Brochure.

It has often been said that the general principles of the publicity and sales departments of central stations are well established on rational lines, but it cannot be said that in the case of the various sub-departments there exists at present that uniformity of purpose and action which indicates thorough understanding of the subject. Especially does there appear to exist some lack of understanding or uniformity of ideas as to the precise lines on which the electric show room should be conducted.

While these statements are generally true there appears an unmistakable exception to the rule in the case of the Commonwealth Edison Company, of Chicago. This central station, which by many has been considered the pacemaker in central-station advertising, has for the past year conducted an elaborate show room in one of the prominent buildings of the downtown district, which, it is safe to say, has not been equaled by any other central station. During the brief year of its existence it has received a vast amount of publicity and it has probably been an important factor in the constantly increasing revenue of the Commonwealth Edison Company.

To further inform the public as to the unlimited number of electric appliances displayed there, this company has recently published elegant brochure pertaining to it which marks a new era in central-station literature. This artistic publication is devoted entirely to the "Electric Shop" of the Commonwealth Edison Company and explains what it is and what it means. In the words of the author the Electric Shop is the latest exemplification of the comfort, convenience and luxury attainable by the use of electricity in the home. It is a quiet, beautifully appointed, high-class shop where one can do all of one's electrical shopping. All of the decorations are sumptuous and elegant, specially designed by artists of experience and taste.

As the Electric Shop is divided into several rooms designed to display various classes of the applications of electricity, likewise, following a general introduction in the pamphlet, each room is treated separately by the author, and all of the equipment is described in detail. Particular attention is given to the illumination as well as the numerous displays of electric heating devices and motors for various household purposes.

The broehure is beautifully bound and finished. The cover design includes an embossed emblem of the Electric Shop. The descriptive matter covering thirty-four pages is illustrated throughout by beautiful tinted photogravures. In every feature this publication is a work of art. It represents a considerable expenditure, but this was believed necessary in order to harmonize with the elegant appointments of the Electric Shop itself.

The Electric Shop brochure is being distributed for the Commonwealth Edison Company by Dana H. Howard, advertising manager. The text was written by William E. Keily and the Binner-Wells Company were the designers and printers.

The December calendar of the Denver Gas and Electric Company, Denver, Colo., makes many suggestions for useful electrical Christmas gifts. This central station distributes an illustrated calendar each month containing a timely advertisement of some electrical appliance.

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Some Effective Booklets of Central Stations.

With the steady increase in the use of electrical energy for lighting, power and domestic purposes there has been correspondingly increased competition with rival systems. For this reason, and also because of the fact that many prospective customers of current are still ignorant of the many advantages of electricity, central stations have found it necessary to include in their organizations a complete and self-contained staff whose duty it is to disseminate information concerning the advantages resulting from the use of electrical energy. This staff, commonly called the publicity or new business department, is now an important factor in every central-station organization.

The general methods of publicity campaigns are now well understood. Much has been written on the subject and has received the attention of central stations throughout the country.

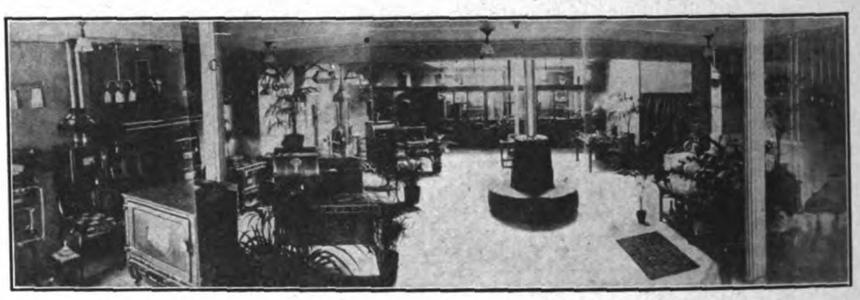
EXAMPLES OF EFFECTIVE BOOKLETS.

That the practice of this important department may now be said to be well established on rational lines and that fairly standard methods are in operation is shown by the attractive and effective booklets being distributed by numerous central stations.

In the accompanying illustration we reproduce three of these booklets as being typical. These particular publications are being distributed by the Central Georgia Power Company, of Macon, Ga., and possess all of the characteristics necessary in an advertisement of this description. They are printed on a good quality of paper, are attractively bound and the arguments presented are brief but convincing. These booklets are distributed at regular intervals in the order in which they appear in the illustration. The one entitled "There Is Life in the Old Land Yet!" is a general introduction to those which follow, and contains a brief history of the development of the Central Georgia Power Company, and in the words of the booklet, "bears on the potential force that will transform Central Georgia into a great industrial beehive." The other two publications shown are addressed to manufacturers and contain convincing arguments in favor of electricity for industrial purposes.

The Keyes Electric Company, Gowanda, N. Y., is distributing a booklet which will undoubtedly secure favorable comment and which affords an excellent example of the high standard attained by central-station publicity departments. It is the style of advertisement that will be read throughout, and on account of its style will undoubtedly create an interest, which, if properly followed, will result in a customer.

"Why Boston Is Growing" is the title of a circular being distributed by the Edison Electric Illuminating Company, of Boston, Mass. It contains eight pages of interesting data and concludes with a paragraph which announces that a special department of the company attends to all inquiries about valuable locations for business and manufacturing purposes and for homes in Greater Boston; also that the company co-operates with all real estate dealers and commercial organizations and spares no effort in helping Greater Boston grow. This attitude is one which all central stations would be wise to follow.



MAIN OFFICE OF THE EASTON GAS AND ELECTRIC COMPANY.

Growth of Easton Gas and Electric Company.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of August 7, 1909, there appeared a brief account of the reorganization and subsequent progressiveness of the Easton Gas and Electric Company, of Easton, Pa. On November 1, 1909, this company extended to the people of Easton an invitation to be present at the opening of its new offices, a view of which is reproduced herewith.

Since the organization of the new company it has followed an aggressive business policy, and on account of the liberal advertising the public in general has always been kept in touch with the advantages it has to offer at all times. The plants and equipments of the corporation have undergone extensive changes and thousands of dollars have been expended for modern appliances and machinery.

The opening of the new offices marked a new era in the history of the company. Practically the entire population of Easton accepted the invitation to be present at the opening, and the affair was a decided success from every point of view. As may be seen, the offices are tastily furnished and arranged, and particularly in the sales room and display room every modern convenience has been provided for the comfort of visitors. Probably one of the principal reasons for the rapid growth and development of this central station is the fact that at all times it has taken the public into its confidence. It maintains a free service department in which a dozen experts are at the call of the public for inspection to better service or to furnish estimates on contemplated changes, and it has been made a cardinal practice of the company that courtesy and careful attention be given by all of its employees at all times to everybody.

Building Up the Load.

The People's Incandescent Light and Heating Company, of Meadville, Pa., has arranged to give several demonstrations regarding the heating ability of electricity.

Hitherto the use of electricity for general purposes in that city has been rather limited, due perhaps to the fact that electricity was available only to a limited section of that city. This progressiveness on the part of the central station follows the general extension of all transmission lines throughout Meadville.

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WIRE FOR AN ELECTRIC HEATER—I want to make an electric heater to be connected to a 500-volt, direct-current circuit. It is to be used on an electric railway bonding car for heating coffee and similar purposes. I wish to use Nichrome resistance wire, but the amperage is of no consequence. Can you help me determine the size and amount of wire to be used?—P. R. S., Sacramento, Cal.

A problem of this kind was considered in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 20th, page 999. As in this case, however, the conditions are a little more specific, it is possible to work out the problem on certain assumptions. These assumptions will be that the heater shall be capable of bringing to the boiling point, within five minutes, about two quarts of water. To simplify the calculations metric units will be used and a further assumption made that the quantity of water is equal to two litres. To make certain that the water will actually reach the boiling point, it will be well for the resistance element itself to run at a slightly higher temperature, say 110 degrees Centigrade. Therefore, to raise the temperature of two litres of water from, say, twenty to 110 degrees, there will be required 180 calories of heat energy. Since each calory requires 1.19 watt-hours, it will be necessary to furnish 214.2 watt-hours. To further provide for heat losses in the heater it will be assumed that 240 watt-hours are to be provided. This amount of energy must be furnished in five minutes, or at the power rate of $2.40 \div 5/60 = 2{,}880$ watts. Since the power is to be 2,880 watts supplied from a 550-volt circuit, 5.2 amperes will be the heating current necessary. The requisite resistance of the heating element will have to be $550 \div 5.2 = 106$ ohms. The nearest size of Nichrome wire that is capable of carrying this current at a temperature of about 230 degrees Fahrenheit, is No. 15. This wire has a resistance of 185.6 ohms per 1,000 feet. Therefore, it will require about 575 feet, or about 5.25 pounds of the wire.

INDUCTION MOTOR CONTROLLER—A controller that I have under my care gives a great deal of trouble on the reverse. It throws fire out of the casing, and gives a violent report. On examining it I find the fingers of the switch and also the cylinder switch badly burned, but I found no ground on testing it carefully. This only happens on reversal. It gives the operator a violent shock, and also opens the circuit-breaker every time it happens. The controller is a thirteen-point controller for a three-phase 440-volt motor. What is likely to be the trouble and the remedy?—R. P., Hebron, Colo.

In all likelihood a portion, if not all, of the resistance in the rotor circuit at the controller is short-circuited when the controller arm is reversed. This causes a very heavy rush of primary current opening the circuit-breaker, and also an exceptionally heavy secondary current which has evidently burned the switch contacts. This short-circuit may be due to a loose connection or wrong connection that develops at one of the contacts on reversal. It would be necessary to examine the controller with great care, removing any substances that may have become lodged between the contacts, and thoroughly cleaning and tightening them.

GASOLINE COMPETITION—We are having considerable difficulty in encountering competition from gasoline lighting. Have any definite data been published as to the relative costs of gasoline and tungsten lighting? I expect that the electric service may cost somewhat more than the installation of a gasoline plant, but I hope to convince any one that it will be in the end as cheap and more serviceable when all things are considered. Can you direct me to any information on this subject?—J. M. R., De Witt, Iowa.

No direct comparisons of such costs that are reliable seem to be available. The agents of gasoline lighting equipments profess to supply figures showing that the cost of gasoline lighting is very much less than that of electric lighting. In such estimates, however, scarcely any allowance is made for maintenance of mantles, chimneys, and other features connected with the system. Nor is the depreciation of the plant allowed for. Another factor that is not given proper attention is the great fire hazard of such an installation, and this alone may often be used as an excellent argument to stir up public objections resulting in ordinances barring such plants. Little consideration is given to the great amount of care required by a gasoline plant in order to keep it in good working order. As this care is not given to it constantly, it very commonly results in very poor service, if not ultimately in disastrous fires. At the recent convention of the Illinois State Electric Association, at Alton, Ill., this subject received some consideration, and it seemed to be the opinion of many that if the electric company will buy up some of the gasoline installations at their actual worth, and offer to put in any of them for comparative trial with electric service, using tungsten lamps, that the latter invariably wins out in every case.

TROUBLE IN A RAILWAY SUBSTATION—In a railway substation, equipped with 600-kilowatt, six-phase rotaries and single-phase air-blast transformers, fed from 13,200 volts, there is frequently an immense rush of current when the automatic oil switch is closed. This sometimes trips the circuit-breaker, which is set for 150 per cent load. A great vibration of the sheet-iron sides of the transformer cases is set up, which gradually dies down in about three seconds. I also notice that on no load the field rheostat can be shifted throughout the whole range without causing the alternating-current ammeter to vary more than a few amperes, but the direct-current voltmeter reading varies over 100 volts. Is it necessary to shift the brushes of a rotary to prevent sparking at different loads?—G. A. R., Excelsior, Minn.

The excessive rush of current is probably due to the fact that the rotary converter is not exactly synchronized at the instant that the switch is closed. That is, if the rotary is not in step a very heavy temporary current is bound to result. This heavy rush of current probably also causes the excessive stray field flux about the transformers, which may partly be the cause of the vibration in their cases. The effect of variation of the field rheostat of the rotary on the no-load current must be comparatively small, because that current itself is very small, and the index of the ammeter is probably registering in

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a portion of the scale that is crowded. The field variation does affect the power-factor of the circuit, and should produce some change in the current due to the variation of its wattless component. If the rotary is provided with reactance coils, and if it is compounded, field variation will affect the direct current voltage. Most rotaries are designed now so that it is not necessary to shift the brushes for various loads in order to prevent sparking.

WATT-HOUR METERS OPERATING AT HALF VOLTAGE—If a 220-volt direct-current watt-hour meter be placed on a 110-volt line, in what ratio will the dial readings be correct? Will the characteristics of the meter be the same on the two circuits?—M. P. S., Monmouth, Ill.

If the watt-hour meter is placed on a circuit having exactly one-half of the voltage for which the meter was designed, it is evident that the pressure circuit of the latter receives only one-half of the current that it normally would, so at first sight it would seem as if the reading of the meter should be multiplied by two. However, the current that the pressure circuit carries is proportional to the exact voltage of the circuit, just as that which the series circuit carries is proportional to the current used on the circuit. Therefore, the readings of the meter are still proportional in the same ratio as formerly to the product of the amperes and volts, or, in other words, the meter should continue to record exactly the number of watt-hours that is actually consumed in the circuit. From this it does not follow that a 220-volt meter is suitable for a 110-volt circuit unless the latter will not carry a greater amperage than the 220-volt circuit. Should the same amount of power be used on each circuit, it is evident that the current on the 110-volt circuit will be twice that on the 220-volt circuit and therefore that the series coil of the watt-hour meter must be capable of carrying twice as much current as when used on 220 volts.

Commonwealth Edison Company.

The directors of the Commonwealth Edison Company on December 7 formally voted a ten per cent increase in the capital stock, or $3,000,00. It will be offered pro rata at par to shareholders on February 1. The first payment of twenty-five per cent will be due on that date. The remaining installments will be payable twenty-five per cent on May 1, August 1 and on November 1.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

MASSACHUSETTS ELECTRIC COMPANIES.

The tenth annual report of the Massachusetts Electric Companies, covering the year ended September 30 last, shows slight increases in gross and net earnings over 1908. Charges were practically unchanged, with the result that the balance available for dividends increased $102,775.

Dividends for the year amounted to $1,000,464, against $880,773 a year ago. Surplus was $125,365, against $142,281. The consolidated income account of the operating companies for the last three years compares as follows:

	1909.	1908.	1907.
Gross earnings	$8,052,355	$7,809,010	$7,758,511
Expenses	5,148,396	5,001,517	5,000,652
Net earnings	$2,903,958	$2,807,492	$2,757,858
Charges	1,778,128	1,784,437	1,702,622
Balance	$1,125,829	$2,023,054	$1,055,235
Dividends	1,000,464	880,773	880,773
Surplus	$ 125,365	$ 142,281	$ 174,462

The profit and loss account of the holding or parent company compares, for three years, as follows:

	1909.	1908.	1907.
Div. on stock owned	$ 967,630	$ 880,841	$ 880,837
Misc. int. on notes.	127,169	107,961	82,003
Total income	$1,094,799	$ 988,802	$ 962,840
Total expenses	19,395	19,395	16,629
Net income	$1,075,404	$ 969,407	$ 946,211
Int. on notes	157,500	157,500	157,500
Net div. inc.	$ 917,904	$ 811,907	$ 788,711
Dividends	513,935	.....	.....
Surplus	$ 403,969	$ 811,907	$ 788,711
Profit sale of stocks	115,997	.....	.....
Prev. surplus	2,378,791	1,566,884	778,173
Total surplus	$2,898,758	$2,378,791	$1,566,884

President Gordon Abbott comments on the year's business as follows:

"The year as a whole showed an increase in gross earnings for all the companies of $258,842 (three and one-third per cent.) Operating conditions during the year have been sufficiently favorable, owing to the low price of supplies, to produce an increase of $125,000 in net earnings despite increasingly liberal expenditures on maintenance over those of previous year, of which $42,569 was absorbed by dividends on preferred shares of operating companies. Remaining increase in net was large enough to justify the Old Colony Street Railway Company in increasing its dividend from four per cent to five per cent.

"On July 1 a dividend of one and one-half per cent was paid on preferred shares of the Massachusetts Electric Companies, and the trustees have felt justified by the results of the year in increasing distribution on January 1 next to one and three-fourths per cent. Although earnings for past year would appear to justify declaration of a dividend at a higher rate, trustees are of the opinion that the time has not yet come when it would be wise to resume the four per cent rate, in view of the fact that the past year is the first since 1903 in which the full four per cent was earned. They think interests of shareholders will be best served by maintaining a strong financial condition until the earning power of property has been demonstrated over a longer period."

The subsidiary operating companies of the Massachusetts Electric Companies are the Boston & Northern Street Railway Company, the Old Colony Street Railway Company and the Hyde Park Electric Light Company. The Boston & Northern operates under lease the Boston & Chelsea, the Boston & Revere, the East Middlesex, the Winnisimet and the Nashua Street Companies. The Old Colony operates under lease the Newport & Fall River Street Railway Company and the Newport Illuminating Company.

RUTLAND RAILWAY, LIGHT AND POWER.

The Rutland (Vt.) Railway, Light and Power Company reports for the twelve months ended October 31, 1909, as follows:

Gross	$254,905
Expenses	131,730
Net	$123,175
Interest and taxes	81,396
Surplus	$ 41,779

CENTRAL PARK, NORTH AND EAST RIVER RAILROAD.

The New York Public Service Commission has issued a report covering the operations of the Central Park, North & East River Railroad Company for the period from August 6, 1908, to June 30, 1909, as follows:

Revenue from transportation	$488,167
Advertising privileges	13,143
Rent of land and buildings	10,980
Rent of carts and trucks	465
Total operating revenue	$512,755
Maintenance of way and structure	11,235
Maintenance of equipment	28,933
Exp. horse car service	117,689
Hired power	60,807
Operation of cars	172,312
General expenses	31,047
Total operating expenses	$422,023
Net operating revenue	90,731
Taxes accrued	12,803
Operating income	$ 77,928
Other income	236
Total income	$ 78,165
Rent of cars, car house, etc.	13,236
Surplus June 30, 1909	$ 64,928

M'ADOO TUNNEL SURPLUS.

An abstract of the annual report of the Hudson & Manhattan Railway Company—the operating company of

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the McAdoo tunnel system—for the year ended June 30 has been made public by the New York Public Service Commission. The income account shows a surplus of $64,370 for the year, after the payment of such part of the total interest charges as the officials thought proper to charge against operation, thus reducing the corporate deficit from $116,820, where it stood at the end of the first year, to $52,449.

MICHIGAN UNITED RAILWAYS.

The Michigan United Railways Company has issued its full annual report for the year ended April 30, 1909. The income account compares as follows:

	1909.	1908.
Gross revenue	$1,021,128	$942,003
Operating expenses	568,157	521,728
Net revenue	$ 452,971	$420,275
Other income	5,667	1,321
Total income	$ 458,638	$421,596
Charges	305,891	262,720
Surplus	$ 152,747	$158,876
Preferred dividend	60,000	60,000
Surplus	*$ 92,747	$ 98,876

*Equal to 1.54 per cent on $6,000,000 common stock.

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of October and ten months ended October 31, 1909, compares as follows:

	1909.	1908.
October gross	$ 596,962	$ 554,166
Expenses	277,174	265,892
October net	$ 319,787	$ 288,273
Charges, taxes, preferred dividends	140,251	138,667
October surplus	$ 179,537	$ 149,606
Ten months gross	5,773,382	5,319,967
Expenses	2,709,742	2,637,918
Ten months net	$3,063,640	$2,682,050
Charges, taxes, preferred dividends	1,388,761	1,283,789
Ten months surplus	$1,674,879	$1,398,261

AMERICAN TELEPHONE.

The report of the American Telephone and Telegraph Company for ten months ended October 31, 1909, compares as follows:

	1909.	1908.
Dividends	$14,070,677	$12,550,557
Interest and other revenue	8,881,897	8,087,076
*Telephone traffic net	3,609,592	3,173,495
Real estate	80,454	135,517
Other sources	1,137,258	647,908
Total	$27,779,879	$24,594,552
Expenses	2,095,191	1,736,061
Net earnings	$25,684,687	$22,858,491
Interest	6,018,789	6,380,746
Balance	$19,665,898	$16,477,745
†Deduct difference	15,725	.....
Balance	$19,650,172	$16,477,745
Dividend for nine months	11,963,758	9,289,624
Balance	$ 7,686,414	$ 7,188,121

*In 1909 all maintenance and depreciation is charged against expenses monthly instead of being partly provided for by an extraordinary charge in December as heretofore. In order that a true comparison may be made between 1908 and 1909, the 1908 figures as now presented include in expenses for each month one-twelfth of the extraordinary provision for depreciation which was made in December, 1908.

†Deduct difference between interest paid on negotiable stock receipts and dividends received from stock acquired in exchange for such receipts.

AMERICAN POWER AND LIGHT.

The American Power and Light Company has issued a statement of income for the month of October and twelve months ended October 31, 1909, which compares as follows:

	1909	1908
Gross	$ 64,654	$ 54,523
Expenses	38,992	38,053
Net	$ 25,662	$ 16,470
*Int. on bonds and floating debt	5,078	4,966
Surplus	$ 20,584	$ 11,504
Twelve Months—		
Gross	$816,748	$675,390
Expenses	540,040	485,571
Net	$276,708	$189,819
*Int. on bonds and floating debt	62,261	58,035
Surplus	$214,447	$131,784

*Exclusive of interest on bonds and floating debt owned by American Power and Light Company.

American Power and Light Company commenced business in September, 1907, but for comparative purposes the earnings of its local properties are given irrespective of the dates of their acquisition.

At a meeting of the American Power and Light Company the following were elected directors: Russel Armstrong, A. C. Bedford, R. E. Breed, A. W. Burchard, F. L. Dame, vice president; S. Z. Mitchell, chairman of the board; F. G. Sykes, president; F. C. Walcott, Henry W. Wehrhane, H. P. Wright, A. M. Young.

NORTHERN OHIO TRACTION AND LIGHT.

The report of the Northern Ohio Traction and Light Company for the month of October and ten months ended October 31, 1909, compares as follows:

	1909	1908
October gross	$184,815	$157,532
Expenses and taxes	100,800	90,258
October net	$ 84,015	$ 67,274
Charges	44,114	43,778
October surplus	$ 39,900	$ 23,495
Ten months gross	1,818,986	1,578,084
Expenses and taxes	988,529	912,300
Ten months net	$830,456	$665,784
Charges	437,456	438,521
Ten months surplus	$393,000	$227,263

FORT WAYNE & WABASH VALLEY.

The report of the Fort Wayne & Wabash Valley Traction Company, for the month of October and ten months ended October 31, 1909, compares as follows:

	1909	1908
October gross	$ 122,805	$ 113,390
Expenses	70,385	59,931
October net	$ 52,420	$ 53,459
Ten months gross	$1,161,155	$1,092,090
Expenses	678,924	613,400
Ten months net	$ 482,231	$ 478,690

AMERICAN CITIES RAILWAY AND LIGHT.

The American Cities Railway and Light Company reports the combined earnings of its operating companies for the month of October of $524,706, an increase of $43,705, and surplus, after interest and sinking fund, of $110,500, an increase of $26,798. Following are the figures for October and ten months ended October 31, 1909:

	1909.	Increase.
Gross earnings	$524,706	$43,705
Expenses and taxes	306,999	14,173
Net earnings	$217,707	$29,532
Interest and sinking fund	107,207	2,734
Surplus	$110,500	$26,798
Am. Cities proportion surplus on basis stock ownership	97,377	23,692
Am. Cities prefd. div.	34,530	.....
Balance applicable to com. stock and reserve	62,846	23,692
Equivalent on Am. Cities outstanding com. stock	7.0%	.....
January 1 to October 31—		
Gross earnings	$4,750,809	$282,514
Expenses and taxes	2,761,247	60,431
Net earnings	$1,989,562	$222,083
Interest and sink. fund	1,063,568	20,870
Surplus	$ 925,994	$201,213
*Am. Cities prop.	818,018	182,710
Am. Cities prefd. div.	345,305	.....
Balance applied to com. stock and reserves	$ 472,713	$182,710
Equiv. on Am. Cities outstanding com. stock	5.27%	.....

*American Cities proportion of surplus on basis of stock ownership.

Illinois Tunnel Company Goes Into Receivership.

On December 2 receivers were appointed for the Illinois Tunnel Company on proceedings entered in behalf of the Corporation Trust Company of New Jersey. The Illinois Tunnel Company, it will be remembered, owns the very extensive network of freight tunnels in the downtown district of Chicago. They are provided with an electric railway for transportation of coal and other freight between the railroad terminals and the downtown office and mercantile buildings. The receivers appointed were Chas. G. Dawes, David R. Forgan and Edwin A. Potter.

The proceedings were brought on account of failure to meet interest charges on the bond issue of $30,000,000. It is believed that another reorganization will be effected. The Chicago Subway Company is at present the actual holding company, but its affairs are not immediately involved in this receivership. Current belief is expressed in financial circles that an assessment on the stock may get the company out of its financial difficulty. The net earnings recently have not been greater than $240,000 a year. The loss of the mail contract with the postal authorities was a serious blow to the company during the past year. If this contract had been renewed, the earnings would have been increased between $350,000 to $400,000.

The Chicago Warehouse & Terminal Company, which is affiliated with the Tunnel Company, was placed in receivership simultaneously.

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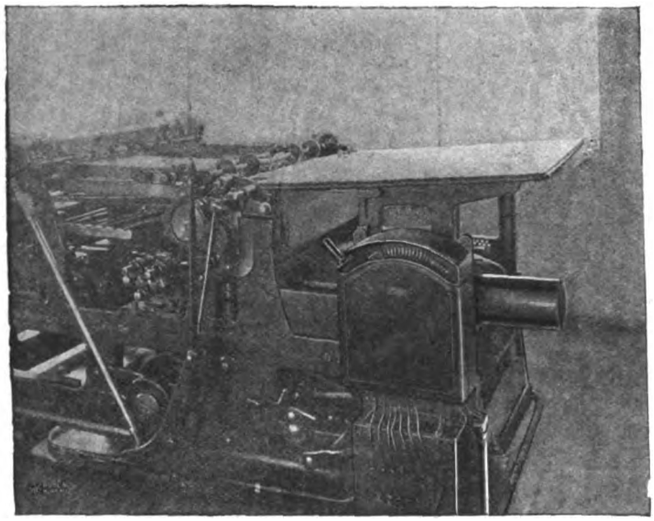
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

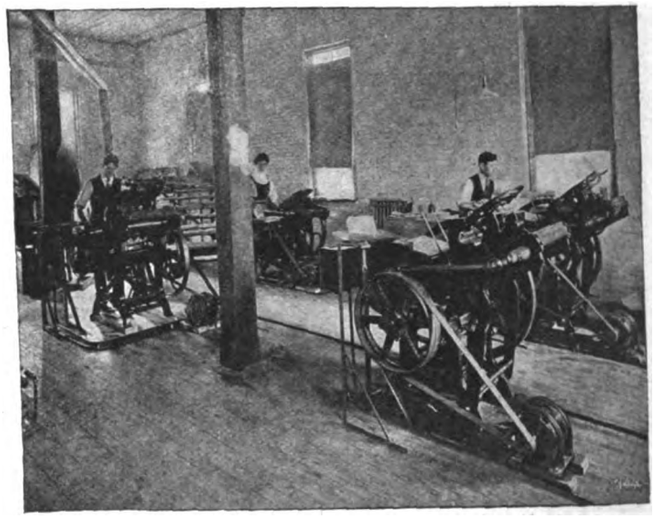
The Electric Drive for Printing Establishments.

The character of the service in printing establishments usually makes it desirable to install the individual motor drive. Among the principal advantages over other drives obtained by driving a press by an individual motor, are positive and easily manipulated speed control through a wide range, low operating cost, improved cleanliness, greater safety, decided space economy, and in general, much higher plant efficiency.

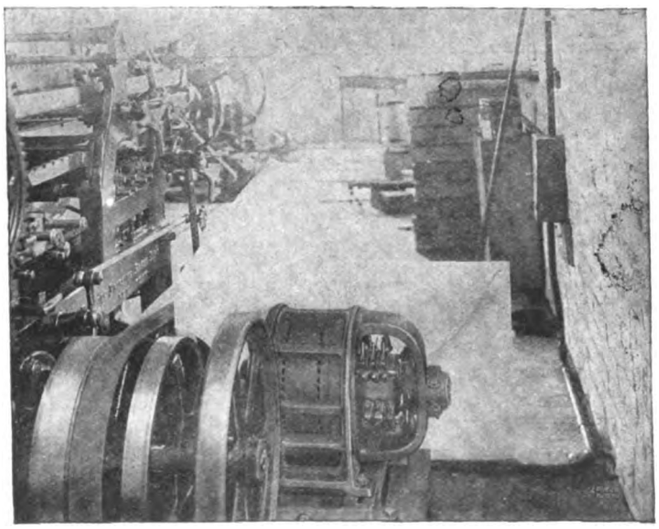
Individual motor drive by General Electric type RI single-phase motors provide all these advantages. RI motors can be furnished with controllers to give a variation of fifty per cent below synchronous speed with uniform and rapid acceleration and deceleration. The performance of both motors and controllers in actual service has proven them to be in every respect entirely satisfactory.



ARRANGEMENT OF GENERAL ELECTRIC CONTROLLER AND RESISTANCE ON BABCOCK OPTIMUS PRESS.



VARIABLE-SPEED, ONE-HALF-HORSEPOWER, SINGLE-PHASE MOTORS DRIVING JOB PRESSES.



TWO-HORSEPOWER VARIABLE-SPEED MOTOR ARRANGED FOR BELTED INDIVIDUAL DRIVE OF OPTIMUS PRESS.

GENERAL VIEW OF PRESS ROOM WITH PRESSES DRIVEN BY GENERAL ELECTRIC SINGLE-PHASE, TYPE RI MOTOR.

An installation of General Electric motors in the plant of a well known job-printing establishment in Warren, Pa., illustrates very forcibly the adaptability of the RI motor to this class of work.

The printing plant in question at first operated its press equipment by means of a six horsepower gas engine. Due, however, to frequent shut-downs and generally unsatisfactory operations, the engine was replaced by a six horsepower direct-current motor. The improvement in service was so marked that in order to secure the added advantages of the individual drive in regard to speed control, etc., the proprietors decided to adopt still further refinements and so installed one General Electric type RI motor to separately drive each of the five presses in use, as well as one stitcher. The final arrangement with individual drive brought about such marked improvements in re-

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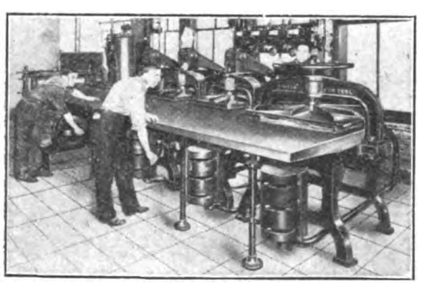
gard to cleanliness, noise, operating costs, etc., that the owner was very well pleased. In a recent letter alluding to the installation, the owner of the establishment wrote as follows:

"The flexibility of the motor drive makes it possible to get out better and more work at a very low power cost. The motors are little beauties and run like a charm. It is certainly surprising how much lighter, cleaner and quieter my plant is now than with the old shafting."

The Wesel-Westinghouse Electric Matrix Drying Table.

In the daily race against time in the newspaper office, during the last hurried minutes before the paper is put to press, no appliance recently added to the printing-plant equipment has worked such improvement in speed, reliability, convenience and cleanliness as the electric matrix-drying table.

With it, "mats" are dried in one-half to one-third the time required by older methods. The close control of the electric heat enables the temperature to be



ELECTRIC MATRIX-DRYING TABLE.

held accurately at the desired point. The controllers are mounted on brackets beneath the bed of the machine, convenient of access to the workman. A very large number of temperature gradations is available. The temperature is shown by an electrical thermometer, the indicator of which is mounted upon an adjacent wall or firm support.

The superior economy of electric matrix driers over those heated by steam, gas or other means, lies in the possibility of applying the heat directly to the work, the other parts of the bed being thoroughly insulated against radiation and conduction losses. As a result of this isolation of the heating element, the temperature of the stereotyping room is much reduced, and since its atmosphere is not devitalized from supporting combustion as with the gas-heated table, an improvement in the comfort, health and work of the operators has been many times demonstrated as the result of the electric matrix drier.

Combined with the greater pressure possible with the use of compressed air supplanting the effort of the hand-wheel, the high temperature of the electric hot-bed results in the production of matrices of greater sharpness and depth, and of superior printing quality. As noted before, the time of drying can be cut to one-half that of any other process, the actual amount depending, of course, on the quality of the work to be done. It is possible, however, to thoroughly "bone-dry" a matrix in less than two minutes, a speed of operation before considered impossible.

These electrically heated matrix-drying tables, for hand or compressed-air pressure, as manufactured by the F. Wesel Company, 70-80 Cranberry Street, Brooklyn, N. Y., employ the well-known Westinghouse heating elements. They are in the service of some of the most progressive newspapers of the country, and have greatly improved the conditions usually found in the stereotyping rooms, besides affecting an important saving in the time of preparing the plates for the various editions. The resistance used has proven thoroughly reliable and permanent, and the expense of electrical operation with the Westinghouse heating element is unquestionably lower than by any other method.

For use where the element of time is not so important in drying the matrix, a slower type of heating bed is supplied. Complete with heating elements, this bed is only two inches in thickness and is designed to be placed directly on the steam-heated bed, making a convenient source of heat quickly available without the delay or difficulty of resorting to steam heat. These electric beds for slow drying perform their service in about the same time as the gas or steam heated beds, and with the same economy of the quick-drying unit.

Swedish Telegraph Board Purchases Long-Distance Telephone System.

A Swedish correspondent states that the Swedish Board of Telegraph Commissioners has purchased for the sum of 25,000 kroner (about $6,700) the Egnér and Holmström long-distance telephone, which has already been mentioned in these columns. The workable radius of this invention is said to be between 3,000 and 4,000 kilometres.

New Type of Electric Toaster.

In the accompanying illustration is shown a new type of electric breakfast room toaster being placed on the market by the Simplex Electric Heating Company, Cambridge, Mass.

This toaster has a polished metal case, in the center of which an upright electric heater extends from end to end. On each side is a door which swings outward and downward and opening sufficiently to permit the placing or removal of bread without chance of burning the fingers. When toasting the doors are closed, confining all the heat within.

A flexible conductor is provided with a lamp socket plug and another plug by which the current may be turned on or off at the toaster. The walls of the casing are double with an air space between. All the interior surfaces are brightly polished providing heat reflectors.

The construction is thoroughly substantial, there being no delicate parts or soldered joints. In operation any

NEW SIMPLEX ELECTRIC TOASTER.

crumbs from the bread fall within the enclosure of the walls and doors on the porcelain enameled base and are easily disposed of by opening the door.

The walls and doors are smoothly polished, with ebony finished handles and the plating is finished in either nickel or silver.

The five points claimed by the manufacturers as emphasizing the value of this toaster may be stated as follows: Convenience and comfortable operation; rapid toasting with high economy; simplicity and durability; accessibility and cleanliness and best of finish in good form.

An Electric Pump for Motor Tires.

An electric pump for inflating motor tires has recently been introduced by E. E. Coy, of Liverpool, England. This is claimed to be one of the essentially useful labor and time saving devices of the up-to-date garage.

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An All-Porcelain Pothead.

The Colonial Sign and Insulator Company, of Akron, Ohio, will soon place on the market a new type of overhead high-tension cable terminal box or "pothead." This device was developed for the Cleveland Electric Illuminating Company by E. E. Noble, its superintendent of construction, and has been used by this company to the exclusion of all other types for the past year. The illustrations herewith show actual installations on this company's 2,300-volt lines. To determine the reliability of this type of pothead, however, certain of them were mounted and subjected by the company's engineers to continuous tests under actual service conditions on voltages from 6,600 to 13,200 for a period of eight months with most gratifying results. A laboratory test showed that the current would arc from one terminal to another at 30,000 volts, but no breakdown ensued.

These potheads are made of brown glazed porcelain, the only metal parts being the terminal contact blocks and the supporting clamp ring. As seen from one of the illustrations and pothead consists of peculiarly shaped body and a suitable cover bell. The cable enters the neck of the body or pothead proper, and the conductors separate within this neck and are brought out and screwed into the contact blocks through the slots provided. Barriers between the phases prevent creeping and short-circuiting. The overhead leads are led up into the contact blocks through notches in the cover so as to form a natural drip loop.

When paper-insulated cables are used, as is the case in Cleveland, the insulation is protected by a wrapping of varnished cambric tape or of splicing gum tape served with P. & B. paint. This is made to extend somewhat below the end of the lead sheath.

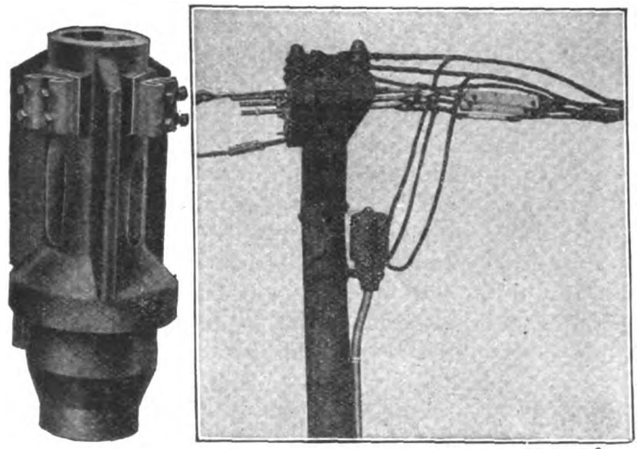
The body is fitted with a lug and the clamp with a socket to prevent the pothead from turning, and the cover bell with lugs between which the barriers of the body engage in order to locate the lead openings in a definite position with reference to the conductor slots in the body.

Some of the advantages claimed for this pothead are its simplicity, compactness, lightness, ruggedness, neatness and its low cost. The removable cover bell permits of rapid inspection, the screw connections in the contact block of quick disconnection for tests or other purposes. The manner of bringing in cable and leads prevents the ingress of moisture. The cable sheath does not have to be wiped on to the body and its outer diameter is immaterial as long as it will enter into the neck.

The only compound used in the pothead is about a half teacupful of ozite or similar high-grade insulation which is filled into a small pocket formed at the top into which the bolts holding the terminal blocks converge. Absolutely no compound is required to protect the end of the cable.

The type illustrated weighs about eighteen pounds, complete and was designed for three-phase, 2,500-volt circuits, but has been found to operate successfully on 6,600 volts and will take cables up to one and seven-eighths inch outside diameter. Potheads for single, two or three-phase service and for higher voltage or larger diameter cables can also be supplied in this type.

ALL-PORCELAIN POTHEAD WITH COVER BELL REMOVED.



INSTALLATIONS IN CLEVELAND, OHIO, OF ALL-PORCELAIN POTHEADS, AT JUNCTIONS OF THREE-PHASE CABLES AND OVERHEAD LINES.

New Type of Tailor's Goose.

The steadily increasing use of electrical devices in industries is constantly creating a demand for improved appliances and in no field has the demand been more insistent than for an electric iron for use in tailor shops.

The requirements of a tailor's iron are more exacting than are those of other irons and the faults more or less common to the majority of electric irons are therefore more conspicuous in the tailor's iron.

If high efficiency is desired in the smaller types, it is even more so in tailors' irons, because the large area of the bottom requires a greater volume of heat and they are used a longer number of hours than are most smaller irons. It will therefore be seen that the quantity of energy required to do a given work becomes, for tailor's irons, no small matter.

It is perhaps the factor of endurance, however, more than anything else which has eliminated the average electric iron from most tailor shops, for as a rule it has a shorter life than other weight irons of the same design. There are two reasons for this: First, because the nature of the work requires a larger volume of heat and much higher temperature. Second, because of the inherently slow starting ability and the intermittent nature of the work there is more temptation to let the iron stand with the current on, in order that the iron be ready for use. The first of these makes it necessary to wind the heating element for excessively high temperature, and the second increases the danger of burn-out still further.

With a full knowledge of the conditions to be met the Central Electric Company, Chicago, Ill., has placed on

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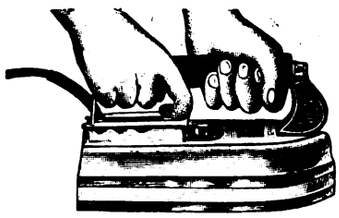
the market the Universal tailor's goose illustrated herewith. This new iron is simply a development of its well-known four and six-pound irons with the necessary changes in design to meet the necessary conditions imposed by the severe service met in tailor shops. A prominent feature of the new iron is the three-heat switch-plug by which all heats can be controlled by a simple motion of the hand while ironing.

This desirable feature is accomplished without withdrawing any plug from the iron, or turning any auxiliary switch. The heating elements are so arranged that the heat is distributed over the bottom of the iron equally correct at any one of the three heats, and at the same time maintaining an equally high efficiency on any of the heats.



CENTRAL ELECTRIC TAILOR'S GOOSE.

The advantages of the new Universal tailor's iron possessing three heats, which can be controlled with a simple movement, are two-fold: First, it gives a greater range of control of temperature than can be obtained by ordinary switch-plug, or by other means. Second, the low heat can be so arranged that the quantity of current consumed will just maintain the iron at a temperature while standing indefinitely.

The first advantage is appreciated by manufacturers who have special temperature requirements and where the nature of the work varies greatly. The second is more important in job shops where an iron is more liable to burn out, as this feature would prevent such by allowing it to stand at low heat instead of high.

This is an important feature as the iron is always maintained at just the correct temperature while standing between jobs and does not cool off or get any hotter. This enables the operator to pick up the iron and go ahead any time without waiting, whereas should the full heat be left on, leaving out the question of consumption, it would become too hot. The medium heat is used only when very light work is to be done, or where only one piece is to be pressed.

A Department Store Pneumatic Cash System and Motor Equipment.

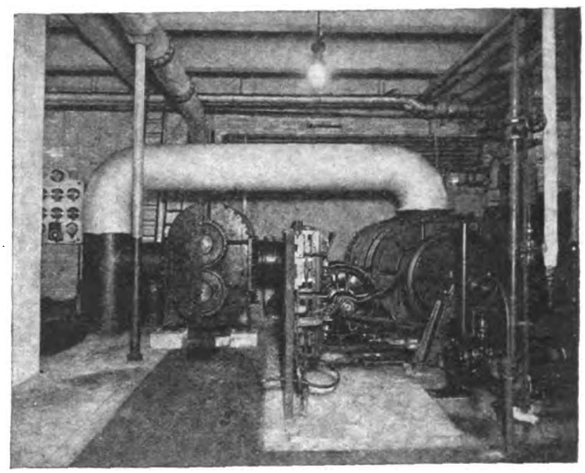
In a modern department store the rapidity with which change is made and charges entered is of the utmost importance. Although a customer may need an hour to decide upon a purchase, if a few minutes are required by the cash office to properly handle the cash or credits, this time is, in the customer's mind, added to the time already spent and the whole is charged against the store's service. The management must have changes made in such a short time that the customer may leave before having the chance to think about the time spent, and, therefore, goes away with an impression of good service.

Boggs & Buhl, North Side, Pittsburg, have recently placed in operation, in their department store, a system which is proving very satisfactory. The store has approximately seven acres of floor space, and it is estimated that there is over three miles of cash tubing. Change is made in an average time, for all stations, of from one to two minutes.

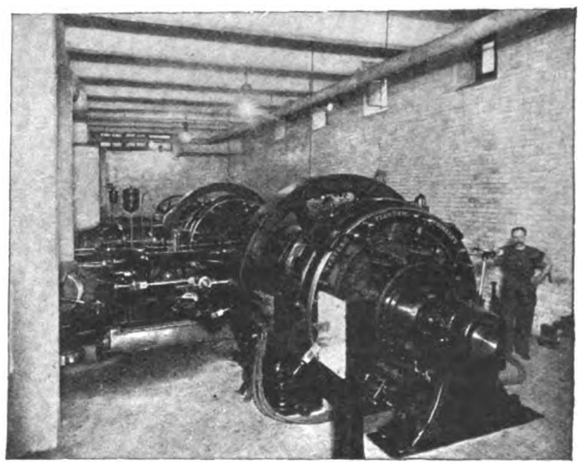
The system which was installed by the Lamson Consolidated Store Service Company is known as an independent vacuum pneumatic-tube system. There are eighty-four lines in operation, seventy-three of which are for cash and the remaining seven take care of the charges.

The cash office, a partial view of which is shown in one of the accompanying illustrations, is located in the basement, under about the center of the building. From eighteen to twenty-four cashiers, of whom four or five are at the charge desks, are employed to handle the business. Each cashier operates from five to seven lines, a space of about twelve inches separating the banks of tubes assigned the operators. The charge desks are located in the center of the cash office. The charge lines, or tubes, branch off from here to the various points, so located that there is one charge station between every two cashiers. This arrangement brings the regular cashier into close touch with those who enter the charges. The charge desks are also connected by tubes with the general offices on the fifth and the credit office on the first floor.

Each of the eighty-four salesmen's stations uses, on an average, six cash and four charge carriers. This equipment has proven sufficiently large to handle satisfactorily the firm's business.



VIEW OF BLOWERS IN POWER PLANT.



VIEW OF POWER PLANT SHOWING DIRECT-CONNECTED UNITS.

The power to operate this system is furnished by two Root blowers chain-driven by Western Electric fifty and fifty-five horsepower motors. The blower with the motor shown at the right of the accompanying illustration is the larger of the two. The machine at the left of the same cut is the smaller of the two blowers, and is used for emergencies only. The starter for the motor of the first set is seen in the center foreground.

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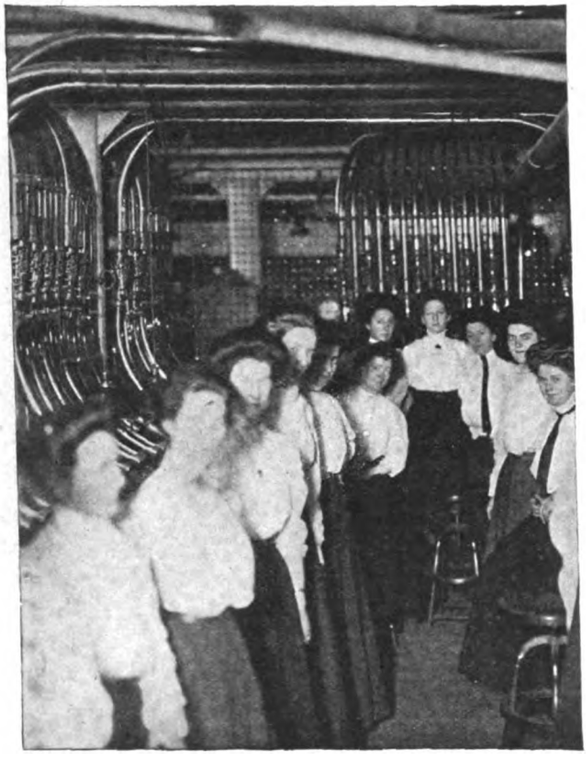
The power for operating the blower motor is obtained from a 110-volt direct-current circuit, which leads from the new power plant just installed in the basement of the latest addition to the building. A view of a portion of the engine room, showing two of the three direct-connected Western Electric generators, is also shown. The whole plant is of the latest design, and is a model for cleanliness.



VIEW OF CASH OFFICE IN PITTSBURG DEPARTMENT STORE.

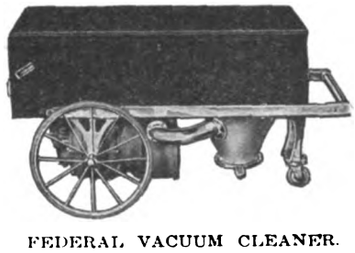
The power plant of this store is of 750-kilowatts output. Power is used to operate the previously described cash system, 500 arc and 2,000 incandescent lamps, eleven elevators, a vacuum cleaning system for the store, a twenty-ton refrigerating plant for cold storage, drinking water and soda fountain, and thirty-eight motors of various sizes, operating sewing machines, carpet machines, saws, dictaphones, adding machines, fans, etc. Probably the most novel application is a motor driving and air compressor, which furnishes air to a tap on the street corner, where automobile owners may pump up their tires. This application is proving a good advertising medium.

Wireless in Australia.

The Australian Government has appropriated $50,000 to establish wireless stations around the coast of Australia.

The Federal Vacuum Cleaner.

The Federal Electric Company, Chicago, Ill., is placing on the market a new type of electric vacuum cleaner which is particularly adapted to residence, office building, church, library, hospital, hotel and theatre cleaning purposes. These cleaners, shown in the accompanying illustrations, have been carefully planned to avoid objectionable features and to perform satisfactorily the work for which they are intended. The cabinet in which the hose and tools are kept is built of mahogany with dull piano finish. It is mounted on two cushion-tired twelve-inch bicycle wheels and a rubber-tired ball bearing caster which makes it easy to move the machine to any part of the house. The large wheels make it particularly easy to move up and down stairs.

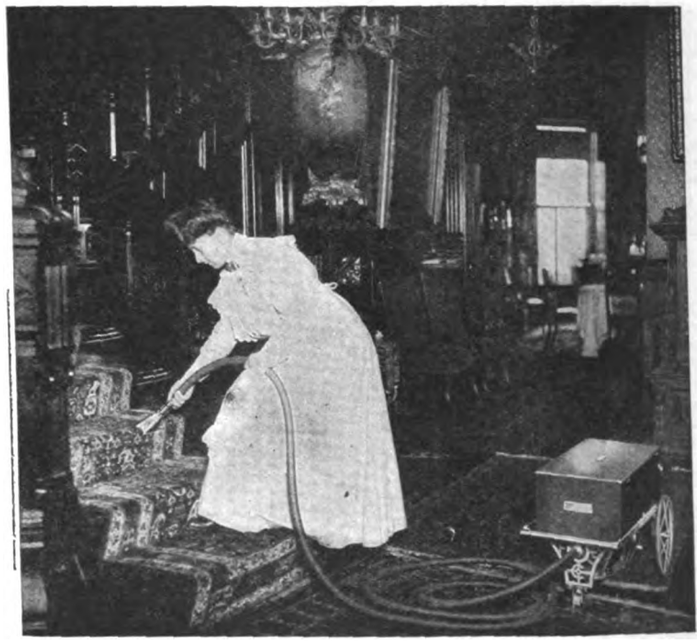


FEDERAL VACUUM CLEANER.

The machine can be attached to any lamp socket and can be furnished for either direct or alternating current. The equipment includes fifteen feet of vacuum hose and twenty feet of lamp cord, which, with the extension handles, gives a radius of action of forty feet from the lamp socket.

The Federal cleaner is equipped with a rotary pump connected directly to a one-quarter horsepower motor, insuring a steady vacuum in the simplest manner. The construction is such that the necessity of carrying or lifting it is eliminated. The motor and pump are made into a single unit by means of a direct connecting device which eliminates vibration and minimizes noise.

We have shown herewith an illustration of the Federal vacuum cleaner in operation cleaning stairs. The manufacturers have designed for this purpose a special tool which fits snugly over the stair edge, preventing loss of vacuum and effectively removing every vestige of dust, both in and beneath the carpet.



FEDERAL VACUUM CLEANER WITH STAIR-CLEANING TOOL.

This cleaner is supplied with necessary tools for cleaning carpets and rugs, draperies and curtains, furniture, hardwood floors or walls.

To Lease Waterpower Sites.

In his recent annual report, Secretary of the Interior Richard A. Ballinger recommends that waterpower sites on public lands still undisposed of, should not be sold outright, but leased for periods up to and not exceeding a maximum of at least thirty years. Mr. Ballinger gives details of his tentative plan in which he proposes that taxes for rent be assessed on the capital invested or on the gross earnings of the plant.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, NOVEMBER 26.—The old question of electric-lighting tariffs was once again discussed at the Institution of Electrical Engineers last night. The matter was raised in a paper by Messrs. Handcock and Dykes in which it was proposed to deal with the small consumer, from which the gas companies derive so much revenue, by the abolition of meters and charging a fixed charge per thirty-watt lamp per annum for an all-day supply, and a smaller fixed charge when the supply is given from "dusk to dawn." The prices suggested as an average were $3 and $2.50 respectively. In order to insure that consumers upon this system shall not change the size of their "contracted" lamps, for lamps of higher candlepower, it is proposed to adopt a special form of holder to the lamps which will only be supplied by the supply authority. A similar system to this has actually been in operation in Harrogate (Yorkshire, England) for a good while, with very satisfactory results, although it is admitted that the total revenue from consumers is under ordinary tariffs. It includes the wiring, however, and there are no meter rents, and it seems that consumers prefer to know exactly what they have to pay. At the same time there is a wide divergence of opinion upon this question, but it is more than probable that the system proposed, or a modification of it, will be tried in many of the smaller towns. There is also some difference of opinion as to whether metal-filament lamps should be used with low-tension or high-tension supply, i. e., twenty-five volts, or the higher voltages in vogue with carbon-filament lamps, and in view of the multiplicity of voltages in use in England today, the suggestion made in the discussion that some steps should be taken towards securing uniformity of voltage throughout the country seems an eminently sensible one.

The Local Government Board has taken the drastic course of refusing a loan to the Finchley (North London) Council for street electric lighting for the reason that the board has not been furnished with comparative figures of the cost of gas lighting. The council took the position that it formed no part of the functions of the board to dictate as to what system of lighting should be adopted. Having an electrical undertaking they considered it their duty to have electric light in the streets. This scheme has already been put in hand and will now have to be paid for out of revenue or met by a special charge upon the rates. The case serves to indicate the attitude which the Local Government Board is taking up in connection with loans for electrical purposes. A similar refusal was made a short time ago in the case of the Marylebone council for a street lighting scheme. In this instance, too, the cost was defrayed out of revenue.

The action of the Welsbach Incandescent Gas Company in putting a tungsten lamp upon the market in competition with the agents in Great Britain of the German Welsbach Company, will very likely lead to a patent infringement action concerning the validity of the patents under which the Welsbach Company's lamps are made. Although called "Welsbach Aur" lamps, it is now known that they are made in Berlin and are in no sense the invention or product of the English Welsbach Company which sells them. The complaint of the General Electric Company here, is that Baron Welsbach should have placed upon the market a metal-filament lamp in competition with the product of his own German company. The police-court proceedings under the Merchandise Marks Act in which the charge is that the lamps have a false trade description, are still going on and likely to for some time yet, but the result in any event may lead to a patent infringement action as already mentioned.

The postmaster-general still finds it very difficult to get over the prejudices of local authorities around London against the use of overhead wires for telegraph and telephone purposes. Because, for obvious reasons, all the wires in the center of London were placed underground at great expense, all the outside authorities seem to regard this as a good argument for resisting the erection of overhead wires in their districts. In hardly a single case are they successful and much of the ratepayers' money is thus wasted in legal fees. The latest example of this kind was decided this week against the Hammersmith Borough Council the postmaster-general's argument that cheapness of service could not be maintained if an expensive underground system had to be installed, gaining the day. A similar position was taken up by the London local authorities in regard to tramways, because the conduit system was installed in the central portions of the metropolis. This prejudice, however, is gradually disappearing.

It is significant that although the London County Council has disposed of its Works Department, a considerable quantity of work is still being carried out by direct labor in the tramways department. Top roofs have been added to fifty double-deck cars by this means and a further ninety cars are also to be dealt with. In addition, it has just been decided to have plows fitted to 200 new cars by a contractor.

Wednesday, next, December 1, is now definitely decided upon as the opening day of the single-phase railway in South London. The management has given it the distinctive name of South London Elevated Railway, and in addition to a very much accelerated service, extensive reductions of fares are announced.

To judge from the preliminary announcements of bills to be promoted in the next session of Parliament there are to be no powers requested for important constructive works. Further linking up of the tube railways in London is proposed, in addition to the amalgamation of the three tube railways affiliated to the District Railway. Several municipal corporations will apply for powers to run trackless-trolley cars, but the new tramways proposed are not very extensive. The Board of Trade will promote a bill authorizing the London County Council to purchase the five "West End" electric supply companies of London, who were for some reason left out of the London Electric Supply Act of 1908 when all the other London companies were placed in this position. A new tube railway from the city to the Crystal Palace has been postponed for the present.

It is stated that an application will shortly be made for an extension of the Marconi fundamental patent of 1896, which normally expires in June of next year. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, NOVEMBER 26.—Among recent electrical projects in France, I note that the Lyons Gas Company is making negotiations for supplying current for the town of Bourg. It is likely that the commune of Figeac will receive a light and power supply from the electric plant which is now in operation at Capdanac. The town of Mer is about to install an electric lighting plant, as also the localities of Montfermeil and Jarnac.

An electric railroad line is soon to be opened for traffic in the south of France. It lies in the Pyrenees region and will eventually make connection across the frontier with the Spanish railroad lines leading to Barcelona. The present railroad is the first standard gauge electric line to be operated as part of the Southern Railroad System, which is one of the leading railroads in France. It runs from Villefranche by way of Vernet to Mont Louis, and it is intended to extend the line from the latter point as far as Bourg-Madame so as to connect with the Spanish lines. The present railroad, although but eighteen miles in length, is remarkable for the fact that it passes through a mountainous region and runs for the most part in cuttings on the mountain side, viaducts and bridges. The road mounts up from 427 to 1,510 meters altitude, which makes the gradients high. The Gisclar bridge is suspended eighty meters above the mountain torrent of the Tet, and is a remarkable work. Current for the railroad is supplied from the Cassagne electric plant, and it is operated on the third rail system.

The town of Schaerbech, Belgium, is taking measures to erect a garbage consuming and electric plant, finding this to be the best means of securing the current supply which is needed. A prominent fertilizer company has promised to take all the products from the furnaces.

In Spain negotiations are under way for the construction of an electric traction line which is to run between the communes of Avanzada and Algorta.

Budweis, Austria, will probably have a narrow gauge electric line running through the town in different sections, these to connect with the railway depots. The lines are to be run on the trolley system. A. DE. C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., DECEMBER 4.—A wireless system of signals, for the running of railway trains, will be installed on the Canadian Pacific Railway between North Parkdale and West Toronto. If the test is a success, there is every indication that this system will be adopted by the company.

The Quebec Railway, Light, Heat and Power Company, the recent big electric merger in Quebec, has made a very successful issue of its securities. It is stated that the underwriting has been over-subscribed by nearly one hundred per cent, and that there will be no public issue of the stock.

With the successful commercial experiments, recently made in the Dominion, in converting bog peat into fuel for heat, light, pro-

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ducer gas and electrical energy, the 370,000 acres of Ontario peat bogs, which average nine feet deep, will be largely used as a substitute for coal in this province. Ontario's coal supply now largely comes from the United States.

The capital required for the construction of the Ottawa & St. Lawrence Electric Railway, has been oversubscribed by English investors, and there seems now no reason why the work should not be proceeded with at once. As required by the charter, work has to start not later than May 15, 1910, and 254 miles of the railway must be finished within two years.

After a long and stubborn fight, in the council and the courts, the city council of Hamilton, Ont., has decided to enter into a contract with the hydroelectric commission for 1,000 horsepower on the terms submitted by the commission. It is three years since the contract was first submitted to the people and on two occasions since that time, the bylaws were indorsed.

Within a radius of eight miles of Ottawa are undeveloped waterpowers amounting to 200,000 horsepower, and within a radius of forty-five miles of the city the amount is estimated at 917,400 horsepower. Of this vast amount only 58,400 horsepower is, at present, in use. Just now, electric power can be purchased here for less than $15 per horsepower per annum, continuous service. A new company, which is seeking a charter from the city, has agreed to sell electrical energy at $11 per horsepower. Another use, to which the electric power will soon be put, will be in the development of the mines in the vicinity of Ottawa, by means of the electric furnace for smelting, there being rich deposits of iron ore within a mile or two of immense waterpowers. It will also be employed in the development of the deposits of zinc, plumbago, mica, phosphate of lime, etc., which as yet have not been properly exploited owing to the great cost of fuel.

The Hydroelectric Commission is not going to pay any attention to the Port Arthur injunction, as far as actual work in constructing transmission lines, power stations, etc., is concerned. It will, of course, be obeyed so far as entering into any agreement with the city is concerned. The work of constructing the power line from Kakabeka Falls to Port Arthur and the transformer station will be proceeded with at once. Port Arthur has twice adopted a bylaw in favor of the contract with the hydroelectric commission, but has twice been stopped by technicalities. The contract of the city with the Ontario, Michigan Power Company expires in March, and unless an agreement can be reached before that time the city will be compelled to sign an interim agreement with the company.

The bill of the Montreal Central Terminal Company, asking for the right to enter into combination and acquire certain franchises has been given a first reading in the Canadian parliament. The company asks to be authorized to enter into agreements with the following railways: The Canadian Northern, the Ottawa Valley, the Boston & Maine, the Intercolonial, the Montreal Terminal, the Montreal Suburban and Chateauguay and Northern railways; to acquire the franchises, rights and properities of the Montreal Light, Heat and Power Company, the Saguenay Company and the Canadian Light Company, and to connect its telegraph and telephone lines with existing companies. The company is to begin its works and expend $500,000 within two years, and if not finished in seven years, its powers will lapse. W.

LIGHTING AND POWER.

(Special Correspondence.)

HETTINGER, N. D.—C. A. Meyer, of Clarkfield, Minn., is about to put in an electric-light plant here. P.

EARLHAM, IA.—Work has been started on the erection of an electric light plant and waterworks system. C.

WATERTOWN, S. D.—The Ferris Brothers System is having plans drawn for a light and power plant. C.

LONG BEACH, CAL.—The Long Beach Electric Company has been incorporated with a capital stock of $10,000.

BRIDGEWATER, S. D.—A. M. Weidenbach, of this city, has been granted a twenty-year electric-light franchise. P.

MARENGO, IA. The Marengo Electric Light and Power Company has been incorporated with a capital stock of $15,000.

RAMONA, S. D.—The Citizens Light and Power Company has let the contract for a $2,000 plant to H. P. Mortensen, of Toronto, S. D.

DUNSEITH, N. D.—John Gottbrecht will commence the construction of an electric light and waterpower plant at Mineral Springs in the spring. C.

PARK RAPIDS, MINN.—The dam of the Park Rapids Power and Light Company is going out. The damage will amount to many thousands of dollars. C.

UPLAND, IND.—The Town Council is preparing to let a contract for the construction and equipment of a combined waterworks and electric-light plant. S.

TACOMA, WASH.—It is expected that the council will shortly call for bids for the construction of the first unit of the $2,000,000 power plant on the Nisqually River.

RAMONA, S. D.—The contract has been let for the construction of an electric light plant, complete with wire, poles, switchboard, dynamo, engine, belting, etc., for $2,000.

COUDERAY, WIS.—The Arpin Lumber Company, of Grand Rapids, Wis., is constructing a water power and concrete dam across the Chippewa River, seven miles below here. C,

TWIN BRIDGES, MONT.—The Madison River Power Company is erecting a dam at the site for the powerhouse on the Madison River in the upper part of the Madison Valley. C.

KALISPELL, MONT.—C. A. Farrar and others have incorporated the Bitter Root Mountain Water Power Company, with a capital of $100,000, to develop more electricity in the Flathead Valley. C.

HAZLETON, PA.—The Harwood Electric Company is extending its transmission line from this city to Berwick through Nuremberg, Derringer and Tomhicken. It is probable that the line will also be run from Tomhicken to Conyngham.

PRESCOTT, ARIZ.—The Prescott Electric Light Company has closed a contract with the Arizona Power Company which has a hydroelectric plant at Fossil Creek. The lighting company is to receive 600 horsepower, which will be distributed by them to their customers.

SALINAS, CAL.—The Monterey County Gas and Electric Company has recently been changed from a two-phase, four-wire system to a three-phase, three-wire system. Power is now transmitted at 2,200 volts and transformed to 220 or 110 volts for power and lighting circuits.

TOMAH, WIS.—The Goodyear Lumber Company has completed at Tomah what is stated to be the first electric sawmill in the country. August H. Meyer, of Appleton, Wis., prepared the plans for the mill and directed its construction. It has a daily capacity of 100,000 feet. M.

GREENFIELD, IND.—The Citizens' Electric Company, of Hancock County, has been incorporated, with a capital of $10,000. The company proposes to erect, maintain and operate a pole line transmission system to furnish current for light and power to the rural citizens of Hancock County. E. M. Leary, R. F. Morgan and John S. Thomas, directors. S.

JACKSON, GA.—The work of constructing power transmission lines of the Central Georgia Power Company has begun, it is reported. The first line will be run from the power plant on the Ocmulgee River, near here, to Macon, Ga., going via Bibb and Forsyth, Ga. It has been stated that a line will also be built from Forsyth to Griffin, Ga., and thence to Atlanta, Ga. B.

REXBURG, IDAHO—A deal has been closed whereby the Idaho Power and Transportation Company, of Idaho Falls, has purchased the electric-light and power plants at Rexburg, Sugar City, Teton City and St. Anthony. These plants belonged to the Hodgens Brothers, of Butte. The deal also includes the water system of St. Anthony and represents a total value of $150,000. These two companies have been competitors in Rexburg and St. Anthony. The headquarters of the company will be retained at Idaho Falls.

ALBEMARLE, N. C.—Local cotton mills have closed a contract with the Southern Power Company for current to be used as the motive power in operating several large textile mills here, this station being on one of the main transmission lines, carrying 80,000 voltage. The town recently voted in favor of electric lighting bonds, and now it is possible that a municipal contract will be drawn up and entered into with the Southern Power Company to supply the necessary current. The matter will reach definite shape in a short time. L.

FT. WAYNE, IND.—The first annual report of the Ft. Wayne Municipal Lighting Plant shows that the cost of maintaining and operating the plant from and including September, 1908, until February, 1909, is $12,273.10. After February 1, the plant had monthly receipts from commercial lighting in addition to receipts for street lighting at $53 per arc lamp which totaled $20,285.91. The total expenditure amounted to $18,164.88, leaving a balance of $2,121.03. The total cost of the plant amounted to $165,254.10, to which $25,000.00 has been added for extending the lighting lines and installing commercial service. S.

SALT LAKE CITY, UTAH—H. E. Smith, of Duluth, Minn., has filed application for 100 cubic feet of water per second from the Sevier River in Piute County. The application states that the diverting works will consist of a dam about sixteen feet high across Sevier River and that the diverting channel will be 42,000 feet long. In the power plant 72-inch Pelton wheels will be used, operating under a head of 330 feet and generating a total of 1,500 horsepower. The electrical power thus generated will be used in electric lighting and propelling machinery in Marysvale, Kimberly, Richfield, Milford, Frisco, Sevier and intermediate points.

MADISON, WIS.—The wholesale removal of poles and wires from several Madison streets has been ordered by the City Council. This work must be done by August 10, 1910, and failure to do so by that time will make the utility companies liable to a fine of $10 to $100 a day for each day after Aug. 10, 1910, until it is done. The Southern Wisconsin Traction Company also has been ordered to erect iron trolley poles on State Street and University, a total distance of twelve blocks, in place of the present wooden poles. This work must be done within six months. A penalty of $10 to $100 for each day after the time limit is provided for if the poles are not replaced as ordered. M.

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SIOUX CITY, IOWA—A vote will be taken December 21 on granting franchises to the Sioux City Gas and Electric Company and the Sioux City Service Company to operate an electric-light and power and gas plant. C.

ROANOKE, IND.—This city has closed a contract with the Fort Wayne & Wabash Valley Traction Company for the lighting of the town by electricity and is now laying plans for the erection of electric arches on the main street.

WILLIAMSON, W. VA.—Captain E. L. Bailey has applied for a franchise to install and operate a light plant at his mines, and incidentally to light this city. Mr. Bailey is now using power from the Williamson Light and Ice Company.

GOLDFIELD, NEV.—A. J. Trumbo, general manager of the New Bonnie Clara Mining Company, has closed contracts with the Nevada-California Power Company for electric power for the mill at Bonnie Clara, and a line will be extended at once. A.

LEWISTOWN, MONT.—The Spring Creek Power and Electric Company, organized by John L. Bright, has been incorporated with a capital stock of $1,000,000, to engage in the light and power business, construct dams, electric railways, power plants, etc. C.

MARBLEHEAD, MASS.—Work on a municipal lighting plant is to be begun at once, so that the lighting may all be taken care of by next summer. The committee on reconstruction elected William A. Brown as chairman and Joseph Coates as secretary.

FULTON, KY.—The Swain-Karmire mill is preparing to install a private electric-light plant at their big mill on the Tennessee side. The plant will furnish illumination for the mill and lumber yards. The engine and dynamo have arrived. Electrician J. W. Stitts will install the plant.

CITY OF MEXICO, MEX.—The Guanajuato Power and Electric Company is preparing to transmit electric power to Aguas Calientes, where the American Smelting and Refining Company's smelter is located. Power will also be delivered to the Asientos and Tepezala mining districts. A.

BOISE, IDAHO—The power site located on the Snake River between Garnet and Henry's Ferry has been withdrawn from entry. If the withdrawal stands this land will not be issued to settlers, but will be improved by the government. The power site is in the big bend north of Bruneau, and is quite valuable.

MUNCIE, IND.—In consideration of $225,000 the Muncie Gas, Light and Fuel Company's property was sold November 26 to N. W. Harris & Company, a well-known bonding company of Chicago. Robert O. Lord represented the purchaser and the sale was made by Edward Daniels, master in chancery of the Federal Court. S.

LINTON, IND.—Because the city council had not fully complied with the law in the proffered sale of the Linton municipal light plant, the court refused to ratify the sale. The council will again offer the plant for sale. There are a number of bidders and the successful bidder will, of necessity, have to improve the plant. S.

DARLINGTON, S. C.—A charter has been issued to the Darlington Water and Electric Company, who have incorporated for the purpose of constructing a general lighting and power business. The officers are as follows: President, A. P. Malone; vice-president, W. H. Haynesworth; secretary, L. C. Ritchie. The capital of the company is $50,000.

ALBEMARLE, N. C.—The cotton mills have just closed a contract with the Southern Power Company for the running of all their machinery, and a substation will be established here. Albemarle is on the main line of the Southern Power Company, which extends from the power plant on the Catawba River to Salisbury. This line carries about 80,000 volts. The city may also be lighted with power from the company.

NATCHEZ, MISS.—The generators for the Southern Railway and Light Company plant have been received, and are being installed. One is a 300-kilowatt generator for the alternating current or private lighting service and the other is a 300-kilowatt direct-current generator for the street railway. The 500-horsepower boiler has been installed, and when the new generators have been placed in position the company will be prepared to handled a much larger service than the present demand calls for.

SACRAMENTO, CAL.—The Rubicon Water and Power Company is putting up several buildings at the intake of the ditch, on the Rubicon River. Men will be kept at work by the company all winter, driving tunnel and doing such other work as the weather will permit. The company has seventeen miles of ditch surveyed. There will be four tunnels, altogether five miles in length, through which the water will flow, and the amount of water controlled at the completion of the project will enable the company to generate 30,000 horespower.

EVANSVILLE, IND.—A franchise has been applied for by the Evansville Public Service Company, recently organized, to build, equip and operate a central electric-light, power, steam and hot water plant in this city. The company proposes to reduce the price of electricity to seven and one-half cents a kilowatt—a reduction of twenty-five per cent of the price now charged. The company agrees to pay to the city fifty per cent of the net earnings of the company after deducting six per cent on the capital stock and four per cent for a repair fund.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SIOUX CITY, IOWA—An interurban line to Mitchell, S. D., is projected by L. F. Phillips, of Wagner, S. D. C.

WINONA, MINN.—The city council denied the petition of the La Crosse and Winona Traction Company for a franchise. C.

SAN DIEGO, CAL.—Bids are now being received for the $1,000,000 car barns which the San Diego Electric Railway Company will erect. A.

HAYWARDS, CAL.—Work will be started in January on the extension of the Oakland Traction Company's Haywards line from this place to Niles. A.

BOISE, IDA.—A survey has just been completed for an electric line from Caldwell to Nampa, which will be built early next spring. The line will cost $150,000.

GLOBE, ARIZ.—The Stone-Webster Company is preparing plans for a street railway in this city, with an extension to Miami and other large mining camps in this vicinity. A.

BILLINGS, MONT.—Geo. H. Kesselsmith and H. F. Pierce are making a preliminary examination for a proposed electric road to Red Lodge, Bear Creek, Fromberg and Bridger. C.

LOS ANGELES, CAL.—An ordinance has been passed granting to the Los Angeles Railway Company the right to construct and operate a double track electric street railway upon certain streets in this city. A.

LOS ANGELES, CAL.—Bids will be received up to December 21 for a franchise for an electric railway commencing at the intersection of Main and Ann Streets and along Ann northwesterly to San Fernando Street. A.

MANKATO, MINN.—Eastern capitalists are behind a plan to build an interurban line to St. Paul and Minneapolis. It is understood that the proposed road will be wholly independent of the Dan Patch line as well as of the Twin City Rapid Transit Company. C.

LA CROSSE, WIS.—The plans of the La Crosse Water Power Company, which owns the Hatfield water power and of which W. J. Ferris is president, provide for a continuous line of modern interurban railways connecting Winona, La Crosse, Sparta, Eau Claire, Chippewa Falls, Menominee, Hudson, St. Paul and Minneapolis. C.

WARSAW, IND.—A mortgage for $1,200,000 in favor of the Carnegie Trust Company has been filed in this county by the Wabash and Northern Indiana Electric Railway Company. The mortgage covers all the company's property in Kosciusko and Wabash County, and this act assures the speedy construction of the road between this city and Wabash. S.

PHILADELPHIA, PA.—Philadelphia and Suburban Railroad Company has fied an application at Harrisburg for a charter to build a subway on Broad Street, Philadelphia, north of the city hall to a point near Cumberland Street. The new plans provide for an extension of the proposed subway system by elevated roads to Fairmont Park, Frankford and Wayne Junction. The original application of the company for a charter to build an elevated road on Twelfth and Thirteenth Streets has been withdrawn.

FT. WAYNE, IND.—As a result of what the directors of the Ft. Wayne and Wabash Valley Traction Company consider unfair treatment, after having spent nearly a million dollars in a monstrous plant, by the city in building and operating a competing plant and putting the price of commercial lighting down to four cents a kilowatt, it has decided to develop the power plants at Huntington and Lafayette expending $250,000 in car barns and repair shops. It was the intention to concentrate all these in Ft. Wayne, but because of the attitude of the city no more money will be expended in Ft. Wayne by the corporation.

SACRAMENTO, CAL.—The directors of the Vallejo Northern electric road, between Sacramento and Vallejo, have filed articles of incorporation. The capitalization of the company is $2,500,000, with $119,000 of the capital stock paid up. From the terminus of the road at Vallejo the route is laid to Napa Junction, Cordelia, Fairfield, Cement, Broderick and to Sacramento. Many branch lines are contemplated, and the country between Sacramento and Vallejo is to be gridironed with trolley tracks by the new company. The directors are Thomas T. C. Gregory, John W. Bauman, William Pierce and Ernest D. Holly, of Suisun, and Winfield R. Madden, of Dixon.

JANESVILLE, WIS.—The Janesville street railway system, perhaps the most dilapidated street car system in the state, owned and operated by the Janesville Street Railway Company, which was controlled by the Bladon estate of Philadelphia, has been sold to New York and Janesville capitalists for about $45,000. The system is to be completely reconstructed. It is rumored that the local lines are to be made a part of the proposed interurban system connecting Madison with Chicago, through Rockford. The present system has a length of five miles. The company's capital stock is $65,000, and the bonded indebtedness $150,000. The new owners will increase the capital stock to $200,000. M.

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ABERDEEN, S. D.—The citizens here are raising $120,000 with which to build a street railway system.

OGDEN, UTAH—Secretary H. H. Rolapp, of the Ogden Rapid Transit Company, states that a line is soon to be run to Brigham City.

BILLINGS, MONT.—Geo. H. Kesselsmith and others are proposing to build an electric road from this point to Red Lodge and other points.

TAMA, IOWA—Preliminary work on the Oskaloosa-Tama interurban is being pushed. The right-of-way is being secured and $80,000 has been pledged to build the road. The road can be built for $15,000 a mile.

GUTHRIE, OKLA.—Two interurban roads have been chartered in the last week—Coffeyville to Nowata and Lawton to Fort Sill. Bert Tiloton was incorporator of the former and D. L. Sleeper, of Tulsa, of the latter.

SALEM, ORE.—The Oregon Electric Railway Company has filed articles of incorporation. This railway includes an extension from Salem to Roseburg, a branch to leave the main line between Portland an Tualatin. A.

GAUDALAJARA, MEX.—The State Government has granted a concession to Jas. H. McCreery and Richard Ivey to construct an electric railroad from Magdalena to the Santiago River at a point near Cabrera mine.

NUEVO LAREDO, STATE OF TAMAULIPAS, MEXICO—An electric street-railway system is to be built in the town of Nuevo Laredo by Dr. J. F. de la Garza and associates. Local capital is behind the enterprise.

MEDFORD, ORE.—J. R. Allen, president of the Pacific & Eastern, will apply for a franchise in this city for an electric railroad. Applications for franchises will also be made in all the other cities of the valley. A.

FITCHBURG, MASS.—The Fitchburg & Leominster Street Railway Company is installing a 500-kilowatt generator in its South Fitchburg power station. This will increase the present generator capacity by about sixty per cent.

LONG BEACH, CAL.—As soon as the Daisy Avenue extension of the Wilmington-Long Beach line is finished the Pacific Electric Company will begin work on the four-tracking of the main line between Watt and Dominguez streets. A.

OSKALOOSA, IOWA—It is stated that the $150,000 necessary to construct the ten miles of line of the Oskaloosa-Tama interurban between Montezuma and Malcom has been subscribed and that work will be commenced shortly. C.

WILKES BARRE, PA.—A charter has been granted to the Wilkes Barre Railway Company to operate an electric railway system. The company is capitalized at $10,000. Abram Nesbitt has been elected president, and C. W. Laycock secretary.

FRESNO, CAL.—Construction work is to be begun very soon on the Fresno-Hanford interurban road. This is the first electric line of any prominence in the San Joaquin Valley and it is reported that other electric roads will soon be started.

STUART, IOWA—The interurban roads proposed to be built by the Des Moines, Council Bluffs & Western and the Red Oak, Des Moines & Northern companies will be built only between Des Moines and Stuart and Council Bluffs and Stuart, respectively. C.

MADISON, WIS.—The Southern Wisconsin Railway Company has just received and put into service a new street car costing $3,800. It is much larger than the other cars in use on the lines and has a greater seating capacity. A steel underframe adds much strength to the car. M.

ATLANTIC CITY, N. J.—A trolley line is being considered between Atlantic City and Cape May. J. Fithian Tatem, representing the Suburban Railway Company, which is behind the project, states that it is the company's desire to have the road in operation as soon as possible.

LEBANON, PA.—Charters have been granted for the North Lebanon, the Richland, and the Millcreek Township electric companies, to supply light and power in the sections named. Each company has a capital stock of $5,000. The incorporators are Harry G. Louser, George L. Roller and Harry Hollis.

INDIANAPOLIS, IND.—The Chicago, Blue Island & Joliet Traction Company has borrowed $5,000,000 from the American Trust and Savings Company on forty-year five per cent bonds. It is the intention to improve this property and make it one of the most substantial and perfect trolley lines in the territory through which it passes.

ANDERSON, S. C.—For the sum of $154,750 the property of the Anderson Traction Company has been sold under the hammer to Edwin W. Robertson, of Columbia. The properties include eighteen miles of city and interurban lines, generally estimated as being worth $250,000. The sale was by order of Federal Judge Pritchard, and resulted from the case of the International Trust Company, of Maryland, against the Anderson Traction Company.

MONTICELLO, IND.—The Northern Indiana Traction Company, with headquarters in this city, is making good progress. The right-of-way has been secured and surveyors are setting the stakes and the contract for constructing the road has been awarded to the La Salle Supply and Construction Company, with headquarters in this city also. The company has contracted for the purchase of the Chicago Heights and Eastern Electric road, which will afford terminal facilities into Chicago. S.

APPLETON, WIS.—Appleton and Outagamie County business interests are considering a proposition advanced by A. D. Barnes, president of the Chicago-Wisconsin Valley Railroad Company, for the construction of an interurban railroad from Appleton northward through Hortonville, New London, Waupaca and to Hancock, Waushara County. The proposed line will connect with the line of the Chicago & Wisconsin Valley road at Hancock, and before September, 1911, will be operating an interurban road from Stevens Point to Chicago.

SPRINGFIELD, MO.—The new electric line from Mansfield, on the Memphis division of the Frisco, to Ava, the county seat of Douglas County, was recently opened to traffic. It is the first interurban line to be completed in the Ozark mountain region. Cars operated by storage batteries were put on and will be run until completed passenger coaches can be secured, this step being necessary on the part of the builders of the road to claim the cash bonus and about 100 acres of land offered them by the citizens of Ava.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

CHOKIO, MINN.—E. V. Danbenberger and others propose putting in a rural telephone line.

KENMARE, N. D.—The Northern Telephone Company is considering the installation of extensive improvements. C.

NEWTON, IOWA.—The Jasper County Telephone Company will install a new switchboard, with a capacity of 2,400 lines, January 1. C.

NEW LONDON, WIS.—The Wisconsin Telephone Company will expend $14,000 in rebuilding its lines and remodeling its central plant in this city. C.

PARK RIVER, N. D.—John A. Dunn, R. F. Waugh, E. Thornberg and others have incorporated the Park River Telephone Company, with a capital of $20,000. C.

GADSDEN, ALA.—It is stated that the Southern Bell Telephone and Telegraph Company is now connected with the new farmers' telephone line reaching out from Gadesden to Odenville, Ala., and other small localities thereabouts. B

VALDOSTA, GA.—It is authoritatively stated that J. H. Dasher will construct a ten-mile telephone line running out from Valdosta in the direction of Bemiss; connection to be had with the system of the Southern Bell Telephone and Telegraph Company. B.

MOBILE, ALA.—The Rabby Wireless Transmission Company has been incorporated with the Mobile branch's capital stock of $10,000. It is the intention of this company to transmit messages by the wireless system to Montgomery, and other nearby cities and towns, using the patents of Chas. J. Rabby. B.

MASON CITY, ILL.—The directors of the various rural telephone lines, aggregating over 250 telephones that run into Easton, held a meeting to discuss plans to consolidate, incorporate and open and operate an exchange. The officers elected at the meeting were J. F. McKinley, president; C. W. Kennedy, secretary, and A. Tomlin, treasurer. It is the intention of those interested to organize a company and install an up-to-date switchboard.

TOLEDO, OHIO—The Tiffin Consolidated Telephone Company, of Tiffin, Ohio, was organized this week to take over and consolidate the interests of the Tiffin Home Telephone Company and the Central Union. The officers of the new concern are: President, Arthur A. Cunningham; vice-president, Louis Selle; secretary, A. J. Mellen; treasurer, J. J. Fleck; directors, H. W. Yeager, W. H. Kildow, J. C. Loomis, J. C. Royer, S. E. Stricklin and E. A. Reed. H.

TOLEDO, OHIO—An ordinance has been introduced into the Toledo city council to repeal the franchise of the Harrison Telephone Company granted in May, 1894. It is claimed that the concern was absorbed by the Central Union Telephone Company, and that $70,000 worth of conduits placed in the streets have been leased to the Postal company, which has been paying $7,500 annually in rentals. The claim is made that it is in violation of the terms of the ordinance, and forfeiture is asked. It was referred by the committee on public improvements to the city solicitor. H.

BRISTOL, VA.—The Cumberland Telephone Company will begin at an early date to construct a long distance line from Bristol through the coal fields of southwest Virginia. The appropriation for this work has already been made, and Manager Leland Hume announces that the new line will be ready for service not later than May next. This will give Bristol and the coal fields long distance connection with practically all the big cities of the country. The first work to be accomplished is the stringing of an additional copper wire from Knoxville to Bristol, a distance of 130 miles. This will be followed by the rebuilding of the line between Bristol and Gate City, Va., and with the construction of a line from Gate City to points in Wise and Lee counties, Virginia.

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RAVIA, OKLA.—The Ravia Telephone Company has been incorporated with a capital stock of $5,000. P.

GRADY, OKLA.—The Grady Telephone Company has been incorporated by J. W. Dunford and others. P.

MART, TEX.—The Limestone Telephone Company has been incorporated, with a capital stock of $4,500. P.

ARMOUR, S. D.—The Missouri River Telephone Company was granted a franchise to maintain a toll line only. C.

ANACONDA, MONT.—The Montana Independent Telephone Company has begun installing the line to Wisdom. P.

WILLOW LAKES, S. D.—Work has been commenced on the construction of the Dakota Central telephone lines. C.

RAPID CITY, S. D.—Bids are being taken for the installation of the Black Hills Independent Telephone Company. P.

OKANOGAN, WASH.—The Okanogan Telephone and Telegraph Company has been incorporated at Okanogan by C. E. Hansen and others. A.

NAPA, CAL.—The Board of Supervisors has granted the application of Antone Rossi for a permit to erect a telephone line along the county road. A.

SYLVESTER, GA.—It is reported that T. A. Spurlin has sold the Sylvester telephone exchange to the Southern Bell Telephone and Telegraph Company. B.

MANDAN, N. D.—The North Dakota Independent Telephone Company will expend $50,000 in the construction of 214 miles of telephone lines north and south. C.

WOODSTOCK, MINN.—The Woodstock Rural Telephone Company, Geo. Moline, secretary, has been organized to construct three or four rural telephone lines. C.

BROOKINGS, S. D.—The Brookings County Telephone Company has been incorporated to take over the holdings of the Thompson, Caldwell and Wilson Telephone Company. C.

YREKA, CAL.—Permission has been granted to the T. Jones Company to erect and maintain a telephone line between the towns of Hornbrook and Walker along the public highway. A.

HELENA, MONT.—Articles of incorporation have been filed for the Deer Creek Telephone Company to operate between Grey Cliff and Big Timber. The capital of the company is $10,000.

LURAY, VA.—The Mutual Telephone Company of Luray County has absorbed the Page Valley Telephone Company, which was the first company to be organized in the Valley of Virginia.

RIVERSIDE, CAL.—The Corona Mutual Telephone and Telegraph Company has been incorporated at Corona with a capital stock of $25,000 by J. B. Golch, A. Lindberg, O. M. Grizzle and Bonfoey. A.

BOYDS, MD.—The Poolesville Telephone Company, recently organized, has sold stock to the amount of $2,500, and is completing a line to take the place of the old one which was owned by the United Telegraph and Telephone Company.

WHITEHALL, MONT.—The Montana Independent Telephone Company will shortly commence the construction of a line through to Dillon by way of Twin Bridges and the Beaverhead Valley and a branch line up the Ruby Valley to Sheridan, Ruby and Virginia City. C.

CAMBRIDGE, WIS.—The Cambridge Telephone Company has made an arrangement with the Wisconsin Telephone Company to connect with their lines and to have installed improved Bell transmitters for the local system. This agreement will greatly improve the local service. M.

OSCEOLA, IND.—A mortgage of $900 has been placed on the property and equipment of the Osceola and Dunlap Company in favor of the Indiana Union Telephone and Telegraph Company. It is the purpose of the mortgagee to extend the lines into the surrounding rural districts. S.

ELECTRICAL SECURITIES.

All of the recent happenings; the Nicaragua affair, the strike of the switchmen and the separation of the Frisco from the Rock Island system, had a bad effect on nearly all securities during the first part of the past week. Prices rose and fell in a haphazard manner. Later in the week values were supported by the more responsible buyers and rose steadily. When the street became more certain that the President's message would probably contain nothing alarming there was a renewal of interest in several industrial undertakings and a consequent upward tendency.

Application has been made to the New York Stock Exchange to list $5,974,000 first refunding mortgage five per cent bonds, due 1939, of the Washington Water Power Company.

Northwestern Elevated, Chicago, shows a daily average of passengers for November of 119,292, or 2.08 per cent increase.

The Old Colony and Boston & Northern Street Railway, Massachusetts Electric subsidiaries, have petitioned the railroad commission for approval of issue of $300,000 bonds each for funding $251,647 floating debt of the former and $266,611 of the latter.

The Atlantic & Pacific Telephone and Telegraph Company has certified to the Secretary of State of New Jersey that its entire capital stock of $259,000 had been fully paid up. The company was recently chartered with a paid capital stock of $1,000. The concern is a subsidiary company of the Bell Telephone interests.

Traffic on the Metropolitan Elevated, Chicago, during November ran about 9,000 passengers daily over that of last year, or over 150,000 passengers daily, which was the largest traffic for any month during the year. Earnings for the year are estimated at $360,000 to $375,000, or a little over four per cent on the preferred stock.

The Electric Bond and Share Company of New York has purchased, but not yet publicly offered, $1,000,000 first mortgage six per cent thirty-year sinking fund gold bonds of the Mount Whitney Power and Electric Company, of Visalia, Cal. This company was organized in November, 1909, as a successor of the Mount Whitney Power Company to operate an electric lighting and power business in Tulare County, Cal., about 250 miles from Los Angeles and San Francisco.

At the annual meeting of the North Shore Electric Company, of Chicago, Solomon A. Smith was elected a director, succeeding Charles A. Spaulding, deceased. Other directors were re-elected. The proposed increase in the capital stock was not acted upon at this time. A special meeting of stockholders will be called for that purpose. The company will make a new stock issue, probably amounting to $500,000 next spring.

DIVIDENDS.

Chicago Telephone Company; quarterly dividend of two per cent, payable December 31.

Columbus Railway and Light Company; quarterly dividend of three-fourths of one per cent, payable January 1.

Interborough Rapid Transit Company; quarterly dividend of two and one-fourth per cent upon all the capital stock, payable January 3 next to stockholders of record at the close of business December 24.

Norfolk Railway and Light Company; the usual semiannual dividend of two per cent, payable December 6.

Oklahoma Gas and Electric Company; quarterly dividend of one and one-quarter per cent upon the common stock, payable December 15 to stockholders of record as of the close of business November 30.

Portland Railway, Light and Power Company; quarterly dividend of one and one-fourth per cent, payable January 3 to stockholders of record December 12.

Washington Water Power Company; quarterly dividend of one and three-fourths per cent, payable January 3.

San Diego Consolidated Gas and Electric Company; quarterly dividend of one and onequarter per cent upon the common stock, payable December 15 to stockholders of record as of the close of business November 30.

NEW YORK.

	Dec. 6.	Nov. 29.
Allis-Chalmers common	15¾	15
Allis-Chalmers preferred	54¾	54¼
Amalgamated Copper	87⅞	86¾
American Tel. & Cable	*80	*80
American Tel. & Tel.	140¾	141¼
Brooklyn Rapid Transit	80⅞	77⅝
General Electric	159	161
Interborough-Metropolitan common	24⅝	22⅞
Interborough-Metropolitan preferred	57¾	55⅛
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	92	92
Mackay Companies (Postal Telegraph and Cables) prefd.	76½	75¾
Manhattan Elevated	139¾	138
Metropolitan Street Railway	20	21
New York & New Jersey Telephone	123½	123½
U. S. Steel common	90¾	88¼
U. S. Steel preferred	124½	124
Western Union	77¾	78
Westinghouse common	84½	84¾
Westinghouse preferred	140	134

*Last price quoted.

BOSTON.

	Dec. 6.	Nov. 29.
American Tel. & Tel.	140¾	141¼
Edison Elec. Illuminating	249	...
General Electric	159	161
Massachusetts Electric common	15½	15¾
Massachusetts Electric preferred	76¼	78½
New England Telephone	134	134
Western Tel. & Tel. common	12⅛	12
Western Tel. & Tel. preferred	89	89

PHILADELPHIA.

	Dec. 6.	Nov. 29.
American Railways	45	45
Electric Company of America	12¼	12¼
Electric Storage Battery common	56½	58¼
Electric Storage Battery preferred	56½	58¼
Philadelphia Electric	12⅛	12⅞
Philadelphia Rapid Transit	27½	26
Philadelphia Traction	88½	89
Union Traction	53½	52

CHICAGO.

	Dec. 6.	Nov. 29.
Chicago Railways, Series 1	95	95
Chicago Railways, Series 2	31	32
Chicago Subway	5¼	5½
Chicago Telephone	135	135
Commonwealth Edison	118	118¼
Metropolitan Elevated common	16½	16½
Metropolitan Elevated preferred	51½	52
National Carbon common	97¼	96½
National Carbon preferred	120	123

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PERSONAL MENTION.

JAMES CAMPBELL, for several years a director of the North American Company, was last week elected president of that concern. Mr. Campbell succeeds C. D. Wetmore who has retired on account of poor health.

A. W. BOXENDALE, manager of the Pacific Cable Company's board, is now in Montreal, Can., negotiating with the Canadian Pacific Railway Company, for the purpose of making some agreement as to carrying the cable company's business across the Dominion. The Pacific Cable Company is at present operating a service between the Pacific coast of Canada and the South Seas.

C. A. S. HOWLETT, formerly connected with the Western Electric Company of Chicago, and ex-president of the Chicago Electric Club, was in Chicago last week on a brief business trip. Mr. Howlett, who is now with the General Electric Company at Schenectady, N. Y., was a guest of the Chicago Electric Club on December 1 and was enthusiastically greeted by his old associates.

E. E. NOBLE, superintendent of construction of the Cleveland Electric Illuminating Company, Cleveland, Ohio, has invented a new pothead for use on cable terminals on poles and within stations. This pothead is made entirely of porcelain, with the exception of the contact blocks, and has been used exclusively by the Cleveland Company for over a year with very gratifying results. The appliance is being manufactured and sold by the Colonial Sign and Insulator Company, of Akron, Ohio.

H. THURSTON OWENS, consulting engineer, New York city, will deliver an illustrated lecture on "Steel Lighting Fixtures" on December 17, at 8:15 p. m. at the joint meeting of The National Commercial Gas Association and the New York Section of the Illuminating Engineering Society. Mr. Owens has investigated the public lighting in most of the large cities of both this country and Europe, and has one of the largest private collections of photographs showing street lighting conditions.

G. BREWER GRIFFIN has been appointed manager and is actively directing the sales policy of the detail and supply sales department of the Westinghouse Electric and Manufacturing Company, in which department transformers, meters, fans, heating appliances, switches, switchboards, railway line material, etc., are sold. Mr. Griffin has been assistant manager of this department for six years, having previously been connected with the sale of detail apparatus in the Boston office, altogether having been employed some seven years with this company. Previous to his connection with the Westinghouse company, Mr. Griffin was with the Manhattan General Construction Company of New York as a special representative, finally opening an office for it in Boston.

S. L. NICHOLSON has recently been appointed general sales manager of the Westinghouse Electric and Manufacturing Company, and has direct charge over the sales policies of the entire company. Mr. Nicholson has been with the company for eleven years in many different capacities, as salesman, as district department manager, and as industrial and power sales manager for the past five years, from which last position he resigned to take the present post. Before coming to the Westinghouse company he was with the C. & C. Electric Company. He is perhaps best known to motor manufacturers as the organizer and president of the American Association of Motor Manufacturers, an organization which has done much in the two short years of its life to improve the art of manufacturing motors.

PAUL M. CHAMBERLAIN has opened a consulting engineering office at 1522 Marquette Building, Chicago. Mr. Chamberlain was graduated from the Michigan Agricultural College in 1888, and from Cornell University in 1890. For several years he was engaged in practical work with the Brown Hoist Company, of Cleveland, Ohio; the Frick Company, engineers, of Waynesboro, Pa., and the Hercules Iron Works, of Aurora, Ill. He then accepted the assistant professorship of mechanical engineering at the Michigan Agricultural College. At the opening of Lewis Institute in Chicago, he took charge of the engineering work and it was largely through his efforts that it was brought up to its well-known standard of excellence. During his connection with Lewis Institute he carried on much consulting work with special reference to power production and factory methods. He resigned this position to act as chief engineer for the McCan Mechanical Works, of Los Angeles, Cal. Later he accepted the position as chief engineer of the Under-Feed Stoker Company of America, where for the past two years and a half he has made a special study of boiler-room equipment, economy in fuel burning and smoke abatement. He will devote his time to new designs and improvement of existing installations.

OBITUARY.

A. E. DRESSER, manager of the Fort Wayne Electric Works' Syracuse office, died on Sunday, November 28, of heart disease and was buried at Ithaca, N. Y., November 30. He was forty-six years of age and had been in the employ of the Fort Wayne electric Works as manager of its Syracuse office for ten years, prior to which he was with the Fort Wayne Electric Corporation and formerly connected with the General Electric and Thomas-Houston companies. Mr. Dresser had a wide circle of friends in the electrical trade in central and western New York, where he always resided.

NEW PUBLICATIONS.

INTERNATIONAL BUREAU OF THE AMERICAN REPUBLICS—The November, 1909, Bulletin, which has just been issued contains almost a plethora of interesting and valuable news of the South American republics, and is recommended to the attention of all who are interested in a business way with our southern neighbors. The most noteworthy article, from an engineering standpoint, is "Opening up Oriente (Cuba)," by I. A. Wright, editor of the Cuba Magazine, Camaguey, Cuba, W. I.

TECHNOGRAPH—The 1908-1909 (No. 23) number of "Technograph," the annual publication of the engineering societies of the University of Illinois, which has just been issued, contains some interesting articles. Among these may be mentioned "The Illinois Engineering Experiment Station," by L. P. Breckenridge; "Steam Turbine Performance" (abstract of a paper read before the Western Society of Engineers, May 5, 1908), by J. C. Thorpe, and "Test of a Three-Kilowatt Westinghouse Type S. Transformer," by Antonio Guell and Hubert M. Turner.

THE GENERATOR, NEW YORK ELECTRICAL SCHOOL—The students of the New York Electrical School have published the November number of *The Generator*, in which there is an excellent article on "Phototelegraphy and the Korn Phototelegraph." There are also contained a large number of interesting notes which show that this little monthly is being excellently handled by the enterprising students of the school. This is only the third number of the publication, but represents considerable progress and speaks well of its fuure.

TUNGSTEN STREET SERIES LAMPS—The Engineering Department of the National Electric Lamp Association has just issued Bulletin No. 6-G entitled, "Tungsten Street Series Lamps." This publication supersedes Bulletin 6-A, and contains much additional information in regard to this very popular type of lamp for incandescent street lighting. These lamps operate quite well on direct current or alternating current circuits. In the latter instance they are used quite commonly with as low as twenty-five cycles without perceptible flicker. The life rating that is placed on these lamps is 1,350 hours, which is known to be a very conservative figure, as in most instances this is very much exceeded. The bulletin gives distribution and other performance curves, complete data of every characteristic of the lamps, and comparisons of tungsten and carbon lamps for this service.

PROPOSALS.

POST OFFICE, LIMA, OHIO—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 10, 1910, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of an extension, remodeling, etc., to the United States Post Office at Lima, Ohio, in accordance with drawings and specifications, copies of which may be obtained at this office or from the custodian at Lima, Ohio, or at the Supervising Architect's office.

POST OFFICE, ATHENS, OHIO—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until December 28, 1909, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Athens, Ohio, in accordance with the drawings and specification, copies of which may be had from the custodian of site at Athens, Ohio, or at the Supervising Architect's office.

POST OFFICE, BEATRICE, NEB.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until December 29 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and tower clock) of an extension, remodeling, etc., to the United States Post Office at Beatrice, Neb., in accordance with drawings and specification, copies of which may be obtained from the custodian at Beatrice, Neb., or at the Supervising Architect's office.

POST OFFICE, CHESTER, PA.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 11, 1910, for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Chester, Pa., in accordance with the drawings and specifications, copies of which may be had from the custodian at Chester, Pa., or at the Supervising Architect's office.

POST OFFICE AND COURT HOUSE, BRISTOL, TENN.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 12, 1910, for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office and Court House at Bristol, Tenn., in accordance with drawings and specifications, copies of which may be had from the custodian at Bristol, Tell., or at the Supervising Architect's office.

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INDUSTRIAL ITEMS.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., is to furnish the Palmilla Milling Company, of Parral, Mex., with twenty-two Allis-Chalmers motors to be used in their new gold reduction plant. The motors will drive stamps and accessory machinery of the latest type, all of which is to be furnished by the Allis-Chalmers Company.

THE CHARLES L. KIEWERT COMPANY, of Milwaukee, New York, and San Francisco, is distributing a circular on Siemens E carbons for direct-current and alternating-current enclosed arc lamps. Among advantages of these carbons there are pointed out their long life, high efficiency, straightness and uniformity and brilliant white light produced.

THE BUCKEYE ELECTRIC COMPANY, of Cleveland, O., is circulating a striking folder with the title, "Ask the Chairman." This shows that the invariable rule of the chairman of any well-established board of directors is to buy of a manufacturer who has a reputation to live up to, and it further makes clear that the Buckeye reputation is one of this order.

THE GREGORY ELECTRIC COMPANY, Chicago, Ill., has just distributed the December "Bargain Sheet" which contains revised and reduced prices on electrical machinery and equipment. In connection with this list, the company is also distributing circulars devoted to descriptions of Century single-phase motors, for which it is the sales agent, and of new National direct-current motors.

THE WIRE AND TELEPHONE COMPANY OF AMERICA, with headquarters at Rome, N. Y., announces that on and after December 14 it will change its corporate name to the ROME WIRE COMPANY. There will be no change in the management or policies of the company, however, and it will continue to manufacture the wellknown "Romeoid" bare and insulated wires for electrical purposes.

THE CENTRAL ELECTRIC COMPANY, of Chicago, Ill., is distributing two new circulars descriptive of D. & W. service switches, fuses and cutouts. These bulletins will be found of considerable value to central-station managers in that they give information on several new devices for use on highly inductive circuits such as offered by power loads. Copies of these circulars will be sent upon request.

THE HOLOPHANE COMPANY, of Newark, O., is sending out an interesting folder entitled, "Who's to Blame?" It shows clearly that seventy-five per cent of the errors that occur in any plant happen after dark, and it points out that the trouble in most instances is caused by very poor light. It also offers to send out a copy of its booklet "The Lighting of Mills and Factory" to those interested in the subject of effective and efficient factory lighting.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing the new price list and discount sheet to be used in connection with catalogue No. 26. The final pages of this publication contain descriptions and illustrations of new apparatus and supplies which have been brought out since the last catalogue was issued. The last page is devoted to electrical devices for domestic purposes and offers suggestions for the holiday trade.

THE HOYT ELECTRICAL INSTRUMENT WORKS, of Penacook, N. H., is distributing Bulletin No. 2, which deals with type 35 Hoyt voltmeters and ammeters. The type IU volt-ammeters are also described. The instruments are especially designed for direct current service and are made both for switchboard and for portable use. The volt-ammeters consist of two type C-35 instruments, one a voltmeter and the other an ammeter, and are particularly suitable for mounting on electric vehicles.

THE FEDERAL ELECTRIC COMPANY, Lake and Desplaines streets, Chicago, which is well known for its manufacture of electric signs and electric lighting specialties, has developed a new line, namely, that of the manufacture of vacuum cleaners. A sixteen-page booklet has just been published by the company relative to the many uses and marked advantages of this machine. The pamphlet is illustrated by many excellent engravings which give a very good idea of the ease of manipulation and the variety of purposes for which the Federal vacuum cleaner is adapted.

THE COLONIAL SIGN & INSULATOR COMPANY, of Akron, Ohio, well-known maker of porcelain electric sign letters and other porcelain electric specialties, is manufacturing a new line of all-porcelain potheads for distribution network cables. These potheads have been tested out under severe service and test conditions for more than a year and have given excellent results. They are weatherproof, compact and light but rugged in construction. Beside standard sizes the company can make them for special conditions and will furnish full information and illustrations of numerous applications upon request.

THE AMERICAN PLATINUM WORKS, of 251-255 New Jersey Railroad Avenue, Newark, N J., have acquired by purchase the real estate and building formerly owned and occupied by the Caffrey Leather Company and J. Liebstein & Sons, located at 225-227-229 and 231 New Jersey Railroad Avenue (Newark), covering half a block on that avenue—110 feet—and having a frontage of 250 feet on Oliver and thirty feet on Chestnut streets. The present buildings will be reconstructed and modernized and additional structures will be erected, which, when finished will give this company one of the most complete plants in the world for the refining of platinum, gold and silver.

THE MOORE ELECTRICAL COMPANY, 169 Malvern Street, Newark, N. J., has just published Bulletin No. 22 dealing with the Moore light. The Moore light is now made in two types, the white Moore tube and the yellow Moore tube. In the former system rarified carbon dioxide is used in the tube, and in the latter nitrogen is used instead. These tubes are operated on sixty-cycle alternating current systems. The white tubes have been found to yield a very close approach to daylight, and therefore are serviceable in many mercantile shops where color matching is an important feature. The yellow tubes are somewhat more efficient and are advocated for the illumination of large areas.

PASS & SEYMOUR, INC., of Solvay, N. Y., have issued their new catalogue No. 18 which is devoted to the large number of specialties manufactured by this old and well-known firm. This catalogue contains 144 pages, giving an excellent idea of the great variety of the products manufactured. It is prepared in a very convenient form, however, so as to be easily slipped in the pocket of electrical contractors or wiremen who have occasion to use the P. & S. specialties very extensively. Accompanying the catalogue is a price list and discount sheet Number 180, which alone contains forty pages. Copies of these publications will be supplied to those interested in electrical wiring supplies.

JAMES BEGGS & COMPANY, 109 Liberty Street, New York city, are distributing a new and greatly enlarged edition of "Feed Water Filtration." This book explains how oil, dirt, etc., get into feed water, what damage they do within the boilers, and how to remove such impurities before this can occur. It tells how water of condensation and returns from heating systems may safely be used to cut down the coal and water bills and it explains the advantages and disadvantages of various methods of filtration. Numerous instances are cited where filtration through terry cloth at the last point in the line before water enters the boilers has proven successful after other methods have failed. The Blackburn-Smith feed-water filter and grease extractor is described in detail. Engineers will find this book well worth writing for.

THE MONARCH TELEPHONE MANUFACTURING COMPANY, Washington and Morgan Streets, Chicago, Ill., has recently issued a booklet entitled "A New Source of Revenue for Telephone Exchanges." This little publication describes quite fully the operation and possibilities of the company's system of electric clocks and electric time stamps. It brings to light the fact that these are yet undeveloped sources of revenue in even the moderate sized telephone plant and sets forth the convenience of a system of electric clocks operated by a master clock at the central station. One of the most interesting pieces of information is a set of tables containing estimates of the expense of installation of clock systems under several conditions. The deduction from the tables is that a telephone company can develop the time-service business and make a profit from two to three times as great as that secured from telephone subscribers.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., is distributing three bulletins known as Nos. 116, 117 and 118 respectively. Bulletin No. 116 is devoted to motor-generator sets, which are important factors in the distribution of electrical energy on the modern power system. No power station could be profitably equipped with the assortment of machinery which would be necessary to supply electric current to meet the varied requirements of a modern power system. The current produced by the central power station must be adapted to the service of the greatest number. In order to supply the needs of the minority, transforming devices of some sort must be used. The functions of the motor-generator set and the methods of choosing the motor-generator best adapted for each condition have been clearly outlined in this bulletin. Bulletin No. 117 describes Form L, direct current machines. Small direct current motors have proved their value in every modern industry and are used for a variety of applications, from running lathes to operating organ blowers. The application of these motors to laundry apparatus, printing presses and other machinery with similar requirements, has brought about changes and improvements in the respective industries which are having an important effect on their development. For this reason this bulletin, describing apparatus of this type, has a decided interest for every manufacturer. It is well illustrated with halftone engravings, showing applications of Crocker-Wheeler motors to various types of machinery. "Motor Drive in the Laundry" is the title of Bulletin No. 118. The application of electric motor drive to laundry machinery has brought about greater cleanliness, better light, saving in power, increased output, saving in repairs, greater comfort to employees and greater flexibility of location of machines. All these items have such a direct bearing on the effectiveness and efficiency of any equipment that no laundryman can afford to ignore them. How motor drive has gained these results for the laundries is clearly outlined in this pamphlet.

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THE McROY CLAY WORKS, Brazil, Ind., manufacturers of conduits for telephone, telegraph, electric light and power cables, is distributing a blotter containing a calendar for the month of December and a convincing illustration of a demonstration of the strength of McRoy conduits.

T. J. COPE, 3244 North Fifteenth Street, Philadelphia, Pa., reports his business as better than it has ever been before in his twenty-four years' experience. Though general business conditions have not been good for the past two years his business has increased to such an extent that he now has five different shops at work turning out his underground electrical specialties.

THE ENTERPRISE MACHINE MANUFACTURING COMPANY, 2625 Sarah Street, Pittsburg, Pa., has placed a new line of pneumatic and water-driven boiler-tube cleaning outfits on the market at an extremely low price. While the company is selling these outfits at little more than half their former price, there has been no decrease in excellence of quality, the drop being due to improved methods of manufacture.

THE ALLIS-CHALMERS COMPANY is supplying the equipment for a municipal lighting plant for the city of Greenville, Texas. It will consist of two 300-kilowatt, sixty-cycle, three-phase alternators, direct-connected to fourteen and thirty by thirty-six cross-compound engines, running 120 revolutions per minute, and will include condensers. There will be one engine and one induction motor-driven exciter, also the necessary switchboard panels.

THE MECHANICAL APPLIANCE COMPANY, Milwaukee, Wis., has published a new bulletin describing its type "K" polyphase induction motors. This pamphlet gives full details of construction of the stator and rotor, as well as of the frame, bearings and shaft. The operating characteristics of these motors are discussed, and the care in inspection and testing that they receive before shipment is made clear. A few of the manifold applications of the motors are briefly described.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a unique price list of the well known Columbia carbon lamps of various types. This price list contains revised prices and should be in the possession of every lamp user. An improved method of indexing enables the user to immediately find the price on any desired line. This company is also distributing a new folder descriptive of a combined electric stove and toaster which is a decidedly new type. This is a universal device provided with a toasting drawer and a heating plate so that you can prepare your coffee and toast at the same time.

THE NERNST LAMP COMPANY, Pittsburg, Pa., has recently distributed an attractive booklet devoted to factory lighting. Since the Nernst lamp was first introduced in 1901 many improvements have been made, among which may be mentioned the wafer heater; the spring type holder for multiple glower lamps and the screw burner for single glower lamps which have simplified the system greatly and made the Nernst lamp particularly suitable for factory lighting. This book contains many photographs of factories in which Westinghouse Nernst lamps have been installed and also many expressions from factory men in favor of this lamp.

THE BUCKEYE ELECTRIC COMPANY, Chicago, Ill., announces that F. E. Whorff, chief electrician of the San Francisco Harbor Commission, has an interesting record on the lighting of the Ferry building. About the first of the year, Buckeye tungsten incandescents were substituted for the carbon filament and arc lamps in use in the waiting rooms and nave of the building. The lighting was improved 100 per cent and according to the records that have been kept the consumption of electricity has been cut about forty per cent. Ten clusters of six 100-watt lamps each, were installed in the nave and the records show that these lamps have given a continuous service of over 2,750 hours, to date. There has been no appreciable loss of candle power. Four lamps were carefully examined recently and showed no evidence of deterioration and when tested with a watt-meter, showed less than the rated consumption in each case. The readings were: 91.0, 92.5, 92.5 and 97.5 watts, respectively, for the four lamps. Renewals since the first of the year have been two in number.

DATES AHEAD.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

Wisconsin Electrical Association. Annual convention, Milwaukee, Wis., January 19 and 20, 1910.

Toledo Electrical Show, Coliseum, Toledo, Ohio, January 31-February 5, 1910.

San Francisco Electrical Exposition, January 29, February 5, 1910.

Philadelphia Electrical Exposition, Philadelphia, Pa., February 14-26, 1910.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the second issue of each month.)

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary, Lloyd Lyon, secretary and auditor Mobile Light and Railway Company, 158 Government Street, Mobile, Ala.

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RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) November 30, 1909.

941,354. INDICATOR. Alfred J. Border, Wellington, New Zealand, assignor of one-half to Lucy Maude Coventry, Wellington, New Zealand. Filed May 10, 1906. A drum can be intermittently rotated in either direction by the action of two solenoids.

941,362. SYSTEM OF ELECTRICAL DISTRIBUTION. Richard J. Dearborn, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed December 3, 1906. The system includes a rotary converter and a storage battery connected to a polyphase alternating-current circuit. A motor-driven voltage regulator varies the ratio of transformation, and the motor works forward or reverse according as the mean current variations in the circuit are above or below a predetermined amount.

941,363. TROLLEY-CATCHER. Charles I. Earll, New York, N. Y. Filed September 30, 1903. Automatic means for checking the rotation of the trolley-rope drum may manually be made inoperative.

941,366. PRIMARY BATTERY. Charles E. Hite, Burlington, N. J. Filed April 15, 1907. A multichambered primary-battery cell is lined with hard rubber, and a removable lid for the same carries, on its under side, springs provided with aluminum terminals.

941,372. SYSTEM OF ELECTRICAL DISTRIBUTION. Paul M. Lincoln, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed December 3, 1906. Similar to No. 941,362, but includes a booster and has different regulation features.

941,388. CROSS CONNECTIONS FOR DYNAMO-ELECTRIC MACHINES. Robert Siegfried, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed October 3, 1905. Cross connections for radially adjustable brush-holder brackets comprise conducting ring segments having end slots.

941,390. UNDERRUNNING CURRENT-COLLECTOR. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to General Electric Company. Filed November 23, 1904. An underrunning contact shoe is supported by a spring-controlled parallelogram device.

941,391. ELECTRIC CAR-CONTROLLING SYSTEM. Arthur B. Stitzer, Philadelphia, Pa. Continuation of application. Filed April 30, 1909. This application filed August 2, 1909. Describes the motor and controller connections for an electric-railway system.

941,397. MOTOR-CONTROL SYSTEM. Harold E. White, Schenectady, N. Y., assignor to General Electric Company. Filed June 23, 1909. The voltage applied to the motor in starting, is increased step by step by contactors operating in succession. The operating coil of the first contactor is at first connected in shunt to the motor, and auxiliary switches, co-operating with the contactors, are provided each to operate a succeeding contactor.

941,408. CONTROL OF ELECTRICALLY-OPERATED SWITCHES. Archibald S. Cubitt, Schenectady, N. Y., assignor to General Electric Company. Filed May 7, 1908. Means controlled by current through any of the several actuating circuits, which are connected successively to successive switches, are provided for temporarily interrupting the succeeding actuating circuit; also means controlled by the several switches for connecting the succeeding switch to its actuating circuit.

941,412. MOTOR-STARTER. Max R. Hanna, Schenectady, N. Y., assignor to General Electric Company. Filed September 12, 1907. The first of a number of switches for operation in succession to increase step by step the voltage applied to the motor, is provided with means for rendering it responsive to the counter electromotive force of the motor. The last switch is made responsive to the current in the motor circuit.

941,416. PRIMARY ELECTRIC CELL OR BATTERY. Albrecht Heil, Frankfort-on-the-Main, Germany. Filed April 6, 1909. A depolarizer is used, consisting of sulphate of mercury, finely divided carbon, and free mercuric oxide.

941,419. ELECTRIC FURNACE. Charles A. Keller, Paris, France. Filed November 4, 1908. The hearth consists of a metal plate with projections therefrom, and constitutes one of the electrodes.

941,425. ELECTRIC-CIRCUIT CONTROLLER. Harry W. Leonard, Bronxville, N. Y. Original application filed November 30, 1901. Divided and this application filed April 6, 1906. Resistance may be automatically inserted in the motor-starting rheostat independently of the movement of the circuit breaker.

941,432. ELECTROPNEUMATIC PIANO-PLAYER. Arthur R. Trist, St. Albans, England, assignor to Trist Piano-Player, Limited, London, England. Filed November 10, 1906. The pneumatic note-actuating mechanism is operated when the electric circuit of the electric control device (fitted to each orifice on the tracker) is completed by the perforated music record.

941,435. INDUCTION-FURNACE. Magnus Unger, Pittsfield, Mass., assignor to General Electric Company. Filed May 6, 1908. A number of magnetic cores are provided with independent primary windings, in inductive relation with which are narrow segmental annular chambers opening into the central treating chamber.

941,436. ELECTRIC METER. Frederick M. Vogel, Lynn., Mass., assignor to General Electric Company. Filed September 14, 1904. A meter for alternating currents has a rotatable conducting member threaded by two magnetic circuits, one of which circuits is energized by a series winding assisted by a potential winding, the other current being energized by a series winding arranged to oppose a potential winding. Short-circuited conductors are disposed adjacent to the rotatable member and oppositely displaced from the axis of the magnetic circuits.

941,439. MOTOR-GENERATOR SET. Wilmot A. Danielson, Des Moines, Iowa, assignor to General Electric Company. Filed August 18, 1908. The motor has a field winding in series with the load circuit, and the generator a field winding in shunt to the motor armature.

941,441. RHEOSTAT. George H. Dorgeloh, Schenectady, N. Y., assignor to General Electric Company. Filed June 10, 1908. An unbiased controlling arm for the starting resistance controls an automatic circuit-breaker, the latter being also controlled by a latch which holds closed a switch which is provided in connection with the arm for short-circuiting the same when it reaches running position.

941,445. ALUMINUM CELL REACTANCE. John J. Frank, Pittsfield, Mass., assignor to General Electric Company. Filed February 2, 1909. Each of a number of aluminum condenser

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cells is connected to the secondary winding of its respective one of a number of transformers, the primary windings of which are connected in parallel by a separate circuit. The electrodes of adjacent cells are electrically connected, the end electrodes being connected respectively to the line wires.

941,456. DYNAMO-ELECTRIC MACHINE. Fred B. Howell, Schenectady, N. Y., assignor to General Electric Company. Filed August 30, 1907. A dynamo field-coil support has a crown-shaped portion, and a flanged portion with upturned edges.

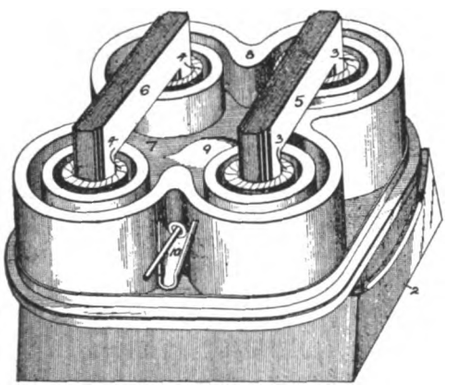
941,459. ELECTRIC METER. Peter C. Morganthaler, Fort Wayne, Ind., assignor to Fort Wayne Electric Works. Filed May 22, 1909. An alternating current meter has a U-shaped core with double poles, a potential pole carried thereby, a series coil surrounding the inner poles of the core, and lagging coils surrounding the outer poles of the core.

941,467. ALTERNATING-CURRENT APPARATUS. William Stanley, Great Barrington, Mass., assignor to General Electric Company. Filed November 23, 1905. Describes a wattmeter for alternating current.

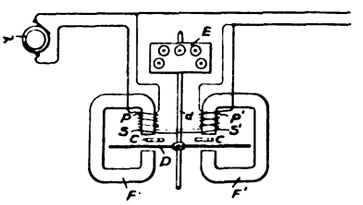
941,468. ELECTRIC METER. William Stanley, Great Barrington, Mass., assignor to General Electric Company. Filed March 19, 1906. Similar to the preceding.

941,469. ALTERNATING-CURRENT METER. William Stanley, Great Barrington, Mass., assignor to General Electric Company. Filed March 21, 1906. Two independent inductors act indirectly on a secondary element common to both of them, and means are provided for eliminating torque produced by the mutual reactive effects of the inductors and for establishing opposing torques.

941,519. INTERMEDIATE TELEPHONE-CONNECTOR. Charles A. Hearn and William H. Feddeohann, Decatur, Ind. Filed August 27, 1908. An arm projecting from a pole is provided with telephonic connections as for establishing temporary telephonic connection with a railroad car.



941,435.—INDUCTION-FURNACE.



941,436.—ELECTRIC METER.

941,534. ELECTRIC-SWITCH HANDLE. Johann G. Peterson, Hartford, Conn., assignor to The Arrow Electric Company, Hartford, Conn. Filed June 15, 1909. A headed spring-retracted stem is movable in the socket of a body of insulating material and is held in position by a suitable yoke.

941,535. ELECTROPLATING APPARATUS. Louis Potthoff, Flushing, N. Y. Filed February 2, 1909. The articles to be plated are placed in a movable tumbler, and automatic progressive means are provided for subsequent washing, etc.

941,541. CAB-SIGNAL CIRCUIT. Paul J. Simmen, Los Angeles, Cal. Original application filed June 19, 1908. Divided and this application filed December 15, 1908. Describes an electric signal system connecting a vehicle cab with a circuit arranged parallel with the trackway.

941,556. SPARK-TIMER FOR INTERNAL-COMBUSTION GAS-ENGINES. Omar L. Brainard, Sacramento, Cal. Filed January 20, 1909. An internal gear is provided with a number of insulated segments.

941,585. METHOD OF PRODUCING INSULATING BODIES. Valentin A. Noodt, Hamburg, and Georg Göttsche, Altona, Germany; said Göttsche assignor to said Noodt. Filed March 19, 1908. Foliated charcoal is added to a liquid binding medium in quantity sufficient to take up the liquid, whereupon the mass is stirred until the charcoal assumes a splinter formation, after which the mass is compressed to form a porous body.

941,593. INCANDESCENT LAMP. Ross D. Tiffany, Bellingham, Wash. Filed August 27, 1908. An electric incandescent lamp has a number of separate filaments and a switch mechanism for including these, as required, in the circuit.

941,599. MEANS FOR RECTIFYING SINGLE-PHASE CURRENTS. Joseph L. Woodbridge, Philadelphia, Pa. Filed May 4, 1908. A dynamo-electric machine, to the rotatable armature of which is supplied alternating current, has its armature mechanically connected to a synchronous motor electrically connected to the circuit.

941,600. SYSTEM OF ELECTRICAL DISTRIBUTION. Joseph L. Woodbridge, Philadelphia, Pa. Filed May 18, 1908. Uses a combination of storage batteries and dynamo-electric machine, etc.

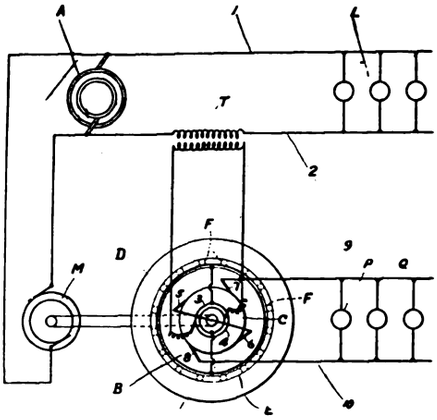
941,660. ELECTRIC SWITCH. Frank W. Smith, New York, N. Y. Filed February 25, 1909. A link pivoted at one end to a pivoted circuit-closing switch arm is electromagnetically moved along a fixed guide bar.

941,666. TELEPHONE SYSTEM. Harry G. Webster, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed December 19, 1902. Describes in detail a telephone system for a central office and substations.

941,673. ELECTROVIBRATORY COUCH. Walter A. Church, Los Angeles, Cal., assignor to Electro-Vibrating Couch Company, Los Angeles, Cal. Filed December 21, 1908. A vibrating crank is operated by an electric motor.

941,690. ELECTRICAL SYSTEM OF DISTRIBUTION. Walter E. Winship, New York, N. Y., assignor to Gould Storage Battery Company. Filed March 11, 1905. A converter is operatively connected between an alternating-current circuit and a direct-current circuit, the latter circuit having a battery operatively arranged in respect to it. This battery is caused to charge and discharge and operatively arranged to respond to variations of load on either circuit.

941,709. RELAY. Thomas W. Gleeson, Boston, Mass. Filed January 29, 1908. An armature having a pair of similar and constant magnetic poles movable in unison, is devised so that each pole will co-operate with one of two opposite poles of the electromagnet of the relay.



941,599.—MEANS FOR RECTIFYING SINGLE-PHASE CURRENTS.

941,720. LINING FOR STORAGE-BATTERY JARS. Albert J. Meier, Glendale, Mo. Filed November 6, 1908. A lead lining for storage-battery jars has longitudinal ribs on the side walls, etc.

941,743. TELEPHONE-LINE SELECTIVE SWITCH DEVICE. John H. Swanson, Baldwin, Wis., assignor of one-fourth to T. F. Robinson, St. Paul, Minn. Filed February 21, 1907. Describes a form of polarized relay.

941,761. RELAY. Elmer R. Corwin and Charles A. Bals, Chicago, Ill., assignors to Corwin Telephone Manufacturing Company, Chicago, Ill. Filed September 21, 1908. A relay comprising a coil, return magnetizable bar, armature, switching mechanism to be operated by the armature, etc., is devised so that the coil with its spool may be removed without dismounting the bar and switching mechanism.

941,762. DESK-TELEPHONE. Elmer R. Corwin and Charles A. Bals, Chicago, Ill., assignors to Corwin Telephone Manufacturing Company, Chicago, Ill. Filed December 26, 1908. Has certain takedown features.

941,763. BANK OF LOCKING SWITCH-KEYS. Elmer R. Corwin and Charles A. Bals, Chicago, Ill., assignors to Corwin Telephone Manufacturing Company, Chicago, Ill. Filed January 29, 1909. A distributing strip having terminals thereon is carried by the framework whereby conductors leading from the series of push-button switches may be connected with external conductors leading to the bank of keys.

941,768. ELECTRIC FURNACE FOR GAS REACTIONS. Otto Dieffenbach and Wilhelm Moldenhauer, Darmstadt, Germany. Filed August 25, 1908. One of the two electrodes is composed of a charge of fragments of carbon through the interstices between which the gas is supplied.

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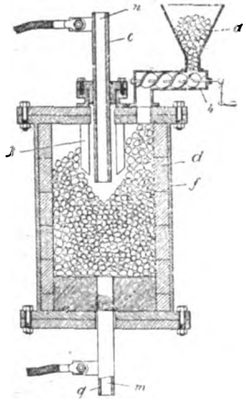
941,777. MEANS FOR CONTROLLING ELECTRIC CIRCUITS. Gerald W. Hart, West Hartford, Conn., assignor to The Hart Manufacturing Company, Hartford, Conn. Filed April 5, 1909. The circuit connections for a translating device, a local circuit for an electromagnetic device in shunt to the other device, etc., are controlled by two three-point switches.

941,796. ANODE-MOLD. John F. Miller, Trail, British Columbia, Canada, assignor of one-half to Walter H. Aldridge, Trail, British Columbia, Canada. Filed November 10, 1906. A drawing member having positive engagement with the molten metal in the mold is provided for withdrawing the cast metal.

941,811. KEYLESS SOCKET. Clarence D. Platt, Bridgeport, Conn. Filed October 22, 1908. One of the ends of an insulating body has side recesses extending to the end surface, and an internal recess extends from the other end of the body to one of the side recesses.

941,824. INDICATING COIN-HOLDER FOR TELEPHONE-USERS. Elijah F. Stone, Chicago, Ill. Filed January 14, 1909. Each of a series of token-holder recesses in a vertical support is adapted to hold a single coin or token by its edge in a horizontal position so that the coins or tokens may be withdrawn separately without affecting the others. An associated index has consecutive numerals for each recess, together with the corresponding days of the week.

941,826. THERMO-ELECTRIC GENERATION. John D. Taylor, Pittsburg, Pa. Filed March 27, 1907. Renewed January 18, 1909. The current is periodically reversed through each thermo-junction.



941,768.—ELECTRIC FURNACE FOR GAS REACTIONS.

941,839. TELEPHONE-EXCHANGE SYSTEM. Charles L. Zahm, Los Angeles, Cal., assignor of one-fourth to Edward E. Clement, Washington, D. C. Filed September 19, 1905. Describes an automatic telephone system.

941,859. TERMINAL FOR ELECTRIC CABLES. Charles W. Davis, Edgeworth, Pa., assignor to Standard Underground Cable Company, Pittsburg, Pa. Filed August 3, 1908. A lead-out is adapted to be secured to a conducting core of the cable and extending through an annular insulator. The lead-out and insulator may be locked together after the former has been secured to the conductor of the cable.

941,860. TERMINAL FOR ELECTRICAL CABLES. Charles W. Davis, Edgeworth, Pa. Filed March 6, 1909. Describes a terminal structure for a multiple-core cable.

941,863. ADJUSTABLE SUPPORT FOR ELECTRIC LAMPS. Leonard Erikson, Malden, Mass. Filed January 16, 1909. The angle of inclination of the lamp may be adjusted by means of a kind of ball-and-socket joint located at the upper end of an adjustable standard.

941,891. SYNCHRONIZING APPARATUS. Pietro Pierini, Rome, Italy. Filed May 16, 1908. Describes an electric device for synchronizing the operation of a cinematograph and a talking machine.

941,904. PROCESS FOR TREATING CERTAIN ORES. Herbert S. Auerbach, New York, N. Y. Filed September 6, 1906. The ore to be treated is supplied to a fused body of metal which is capable of taking it into solution; an electrolyte is formed above the metal and out of contact with the ore, and the ore is connected as the cathode of an electric furnace and is reduced by the passage of an electric current through the metal and through the electrolyte.

941,938. TELPHERAGE SYSTEM. Herman Müller, Leipzig, Germany. Filed February. 7, 1906. Describes a circuit-closing arrangement for telpher cars.

941,941. SWITCH FOR INCANDESCENT-LAMP SOCKETS. Will A. McDonald, Grampian, Pa. Filed February 26, 1909. A pair of levers pivotally mounted in a stationary frame at right angles to each other are provided with handles on their projecting ends. One of these levers constitutes a contact member and is arranged to be locked in its operative position by a movement of the other lever.

941,944. TROLLEY-RETRIEVER. Charles Palm, Aurora, Ill. Filed September 22, 1908. A rotatable drum is engaged by a rotary clutch.

941,979. ATTACHMENT FOR ELECTRIC APPLIANCES. Harry W. Denhard, San Francisco, Cal., assignor to George B. Katzenstein, Jr., San Francisco, Cal. Filed August 7, 1908. A ring or eyelet is secured at the point where the individual conductors of a turn conductor diverge or separate from the twin. There is a retaining band in the rear of the ring and the ring is secured in place by the individual conductors.

941,996. PROCESS OF SEALING FILAMENT-CARRIERS INTO BULBS OF ELECTRIC INCANDESCENT LAMPS. Johann Kremenezky, Vienna, Austria-Hungary. Filed September 17, 1908. The (originally cylindrical) neck of the vertically disposed bulb blank is caused by a blowpipe flame to contract and fuse on to a disk which forms the bottom of the filament carrier, the lower portion of the neck separating and falling away by virtue of its own weight.

942,002. WALL CABINET FOR ELECTRICAL APPARATUS. Ernest R. Le Manquais, Bellemead, N. J., assignor to Le Manquais Electrical Manufacturing Company, Bellemead, N. J. Filed May 11, 1907. The side portion of the box is partly formed of a number of independently removable sections, etc.

942,044. WIRELESS TELEPHONY AND TELEGRAPHY. Alexander W. Sharman, Clapham, London, England. Filed July 16, 1909. A telephonic transmitter is placed in circuit with a self-induction coil (grounded at each end) and a source of low-tension current; a telegraphic interrupter is adapted to be placed in the same circuit, and a signal key is provided to break suddenly the circuit through the coil.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 6, 1909:

487,242. ELECTRIC MOTOR. Franklin H. Beers, Newark, N. J.

487,285. ELECTRICAL HEATER. Willis Mitchell, Malden, Mass.

487,302. METHOD OF ELECTRIC WELDING. Elihu Thomson, Swampscott, Mass.

487,307. CONNECTION FOR COMMUTATORS AND ARMATURE WIRES. Ernest P. Warner, Chicago, Ill.

487,315. ELECTRIC ARC LAMP. Jas. J. Wood, Fort Wayne, Ind.

487,324. GALVANIC BATTERY. Jas. I. Gethins, Boston, Mass.

487,329. ELECTRIC MOTOR FOR CARS. Chas. A. Jackson, Reading, Mass.

487,332. CLAMP FOR ELECTRIC CONDUCTORS. Henry Lindahl, Chicago, Ill.

487,356. APPARATUS FOR DISTRIBUTION OF ELECTRICITY. Thomas Tomlinson, London, England.

487,360. INCANDESCENT ELECTRIC LAMP. Eugene W. Applegate, Omaha, Neb.

487,437. ELECTRIC BELL. Peter Wagner, New York, N. Y.

487,457. SWITCH OPERATING DEVICE. John D. Stone, Syracuse, N. Y.

487,461. ELECTRICAL DEVICE FOR PREVENTING CRIBBING IN HORSES. Geo. W. Whitefield, Evanston, Ill.

487,462. CONNECTION-PLATE FOR DYNAMOS. Jas. J. Wood, Fort Wayne, Ind.

487,477. INCANDESCENT ELECTRIC LAMP. Gustav A. Frei, Springfield, Mass.

487,479. INCANDESCENT ELECTRIC LAMP. Gustav A. Frei, Springfield, Mass.

487,543. SYSTEM OF ELECTRICAL DISTRIBUTION. Oliver B. Shallenberger, Rochester, N. Y.

487,584. MOTOR. Benjamin S. Partridge, Jacksonville, Fla.

487,607. METHOD OF ARC AND INCANDESCENT METAL HEATING. Chas. L. Coffin, Detroit, Mich.

487,644. PROCESS OF AND APPARATUS FOR GENERATING ELECTRICITY. J. S. Rogers, New York, N. Y.

487,654. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. Albion A. Vanderpool, Newark, N. J.

487,655. ELECTRO-THERAPEUTIC PROCESS AND APPARATUS. Joshua M. Wardell, Cadillac, Mich.

487,676. ELECTRIC SIGNALING APPARATUS. Morris Martin, Malden, Mass.

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CONTENTS.

EDITORIAL:
Advantages of Storage....1171
Two Central-Station Experts Wanted....1172
Popularizing the "Electric Home"....1173
Denies Control of Western Union....1174
New Western Union Directors....1174
Advanced Instruction in Electrical Engineering at the Massachusetts Institute of Technology....1174
Mr. Westinghouse, President of the American Society of Mechanical Engineers....1175
American Society of Mechanical Engineers, Annual Meeting....1176
Educating the Factory Owner....1179
Toledo Electrical Show....1179
The Plant of the Victoria Falls and Transvaal Power Company....1180
Electrical Exports for October....1181
Arrangements for the Chicago Electrical Show....1181
Centralized Light, Heat and Power in a Large Automobile Works....1182
Another Suit Brought Against the Economy Power Dam....1184
December Meeting of the Electrical Engineering Society of Columbia University....1185
Another Plan for Third Avenue Railway....1185
Navy Department Supplies....1185
CENTRAL STATION PRACTICE:
Development of Electrical Undertakings....1186
Cheap Power from Coke Oven Gas....1188
Hydroelectric Plant in Old-World Village....1188
A Review of Electrical Development in England....1188
TELEGRAPHY—TELEPHONY AND WIRELESS:
International Independent Telephone Association Convention at Chicago....1190
To Value Wire Lines....1192
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
Illuminating Engineering Society of Great Britain....1193
A New Method of Measuring Light Efficiency....1194
Saving the City Money....1195
ELECTRIC TRACTION:
Convention of the National Association of Railroad Commissioners....1196
Indiana Railroad Commission Urges Work on Block Signals....1198
Wires Over Railways to Be Improved....1198
Twelve Thousand-Volt Operation of Shore Line....1198
INDUSTRIAL POWER:
Modern Application of Electric Motors to Mine Hoisting....1199
Some Electrodynamic Storage Problems....1201
An Electric Groomer and Horse Clipper....1202
An Electrically Propelled Ship....1202
FINANCIAL REPORTS OF ELECTRICAL COMPANIES....1203
INDUSTRIAL SECTION:
Westinghouse Electric and Manufacturing Company's New Repair Department....1204
The Multinola; an Electrically Operated Multiple Phonograph....1205
A High-Tension Contactor Panel....1205
Arc-Lamp Illumination for Iron-Working Shops....1206
Flaming-Arc Lamps to Be Changed in Newark....1207
High-Tension Entrance Tubes....1207
New Type of Fuse....1207
CURRENT ELECTRICAL NEWS....1209
RECORD OF ELECTRICAL PATENTS....1216

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ADVANTAGES OF STORAGE.

Most drainage areas in the United States now yield only a small fraction of their possible energy in the form of water power, but a great increase may be obtained by means of storage.

A good illustration of the relatively large amount of work that may be done by quite small streams with the aid of storage is afforded by the Delta and Hinckley reservoirs that have been designed to supply water for the Rome summit level of the new Barge Canal in New York.

The lesser of these two reservoirs is to be created by a dam on the Mohawk River about five miles north of Rome, N. Y., at a point above which the drainage area is 137 square miles. By means of a dam 1,100 feet long and 100 feet high at the crest above the lowest foundation the reservoir will be given an area of 4.33 square miles, or 3.1 per cent of the drainage area.

Just behind the dam the water will be seventy feet deep below the crest, and its average depth over the reservoir will be about twenty-three feet, giving a capacity for 2,750,000,000 cubic feet. The crest of this dam is at elevation 550 feet above tide water, and at the gate house are four sixty-inch discharge pipes with their centers at elevation 481.5 feet, or 68.5 feet below the crest of the dam. After going over the spillway of this dam the water will follow the bed of the Mohawk to Rome, five miles below, and there enter the Barge Canal at elevation 420 feet above the sea. From the crest of the dam to the surface of the canal at Rome, the fall is thus 130 feet.

The present low-water flow of the Mohawk River at the site of the dam is about 100 cubic feet per second, and its maximum recorded flow is 8,200 cubic feet per second, giving a ratio of eighty-two to one between the maximum and minimum discharge. When the dam is completed it is estimated that the minimum flow from the reservoir in the driest years will be 188 cubic feet per second, or eighty-eight per cent more than at present, and that the maximum flow will be thirty-two per cent of what it is now.

As floods usually reduce the power of a hydroelectric plant by lowering the head of water on the wheels, it is evident that the increase of minimum flow and the decrease of the maximum would largely add to the output of a water power at the site of this reservoir.

The larger and more elevated of the two reservoirs under

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consideration is to be created by a dam at Hinckley, N. Y., on West Canada Creek, about twenty miles north of Utica. Above the dam this creek has a drainage area of some 372 square miles, and the area of the reservoir will be 4.46 square miles, or 1.2 per cent of the drainage surface. For the creation of this reservoir a dam 3,800 feet long, with a maximum height of ninety feet, will be constructed, giving a depth of about seventy-five feet of water on the upstream side and an average of thirty-six feet over the entire area. At the level of the dam crest the reservoir is to have a capacity of 3,445,000,000 cubic feet, and all except 60,000,000 cubic feet of this water may be drawn off through four sixty-inch pipes of cast iron, which are provided with gates and valves.

At the crest of the spillway section the elevation of the dam is 1,225 feet above tide water, and the centers of the four discharge pipes are at elevation 1,169.5, giving a head of 555 feet on these pipes with the reservoir full. On leaving the reservoir the water will follow the natural bed of West Canada Creek for about five miles to a point near Trenton Falls and below the hydroelectric plant located there, whence energy is now transmitted to Utica. At times of low flow the elevation of the tailwater at this hydroelectric plant is about 754 feet above tide, or 471 feet below the crest of the Hinckley dam, and 415 feet below the centers of the discharge pipes mentioned above.

Not counting the friction loss in the pipe line, wheels supplied with water from this reservoir and discharged below the existing hydroelectric plant would thus have a water head of 415 to 471 feet.

The discharge of West Canada Creek at Trenton Falls runs as low as eighty-one cubic feet per second, and as high as 40,000 cubic feet, giving a ratio between maximum and minimum of nearly 500 to one. It is estimated that in the driest known year the reservoir will regulate the discharge of the creek at that point to a minimum of 518 cubic feet per second, with a minimum of about 1,000 cubic feet in an ordinary year. The reservoir will thus increase the minimum discharge of the creek to more than six times the present figures. At times of flood the reservoir will reduce the present maximum of 40,000 cubic feet per second to not more than 19,000 cubic feet, and thus prevent loss of head and damage by flood.

The Hudson River has a drainage area of 2,800 square miles above the Fort Edward dam, or nearly eight times that of West Canada Creek above Trenton Falls. At Fort Edward, however, the discharge of the Hudson falls below 600 cubic feet per second, or down to not more than the 518 cubic feet that may be had as a minimum in West Canada Creek by the use of the Hinckley reservoir.

While the hydroelectric plant at Trenton Falls now operates with a much less head of water than a pipe line from the Hinckley reservoir would give, this plant will get the benefit of the regulated discharge from the reservoir, and should be able to show a much larger output after the reservoir is completed.

If it be assumed that water from the Hinckley reservoir may be delivered by a pipe line to Trenton Falls under an average head of 400 feet, a minimum discharge of 500 cubic feet per second gives 22,700 gross or water horsepower amounting to sixty horsepower per square mile of drainage area. While the above reservoirs are designed for canal purposes, it is not unreasonable to expect that some change in the present statute will permit the electrical development of the fairly large and very constant powers that their construction makes possible.

At all events, these reservoirs serve as a strong object lesson of what may be done for the development of large and constant powers from comparatively limited drainage areas by the aid of suitable storage reservoirs.

New York, New England and the group of states that form the older South offer numerous situations where large storage areas at elevations of 500 to 2,000 feet may be created for power purposes, and as the advantages of such storage is more fully appreciated development will doubtless follow along these lines.

TWO CENTRAL-STATION EXPERTS WANTED.

In this age of specialization everything that tends to ultimate economy is not only a desideratum but an absolute necessity. There is no business man or head of a department of a business firm or corporation who is so well-informed that he cannot obtain ideas from outside sources that will enable him to cut down his operating expenses for the same output, to increase his turnover or profit for the same operating cost, or to increase his business or field of activity so as to bring in greater and increasing returns. The cleverest bookkeeper realizes the benefits of the periodical overhauling and analysis of his accounts by the expert accountant, and so it is with every specialist in his particular line.

This country has taken the lead in the matter of specialization and standardization of the mechanical industries, especially in the machinery and iron and steel trades. The result in these cases has been that notwithstanding the high cost of labor in this country, American products are able successfully to compete with those of foreign countries which have a superabundance of low-priced and efficient skilled labor.

In the great and growing field of central-station practice much good work has already been effected, but still more remains to be done. There is a paucity of information to be had regarding the operating costs of the multitudinous central electric-generating stations scattered throughout the country, but enough data are available to show beyond a doubt that in nearly all of them there is much room for improvement. Some good work has already been done by the various electrical associations and the prominent electrical journals toward the betterment of the existing conditions, and these leaders have been aided in no small

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measure by the manufacturers interested in the problem.

The situation is not an easy one. Each central station presents its own definite problem depending largely on the peculiar elements introduced by local conditions. The type of plant best suited to a particular locality, for instance, depends on the kind of fuel or power available and on the character of the station load. If a good cheap supply of coal is ready to hand, a steam-driven plant may be advisable, and even if this is decided on, there is a multiplicity of engine types from which to choose. If good coal is dear and a poor quality of slack coal is available at a reasonable price, a gas-producer plant may prove to be the most economical. In special cases gas engines may be driven by natural gas, blast-furnace gas, peat-producer gas, etc. In large municipalities a refuse destructor may economically be used in conjunction with suitable boilers to furnish the power, or in other cases a waterpower may be conveniently situated close at hand.

All of these possibilities call for the services of the expert consultant, for a man who will specialize in this to the exclusion of all other business. He must be a man who can go into a locality which proposes to erect a central station, to examine and analyze carefully the local conditions without bias or partiality, and thus be able to report on the most efficient type of plant suited to the needs of that locality and adapted to the supplies of fuel or power available therein. Such a man is able to draw a still greater patronage from existing inefficient central stations. These he can subject to an exhaustive overhauling with a view to recommending changes in the existing plant, and in the operation thereof, which would tend to the greatest ultimate economy. In some cases, perhaps, where a complete remodeling of the existing plant might be inadvisable or even impossible under the circumstances, as for instance, on account of the capital cost involved, he might recommend less radical changes which would still be worth while the making. A man specializing along these lines speedily attains such a revenue of information as to make his services of value to almost any central station in the country, and with the continued improvements in central-station practice which are taking place, his periodical inspections and reports would be desirable for many years.

Another expert who is needed perhaps ever more than this man is an engineer who can specialize on load factors. It is unnecessary to point out that the services of a man who can improve the load factor of an existing central station would be even more valuable than the mythical philosopher's stone. There seems to be no reason why a specialist in this field should not develop. Each community has its own requirements, and a skilled engineer and investigator should be better competent to deal with such a problem than even the most enterprising and up-to-date central-station manager. Much desultory work along this line has been done already and many good ideas have been promulgated, a few of the most enterprising central stations having men in their organization who have done remarkable work in this direction, but there is still a great deal of room for improvement. The establishment of a day load to outside customers is largely if not entirely a matter for the local central-station managers, but this is not the only solution of the problem. In many cases it should be profitable for the central stations to establish subsidiary industries, as the manufacture of artificial ice, fertilizers, etc., for the utilization of their current in off-peak intervals. This is where the load-factor engineer would come in, so that he might, after examining the local conditions, recommend suitable types of plant, the operating and depreciation cost of which would not invalidate the good results thereby obtainable. In other words, the auxiliary plants would themselves have an expense account, and a load factor too, and these must be made compatible with the total operating costs of the central station to show an ultimate gain in percentage returns on the total expenditure.

The building up of data in connection with the first of the above recommendations might well be taken care of by the various electrical associations, but the second, that concerning the load-factor expert, would seem to be a question to be decided upon by the individual central stations.

It must be noted that there are many consulting engineers in this country who for several years have specialized more or less along the lines indicated above, but particularly on the engineering aspects of central-station practice. Some, in fact, have organized staffs on a large scale and make a business of taking over public utilities and operating them until they are placed on a sound commercial basis. Nevertheless there is an extremely large number of small central stations that do not avail themselves of the services of consulting engineering firms and these stations are the ones for whom an individual expert making careful studies of the actual conditions on the ground will be of the greatest service.

POPULARIZING THE "ELECTRIC HOME."

The attention of central-station men is especially directed to the Great Britain weekly letter in this issue. Herein is described a unique scheme adopted by a British central-station company for showing the possibilities of electricity in the modern home. The company in question has thoroughly equipped a typical residence from "cellar to roof" with electric lighting, and with electric heating, cooking, and other household appliances. The householder is furnished with this installation entirely free, on the understanding that he must afford every facility for inspection of the same to any "prospects" that the central station may send around with an order to view. The scheme is a novel one and calculated to afford the public an insight into the possibilities of electricity in the home which probably could not be so thoroughly attained in any other way.

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Denies Control of Western Union.

The latest outcome of the investigating committee appointed for the purpose of determining whether the telephone companies should be placed under the Public Service Commission, has been the testimony of Theodore N. Vail, president of the American Telephone and Telegraph Company.

Mr. Vail gave the details of the negotiations which resulted in his company obtaining possession of $30,000,000 out of the $100,000,000 capital stock of the Western Union Telegraph Company. He intimated that the reason for taking stockin the Western Union was to build up a national system of combined telephony and telegraphy.

While admitting that he had purchased 30,00,000 of the total $100,000,000 stock of the Western Union Telegraph Company, Mr. Vail denied that the American Telegraph and Telephone Company controlled the Western Union Company and furthermore refused to state the price paid for the stock.

New Western Union Directors.

The American Telephone and Telegraph Company, which recently purchased about 28 per cent of the stock of the Western Union Telegraph Company, including the holdings of George J. Gould, put its representatives in the board of directors of the Western Union last week, when all of the Goulds, except George J. and Edwin, resigned along with seven other directors. An interesting feature was the election of Henry P. Davison, of J. P. Morgan & Company, who have been closely identified with the financing of the American Telephone and Telegraph Company, in association with Boston bankers. Lee, Higginson & Company, of Boston, are represented in the new board by Robert Winsor.

President Clowry remained in the directorate and the American Telephone and Telegraph Company's president, Theodore N. Vail, was elected to one of the vacancies.

Other newly-elected directors were Judge Robert S. Lovett, of the Harriman system, William H. Moore, of the Rock Island Company, and these American Telephone and Telegraph men: Henry S. Howe, John I. Waterbury, Edward J. Hall, Union N. Bethel and H. B. Thayer.

It is understood that George J. Gould and Edwin Gould offered their resignations, but were requested to remain.

Advanced Instruction in Electrical Engineering at the Massachusetts Institute of Technology.

During the past year, the regulations for the degree of Doctor of Engineering at the Massachusetts Institute of Technology have been made more definite and have been placed in the hands of the board which also administers the regulations for the degree of Doctor of Philosophy. The requirements for these two degrees have now been made substantially equivalent, as far as the period of study and the candidate's attainments are concerned. The executive committee has voted to maintain two Austin research fellowships carrying a grant of $500 each and the remission of tuition fees, which are now to be open equally to candidates for the Doctor of Engineering and Doctor of Philosophy degrees. In addition to these Austin fellowships, other graduate scholarships and fellowships are maintained, numbering fifteen this year.

During the present year seventeen candidates for advanced degrees have been awarded fellowships or graduate scholarships. Two of these were for the encouragement of advanced study in Germany by graduates of the Institute and the remainder for the encouragement of advanced study in the Massachusetts Institute of Technology.

The number of candidates for the doctor's degrees in engineering and philosophy have this year increased largely over the number of candidates last year. The increasing importance of this work at the Institute has led to a more effective organization of the arrangements for carrying on the work.

The number of students entered as candidates for the master's degree are also considerably increased over last year.

The advanced instruction in the theory of alternating currents and electrical transmission of power accompanied by advanced research is continued this year under the direction of Dr. Harold Pender, whose investigations in these branches are well known. Professor Pender's duties in the electrical engineering staff of the institute of Technology include the direction of the important undergraduate course in the elements of electrical engineering which is provided for the junior students in electrical engineering and electrochemistry, and the naval constructors who are detailed by the United States Government for study at the Institute, and also include the advanced lectures for graduate students just referred to on alternating currents and the transmission of power and the investigations and research carried on by such students. Other work carried on by the department for the benefit of students desiring to do original research or who are studying with a view to obtaining advanced degrees, include the lectures and investigations under Prof. Dugald C. Jackson on the organization and administration of public service corporations, and instruction in the designing of electric plants by Professor Wickenden.

In addition to the growing importance of the advanced study and research carried on by the electrical engineering department at the Institute, the undergraduate classes are growing rapidly, and this is particularly true of the junior and senior classes which are recruited to a considerable degree by graduates from the humanistic or scientific courses of other institutions. Forty per cent of the men who graduated from the electrical engineering course of the Institute at the last commencement had previously received college degrees and had thereafter spent from one to three years in the electrical engineering studies at the Institute of Technology. The increased number of students following the electrical engineering instruction is particularly felt in the laboratories and the number of student hours of instruction in the electrical engineering laboratory is now approaching a figure about twice as great as it was three years ago.

Joint Meeting in Chicago.

The next joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers will be held on the evening of December 22 at the latter society's rooms in the Monadnock Block, Chicago. Ralph H. Rice, assistant engineer of the Board of Supervising Engineers, Chicago Traction, will present a paper on "Low-Tension Street-Railway Feeder Systems."

Wireless Joins England and Germany.

A cablegram from Berlin last Wednesday stated that the first direct wireless communication was established between England and Germany when messages were exchanged on that day between Brunswick and London.

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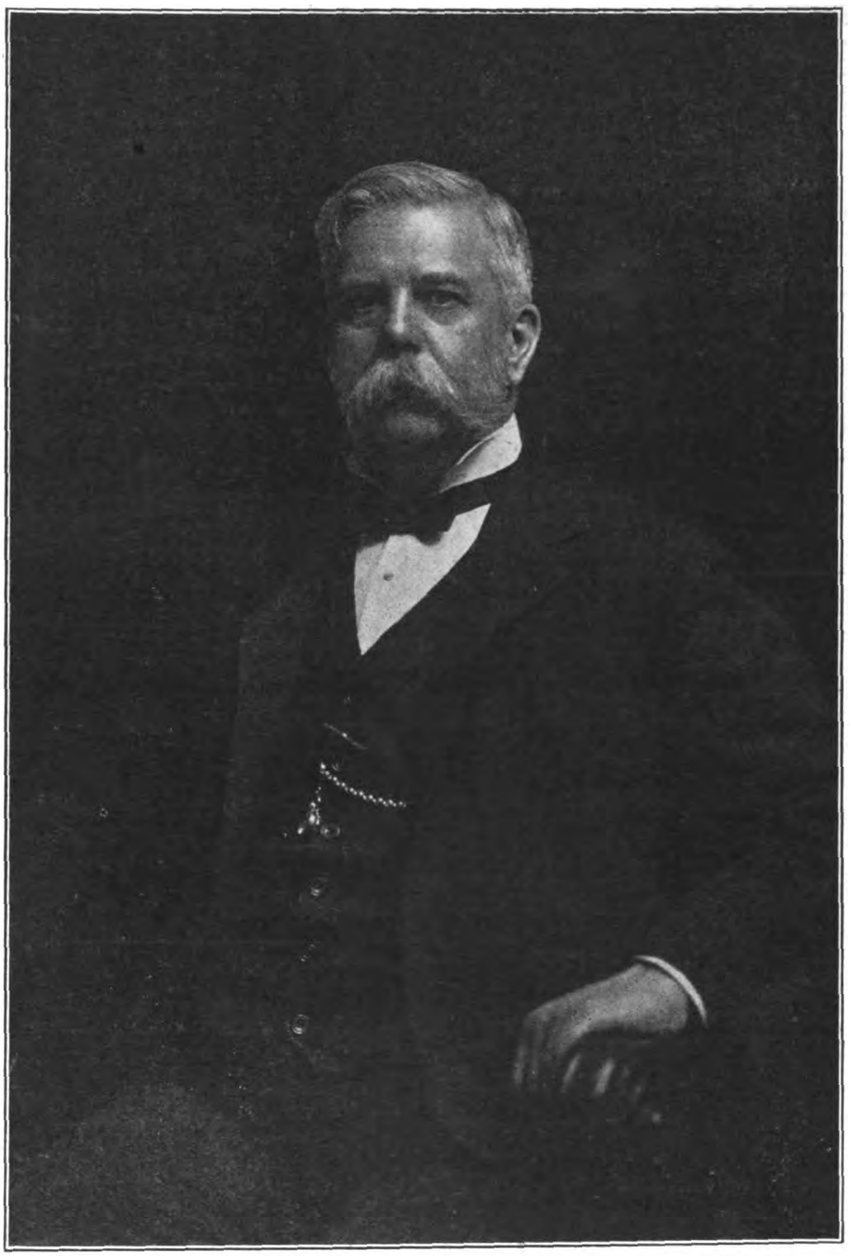
Mr. Westinghouse, President of the American Society of Mechanical Engineers.



GEORGE WESTINGHOUSE.
The American Society of Mechanical Engineers Elected Him President at the Thirtieth Annual Convention, Held December 8, 1909.

"Escorted by three former presidents, Mr. Westinghouse took his place on the platform. He was applauded by seven hundred engineers, their wives and friends. Then there was a reception." So reads the brief paragraph in a New York newspaper. And there should have been a reception; and it must have been a proud moment for those three former presidents to escort this strong man of invention, organization, and financing to the rostrum where he was hailed as the chief executive of one of the leading national engineering societies.

George Westinghouse is a leading exponent of the adaptability of inventive genius to the co-ordinated efforts of investing and manufacturing, and has exemplified in countless ways the true conception of the meaning of engineering: "The utilization of the world's resources for the benefit of mankind."

Mr. Westinghouse's father before him was a prominent manufacturer, and the old factory of George Westinghouse & Company is still a landmark in Schenectady, N. Y. Mr. Westinghouse was born at Central Bridge, Schoharie County, New York, October 6, 1846. He spent many of his earlier days in his father's machine shop, inventing, at the age of fifteen, a rotary engine. He was a member of the 12th New York National Guard and of the 16th New York cavalry in the Union Army from June, 1863, to November, 1864, when, making good use of his remarkable inventive and mechanical talent he became assistant engineer in the United States Navy, retiring in August, 1865. He attended Union College after this until the sophomore year, from which college, by the way, he received the degree of Doctor of Philosophy in 1890. In 1865 he invented a successful railroad frog for replacing derailed cars, and it was shortly after this that he made his very important invention of the air brake. Since that time he has introduced various improvements which have been of almost as great value as the original invention, and the high speeds at which our railroads operate in safety today are due largely to the inventive skill and methods of manufacture introduced by this pioneer in the production of modern railway appliances.

There is one thing throughout the entire career of Mr. Westinghouse which stands out more prominently than any other. This is his ability to take off his coat and go to work to save a situation which apparently was going wrong. And time and again he has devoted his entire private fortune and all the great ability he has been capable of to the protection of the investments of those who, with confidence in him, have made their investments in the enterprises for which he stood sponsor. The introduction of the air brake, the development and utilization of electro-pneumatic signaling devices, the introduction of the alternating-current system for transmission, for lighting and power, all received their greatest impetus from the determined and successful work which Mr. Westinghouse initiated. In the electrical field the inventions of Stanley and Tesla in alternating-current phenomena, the work of von Welsbach and Walther Nernst on the Nernst glower, the work of Peter Cooper Hewitt on the mercury-vapor lamp, the work of Bremer on the flaming arc, and many others have been backed by Mr. Westinghouse. And although all these were revolutionary in their inceptions they have become stable and a part of common engineering practice largely because of the unfaltering determination of this man who brought to invention the assistance of capital and the possibilities of great manufacturing facilities.

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AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

ANNUAL MEETING, NEW YORK, DECEMBER 8, 9 AND 10.

The first session of the annual meeting of the American Society of Mechanical Engineers in New York was held on Wednesday morning, December 8. The session was a purely business one, being devoted to the reports of the tellers of election and of standing committees. George Westinghouse was elected president for the ensuing year. Among the reports presented were those of the gas power sections committee on standardization and on plant operations. The report of the standardization committee considered the following subjects: The making of certain general recommendations acceptable to all good engineers; defining specifically those terms or conditions whose interpretation seems to be a matter of agreement and practice; and pointing out where the difficulty lies in the remaining cases, in which, due to insufficient progress there is not a complete understanding or agreement. The committee stated that the capacity of a unit may be considered as its output in some unit, and its efficiency the ratio of output to input measured in the same units. The capacity and efficiency of engines, producers and complete plants will be defined when definitions are fixed for: (a) Input of producers; (b) output of producers = input of engines (when all gas generated is taken by the engine); (c) output of engine. To these must be added a definition of regulation of each unit and the adaptability or suitability of fuel supply to the needs of the unit. These are (d) Regulation of producers; (e) Regulation of engines; (f) Adaptability of coal for producers; (g) Adaptability of gas for engines. The report then defines these various terms and shows that a further definition of a number of other conditions is necessary, including quality and quantity of coal consumed together with its thermal equivalent, the quality, quantity and thermal equivalent of gas, the horsepower of engines and variation of horsepower, the consecutive time producers may continue to deliver gas of defined quality and quantity, or engines to deliver defined horsepower, the number of revolutions in any time interval together with variations, the time interval for the completion of any number of revolutions and the change in the time intervals with the number of revolutions chosen for observations or with load conditions of the engine, the physical or chemical condition of coal not included in the quality definition but affecting the adaptability of the producer, the physical or chemical condition of the gases not included in the quality definition, but affecting the adaptability to the engine. These various definitions are discussed in considerable detail in the report and recommendations made regarding them.

Following this, the report of the plant operation committee was taken up. This presents a series of blanks for recording data, by means of which the various features of gas engine plant operation can be studied, together with recommendations and discussion of the blanks. The discussion on both of these reports was voluminous and they were adopted at the meeting of the gas power section the next day.

The first regular professional session was held on Thursday morning. Four papers were presented and formed a symposium on measuring the flow of fluids. They were entitled, respectively, "Tests on a Venturi Meter for Boiler Feed," by C. M. Allen; "The Pitot Tube as a Steam Meter," by Prof. George F. Gebhardt; "Efficiency Tests of Steam Nozzles," by Prof. F. H. Sibley and T. S. Kemble; "An Electric Gas Meter," by Prof. Carl C. Thomas.

The object of the tests with the Venturi meter was to determine how well adapted it would be for use in measuring the feed to a boiler, in view of the variety of conditions under which it might have to operate. The methods of pumping the water through the meter, the different temperatures of the water pumped, various and fluctuating pressures and velocities of flow—any one or several of these conditions might be met with in actual service, and the results obtained indicate that such occurrence would have practically no effect on the satisfactory performance of the work of the meter. However, there are limits to this satisfactory operation of any one meter, and the lower limit for this size seems to be reached when the velocity of the water through its throat becomes lower than about ten feet per second. In case the desired amount of water is smaller than the quantity which would produce this velocity in the meter, a smaller meter would be installed. It is evident from these tests that the Venturi meter is sufficiently accurate for the majority of commercial or engineering requirements.

Professor Gebhardt's paper on the Pitot tube is in abstract as follows:

The application of a Pitot tube system along the lines described in the paper is an accurate means of determining the velocity of steam at any point in a pipe, provided the values of the various influencing factors are known; and for straight lengths of piping with continuous flow, under these conditions, it is an accurate means of determining the weight of steam flowing. Under average commercial conditions in which the pressure and quality of the steam fluctuate and an average value must be taken for the density of the self-adjusting water column, only approximate results can be obtained, the extent of error varying with the degree of fluctuation. For velocities in excess of those corresponding to a one and one-half-inch water column (about 2,000 feet per minute for pressures over seventy pounds gage pressure), tests gave a maximum error of about two per cent for continuous flow in straight lengths of piping.

The paper by Professor Sibley and Mr. Kemble is the result of a series of tests begun in 1905 at Case School of Applied Science to determine the proper proportions and efficiency of steam turbine nozzles for given steam conditions. The paper gives the final tests, and in brief is as follows:

Two methods were tried out for finding the efficiency: (a) by first finding the pressure in the nozzle by means of a search tube placed axially in the nozzle; (b) by finding the reaction of the nozzle. This was done by suspending the nozzle in an air-tight box at the end of a flexible steel tube. The deflection of the tube caused by the reaction of the nozzle, was measured by a calibrated spring. Friction was eliminated. Preliminary work was done to calibrate the springs to determine the volume of flow of the various nozzles and to determine the pressure in the nozzle and the surrounding medium. The results of the tests indicate: (a) that the reaction is affected by a difference in pressure between the muzzle of the nozzle and the medium surrounding the nozzle; (b) that the efficiencies of the various nozzles were determined within a probable error of two per cent; (c) that the efficiency is affected more by the smoothness of finish on the inside of the nozzle than by the exact contour of the nozzle.

Quite a little discussion on this paper ensued, and it was stated that the high efficiency attained would be surprising to one not familiar with recent developments in the design of nozzles. The effect of moisture in the steam may be overcome by the use of superheated steam, and it is also possible that more data are necessary as to the proper lengths of nozzles.

The electric gas meter described by Professor Thomas in his paper is a meter for measuring the rate of flow of gas or air, which can be adapted for use as a steam meter or as a steam calorimeter, taking the quality of all the steam passing through a pipe instead of that of a sample of steam. The meter consists of an electric heater formed of suitable resistance material disposed across the gas passage so as to impart heat at a uniform rate to the gas. The resulting rise of temperature is measured and autographically recorded by means of two electrical resistance thermometers, one on each side of the heater. These consist of resistance-wire wound upon metal tubes so placed that all the gas passing through the meter comes in close proximity to the thermometers. The adoption of this principle of operation is stated to permit the construction of a very accurate and sensitive autographic meter of large capacity containing no moving parts in the gas passage; independent of fluctuations in pressure and temperature of the gas; capable of measuring gas or air at either high or low pressures or temperatures. The electrical energy required is about 1 kilowatt per 50,000 cubic feet hourly capacity, at the pressures ordinarily used in gas mains.

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The principle of operation is that a certain known quantity of heat is added electrically to the fluid flowing through the meter and the rate of flow is determined by the rise in temperature of the fluid between the inlet and the outlet of the meter. This paper provoked quite a little discussion in which it was pointed out that the possibility of error in this type of meter must be carefully examined. The volumes recorded by the meter are not actual volumes, but must be reduced to some known standard of temperature and pressure. There are possibilities of errors in measuring blast furnace gas with a meter of this type, if it has gone through washers, due to the moisture in the gas. This might amount to twenty-five per cent if the gas is supersaturated with vapor. The method of calibration was criticized and it was shown that there were large possibilities of error if the gases measured were of different analyses from the gas with which the meter was calibrated, and also if the gases were of different specific heat. To one speaker it did not seem possible to calibrate the instrument for illuminating gas at one locality and use the same calibration for measurement of illuminating gas at another locality. It did not seem that the instrument could be used for accurate work unless constant analyses were made of the gases. Another speaker questioned whether the thermometers, due to the construction of the meter, gave the true average temperature of the gas. Inquiry was made as to the effect of the deposition of impurities from the gas on the resistance grids, but the author pointed out that this deposition had little or no effect, inasmuch as the heat is generated in the gas and could pass to no place but the gas itself.

At the regular session on Thursday afternoon the papers presented dealt with steam engineering. David M. Myers presented one on "Tan Bark as a Boiler Fuel," an abstract of which is given below.

The average fuel value of spent hemlock tan is about 9,500 bituminous test units per pound of dry matter, which is about 35 per cent of its total moist weight in the fireroom. The available heat value per pounds as fired is 2,665 bituminous test units. One ton of air-dry hemlock bark produces boiler fuel equal to 0.42 tons of 13,500 bituminous test units coal. The degree of leaching does not affect the number of heat units per pound of dry matter, but of course reduces the available material. Boiler tests under normal conditions show thermal efficiencies of from fifty-eight to sixty-eight per cent, and a higher efficiency has been obtained under special conditions.

Tan presses have produced no marked increase in boiler and furnace efficiency when tested. Grate surfaces should be materially reduced when tan is pressed. Mixing coal with tan under proper conditions increases both the capacity and the efficiency of the boiler and furnace.

Conditions productive of best results have been: ample combustion space, and a refractory arch over the entire grate; no less than 0.5 inch and preferably 0.6 inch water-gauge draft with ample draft passages; feeding through holes in top of furnace in small quantities and at frequent intervals to approximate the rate of combustion; constant care to prevent blow-holes; a small shallow-fired furnace; a high arch above the fire (which is about the most important single requirement); proper ratio of heating surface to grate surface for local conditions; the pressing of tan under certain conditions.

The next paper was on cooling tower practice and was presented by J. R. Bibbins.

Developments of recent years in both steam and power plants have demonstrated the usefulness of the cooling tower. It is true that in some plants the maximum effectiveness of the cooling tower and that of the condensing plant are in a sense diametrically opposed. The tower works best when the vacuum is lowest. On the other hand this tends to a general operative equilibrium. Fortunately, improvements in condensers are being actively pushed, the trend being to secure higher hot-well temperatures. This immediately enhances the effectiveness of the cooling tower. Similarly, in gas-power plants, the possibility of cooling jacket water by means of this apparatus is favored by the high temperatures of discharge which prevail in engines of good construction. It is not an impossible state of affairs for the jacket water in a gas-power plant to cost more than the fuel, if not cooled and used over again, so that from all standpoints the cooling tower is worthy of careful study.

The deductions of the author were questioned in the succeeding discussion and the quotations of prices of forced draft towers suitable for a load of several thousand kilowatts, not including the motor or engine for driving the fan, as obtained by Mr. Bibbins from a number of builders, and which were given in the paper as ranging between $4.80 and $6.93 per kilowatt were considered high. The prices, it was stated, must have been made on an installation for minimum service conditions. While cooling towers have been in use in the United States for twenty-five years, the first installation having been made in 1884, for more than ten years their design has been on a scientific basis, and their building is now an engineering specialty. The reason of their restricted use in this country is not the excessive cost of towers nor the lack of knowledge of their construction, but rather the fact that good water supplies are more plentiful in this country than abroad. As many of the statements in the paper were questioned in the discussion the author preferred to reply to it in writing rather than with an oral closure.

"Governing Rolling Mill Engines" was the title of a paper presented by W. P. Caine.

The paper describes first the types of rolling mills and the engines driving them; analyzes the distribution of power, the design and the operation of the engines, calling attention to causes of low steam economy, high repair changes and the danger of broken flywheels; describes and gives indicator cards and speed curves of a Corliss engine driving a three-high mill under two different conditions of governing, (a) under the widest range of adjustment of cut-off, (b) under a limited range, increasing the economy and making the engine run much more smoothly and safely. It also gives the reasons for the different results shown. A table is given showing the power required for rolling in the mill and the momentary source of the energy, whether from the cylinder or flywheel. A diagram shows this graphically. A description is also given of the tachometer used to take the speed curves.

Henry C. Ord stated, in discussing the paper, that the conservation of energy as applied to rolling mills had received but little attention until lately. The continuous indicator and the recording tachometer were the first means offered to measure the power required to roll a given piece of steel. Steel manufacturers prefer two-high reversing mills to three-high mills, because they can be easily reversed should a piece not enter the rolls properly. For this reason certain modern three-high electric motor-driven rolls are provided with an emergency reversing device which can also be used as a quick safety stop in case of accident. Two-high mills do not have the complications of three-high mills, there being fewer rolls and no table raising and lowering mechanism. The power required for the tilting table mechanism should be charged to the three-high mill, although power is not the only consideration. A serious question is that of a maximum tonnage in a minimum time.

Another speaker gave it as his opinion that but little if any advantage can be gained in any blooming mill work with the three-high mill if it is steam driven. The only economy to be obtained over present practice will be by means of the two-high reversing mill electrically-driven. Such an equipment should have the necessary power to avoid delay in gripping the ingot, the means for instantly cutting out the power at the release of the ingot and also a continuously running steam engine with a sufficiently heavy flywheel at the generator.

An experience with leaky vertical fire tube boilers formed the subject of a paper by F. W. Dean.

This paper discusses the difficulties expe-

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rienced with some large vertical boilers somewhat over ten feet in diameter, and containing 6,000 square feet of heating surface. The boilers leaked badly soon after being started and nothing that was done improved their condition until the water legs were lengthened from two feet to seven feet, two and three-quarter inches. The boilers were raised five feet two and three-quarter inches. Before they were raised the lower ends of the tubes would cover with very hard clinker and become stopped up. This clinker could be removed only by cutting it off when the boilers were cold. After the boilers were raised, a light clinker that could be blown off formed about the tubes; by removing this by blowing every three or four hours the leaks were stopped and they have never returned. The trouble varied with different kinds of coal. Each boiler had been run constantly at over 1,000-horsepower, and the economy seemed to be about the same no matter what the power was. So far it has been difficult to obtain good combustion, but the heat-absorbing power of the boilers is admirable. The experience with these boilers indicates that there is no ordinary limit to the size of a vertical fire-tube boiler.

Prof. L. P. Breckenridge said that the paper was of great value as it recorded a failure, the usual practice in preparing papers being only to present successful construction. The consensus of opinion was that the combustion chamber was too small and the tubes in the boiler entirely too long. The deposit at the end of the tubes was thought to be principally carbon. Colonel E. D. Meier gave an experience with boilers at the World's Fair, Chicago, burning oil fuel, all of which lost tubes. It was deemed impossible to account for this fact, but later the boilers exhibited by Colonel Meier were shipped to California and no further trouble was encountered with the tubes despite the use of oil fuel. The burners at Chicago were directed downward and it was believed the drops of oil not thoroughly vaporized were deposited on the tubes at the Chicago plant, the carbon of the oil adhering to the tubes. This caused blisters which in a short time resulted in the tubes burning out.

F. W. Dean then presented another paper entitled "The Best Form of Longitudinal Joints for Boilers."

This paper deals specially with the defects of the usual form of butt joint used on the longitudinal seams of boilers, in which the inside strap is wider than the outside strap.

While stating that there has never been an explosion of a horizontal return tubular boiler built with the ordinary form of butt joint, the author gives an example of the rupture of such a joint that would have resulted in an explosion. The joint recommended as a substitute for this is one that has the inside and outside straps of the same width, but the outer row of rivets is made with a wide pitch and the straps are made sufficiently thick to stand caulking between the widely pitched rivets. Ordinarily the efficiency of this substitute joint is from eighty-four to eighty-five per cent, but it can be made as great as that of any other form of joint, if the pitch of the rivets is wide enough, in which case the straps would have to be thicker than would otherwise be necessary.

At the meeting of the gas power section held simultaneously with the regular session Thursday afternoon, the reports above recorded were received and accepted after the chairman, F. R. Low, had read a report outlining the work of the section for the past year. After the announcement of the election of J. R. Bibbins to the chairmanship of this section for the ensuing year, a paper entitled "Testing Suction Gas Producers with a Koerting Ejector," by C. M. Garland and A. P. Kratz, was read.

The paper describes a method of testing the suction gas producer which is independent of the engine. The engine is blanked off from the producer and a Schutte & Koerting steam ejector is inserted, which draws the gases from the producer and delivers them to a scrubber in which the steam used by the ejector.

The results of one test are included in the article together with a graphical log illustrating the conditions during this test.

In the discussion it developed that the speakers did not regard the orifice method of measuring gas as absolutely reliable, and it was pointed out that the variation of steam required in the operation of the producer was due to the variations in conditions of running and not to errors of observation. It was also pointed out that the depth of fuel bed was too great, and that the fuel bed should have been brought to a normal condition by means of a three-day preliminary run instead of starting with a clear fire. The combustion, it was pointed out, was far too high, being about thirty-four pounds per square foot of grate surface per hour whereas ten to fifteen pounds was nearer to average practice. It was also pointed out that the paper gave evidence that the fuel bed as described in the paper was not in the same condition at the end as at the beginning of the test, which left the accuracy of the paper open to serious question. In reply to a question by one of the speakers, it was stated that the producer efficiency does not seem to change from 20 per cent to 100 per cent of normal full load.

Following this paper, "A Bituminous Gas Producer of the Double Zone," was described in a paper by J. R. Bibbins.

Much time and money has been spent by the various manufacturers in the development of a tar-free gas producer and in some respects the obstacles have seemed insuperable. Every advance is therefore of interest and importance and it has seemed worth while to report a long series of tests conducted by the builder of the producer described in the paper to determine the net results under commercial conditions, whether good or bad. These tests are characterized by their unusual duration and absence of outside conditions affecting the results. These results in general will speak for themselves and it is necessary simply to emphasize the fact that continuous operation has been secured with tar-free gas of reasonable heat value and producer efficiency and an over-all plant economy of about one pound of fair bituminous coal per brake horsepower (proportionate economies for poorer grades). More important still, the fact has been developed that the efficiency and general effectiveness of operation of the producer on low-grade fuel, lignites, etc., is practically as high as with the higher grades. This places within the reach of the producer the enormous fuel deposits of the West and South, which are practically invaluable for steam work.

The discussion on this paper was voluminous and devoted mostly to criticisms of the producer described and to the relation of experiences obtained in its operation.

The final sesison was held Friday morning and comprised papers on various engineering subjects. The Bucyrus locomotive pile driver was described in a paper by Walter Ferris. The paper attracting the greatest attention was that entitled "Line Shaft Efficiency, Mechanical and Economic," by Henry Hess.

This is the description of a complete test of the relative efficiency of a lineshaft of 2 7/16 inches diameter, making 214 revolutions per minute, with a bearing load due to the weight of the parts plus the tension of the belts subjected to known stress by counterweighting, when running in ring-oiling babbitted bearings and when mounted in ball bearings. Sixteen tests, each of forty minutes' duration, with belt tensions of twenty pounds to ninety pounds per inch width of single belt, were carried out. The instruments by which the electric energy consumed was measured, as well as all other instruments and the motor, were calibrated before and after the tests. The savings in power consequent on this change ranged from fourteen to sixty-five per cent, with thirty-six and thirty-five per cent under average conditions of good practice, due to belt tensions of forty-four pounds and fifty-seven pounds per inch width of single belt respectively. The paper gives data for determining the power savings that may be expected in various plants, as a percentage of the plain bearing shaft friction and as a percentage of the total power consumption; also exact figures taking into account extra investment, depreciation, maintenance, interest on extra investment and power savings, which show that for the plant tested and described the savings represent thirty-seven per cent per annum.

The speakers discussing the paper agreed that it was of great value but Professor Carpenter stated that the friction load was preferable as a unit of measurement to the coefficient of friction, inasmuch as it was a more constant quantity. Another speaker presented the term "watts per bearing" as a convenient one for measurement. This is obtained by measuring the current required by the motor to drive the line shaft and by counting the

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number of bearings and loose pulleys. The quotient of the total watts by the number of bearings and loose pulleys gives the energy required per bearing. Results of a number of tests were given showing the watts required per bearing with various sizes of shafts. One-inch shafts at 400 revolutions per minute required 27 watts per bearing, one and one-half inch shafts at 300 revolutions per minute required 66 watts, two-inch shafts at 190 to 250 revolutions per minute required 99.1 watts, two and one-half-inch shafts at 200 to 250 revolutions per minutes required 108 watts per bearing. These results were the average of a large number of tests.

In a general discussion of the subject, it was stated that roller bearings had been applied to railway cars with a consequent reduction in the motive power required. Another speaker stated that the coefficient of friction in railway service was already very low, and the author in his closure stated that the main object of ball bearings in railway service is not the elimination of friction but the getting rid of other troubles, such as those of lubrication. A hot box is unknown with ball bearings. In electric railway service an important result of the use of ball bearings is the ability to coast, with a resulting saving of power required on the system of sometimes as much as 30 per cent.

Two other papers, both by A. F. Nagle, were read at this session. The first was entitled "Pump Valves and Valve Areas."

This paper is designed to call the attention of engineers to the need of reviewing the common notion that "valve-seat area" is synonymous with "velocity of flow." It is evidently the purpose of specifications for pumping engines to secure a low velocity of flow through the valves, thus reducing the head required to force water through the pump; but to accomplish this laudable purpose, special and intelligent attention should be given to the springs of the valves, rather than to valve-seat areas. If that be done, valve-seat areas need not be greater than the plunger area for the vertical triple-expansion pumping engines so largely used in city pumps. A slight economy in both construction and operation could be effected by giving more study to the proper design and strength of springs for pump valves.

The discussion on this paper was principally in regard to points in the field of machine design. The second paper was "A Report on Cast Iron Test Bars."

This paper is designed to show engineers that test pieces, whether cast in separate molds or in the same mold as the main casting, are not perfect indications of the character of the iron in the main casting. In other words, uniformity of results is not found in practice where we know of no reason why they should not be uniform. These test bars were used in the construction of over 3,000,000 pounds of pumping-engine castings, involving soft and hard irons for the various parts. Tables 5, 6 and 7 would indicate a probable variation of fifteen per cent where uniformity might be expected.

This provoked but little oral discussion and but one written discussion, which was of a highly mathematical nature.

Educating the Factory Owner.

The following commentary on Dr. Gisbert Kapp's presidential address to the Institution of Electrical Engineers in England, which appeared in a recent issue of the London *Times*, should prove of interest:

"In itself a summary, the inaugural address of Dr. Gisbert Kapp, the president of the Institution of Electrical Engineers, does not lend itself to any attempt to summarize its content as the basis of any controversial theory. There will certainly be no such dialectical outburst as followed Mr. Mordey's famous utterance of a year ago. Indeed, as far as Doctor Kapp allows any echo of that discussion to make itself heard, his only reference suggests that he has in the meantime discovered in what respect, and how far, we [*i. e.*, English electrical manufacturers] are 'backward,' namely, in the comparative slowness of our adoption of the industrial and social uses of electricity.

"The greatest and most stubborn obstacle to electrical progress in this country (England) is to be found in the complacency of factory owners who will not even consider the claims of electric driving, although it may be almost universally adopted, for sufficient reasons, by their foreign competitors. In no other manufacturing country is there any parallel, for example, to the self-inflicted blindness of our textile industry, and in such circumstances it is to be regretted that Doctor Kapp, instead of covering such an extensive field in his survey, did not devote his address almost exclusively to the enormous benefits to be attained through the more rapid application of electricity to textile and other factory purposes.

"The one point on which all ranks and sections of the profession are unanimously agreed is that the use made of electricity is not sufficient, and whatever difference of opinion there may be otherwise on the subject of 'backwardness,' it is plainly important that, from the president downwards, electrical engineers should be more concerned with the education of the factory owner than the detail improvements in traction motors and other apparatus."

Toledo Electrical Show.

As previously mentioned the first annual electrical show of Toledo, O., will be held in the Coliseum Building, January 31 to February 5, under the auspicies of the Electrical Dealers' Association of that city.

A space chart has been distributed showing the locations of the booths, many of which have already been engaged, and the prices quoted include the space, booth and sign.

The preliminary interest shown in this exposition indicates that the event will be a decided success and it is believed that the Electrical Dealers' Association will feel justified in holding a show annually hereafter.

President T. D. Buckwell and Secretary I. G. Golden, of the association, are the managing directors of the show.

McCall's Ferry Power Plant Sold.

Henry F. Brown, special master, on December 7, sold all the real and personal property of the McCall's Ferry Power Company at public sale to William M. Barnum, of New York, for $2,000,000. His was the only bid and it is understood he represents the majority bondholders.

The company was engaged in building a 100,000 horsepower hydroelectric plant along the Susquehanna River at McCall's Ferry, Pa., and was unable to proceed with the work after the failure of the Knickerbocker Trust Company, of New York, which was financing the project. The plant was described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of February 27, 1909, page 380.

A Europe-Argentine Cable.

An American Consul-General reports that the President of the Argentine Republic has signed the bill approving the contract with John Oldham, representing the Western Telegraph Company, for the construction of a direct cable between the Argentine Republic and the continent of Europe. This contract nowhere refers to radiographic communications. All advantages, profits, and privileges accorded to the company, as well as any restrictions thereby imposed on the Argentine Government to conclude new contracts in such manner as it may deem advisable, are limited to twenty-five years.

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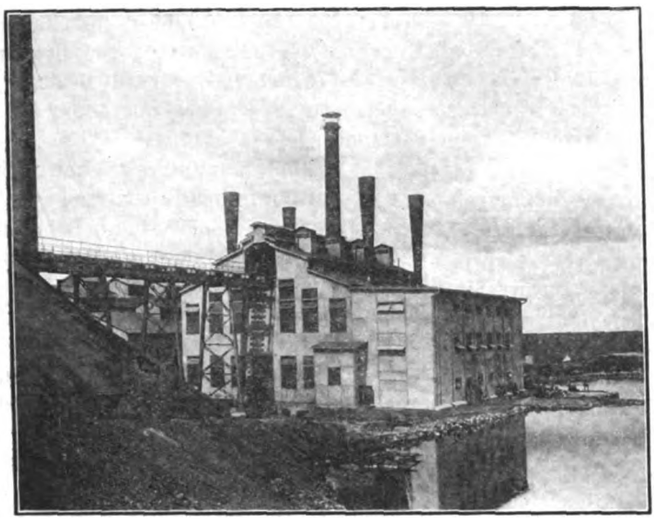
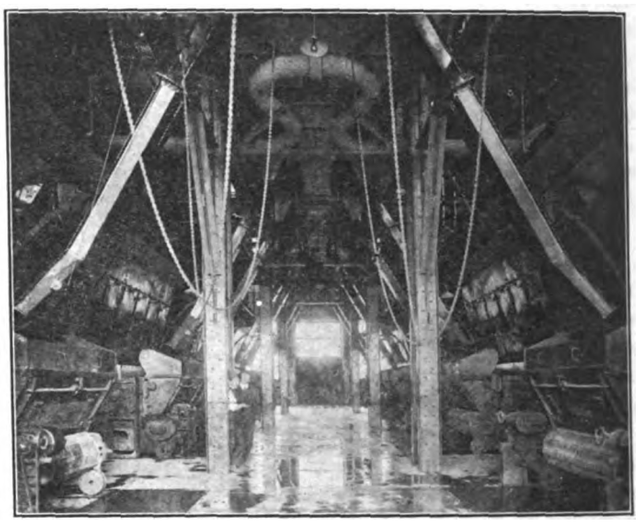
THE PLANT OF THE VICTORIA FALLS AND TRANSVAAL POWER COMPANY.

BY DR. ALFRED GRADENWITZ.

Some problems connected with the installation of the huge power plant of the Victoria Falls and Transvaal Power Company have been recently solved satisfactorily, so that its future can be considered as fully warranted. A short description of this imposing scheme, together with a few photographs showing the Brakpan central station, would therefore seem to be interesting.



CENTRAL STATION AT BRAKPAN.



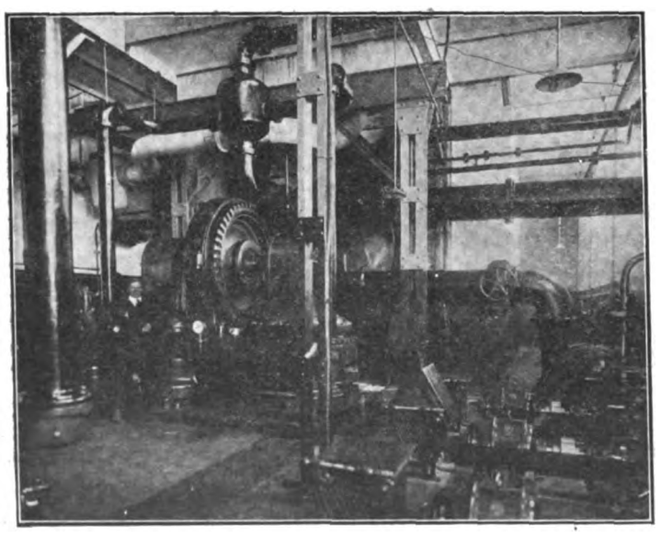
INTERIOR OF BOILER HOUSE.

The main part of the building which is to comprise five generator sets of 12,000 kilowatts each, will be erected at the Rosherville Dam. This artificial embankment, locked by a wall, has a capacity of 600 millions of gallons. The same central station is to contain, in addition to those five turbine-driven sets, four steam-driven turbo-compressors (under a pressure of nine atmospheres) of from 4,000 to 5,000 horsepower each. While the turbo-generator sets possess the largest dimensions of any ever constructed in Europe, these turbo-compressors are likewise the largest sets ever manufactured, the maximum output of any compressor so far constructed either for turbine or reciprocating-engine drive, being 1,500 horsepower.

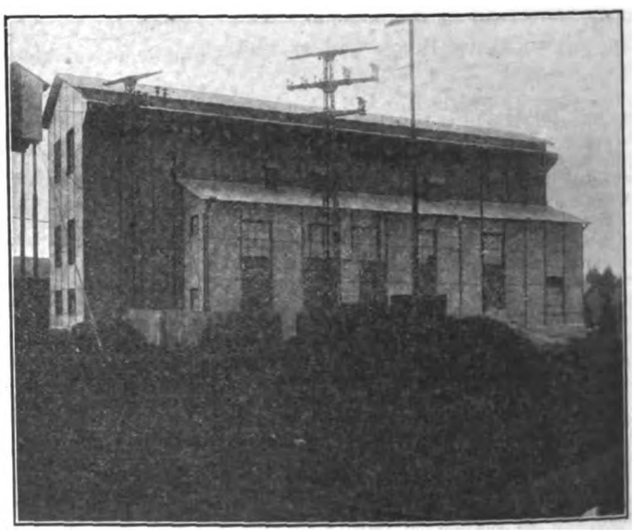
The second set of compressors, comprising six electrically driven units, is installed at a compressor station near Robertson Deep at about twenty kilometres distance from Rosherville Dam. This station at the same time serves as main transformer station. There will thus be three central stations, inclusive of those of Brakpan and Simmerpan on the embankment above mentioned, that of Simmerpan being extended by the addition of two machine sets.

Two further turbines, of 12,000 kilowatts each, are to be installed at some other place, presumably at Vereeniging, about fifty-five kilometers to the north of the Rand. Should present difficulties in obtaining the governmental authorization for the laying out of the overhead conductors not be overcome, these two machine sets would have to be installed at other points near the Rand. The total output of the machinery installed in those three central stations works out at about 175,000 horsepower.

The conductor system, starting from the three central stations, is being so arranged as to cover the whole of the Rand with a large network of high-tension lines, at 40,000 volts. The central part of the Rand is provided, in addition, with a cable system at 20,000 volts, fed partly from the Rosherville



CONDENSER PUMPS AT BRAKPAN CENTRAL STATION.



SWITCH HOUSE OF THE VICTORIA FALLS POWER PLANT.

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power house, partly from the main substation at Robertson Deep, and being connected with the substations.

In the substations, the tension of the current is reduced to the working tension of the mines, that is, mainly to 2,000, and, to a smaller extent, to 500 volts. A total of thirty-two substations, varying in size between 1,000 and 6,000 kilowatts each, is being designed.

In the outside districts (to the west and east), the consumers' substations are fed by overhead conductors, mainly at a tension of 10,000 volts. All the conductor systems are provided with differential fuses, the overhead conductors being equipped with lightning arresters, consisting of three substantial steel wire ropes, suspended above the overhead conductors.

The design of the central station of Brakpan shows many departures from previous practice, the boilers, economizers and chimneys being combined into a single system. For each two boilers is provided an iron chimney, equipped with suction ejectors, which arrangement has given excellent results. The boilers have given in actual service a high efficiency in spite of the fact that coal of a low calorific value is used. Furthermore, the boilers are practically smokeless in working, the boiler room remains perfectly cool, and heat radiation is reduced to a minimum.

The switchgear is arranged in a special building independent of the central station, and is worked absolutely automatically, thus offering the advantage of allowing alterations and extensions to be made at any time, there being plenty of room on all sides.

The demand for current supply will be extremely high, contracts with the Eckstein Company alone covering 270 millions of kilowatt-hours, while an increase to 320 millions is anticipated. The demand of the gold fields will presumably reach fifty to sixty millions of kilowatt-hours, to which should be added a number of other consumers, so that a total initial consumption of 400 millions of kilowatt-hours will probably be attained.

To Send Money by Cable.

The British Post-office Department has concluded an agreement with the Western Union Telegraph Company, to become operative on January 1 next, whereby the company may make cable transfers of money to Great Britain and Ireland, where the orders will be honored through the postal department.

Electrical Exports for October.

The Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., has completed its monthly summary of exports and imports of the United States for the month of October. From this the following statistics relative to the electrical exports from this country during October are taken. As shown below the total is a trifle less than that of the preceding month, but much greater than that of the corresponding month a year ago. As compared with the conditions last year the exports of electrical machinery are still low, but their deficiency is more than made up by the increased exports of electrical appliances.

To give an idea of what the annual total will be as compared with the preceding years, the following figures giving the total electrical exports for the ten months ending with October in each case are of interest: 1907, $14,864,463; 1908, $10,655,052; 1909, $10,829,636.

The comparative monthly data are as follows:

	Oct., 1909.	Oct., 1908.	Sept., 1909.
Electrical Appliances	$ 683,819	$432,907	$ 686,049
Machinery	443,388	543,188	480,835
Total	$1,127,207	$976,095	$1,166,884

The principal countries to which electrical products were shipped from the United States during October, with the values of these exports, are as follows:

Exported to—	—Electrical— Appliances.	Machinery.
United Kingdom	$ 56,798	$ 33,521
Belgium	7,739	.....
France	9,277	12,976
Germany	5,388	1,844
Other European Nations	8,889	27,003
British North America	167,249	82,205
Central American States and British Honduras	13,903	13,892
Mexico	79,906	40,252
Cuba	38,884	6,876
Other West Indies and Bermuda	5,957	2,910
Argentina	19,441	22,755
Brazil	107,992	20,254
Other South American Countries	25,746	12,137
British East Indies	.....	15,471
Japan	15,614	73,220
British Australasia	28,879	40,350
Philippine Islands	79,686	3,849
British Africa	5,849	26,694

Arrangements for the Chicago Electrical Show.

But comparatively little unreserved space is now left for Chicago's fifth annual Electrical Show which is to be held in the Coliseum from January 15 to 29 next, the concerns having already made contracts including manufacturers and dealers from every section of the United States. To date there are more than one hundred exhibitors and it is estimated that twenty-five per cent more floor space will be sold this year than was disposed of at the 1909 show.

The feature of this year, from the novelty standpoint, will be the Wright aeroplane, which is to be placed upon exhibition by the War Department of the United States Government. The management of the exposition has had a special representative in Washington for several days in a successful campaign to secure this marvel, and it was through the personal request of President Taft that Secretary of War Dickinson authorized the display in the interest of areonautics and of electrical science. The government owns the Wright Brothers' patents and will send its only machine in charge of Lieutenant Foulois, the ranking signal officer, and a corps of signal men with complete wireless and telephone equipments. The government experts will make several interesting demonstrations and tests with the wireless outfits, sending and receiving from the aeroplane to and from stations throughout the Middle West and the vessels of the Navy Department in the lakes. The big aeroplane will be suspended from the center of the roof of the Coliseum against what are planned to be the most gorgeously beautiful decorations that have been created for any show building in the world.

There will be several interesting special days during the show in which the following organizations will feature: Wisconsin Electrical Association, Illuminating Engineering Society, Thomson-Houston Veterans' Association, Sons of Jove, American Institute of Electrical Engineers and the Chicago Electric Club. Other special days are being planned, and announcements will be made shortly.

In addition to space arrangements already concluded, contracts for space in the coming show were made during the last week with the following concerns: Allis-Chalmers Company, American Sign Company, G. M. Gest, Thompson Brothers Company, Hoover Suction Sweeper Company, Bishop & Babcock Company, Como Electrical Company, Collins Wireless Telephone Company, General Electric Company, Shelton Electric Company, W. W. Shaw Company, Chas. L. Kiewert Company, Enterprise Optical Manufacturing Company, Stromberg Electric Manufacturing Company, Electric Storage Battery Company, C. G. Everson & Co., Pacific Electric Heating Company and North Shore Electric Company.

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CENTRALIZED LIGHT, HEAT AND POWER SERVICE IN A LARGE AUTOMOBILE WORKS.

PLANT OF THOMAS B. JEFFERY & COMPANY AT KENOSHA, WIS.

Probably no better indication of the enormous growth of the automobile manufacturing business can be given than comparisons of such factories of today with the same factories a few years ago.

In this respect undoubtedly one of the best examples which could be given is the factory of Thomas B. Jeffery & Company, Kenosha, Wis., manufacturers of the Rambler automobile, which, under the guidance of a single individual, can claim a growth of 700 per cent during the short period of eight years.

In 1901 Mr. Jeffery purchased, for the purpose of manufacturing automobiles, the factory building comprising the original Sterling Bicycle Company, covering an area of 70,000 square feet and located on the same site as the present Rambler Works. During 1902 an iron foundry, 100 feet by 80 feet was added. The following year an additional building covering approximately 257 feet square was constructed; and during the succeeding years, on account of the steadily increasing business, in addition to the firm's intention of manufacturing more details of its machines, buildings were added until the present floor space covered is 455,672 square feet, and already plans are being formulated for the further extension of the factory.

By referring to the accompanying plat, some idea of the general lay-out of these various buildings may be gained. The original factory, 633 feet by 101 feet, forms the base line of an L-shaped group, the more recent buildings, known as Nos. 4, 5, 6, 7 and 8, forming the vertical line. With the exception of the former, all buildings are of concrete construction with saw-tooth roofs of sheet iron and glass. Much attention has been given to the natural illumination, there being innumerable windows in addition to the glass roofs already mentioned.

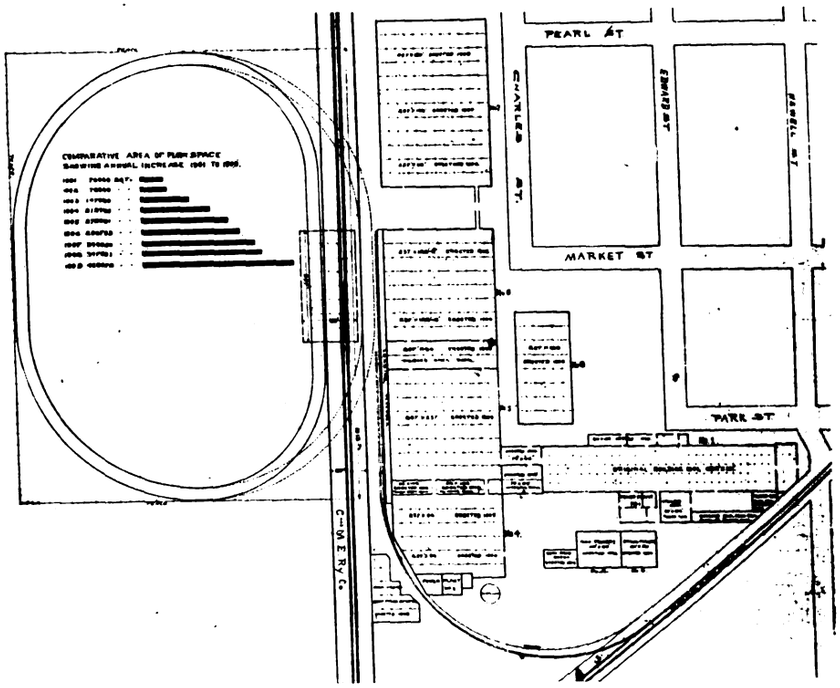
While the foregoing brief outline of the rapid growth of this Kenosha factory is in itself interesting, a study of the development of the methods of transmitting power, of lighting and of heating, as evidenced by the changes from belt transmission to rope drives and finally to the complete substitution of electric transmission, used in connection with the various stages of the growth of this factory presents some unique and interesting features.

Referring again to the plat, the power plant for the original factory may be seen adjoining it at the center on the south side. The building is approximately seventy-five feet square, and its equipment consisted of four seventy-five-horsepower tubular hand-fired boilers, and a 300-horsepower Reynolds Corliss engine. This engine transmitted power by means of belts to the various shafts and countershafts, which, in turn, were belted to the individual machines. A small generator was included in this equipment which supplied current for the open arc lamps used for general illuminating purposes and the incandescent carbon lamps for individual machine lighting. The heating system comprised blast fans with galvanized-iron air ducts. With the addition of the iron foundry in 1902 directly in the rear of the power plant, the problem of transmitting power to this building was solved by means of rope transmission from the same engine through the intervening space to the main shaft of the foundry.

With the addition of building No. 5, the first of the row of buildings running north and south, it was found necessary to install in the power plant a 100-kilowatt direct-current Western Electric generator. This machine was belt-driven by the same Corliss engine, and the current was transmitted through cables to the various departments of the new building. When building No. 4 was added, the capacity of this generator was too small to furnish the additional current required. Therefore, it was found necessary to erect a new power plant at the south end of the row of north and south buildings. In this plant were installed a 300-horsepower Allis-Chalmers Corliss engine and four 150-horsepower fire-tube boilers. This station was known as plant No. 2. The transmission of power to building No. 4 was accomplished by the installation of a rope transmission system, and the electrical load in building No. 5 originally carried by the generator in plant No. 1, was divided and half of the current was supplied by a 100-kilowatt six-pole Bullock generator installed in the new station. This generator was driven by the engine by means of an intricate rope transmission system.

The buildings constructed during the years of 1904 to 1907 were supplied with power by the Bullock generator which was later augmented by the addition of a ninety-kilowatt Crocker-Wheeler direct-current belt-driven generator. The lighting system of the new buildings was comprised of 250 enclosed arc lamps for the general illumination, and carbon incandescent lamps for individual machine lighting.

The introduction of additional machines and departments, such as up-



PLAT OF THOMAS B. JEFFERY & COMPANY'S PLANT, KENOSHA, WIS.

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holstering and wood working, body department, wheel department, etc., together with brass and aluminum foundries in addition to the great distances to be covered, so far increased the load on the existing electrical mains as to necessitate either expensive additions or a change in the methods employed, which would suggest a third power plant located remote from plant No. 2. This, however, would bring in questions of coal supply, additional buildings, additional help and fire risk, which would necessarily be undesirable. It would also require additional expenditures for large copper mains in carrying out the low-tension direct current scheme.

After a thorough study of the situation, it was deemed advisable to change over to the alternating-current system with the provision that this would ultimately supersede the existing systems of transmission. It was also decided to install the necessary apparatus in the plant known as No. 2, changing over from the 110-volt direct-current system to a 480-volt three-phase system. To obviate the delays incidental to this change and to overcome the necessity of closing down any part of the shops while the change was being made, three new cables similar to those in service were installed, branching out from power plant No. 2 to building No. 7 on the north, and to buildings Nos. 2 and 3 on the east. The four existing cables were allowed to carry the load uninterrupted while the three additional cables were being supplied with a higher voltage. An induction motor of proper size and speed was placed alongside every existing direct-current motor and fitted with appropriate belt and pulley. One by one the direct-current motors were eliminated and the alternating-current machines connected in until the entire group were displaced and the load transferred from the old cables to the three new ones.

To change over the lighting system without disturbing the feeders and branch lines, the various sections were divided and connected to single-phase stepdown transformers. These were in turn connected to the three new alternating-current mains until all of the lighting circuits were disconnected from the old mains, leaving them idle.

Three of these old mains were then transferred from the direct-current machine to the alternating-current generator. The fourth main was then removed and used as one of the three additional lines connected with buildings Nos. 2 and 3 in which the same operations were repeated.

In this way the first three mains were used as power mains, while three of the four old mains were used for the 110-volt lighting circuits only, it being deemed advisable in a plant of this size to have the lighting and power current transmitted through separate mains.

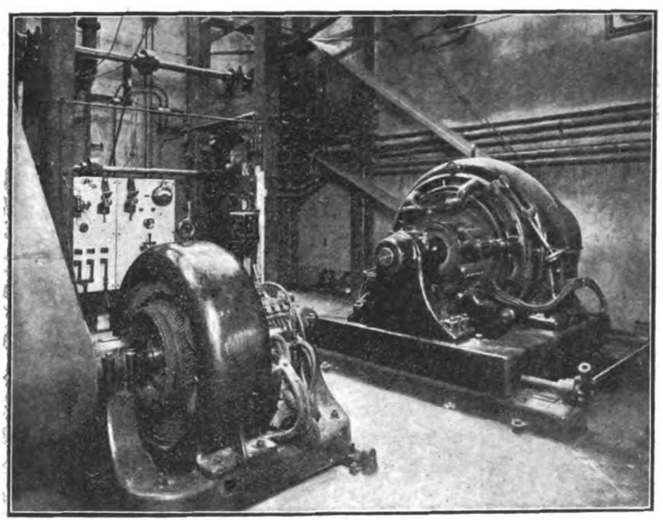
This development meant extensive changes in power plant No. 2, and when the new equipment was installed proper provision was made for the extension of the alternating-current system of transmission to accommodate the further developments which will necessarily take place.

The new unit installed consisted of a 375-kilowatt, 480-volt, three-phase, sixty-cycle General Electric alternator direct-connected to a 24 by 25 Fleming-Harrisburg four-valve engine. Both the engine and generator represent the best types of machines suitable for a station of this character, the former being the product of the Harrisburg Foundry and Machine Works, Harrisburg, Pa. The engine is self-oiling throughout and has a steam economy of twenty-three pounds per indicated horsepower per hour. A twelve-kilowatt, 125-volt, direct-current exciter is employed for this unit, mounted on the engine shaft.

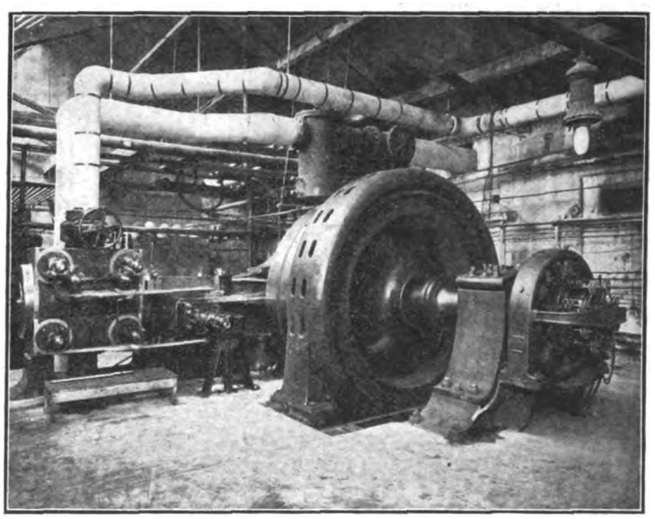
In connection with the increases and changes in the electrical department, steps have been taken to bring the steam-generating end up to a similar plane of efficiency, the magnitude of the plant being such as to render the coal shovel and low-pressure steam boilers obsolete. The first step in this direction has been taken in the installation of a 500-horsepower Stirling water-tube boiler equipped with a Green chain-grate mechanical stoker. This boiler is equipped with a steel smokestack 125 feet high and five feet in diameter. It is intended that every additional boiler installed will have an individual stack.

An efficient coal-handling system is now under construction wherein 1,500 tons of coal will be stored in overhead bins and automatically distributed to the boilers after having been conveyed from the cars by means of coal-conveying apparatus.

The new engine-room piping runs parallel to the old system and is so arranged that the new sections may gradually be substituted for the old ones without interfering with the operation of the plant.



VIEW OF BELT-DRIVEN GENERATORS WHICH WILL BE REPLACED.



NEW ALTERNATOR DIRECT-CONNECTED TO FLEMING-HARRISBURG ENGINE.

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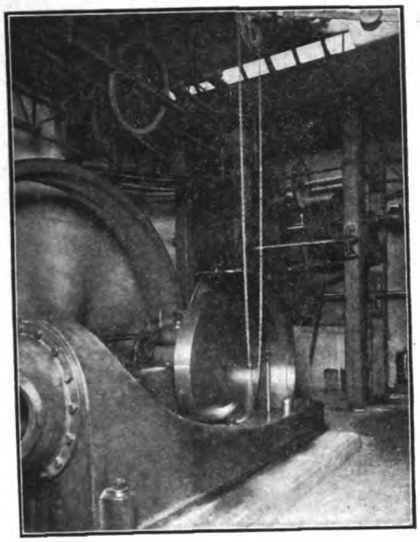
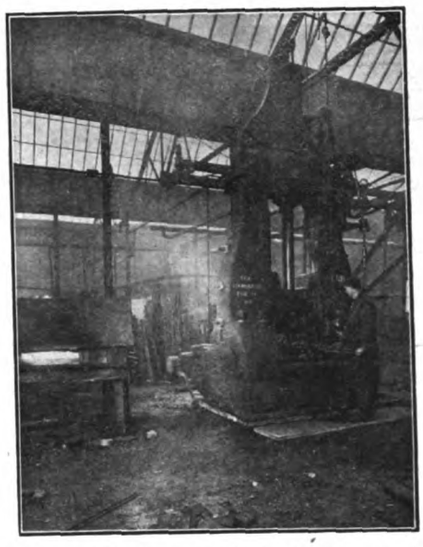
The heating apparatus consists of overhead ceiling coils, using exhaust steam, and connected with a return system of vacuum pumps located in the engine room, the arrangements of the return system being such as to permit of the independent control of the temperature of each building by the engineer in the engine room. The temperature of the entire group is covered in this way. All of the returns are pumped back to the boilers. In this system of heating about 500,000 feet of one-and-one-quarter-inch piping is used, each coil comprising on the average about 1,500 feet.

In keeping with the developments throughout the factory, all of the direct-current arc lamps were replaced by 250-watt tungsten lamps with special reflectors, suspended, one in the center of each truss. A tungsten lamp was substituted for each arc lamp, all of the old circuits and cut-out boxes remaining the same. This system has so far proved very efficient, it being possible in many instances to eliminate the individual machine incandescent lamps.



VIEW OF OLD ROPE TRANSMISSION SYSTEM.



MOTOR-DRIVEN HAMMER IN OPERATION IN SHOP.

The motor system employed comprises various sizes of induction motors, the maximum rating being fifty horsepower each. It is the intention to employ no larger machines than these. All of the speeds and pulley diameters being fixed and the same, it is planned that when a given department can no longer be operated by a fifty-horsepower motor it will be divided into two departments and another motor installed. The second motor can be smaller if desired, and it in turn can be replaced by a larger one as the needs of the department demand. In this way a very flexible power system is provided for.

The weight of the fifty-horsepower induction motor, together with its slide-rails and base, being little over 2,000 pounds, it is very easily handled and it is also comparatively easy to remove the small motor that has become overloaded and replace it with the size larger in such a short period of time that the work of the departments will not be interrupted. The construction of the floors of the shops of cement readily permits of easy anchorage by means of expansion bolts, no other foundation being necessary, while the smallness of the motors permits of their being moved around on an ordinary factory truck. This plan also enables the load of all of the motors to be adjusted to a nicety and keeps the entire equipment in balance.

A similar method is employed with the transformers. The need of a flexible and easily changed method of increasing the power and lighting circuits is most valuable in the automobile manufacturing business where the expanding departments crowd each other, necessitating continued readjustments of power and lighting facilities.

In addition to the above mentioned equipment the entire factory is provided with a modern sprinkler system. With this and an organized fire department on the premises the fire risk is reduced to a minimum.

On account of the innumerable machines and the limited amount of space, the employment of individual motor-driven machines is almost impossible. However, the larger machines are all individually motor-driven, the motors being in some instances belt connected and in other instances direct connected to the machines which they operate. In one of the accompanying illustrations is shown a 300-ton press driven by a General Electric induction motor.

The construction of the plant, together with the details of the installation and maintenance of all power machinery has been under the direct supervision of John Erwood, mechanical engineer, Chicago, Ill., who, associated with Mr. Jeffery, has worked out a programme which provides for the ever increasing lighting, power and heating facilities. The wiring was done by Henry Newgard & Company, electrical contractors, Chicago, Ill. The Fleming-Harrisburg engine was installed for the Harrisburg Foundry and Machine Works by W. W. Bird under the supervision of A. M. Morse, Chicago, district manager of the company.

Another Suit Brought Against the Economy Power Dam.

On December 14 suit was entered in the United States Circuit Court at Chicago by United States District Attorney E. W. Sims, acting under instructions from Attorney General Wickersham, against the Economy Light and Power Company, of Joliet, Ill. The government asks that the company be enjoined not only from doing any further work on the construction of its dam at Dresden Heights on the Desplaines River, but also that the construction work already done be taken out, leaving the river in its original state. The federal attorneys contend that since the opening of the Chicago Drainage Canal the Desplaines River has been a navigable stream and is therefore under the jurisdiction of the Department of War. The contention also is that the company should have obtained a permit from the Secretary of War.

It will be remembered that a few weeks ago a similar suit brought on behalf of the State of Illinois was thrown out by the Supreme Court of that state, and it seemed that the company was therefore firmly intrenched in its projected power development at Dresden Heights.

It is believed that the advocates of the deep waterway from "The Lakes to the Gulf" have prevailed on the federal government that the Economy dam is a hindrance to this project.

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December Meeting of the Electrical Engineering Society of Columbia University.

On December 10, J. W. Lieb, Jr., addressed the members of the Society on the general subject of "The Relations Between the Electrical Industry and the Public." Though the subject is a very broad one, Mr. Lieb's long connection with the lighting industry, especially as vice-president and general manager of the New York Edison Company, indicated that he was well qualified to cover the subject comprehensively, and this expectation was fully realized. Prof. G. F. Sever is to be congratulated upon his success in adding to the already long list of prominent men who have addressed the meetings.

Beginning with the problems of generation, Mr. Lieb called attention to the great increase in hydroelectric plants. He stated that the public clamor against soft coal usually included the indictment that it was used on account of being cheaper than hard coal, which was contrary to the facts, the preference being due to the greater ease of working.

He used many slides during the lecture, the first ones showing Waterside Stations No. 1 and No. 2. As an indication of the revolutionary development among genertaing units, the major part of the equipment of Waterside No. 1, which was installed in 1902, will very shortly have to be scrapped. These two stations are capable of delivering 180,000 kilowatts, which is almost equal to the present output from Niagara Falls. Charts were shown giving the distribution and the hourly, daily, weekly and monthly loads. The load factors in the private house district were about the same as those in the business district, namely, 42.5 and 41.3 per cent, but the hours of use did not coincide, thus creating a valuable diversity factor.

The immense electrical requirements of the Hudson-Fulton celebration were not matters of as great concern to the company as many of the public imagined, for the maximum demand on the station during the celebration was less than one-half of that of the maximum during the preceding December. In conclusion, charts were shown showing the great increase in lamp life and efficiencies now attainable.

Announcements of forthcoming lectures, which will be given by prominent men, will be announced shortly.

Another Plan for Third Avenue Railway.

A second plan of reorganization for the Third Avenue Railroad has been submitted by the Bondholders' Committee of that company to the Public Service Commission. This plan is more nearly in line with the position of the commission, although no reduction in the total securities of the Third Avenue property is contemplated. There are at present mortgages amounting to $58,460,000 on the Third Avenue properties, not counting the underlying issues. The report of the company for the year ending June 30, 1909, showed an amount of $1,300,000 remaining after paying interest on this amount.

The new plan of organization contemplates continuing the present first mortgage bonds and adding 15,799,000 first and refunding four per cent fifty-year bonds.

Metropolitan Lien Injunction.

Justice McLean, in the Supreme Court, has granted an injunction restraining New York City Collector of Assessments and Arrears Moynahan from selling the city's tax lien on the Metropolitan Street Railway Company. The court held that because of oversight, neglect or other official fault exorbitant sums are stated to be due for the taxes on the road between 1901 and 1907.

Justice McLean has also granted an injunction restraining New York city from selling its tax lien against the Second Avenue Railroad Company of New York.

Lecture on Storage Batteries.

An illustrated lecture on "The Care and Operation of 'Exide' Batteries in Electric Vehicles" was delivered in Washington Hall, Detroit, Mich., on December 9, by Bruce Ford, one of the engineers of the Electric Storage Battery Company, Philadelphia, Pa.

The lecture was given under the auspices of the Edison Illuminating Company, of Detroit.

Gyroscopic Balancing.

It is stated that Louis Brennan's master patent of 1903, which has been taken out in thirteen different countries, is so broad in its claims that it covers the use of gyroscopes to make any unstable body stable, whether on land, at sea, or in the air. Dr. Otto Schlick's gyroscope for use in ships to minimize rolling, is stated, on the other hand, to be a device to increase the natural period of oscillation of the ship so that the latter does not respond to the successive rocking efforts of the waves. From this it would appear that Mr. Brennan has a monopoly, which, if not so valuable as such basic patents as the Bell telephone, should at least be productve of considerable returns if sufficiently developed and exploited within the next few years in the fields of terrestrial locomotion and aerial and water navigation.

Cheap Yearly Rates for Electric Current.

According to the London Electrician, the Lighting Committee of the Borough of Hampstead, London, England, has been authorized to enter into agreements with occupiers on a basis of £8 5s 0d (about $41) per kilowatt per annum (payable in advance) for the maximum demand required for lighting houses throughout with electric light, and one (English) penny (two cents in American money) for all current supplied. This is to be done in order to encourage the use of electricity for heating and power in private houses.

Navy Department Supplies.

The Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., will open bids on the dates given below for the following equipment and supplies. Bidders should without delay make application to the Bureau for copies of schedules, being careful to give the schedule number. Copies can be obtained on application to the Navy Pay Office nearest each navy yard.

Date of Opening.	Material.	Quantity.	Delivery at Navy Yard.	Schedule No.
December 21, 1909...	Appliances, wiring	Miscellaneous	Norfolk, Va	2025
	Cells, storage battery	24	" "	2025
	Conduit and fittings	Miscellaneous	" "	2022
	Lamps, arc, direct current	25	" "	2025
	Lamps, flame and carbon arc	12	Brooklyn, N. Y.	2021
	Mica, uncut	100 pounds	" "	2022
	Panel, battery control	1	Norfolk, Va	2025
	Supplies, electrical	Miscellaneous	" "	2025
	Unions, conduit, brass	2,550	" "	2022
	Voltmeter and millivoltmeter	1 each	" "	2025
	Wire	Miscellaneous	" "	2021
	Wire and cable	"	" "	2025
	Wire, fireproof, solid	2,950 feet	" "	2021
	Wire, rubber-covered	28,000 feet	Brooklyn, N. Y.	2021
December 28, 1909...	Generators, 2 kilowatt	5	" "	2040
	Tape, rubber, insulating	2,600 pounds	" "	2045

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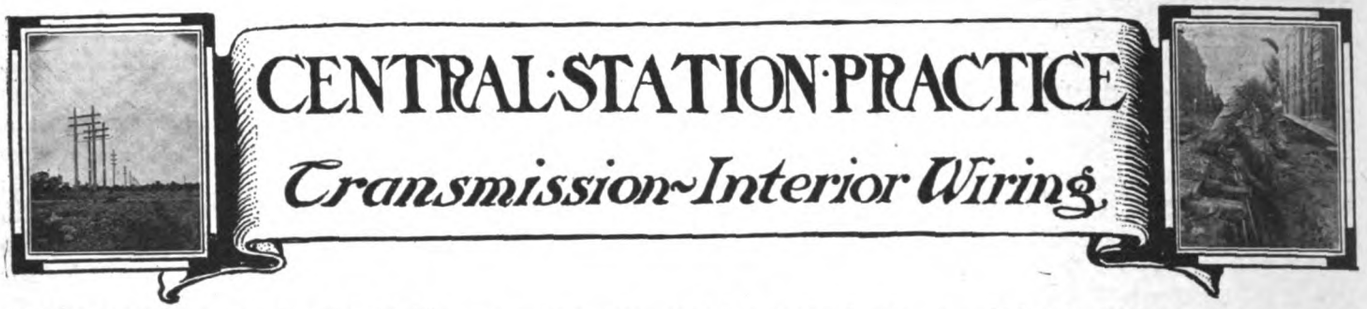

DEVELOPMENT OF ELECTRICAL UNDERTAKINGS.[1]—III.

BY S. J. WATSON.[2]

One of the greatest changes that has taken place in recent years has been in the extended usage of multiphase current, brought about principally through the necessity of generating and transmitting high-pressure currents which could be reduced to a lower pressure by means of static transformers and then used for power purposes.

As it has become the common practice to generate multiphase currents, it is somewhat remarkable that so little has been done in the distribution of such supply direct to consumers without conversion. A three-phase system of generation and distribution at high or extra high pressure to static transformers, and thence through a three or four-wire low-tension network to consumers, appears to offer the highest efficiency with a minimum cost for attendance and for capital outlay, and in the future I feel sure that progress along these lines will be recorded. On the other hand, without wishing to raise a heated discussion on the respective merits of direct versus alternating-current motors, there is no doubt that many manufacturers appreciate and have taken full advantage of the improved results obtained by using direct-current motors with efficient long-range speed-regulating devices, and would not have a constant-speed motor even if it was given to them. For other classes of work the alternating-current motor, with the speed depending on the periodicity and practically unaffected by changes of pressure or load, has undoubtedly given good results, but with the exception of the fine spinner and a few other special trades, and then only when they are always engaged in the production of materials of exactly the same kind, I am not altogether convinced that a direct-current motor with speed regulation will not be equally satisfactory. It naturally follows, I think, that what may be the best speed for a given machine, be it a lathe, a rolling mill, a spinning mule or frame, or a loom when in use on the particular class of work, will not be the best speed when in use for a different class of work, and, therefore, some range of speed is a very desirable thing to have. I have been led to this conclusion through remarks made to me recently by two different textile manufacturers in my town. Both of them installed a few direct-current motors with shunt regulators to drive a portion of their premises. These worked very well, and I was subsequently approached in regard to the driving the remainder of the mills. A question then arose as to whether they should continue to use the existing direct-current supply or wait a few months until alternating current is available. In each case, much to my surprise, on pointing out how much better it would be to use constant-speed alternating current motors with no brush or commutator troubles, I was told that they did not want constant speed, as they had found it exceedingly convenient to alter the speed slightly to suit the work they might happen to be engaged on, and in regard to commutator troubles, they had not experienced any, and so would not benefit by the change. Some amongst you have probably had experience exactly opposite to the above, but I am inclined to think that the failure of direct-current motors in many instances has been due to the fact that the supply was given from private plants, and probably had considerable variation in voltage with consequent variation in the speed of the motors, or that the motors were over-rated and varied widely in speed with changes in load. Where such a condition of affairs existed, obviously much better results would be obtained by using alternating-current supply from the public mains. Most supply undertakings having alternating-current generators naturally enough wish to sell their supply without conversion, and they may be inclined to overlook the advantages their customers might obtain if such supply was converted to direct current.

In regard to distributing and feeder-cable systems, it is extraordinary what little alteration in methods obtain today as compared with 1894. The only changes of importance to be chronicled are that vulcanized rubber insulated cables have ceased to be laid for underground work, and the same remarks must also be made concerning the various systems with bare copper conductors. Otherwise the practice today is almost identical with that of 1894. Cables were then laid solid in wood or iron troughs and filled up with bitumen or were drawn into stoneware conduits very much in the same way as they are today, and advocates for one system or the other were equally strong in their approbation or condemnation then as now, but I think that on the whole the tendency is more towards the use of cables having an insulated outer covering such as bitumen than a conducting covering such as lead. One important improvement has been carried out, as it is now common practice to divide up the distributing network into sections correspondingly roughly to each feeder, and to provide fuses for each set of distributors so that a fault or a short-circuit on one set of cables shall not interfere with the maintenance of the supply to the others.

Integrating meters both for direct and alternating current have been much improved in recent years both in accuracy over a long range, in the smallness of the starting current, and in general reliability. Considerable ingenuity has also been shown in the design of slot, two-rate, and time meters.

Although a great deal has been said and written at different times in regard

1 Chairman's address at opening meeting, Institution of Electrical Engineers, Manchester (Eng.) Section, October 22.
2 Borough Electrical Engineer, Bury, Eng.
Note.—The English money values have been changed in all cases to approximate American figures.

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to the charges for electricity supply, I am tempted to say a few words on the matter. The fundamental groundwork on which the charges are based is very well known and need not here be referred to, but it is in the application of these principles that there exists so much difference of opinion. Some discrimination must be shown between the long and the short-hour user, between the large and the small consumer, between those using the supply intermittently and those using it continuously, between those who are prepared to use it for a short time after sunset, and those who will agree not to do so during this period, and so on. No tariff has yet been devised that will take into consideration all these different elements, nor would it appear possible to work out a tariff that will deal in a fair and comprehensive manner with the great diversity of conditions which must always prevail.

It is probably less difficult to ascertain the amount to be charged to individual consumers on account of the working expenses of the generating plant than to arrive at a fair figure for the cost of distribution. Apart from other factors, an appreciable difference in price should be quoted to a consumer who only necessitates an expenditure of $500 on mains as compared with another at a distance on whose behalf $25,000 has to be spent. The capital charges in the one case at ten per cent per annum will be $50, and in the other $2,500. If the revenue received from each consumer at the same price per unit is $25,000 a year, it is clear that one is being charged five per cent too much and the other five per cent too little for the services rendered.

Another point which is often lost sight of is that the cost of meter reading and repairs, office expenses in making out and collecting accounts, depends entirely on the number of consumers supplied or on the number of meters fixed, and is independent of the consumption of each consumer or on the amount of the annual account. Assuming that 500 consumers are supplied using between them 1,000,000 kilowatt-hours a year, and that the cost of the above items come to $2,500 a year, equal to $5 per consumer per annum, or an average cost of 0.24 of a cent per unit on the total consumption. If one additional large consumer is connected using another 1,000,000 units a year, which at a power rate of one cent per unit would give an income of rather more than $10,000 a year, the extra cost of the items mentioned will only be $5 per annum instead of another $2,500, and it would be grossly unfair to reduce the charges to the other 500 consumers by 0.12 of a cent per unit and to charge the large consumer 1.12 cents instead of one cent per unit when the actual cost of supplying him is only quite an insignificant sum. Moreover, the difference between the price of 1.12 cents and one cent per unit on the output supplied to the large consumer is twelve per cent, and represents in cash nearly $1,250 a year, surely no small matter in these days of competition.

I have only mentioned these two aspects of the problem to illustrate the difference which must be made in the charges as between one consumer and another if the business is to be carried out on sound commercial lines, and how unjustified is the contention so often put forward by those insufficiently acquainted with the subject that all consumers should be charged alike without taking into consideration all the circumstances of the case.

There is just one other point in connection with charges for power supply on which I should like to say a few words here in Manchester, the busy industrial center of Lancashire. When the question of power supply has been under discussion at engineering meetings in this and other districts, I have heard the remark made time after time, that if any great progress is to be made in the application of motor power supply from public mains, the price will have to be brought down to about 0.6 of a cent per unit, because that is the total inclusive price (usually stated as rather on the high side) it is costing large consumers to work their own plant. Well, gentlemen, figures speak for themselves, and if there is one fact more than another which stands out prominently in connection with the most of the supply undertakings in Lancashire it is in the tremendous growth in the demand for power supply during the last few years. At first only comparatively small users were connected with ten to twenty horsepower, then, with slight concessions in price, applications came in from those having fifty horsepower, and with further slight concessions in price from 100 horsepower, and so the demand has increased by leaps and bounds, until today there are quite a number of consumers connected with demands of 1,000 horsepower and upwards.

To demonstrate the many advantages incidental to electrical driving, it has doubtless been necessary for undertakings in some cases to enter into a contract to supply at 0.6 of a cent per unit, but I feel quite sure it is unnecessary to quote so low a figure nowadays. Many large manufacturing concerns have found it remunerative in the long run to purchase from outside sources at prices varying between one and one-half cents and one cent per unit, depending on the conditions; but, unfortunately, it is difficult to get those who have made the change to come forward and give facts and figures to show what electrical driving has done for them. We are mostly left to assume that they are entirely satisfied through the way motor installations are extended as the opportunity occurs. There is not the slightest doubt also that a price between one and one-half cents and one cent per kilowatt-hour is quite sufficient to enable the most of the larger undertakings to maintain and even improve their financial position, as their accounts show that with the access of the power load at these low prices the working expenses per unit have been very largely reduced and improved financial results attained. These prices are only intended to refer to mills or workshops using the supply during ordinary factory hours and where fuel can be obtained at about $2 per ton. For longer hours the price can be appreciably reduced. If the demand can be used twenty-four hours a day all the year round it would be possible to quote a works situated near the power station a price of 0.4 of a cent per unit, equal to an annual charge of $35 per kilowatt per annum. The load factor in such a case would, of course, be 100 per cent. As a better load factor than this cannot be obtained, the working expenses could not be further reduced, but a slightly lower price might still be quoted if a consumer was able to appreciably reduce or entirely cut out his consuming device during certain hours in the winter months as a portion of the capital charges on the generating plant would then be allocated elsewhere. It does not appear likely that many large consumers of this kind will be forthcoming in the immediate future, and if they do arrive there will be very keen competition on the part of supply undertakings to obtain their

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custom, but an outlet for the supply under such conditions may eventually be found if investigation into one or another of the chemical or metallurgical processes are brought to a successful conclusion.

I have endeavored to show that progress has, indeed, been made by electrical supply undertakings during the past fifteen years, and to define some of the means whereby such progress has been possible. In this case it is, however, somewhat difficult to discriminate between the cause and the effect, but I consider that probably the most important influence has been the gradual reduction in the price of electrical plant and appliances. Large generators which cost $30 per kilowatt can now be obtained for $8. Motors which cost $600 can now be obtained for $150. It may, in fact, be said that the price of all standard electrical apparatus has been reduced fifty per cent to seventy-five per cent. The use of electricity has in consequence steadily grown in popularity, and with the increase in outputs supply authorities have also been able to grant large reductions in the price per unit.

The only matter for regret is that many of the old-established manufacturing concerns, who have contributed so largely to the success of the industry, have not themselves received the financial reward their services deserve. The difference between a successful and an unsuccessful business is, after all, only a question of the addition or deduction of a few per cent to or from the manufacturing cost of the article produced. The annual value of appliances made and sold in this country has immensely increased during recent years, but coincident with this there has been no improvement, but rather a falling off, in their financial position.

In the earlier years of any industry changes and improvement take place at more frequent intervals of time than is subsequently the case, due in no small measure to the keenness and perseverance with which the young and vigorous brains and bodies of those always associated with new industries in the early days, are applied to the solving of the different problems as they arise. The electrical supply business will doubtless in time tend to remain stationary rather than to make further advancement. It does not appear possible, for instance, that manufacturers can reduce the cost of appliances by another fifty per cent or seventy-five per cent, or for the costs and charges of some of our larger supply undertakings to be reduced by a similar amount.

Cheap Electric Power from Coke-Oven Gas.

A dispatch from Big Stone Gap, Wise County, Va., states that this place will shortly be in a position to offer to the manufacturing world the very cheapest power to be obtained. The source of this power is coke-oven gas, a hitherto waste product of no value.

A short while ago a progressive coke operator in Wise County connected by a flue thirty-nine ovens and conducted this gas to his boilers, four in number, of 300-horsepower each, and from this gas as fuel, he is supplying power to run two 300-kilowatt, 1100-ampere generators, and a large compressor as well, at a cost which is slightly less than three mills per kilowatt-hour. This is on a small development of 1,000-horsepower. So satisfactory is this installation that he is now laying copper wire to the next plant, which he will supply with an electric current.

Big Stone Gap is the actual hub of the coalfields, and within a comparative short radius of the town there are 3,800 coke ovens and therefore there seems to be a possibility of an immense development in the future.

Hydroelectric Plant in an Old-World Village.

The village of Grassington, on the River Wharfe in Yorkshire, England, is one of the oldest "townships" in that part of the world, insomuch as it has a charter granted as long ago as the year 1286. In size, however, it is but a small village, having a population of about 500 people.

In spite of its small size and venerable antiquity, Grassington now possesses a modern electric-lighting plant, which was officially inaugurated a few weeks ago. The plant is hydroelectric and is of the simplest description throughout. The working head of water is eight feet, and a twenty-six-inch, vertical-shaft, water turbine is used to drive, through gearing, a twenty-kilowatt open-type, protected, continuous-current dynamo at 1,100 revolutions a minute. The supply pressure at the consumers' terminals is 230 volts.

The price for lighting is ten cents per kilowatt-hour, special rates and arrangements being made for power service whenever this may be required.

A Review of Electrical Development in England.[1]

Little advance has been made in the efficiency of the generating plant, and indeed there was little to expect with an existing efficiency of some ninety to ninety-three per cent. Large units have of course been constructed, and the form of generator modified to keep in touch with its prime mover.

Progress in the method of construction and improved quality of material have of course been added to the efficiency of modern machines. In high-speed machines the use of stalloy iron may increase the efficiency by one to two per cent, the use of ball bearings is also another improvement especially for increasing the efficiency of light loads. The use of interpoles on direct current machines is beneficial from the efficiency point of view, the losses in the commutator can be much reduced by the use of interpoles, though the losses in the interpoles themselves have to be remembered, and as the air gap can be much smaller than in machines without interpoles, hence smaller field losses occur in interpole machines than in other types of dynamo-electric machines.

In transformer construction the use of stalloy iron has reduced the no load losses by forty to fifty per cent without increasing the prime cost of the apparatus.

Vast improvements have been made in switchgear, the work being now more substantial necessarily owing to the use of heavy currents and higher voltages.

Considerable economies have been effected both by the use of simple devices and arrangements for the meeting of given service conditions, and also by the simplification of constructional details in individual apparatus.

The cost of oil switches and circuit breakers for most services has decreased without the loss of efficiency. An instance might be mentioned of the modern traction feeder circuit breaker, consisting of only a copper brush carrying an auxiliary metal and carbon contact, and pressed home onto two plain copper blocks by means of a simple toggle joint and handle. Compare this with the old arrangement of magnetic blow-out breaker, or an early design of carbon circuit breaker for the same service.

1 Abstracted from President W. M. Rogerson's inaugural address, "Electrical Power for Light and Tramways," to the Leeds Local Station of the Institution of Electrical Engineers, October 27, 1909.

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Another instance is in the protection of a high-tension feeder circuit, where direct-acting trip coils are excited off instrument current transformers and given protection against overloads, with a time characteristic and discrimination against faults to earth, without the use of relays, dashpots, clockwork, auxiliary supply circuits and batteries, auxiliary trip coils to work with same, together with current transformers, which would have been supplied for the same service a few years ago.

Slate is commonly used now where it was once thought necessary to use marble with insulating bushes, and the recent reduction in the cost of aluminum is bringing this material into use in place of copper, now that satisfactory methods of working it have been evolved.

The enlightened application of electrical storage to the needs of a power station, whether direct or alternating current be generated is proving another fruitful source of saving in operating costs. While of course a load which can be economically dealt with by a generator should never be thrown on storage, yet there are in every generating station fitful and fluctuating demands that are unremunerative if supplied direct, in which case storage becomes a real boon, and properly proportioned as to capacity, may be made to contribute to revenue, so that the capital expenditure on the battery equipment, plus interest, upkeep, etc., are entirely redeemed in the course of a few years.

No great changes in the construction of accumulators have to be chronicled, yet present-day cells of reputed makers are in numerous respects an important advance due to careful development and improved methods of mounting.

Negative plates of the "box type," in which the active material is no longer expected to be partly self-supporting, retain their porosity and capacity much longer than the plate form.

By thorough screening of plates of opposite polarity by porous diaphragms, the tendency to buckling has been lessened, and there is no need to prospect for likely "shorts" with a battery stick between the electrodes, thus disturbing the active surface. Again, the avoidance of internal structures as far as possible (plates being now almost universally suspended in tension, instead of resting on bottom blocks) taken together with a liberal clearance for sediment, puts off by years the need of cleaning-out operations, and thus tends to increase the useful life of cells. Of course, weight should be the determinating factor in the purchase of a battery, other things being equal, prima facie, the more lead there is in the plates to begin with, the greater the life and the residual value at the end.

The revenue-earning capacities of a battery on the old-time method of floating batteries with cell regulators, charging batteries for hours and then allowing them to stand charged, inactive, waiting to be discharged, is not the most profitable way of using storage, and its real potentialities can only be brought by the automatic reversible booster. With modern practice, a quick-acting sensitive reversible booster controls the battery, and compels it to contribute its fair share of the work during the entire twenty-four hours of the day, and thus enables the boilers, engines and generators to be operated throughout at the point of highest efficiency. Efficient control, in fact, is the crux of storage battery engineering, as in this, far more than in the battery itself, depends the success or otherwise.

Another form of remunerative utilization of electric storage I can forsee, in the supply of current for lighting purposes and power, in districts served by electric tramways, but to which mains have not yet been extended. Of course, voltage variation at the nearest feeding point would cause the supply to be defective, if taken direct apart from interruptions, which are bound to occur from time to time; but the employment of a battery, together with a suitable booster and motor generator, would solve the problem satisfactorily, a relatively small battery sufficient to watch over the local circuit, when the breakers come out on traction, and after tramway service hours would suffice. There is, I think, much scope for the development of this class of supply, in the interests of undertakings owning combined stations.

Vulcanized rubber was largely used as an insulating material in early days, while pot drain pipes and cast-iron conduits were used for drawing into. Rubber insulation has, however, proved unsatisfactory, and to a large extent vulcanized bitumen and lead-sheathed paper cables have taken its place, either drawn into earthenware or iron conduits, or laid solid in pitch or bitumen in wood or iron troughs; the question of joint boxes and disconnecting pillars has also received consideration. Also the type of cable has to a large extent been changed, triple concentric and three-core taking the place of three singles, so diminishing the cost of the necessary protection, and minimizing the chance of electrolysis. The fear of electrolytic action in connection with lead covered cables has died out, as is evident by their almost universal use.

Another consideration has been the very greatly diminished cost of service connections, though there is no doubt room for great improvements in this direction still.

Meters will now start on a smaller current, are accurate on much smaller loads and give a straight curve up to full load and also with considerable overload; starting current is indeed of great importance with the introduction of the new metallic filament lamps.

The introduction of this lamp has been the most remarkable event of late years, when it is considered that at least three times the light can be obtained with the same energy, its advent has been and will be severely felt by supply authorities, and although in time losses will be made good, yet it has to be remembered that additional capital will have to be laid down in the shape of service connections to obtain the same revenue, so that it is imperative that energy in another form, as for heating and cooking, will have to be used, if we are to maintain our revenue from the private consumer.

Waterpower in Europe.

According to Herr Koehn, says *The Electrical Engineer*, of London, England, the available hydraulic power of Europe is distributed as follows: Austria, 6,460,000 horsepower; France, 5,857,000; Germany, 1,425,900; Great Britain, 965,000; Italy, 5,500,000; Norway, 7,500,000; Sweden, 6,750,000; Switzerland, 1,500,000. Russia and the Balkan States, which are among the districts left out of the above list, also possess great possibilities.

A Novel Use for Electricity.

A curious patent has recently been issued to a German inventor. This is for a device for milking cows, in which the flow of milk is to be promoted by subjecting the animal to a "slight electric shock." While reserving comment on the humanity side of the question, it would be interesting to note what attitude the cow herself would take toward the operator of such a device.

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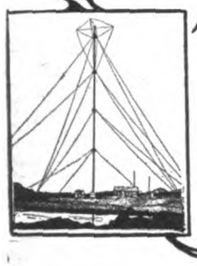

TELEGRAPHY—TELEPHONY and WIRELESS.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION.

REPORT OF CONVENTION SESSIONS ON DECEMBER 8 AND 9.

As was already reported in these columns in the previous issue the annual meeting of the International Independent Telephone Association was held on December 7, 8 and 9 in the Auditorium Hotel, Chicago, Ill. An account of the first day's meeting of the convention was given in the last number. A summary of the proceedings of the second and third days will be found below.

Owing to the temporary absence of the president, the Hon. E. H. Moulton, Minneapolis, Minn., and the vice-president, P. C. Holdoegel, Rockwell City, Iowa, the second session, opened Wednesday morning, was presided over by the Hon. E. B. Fisher, of Grand Rapids, Mich., second vice-president.

After the opening of the meeting, F. T. Dagger, of Ontario, Can., presented a very interesting paper on the subject, "Is the Telephone a Natural Monopoly?" dealing with the conditions which tend to establish monopolies not only in the telephone business, but in any industrial operation. No reasons, he stated, could be given and properly supported, that the telephone or any other business was naturally a monopoly. After the twenty years of monopoly in the telephone business which preceded the expiration of the Bell telephones, there were approximately one-quarter of a million telephones scattered throughout the United States, while at the expiration of twelve years of competition this number was increased to nearly seven million. Similar conditions prevailed in Sweden, where, after the sale of the Bell companies, and after some years of competition between the government company and the independent company, there was an average in Stockholm of 230 telephones to each thousand inhabitants. In direct contrast to this is the city of Chicago, in which there has been for thirty years undisputed monopoly, there is an average of only seventy telephones to a thousand inhabitants.

The Telephone Fire Insurance Exchange was the subject of a paper read by J. B. Hoge, Cleveland, Ohio, in which he spoke of the necessity of carrying company insurance on the telephone exchange and properties. The Telephone Fire Insurance Exchange operates in much the same way as the Mutual Life and Fire Insurance Company. Inspectors are employed to look over the equipment of the plants, and the company not only insures the building in which the exchange is located, but the entire system. That the company is in good condition financially may be seen from the fact that less than sixty-five per cent of the contingent fund is necessary to pay all losses and expenses.

Frank H. Woods, in dealing with "The Proposed Changes in the Association," said that he felt the need of steps toward a better organization, and commended the association on the work that had already been done toward such an end. Feeling the need of a better and closer organization, a committee, of which Mr. Woods was chairman, presented a report on amendments. One of the important things brought up for consideration was the change of name of the association from "International Independent Telephone Association" to "National Independent Telephone Association," as the Canada section has already formed an independent organization. Although the election of president has always been carried out in the past by popular vote on the last day of the convention, this was found to be unsatisfactory, and a motion was brought for the election of fifteen delegates to elect a president. Motion was also brought to assess each member of the association five cents per unit on their telephone exchanges, the money to be used in carrying out the work for the next year. The motion for the adoption of all of these amendments was unanimously carried.

H. L. Gary in speaking of the laws governing telephone companies urged the framing of such contracts with the association that even should the holders of telephone stock sell to the Bell company, or any other monopoly, the stock of the sale should be subject to the National Independent Telephone Association, and could not conect with the Bell company's lines. He mentioned a few companies, including the Des Moines telephone system which could have been saved from the Bell company by such contracts. He also urged strongly against the use of dual connections, stating that if they were not supplied they would not be demanded by telephone users.

C. B. Cheadle in discussion referred to the decision of the United States courts against all combinations which had been involved in legal proceedings. H. T. Critchfield, of Chicago, added that of the calls his company had received eighty-three per cent were in Illinois, and eighty-nine per cent were within the two states of Illinois and Indiana. He stated further that in two-thirds of the county seats no real competition with the Bell company had ever existed. A decided sensation was created by Mr. Critchfield's announcement that contracts have already been signed insuring the carrying out of an independent telephone system in competition with the Bell system in the city of Chicago between now and the end of the year 1910. Contracts for the carrying out of this project have been underwritten and signed by men of undoubted business ability, and contracts for connections have also been made.

The afternoon session of the Technical and Operating Conference was opened by a paper on "Office Accessories" presented by John W. Coffey, secretary of the Independent Traffic Association, Indianapolis, Ind. This seems to have been a much neglected side of the equipment of many telephone companies, and he demonstrated by many examples how improved methods of letter filing and account keeping would increase the income of nearly any tele-

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phone company. After a short discussion of this paper the meeting was turned over to the officers of the convention, who reported the names of the seventeen directors entrusted with the management of the association and the election of a president. The directors elected were: E. H. Moulton, Minneapolis, Minn.; Theodore Gary, Macon, Mo.; S. W. Harper, Wheeling, W. Va.; Walter J. Uhl, Logansport, Ind.; Manford Savage, Champaign, Ill.; E. F. Day, Council Bluffs, Ia.; Wm. A. Jackson, Detroit, Mich.; Walter E. Doolittle, Lafayette, Ind.; A. E. Boqua, Ft. Smith, Ark.; Frank H. Woods, Lincoln, Neb.; E. B. Fisher, Grand Rapids, Mich.; O. C. Snider, Kansas City, Mo.; Charles West, Harrisburg, Pa.; S. A. Ward, Mansfield, O.; H. D. Critchfield, Chicago, Ill.; Max Koehler, St. Louis, Mo., and Richard Valentine, Janesville, Wis.

The conference was then continued with the paper on "Practical Methods to Handle Increased Volume of Toll Business" by W. S. Vivian, secretary of the Michigan Telephone Traffic Association. Mr. Vivian gave an account of his work in systematizing the phrases and methods of the central offices of the independent companies in Michigan. He dwelt particularly on the value of using certain definite phrases in establishing long-distance telephone connections. This is a direct revolution against the old method, which directs that the operator shall get a message through and "get it through anyhow."

Max W. Zabel, Chicago, treated the subject of "Patents—Uses and Abuses," especially as it applied to the telephone manufacturing industry. He pointed out several errors in the methods of taking testimony in patent cases and in the complicated and almost endless methods of litigation now in use.

The convention passed again to the subject of economic operating, or the paper on "Some Economic Problems in Telephony" by J. P. Boylan, Cleveland, Ohio. Speaking of the difficulty of obtaining experienced operators, he raised the question as to whether it would not be more economical for each company to train its own operators rather than to try to secure experienced girls. At the schools in Louisville, Ky., and Detroit, Mich., the operators are trained at an exceedingly small expense, and with excellent results. The meeting was then adjourned to resume the following morning.

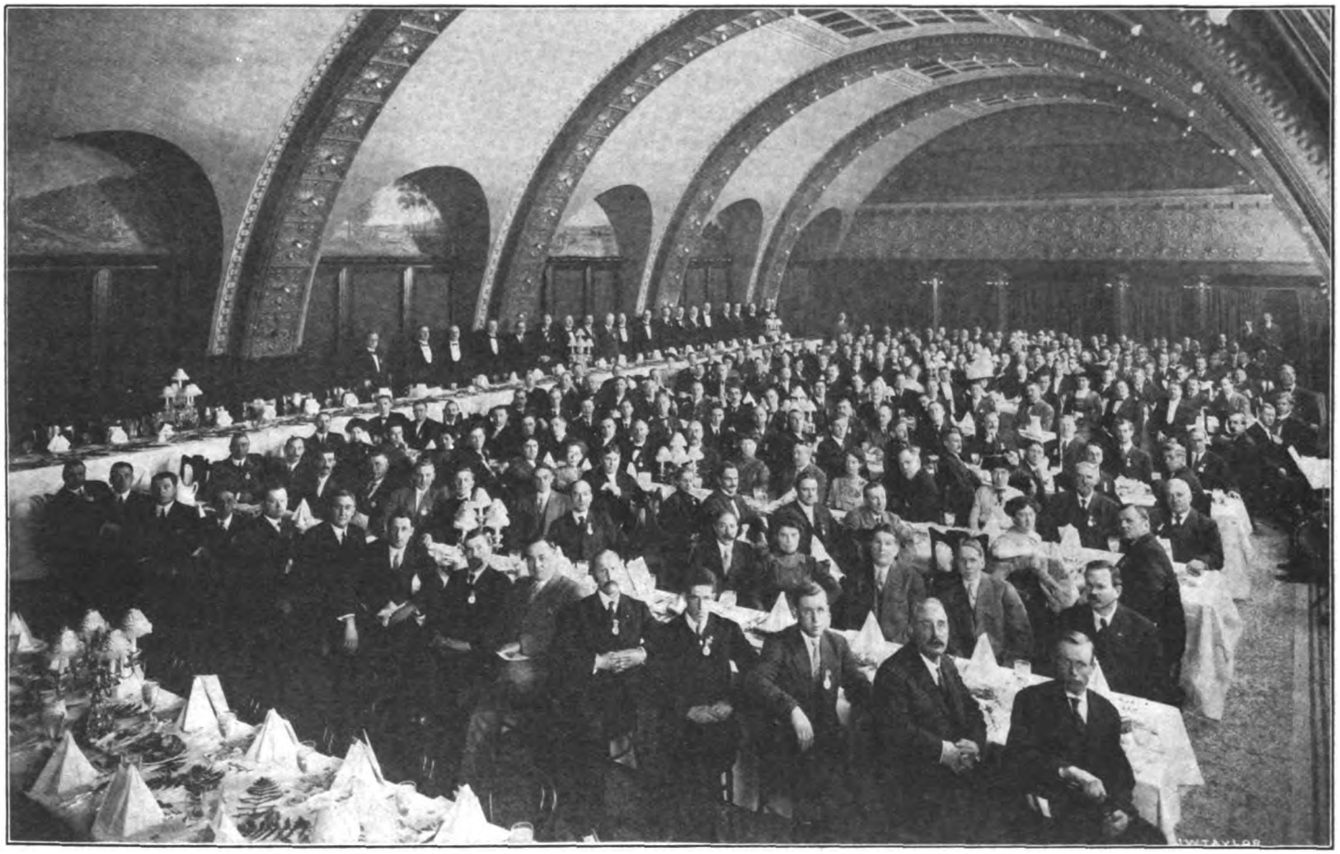
The annual banquet given Wednesday evening was a great success, and in spite of the fact that the president, Hon. E. H. Moulton, and secretary, A. C. Davis, were unavoidably absent, proceedings went on with the joy of good fellowship so necessary to such events.

Hon. Mat. G. Reynolds, St. Louis, Mo., responded to a toast "Truth is the Daughter of Time," and encouraged the spirit of loyalty which brings men engaged in the same business and fighting the same battle together for conference and discussion.

Manford Savage, Champaign, Ill., speaking of "The Emblem," remarked that the Bell company had up to a short time ago regarded the independent as "goats which jumped into an enclosure containing sheep adorned with the blue bell of the Bell company."

In the "Live Wire," a toast responded to by Hon. W. B. Pedigo, Parkersburg, W. Va., a brief outline was given of the development of the independent companies, and showed how their precept of "the public be damned" had been to their great disadvantage. He concluded with the wish that the independents might always give the greatest good to the greatest number.

N. G. Hunter, Wabash, Ind., was one of the first independent telephone men and his reasons on the subject "Why Independent Telephones Should be Supported" were full of the logic given by



MEMBERS OF THE INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION AT THEIR BANQUET IN THE AUDITORIUM HOTEL, CHICAGO, ILL., DECEMBER 8, 1909.

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years of hard fighting. "It is public opinion," he said, "that has raised the independent telephone companies to their present position, and so long as public opinion is on their side they will hold this position." He spoke for close organization and for permanency, discrediting any tendency towards monopoly.

D. M. Neil, Red Wing, Minn., told of the difficulties the Bell Telephone Company had met with and were meeting with in Minnesota. They have for some years, through laws which have been passed, been unable to declare any dividends, and are at present unable to pay their debts. In this State at least are the independent companies triumphant.

H. D. Critchfield was called upon for an impromptu talk, and responded by telling of some of the methods used by the Bell company for fighting their competitors. He stated that there could be no doubt of the success of the independent companies if they continued to support the public as the public has supported them. Such co-operation cannot fail to improve the association, which is even now in better condition than it has ever been before.

The Thursday Technical and Operating Conference was opened by Gansey R. Johnson, chairman, who, in the absence of H. E. Davis of Topeka, Kans., read his paper on "Operators; Answering Jacks; Maintenance." After a short discussion of this the meeting was continued by a paper on "Why Good Construction Reduces Depreciation" read by C. H. Judson, Seattle, Wash. The company represented by Mr. Judson has met with unqualified success in enforcing the installation of pay-telephones in drug stores and public places. The installation of these telephones had a deterrent effect on useless conversations, and considerable increase in the revenue of the company. There are at present no free telephones in Seattle with the exception of those of the Bell company, and even when one of the independent telephones is installed in the same store and even beside a free Bell telephone, there has been a monthly income of as high as $30.00. The growth of Seattle is at present so rapid that in many cases it is impossible to promise installation to some subscribers before a period of six months. Even under these conditions people have waited for an independent telephone rather than to take the Bell.

Franklin H. Reed, editor of *Telephony*, in a paper on "Co-operation as a Factor in Development," dwelt on the necessity of exchange of useful ideas through the technical papers. When one man finds some new method of solution of a problem it is his duty to his fellows to make that known in some way, and there is no simpler way than writing an account of the difficulty to some technical paper. If each operator would do this and each operator would read the technical papers there would be no doubt of the value of such co-operation. In discussion Mr. Johnson stated that he had obtained excellent results by subscribing for several magazines and giving the desired articles to his employes. At the close of this discussion Hon. E. B. Fisher opened the convention proper, and, after reading a few resolutions which were unanimously carried, the matter of collecting money for the next year was taken up. Through a popular subscription the amount of $20,000 was collected, the Continental Telephone and Telegraph Company alone giving $10,000.

EXHIBITS AT THE CONVENTION.

As is customary, a fairly complete exhibit of the electrical industry was held by the leading electrical manufacturing companies of the country and these were only second in importance to the convention itself. A few of those which attracted the most attention are given below:

The American Automatic Telephone Company, Urbana, O., exhibited a full line of switchboards and instruments and also an assortment of telephones and parts for both the automatic and manually operated systems. This exhibit also contained a number of electric clocks, time stamps, etc.

The Automatic Electric Company, Chicago, Ill., showed a complete equipment of automatic telephones and telephone systems.

The American Electric Telephone Company, Chicago, Ill., exhibited their latest switchboards, telephones and parts.

The Corwin Telephone Company, Chicago, Ill., offered for inspection its interior telephones.

The Dean Electric Company, Elyria, O., included in its exhibit, telephone switchboards, harmonic ringers and a full line of apparatus.

The Electric Appliance Company, Chicago, Ill., exhibited an assortment of Cracraft-Leich telephone equipment and a general line of supplies.

The Ericsson Telephone Manufacturing Company, Buffalo, N. Y., showed telephones, switchboards and parts.

The Holtzer-Cabot Electric Company, Chicago, Ill., exhibited a motor-generator set in operation, watchmen's clocks and a completely inclosed, waterproof mine telephone.

The Kellogg Switchboard and Supply Company, Chicago, Ill., showed some of their latest boards and a complete exhibit of telephones and supply parts.

The North Electric Company, Cleveland, Ohio, presented its auto-manual and manual switchboards, telephones and accessories.

Monarch Telephone Manufacturing Company, Chicago, Ill., exhibited switchboards, telephones, time service systems and supplies.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., showed telephone apparatus, aerial and underground cable.

The Swedish-American Telephone Company, Chicago, Ill., presented for inspection its telephones, switchboards and parts.

To Value Wire Lines.

Following closely after the recent reports of the merger of telegraph systems in the United States, a concurrent resolution was introduced last week in Congress by Representative Hitchcock of Nebraska directing the Secretary of Commerce and Labor to have the Bureau of Corporations prepare for Congress a statement of the physical valuation of the telegraph, telephone and cable lines and other tangible property belonging to the Western Union Telegraph Company, the Postal Telegraph and the American Telephone and Telegraph Companies.

The data will be complete to December 1, and is to embrace the subsidiary concerns, include the capital stock and the bonded debt of each of the three corporations and approximately the market value of the stock and bonds. The resolution authorizes the bureau to employ surveyors and appraisers for this work.

A Smoke Recorder.

An automatic smoke recorder, which has been placed on the market in this country, is attracting attention from cities where smoke ordinances are in force. The chart continuously shows the comparative blackness of the smoke at any time.

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ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

ILLUMINATING ENGINEERING SOCIETY, OF GREAT BRITAIN.

INAUGURAL ADDRESS OF ITS FIRST PRESIDENT, PROF. S. P. THOMPSON.

On November 18 there was held the first regular meeting of the newly organized Illuminating Engineering Society, of Great Britain. The principal incidents relative to the formation of this British sister society to the American body of the same name have been chronicled in these columns at various times during the past year. The inaugural meeting was held at the quarters of the Royal Society of Arts, London, and the leading feature of the meeting was the presentation of the inaugural address of Prof. Silvanus P. Thompson, the first president. An excellent abstract of this address was given in *The Electrician*, London, November 26, and from this the following is taken:

In these days when so many associations exist for the diffusion of knowledge the foundation of any new society is a proceeding of questionable expediency unless it can justify its claim to existence. Its founders must be prepared to show that there has arisen some new science or else that in the organization of the sciences there has occurred some real need which existing societies fail to meet. Those who have founded the Illuminating Engineering Society have no hesitation whatever in putting forward the claim to justification on both these grounds. This society has, in fact, been founded to bring together all those who are interested in the problems of the art of directing and adapting light to the use and convenience of man. Their diverse and individual interests center around a common topic which, in default of a more appropriate name, is known as "illuminating engineering."

To advance the subject of illuminating engineering; to investigate the facts within its domain; to increase and diffuse knowledge respecting them; and to unite those who are devoting their energies to those things are the objects of the society. The ascertained facts are few; their significance is immense; their economic and social value is great but the ignorance respecting them generally is colossal. The subject is too new; for practically a century only have there been any systematic means of illumination in use and it is only within the last few years that the present position has been reached in a few enormous strides.

Foremost in the work of the society there must stand the question of units of measurement and the promulgation of proper definitions concerning them. Agreement as to what shall be taken as the unit of light and what as the unit of illumination at a surface must be secured. The former appears to be settled by the recent adoption of the international candle, but about the unit of illumination there is still some disagreement, both the lux and candle-foot being used. Adopting the latter for present purposes, all authorities are agreed that for reading at night not less than one candle-foot is required. Reading is impossible with an illumination of less than one-tenth candle-foot, difficult and fatiguing with one-fifth candle-foot, comfortable with from one and one-half to three or four candle-feet and dazzling if the illumination exceeds six or eight candle-feet. Very seldom does the artificial illumination exceed three candle-feet, though in a room receiving direct sunlight four or five candle-feet may be attained.

No one can have worked at the photometry of modern lamps without becoming conscious of how much misunderstanding there is of the elementary laws of illumination. The inverse square law is often misapplied, being used in calculations of illuminations from sources other than points.

One of the things that ought to be undertaken by the Illuminating Engineering Society should be the formation of technical committees charged with the duty of preparing reports on different branches of the subject. One such subject on which information is badly needed is the specific brightness of surfaces of different kinds when subjected to a standard illumination. The subject of diffuse reflection has indeed been partially investigated by Doctor Sumpner and Mr. Trotter, but about diffuse refraction little is known. Again, there are a number of semi-physiological problems which demand investigation and settlement. For instance, does the contraction of the pupil depend on the total amount of light entering the eye or on the intensity of the image on local patches of the retina. Why should a light of tenfold brilliancy not produce a sensation ten times as intense? And why should a greater brightness of general surroundings relieve us of the annoyance of those colored after-images? After-images can be seen even under extremely feeble illumination. Has anyone discovered any exact law governing their occurrence?

There are even more important questions before the society, for now that we have a standard of illumination and simple portable instruments that will measure it, there can be no excuse for inaction or ignorance in applying that knowledge to securing proper illumination of schools and buildings. The former is most important, for whatever bad results flow from bad lighting of churches, factories or railway stations, those which result from the bad illumination of schools are far more to be deplored—they imperil the eyesight of the next generation. All ophthalmogists agree that the cause which forces children into increasing short-sightedness is protracted poring over books under an insufficient illumination. The London County Council has begun reforms in this direction, and the next step should be to secure a systematic numerical measurement with a simple portable illumination photometer of the actual conditions existing in the schools. Then the council will be able to instruct its surveyors

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and architects as to what are the real requirements that ought to be fulfilled in the future. They ought to require an illumination of one and one-half candle-feet at the worst-lighted seat in the school-room. Another point in school lighting is the proper treatment of ceilings. In schools, as in all buildings, there must, moreover, not be over-illumination.

The lighting of factories is another matter requiring attention, for while the British Home Office issues regulations regarding the sanitary conditions in factories the lighting need only be "adequate." Holland appears to be the only country in which legislation has fixed a statutory amount of illumination, the figure there being from ten to fifteen candle-metres or 0.9 to 1.35 candle-feet.

Architects are often blamed for deficiencies in the lighting of the buildings they design; perhaps more often for the deficiencies found at night by artificial lighting than for those of the lighting by day. For this the fault rests, no doubt, largely with the persons who have installed the lighting arrangements. And one must not blame the architect too severely for having been as ignorant as all the rest of the world about the principles of illumination. But henceforward, when once it is known how much illumination is required in rooms of different kinds the architect ought, in his specification, to set down with appropriate numerical values, what degree of illumination is required in the various parts of his building. It would be a good thing if, in the public interest, the society could draw up a model specification for architects in which the proper way of presenting the requisite amounts of illumination, in different classes of cases should be set forth.

There is an immediate and direct function for the society to discharge in the collection, discussion and dissemination of knowledge; and in arousing the interest of the public and of public bodies to the economic and social importance of the questions for which the society is now united together.

The Interborough Rapid Transit Company, of New York city, has been ordered by the Public Service Commission to install sixteen-candlepower lamps in both the subway and elevated cars in place of the low-powered units heretofore used. It will cost about $25,000 to change all the lamps.

A NEW METHOD OF MEASURING LIGHT EFFICIENCY.[1]

BY C. C. HUTCHINS.

The measurement of light efficiency has been attended with unusual difficulties considering that what is required is merely the ratio of two numbers representing respectively the values of the visible and total radiation of the source. Nor do the difficulties arise merely from the necessity of comparing large things with small, but rather for the want of some method of properly separating the quantities to be compared.

To obtain a complete energy curve, and to compare the integral of the visible portion with the total is an extremely tedious and somewhat uncertain procedure. Angström's method requires an elaborate apparatus and the application of several troublesome corrections.

It is believed that the following method will be found as accurate, and much more simple and direct than those hitherto in use.

Theoretical.—Let the figure represent the energy curve of the light source; the vertical line separating the visible (a), from the infra-red (b). If now we define efficiency as the ratio of the visible to the total radiation, we have:

$$\text{efficiency} = \frac{a}{a+b}.$$

Let a water cell a few millimetres thick be placed in the path of the light. Assuming for the moment that the water is perfectly transparent to light, $a + c$ becomes the transmitted energy, the curve coming down to zero at wave length 1.8μ.

Further let a cell identical with the water cell, but containing a water solution opaque to light but transmitting more or less infra-red, be interposed, and let the transmitted energy be d. The transmission curve d must lie within the same narrow limits with c and the two areas be strictly comparable under like conditions.

If now we can measure $a + b$, $a + c$, d, and the ratio of c to d we have all that is required. For let

$$a + b = n$$
$$a + c = m$$
$$\frac{c}{d} = r$$

then
$$\frac{a}{a+b} = \frac{m-dr}{n}$$

Apparatus and Methods.—A thermopile consisting of a single junction at the focus of a small concave mirror set in a proper tube with diaphragms is pointed at the light and exposure made by moving a double wooden shutter. The deflection of the galvanometer is reduced by a known amount by putting resistance in the circuit. The deflection so obtained is proportional to n.

A water cell about five millimetres thick, having thin plate-glass walls, is then placed behind the shutter; the resistance is removed from the circuit, exposures made as before, and we obtain deflections proportional to m.

For obtaining d, a preliminary study of a large number of substances showed potassium permanganate to be quite suitable. It is very strong in color in solution, may be made opaque to sunlight in a thin layer, while transmitting a considerable amount of infra-red. A duplicate of the water cell is filled with a solution of permanganate of such strength as to just show the light under investigation, when held between the light and the eye. This cell being substituted for the water cell, we obtain a deflection proportional to d.

To find the ratio r. A spectroscope was given the following additions. A long slit was put in the place of the ordinary short one. The eye-piece was removed and replaced by an ebonite screen having a rectangular opening. One edge of the opening was cut to fit the curve of the spectrum lines in the red. The spectrum of the light source is focused upon the screen and the telescope adjusted so that the visible spectrum is just cut off by the curved edge. The infra-red alone now appears in the opening. In this position the telescope is firmly clamped.

Over the eye end of the telescope is now slipped a tube, having at its farther end a concave mirror and thermal junction. The mirror is large enough to receive the entire cone of rays coming through the screen, and condenses them upon the junction at its focus. This arrangement was used because it was at hand; a thermopile or bolometer, having a suitable receiving surface, placed immediately behind the screen, would be simpler. An image of the light source being thrown upon the slit of the spectroscope, the water and permanganate cells are placed alternately against the objective of the collimator;

1 Abstracted from the *American Journal of Science*, December, 1909.

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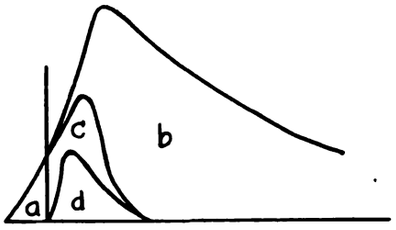
a shutter is moved as before, and the attached galvanometer gives deflections proportional to c and d respectively.

Remarks Upon Setting the Screen.—It has been customary in determinations of light efficiency to assume some definite limit to the visible spectrum, as 0.76 μ. Such a limit is quite useful for purposes of uniformity, that one man's work may be compared with another's, but only roughly corresponds to fact except in the case of sunlight. The limit of the spectrum is not the same for all lights or all eyes. It would therefore seem more logical to set the screen upon or near the limit of the red of the light under examination, although this will commonly give a smaller value for the efficiency than that obtained from 0.76 μ as a limit. This procedure seems further justified when we observe how steeply the energy curve rises at the limit of the red; so that a very slight movement of the screen upwards in the



CURVES OF VISIBLE AND INFRA-RED RADIANT ENERGY.

spectrum diminishes the apparent efficiency largely, while the actual light is diminished by an inappreciable amount. The smaller values therefore more nearly represent practical efficiencies.

Example of the Method.—The following measurements were made upon a portable acetylene lamp in which the gas was generated by automatically feeding granular carbide into water contained in the base of the lamp. The feed being intermittent, the light varied considerably but a fair average could be obtained by distributing the readings over a considerable time.

The resistance of the galvanometer and circuit was 2.203 ohms.

Through water the mean of five deflections was 202.2 millimetre divisions; through permanganate, 45.0 divisions. Ten ohms were added to the circuit, and the lamp direct gave 230.6 divisions, which when reduced to the scale of the others becomes 2531.

With the prismatic apparatus the mean of twenty readings through water with four ohms in circuit was 293.7. The resistance of the circuit was 2.203, and the deflection without added resistance reduced to 827.0.

The mean deflection through the permanganate cell was 205.8.

From these readings we have

$m = 202.2$ $\quad dr = 180.9$

$n = 2531.$ $\quad m - dr = 39.3$

$d = 45.00$ $\quad m - dr$

$r = 4.028$ $\quad \dfrac{m - dr}{n} = .0263$

This result is subject to a plus correction of thirteen per cent because of the loss of light to that amount in passing through the water cell. Applying this correction, we get .0296 for the light efficiency.

A second determination made after resetting the screen and changing the sensibility of the galvanometer gave .0323. The mean of the two is .0309 and the departure from the mean six per cent. The result may be considered very satisfactory considering the large change in apparent efficiency produced by a small displacement of the screen.

Saving the City Money.

Under this title the well-known American central-station expert, Glenn Marston, has written a striking article in *The Electrical Times* (London) November 11. As his argument is brief and to the point, it may be given practically in full:

"The tremendous advance made in illumination for advertising purposes has, in the past two years, had a unique effect on the cost of public lighting in the United States, and may account, to a great extent, for the fact that American lighting by local authorities is inferior to similar lighting here.

"The advertising load in American central stations is usually an important factor. In some districts mercantile associations have banded together and installed, at their members' expense, magnificent schemes of street lighting. Competition between cities is very keen, and it has been found that lavish lighting is one of the very best drawing cards for new population. It indicates an aggressive bid for trade, and at night draws people on to the streets in such numbers as to give an impression of exceeding liveliness.

"Competition between shops has brought window lighting to a very advanced stage, and the cheapness and effectiveness of electric signs has brought about a huge increase in this class of lighting. The result is that the average American business street has sufficient illumination to make public lighting unnecessary, except after the advertising lights have gone out, usually midnight.

"Electric advertising has a pronounced police value. Cities once notorious for outlawry have become peaceful as country villages with the advent of extensive lighting. The mayor of Denver is the authority for the statement that the police force of that city would have to be doubled if the electric signs were removed. Since the civic economy of electric signs has been demonstrated, the rules for the erection of signs in Denver have been so framed as to encourage electric signs. The danger from frightened horses, which has been mentioned as a deterrent to sign erection in England, has never even been mentioned in America to my knowledge.

"Perhaps one of the best examples of economy in public lighting due to private illumination is in the city of New York. Broadway, as is well known, starts at the point of Manhattan Island, and runs nearly due north beyond the city limits."

Mr. Marston shows two strikingly contrasted pictures, both taken along Broadway and quite familiar to metropolitan readers. One shows that portion of it above Thirty-fifth Street and the other shows the section above 135th Street, five miles further uptown. The former marks Broadway's path through the "Tenderloin," the other shows it where it has attained more sobriety and dignity, lined on either side with six and ten-story apartments.

"In the uptown picture are shown about forty public arc lamps, costing the city about $90 per year each, a total of about $3,600 to light properly this half-mile of New York's principal thoroughfare. Compare this with the downtown picture. There are only five public lamps between Thirty-fifth Street and Forty-second Street, yet this is the most brilliantly lighted half-mile in the world. The cost to the city is in the neighborhood of $450, a saving, on a half-mile of thoroughfare, of $3,150 per year. That saving represents aggressive and conscientious effort on the part of the electric company to better the street illumination.

"The energy of the company in thus saving money to the city is in no sense unselfish. It derives a far larger income from the downtown lighting. It is a brilliant example of the benefit a company may be to a community while working for its own best interests at the same time."

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ELECTRIC TRACTION

Convention of the National Association of Railroad Commissioners.

During the convention of the National Association of Railroad Commissioners held recently in Washington, D. C., much of interest to electrical men was brought to the attention of the convention. Among the very important papers read was one by J. H. Smith, vice-president New York Central & Hudson River Railroad, on "Progressive Safety in Railroad Operation."

During the course of his remarks Mr. Smith touched upon the history of signal developments which grew out of the need of indicating the conditions of the road to trains and came with the increase in traffic and speed. As these conditions developed in England before they did here, the first steps were taken in that country. In 1834 the Liverpool & Manchester Railroad introduced the first system of fixed signals, consisting of an upright post with a rotating disk at its top, showing red for danger and the absence of indicating color by day and a white light at night indicated that the track was clear. This method was improved upon the opening of the Great Western Railway, when experiments by Messrs. Chappe, the inventors of optical telegraphy, showed that under certain conditions of illumination the color of any body would disappear. This demonstrated that the form and not the color of the day signal could be relied upon. It was also found that a long narrow surface could be seen further as projected against the horizon or landscape than the same area in a square or a circle. Making use of these results, Sir Charles Gregory, in 1841, designed and erected at New Cross the first semaphore signal. There was, at that time, no communication between stations, each signal man displayed his signal at danger after the passage of a train until a certain time had elapsed, when it was clear. The only information conveyed to the engineman was that the preceding train had passed at least the required length of time before.

The failure or inability to act with sufficient promptness at the display of the danger position and the consequent collisions, led to the installation of additional signals to give advanced information to the engineman by the position of the signal he was to obey. C. V. Walker, of the Southwestern Company, introduced the "Bell Code," which was the first audible method of communicating between signal stations. The same year Mr. Tyler supplemented this with electric visual signals, the object being to give the operator indication of the signal having been received and given, and at all times to show the exact position of the signal itself. This suggested the space interval between trains, in place of the time interval, making signal indications definite. In 1858 the positive block-signal system was established in England, based on the space-interval system.

Making use of telegraphic communication, Ashbel Welch, chief engineer of the United New Jersey Canal and Railroad Company, devised and installed during 1863 and 1864 the first block system of signals in this country, on the double track between Philadelphia and New Brunswick. Signal stations were suitably spaced, and at each station a signal was provided, visible as far as possible each way. The signal itself was a white board by day and a white light by night indicating "clear", shown through a glass aperture two feet in diameter in front of the block signal box. For the "danger" indication a red screen fell to cover the white board or light. On a train's passing a station the signalman released the screen, which fell by gravity, and did not raise it until advised by telegraph that the preceding train had passed the next station, thereby maintaining a space interval Thus was evolved the telegraph block system, still generally used, with modifications of apparatus and signals, on lines of light traffic. Elaborations of this system were later installed, following more closely the English practice, perhaps reaching the most complete development upon the New Haven and New York Central lines, where it is still in use. Notwithstanding the numerous improvements in apparatus, the same practice of fixing a positive space interval by means of communication between block stations still holds. The addition of track circuits for locking and indicating purposes and interlocking between stations, more fully effected by the introduction of the "Coleman block instrument," in 1896, has thus evolved the controlled manual block system as now used.

In 1867 Thomas S. Hall patented an electric signal and alarm bell, used in connection with a switch or drawbridge. Its shortcoming lay in the fact that a break in the circuit or failure in the battery gave no indication. To correct this, a closed circuit was necessary, though more expensive. In 1870 William Robinson devised the plan of having the circuit closed at the point of danger, if conditions were favorable, and opened a short distance in advance of the signal. The wheels of the approaching train depressed a lever, which closed the circuit and cleared the signal, unless interrupted at the point of danger. Subsequent modifications were made, whereby the circuit once completed remained so through the agency of an electro-magnet, and reopened when the train passed out of that portion of the track governed by the signal.

In 1871 Mr. Hall put into operation the first automatic electric block system on the New York & Harlem Railroad, between the Grand Central Station and Mott Haven Junction. It was normal "safety." The wheels of a passing train striking a lever completed a circuit, which put the signal to danger, after the train, and held it so until the succeeding signal indicated danger, when a separate circuit was completed, which released the former signal allowing it to return to clear.

The disadvantage in having the wheels of a train strike a lever to complete the circuit led F. L. Pope to experiment. After a successful attempt

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in transmitting an electric circuit through an ordinary track with fish-plate joints, he made a signal test at East Cambridge, Mass. A section of track was insulated from the rest, with a wire circuit, including a battery and electro-magnet for operating the signal fastened to either end of the opposite rails. The metal wheels and axles completed the circuit, throwing the signal to danger against following trains. A detent served to keep the circuit closed until the next signal was reached, when a separate circuit released the detent, permitting the signal to clear.

In 1879 this system was put in service and, with some alterations, still remains in some localities.

Following the original manual semaphore and the controlled manual system of operation came the pneumatic and electric systems. For localities which required a great number of signal movements, with the development of motors and batteries capable of economic operation, automatic signals of the semaphore type have been successfully and widely installed.

On account of the wide-spread prevalence of electric lighting and the building up of the territory adjacent to railroads, changes in the color indications of night signals have been adopted, generally in such localities using green instead of white for the safety indication.

Developing with the manual operation of signals, and as a safeguard against mistakes of the signal men, interlocking grew up as a means for preventing conflicting signals being given at the same time. After a trip to England in 1869 Mr. Welch recommended the advantage derived from the English method of operating switches and signals in large yards and terminals, where the entire control fell to one man so located as to be in touch with the whole situation and equipped with a machine that would not permit of setting up conflicting routes. In 1900 an all-electric interlocking machine, advantageous where distant functions were to be embraced within the operation of the plant and applicable to localities where electric traction was in use was devised.

The more recent development of power-operated interlocking systems, with complete electric indications of the conditions on all tracks, has made it possible for larger systems to be consolidated under the control of a central plant, and thus under the direction of a central authority.

In train dispatching in this country the first radical departure from the time interval and flagging method of operation came in 1851. The New York & Erie Railroad established a single line of telegraph between Piermont, on the Hudson and Dunkirk, on Lake Erie, for company business in that year. Since that time the telegraph has been generally used for train dispatching.

Within the past few years experiments have been made with a system of train dispatching by telephone, now in successful operation upon some important lines, and growing in extent. Advantage lies in the ability to use trained railroad employees who cannot work under the telegraph system, not only insures a rapid distribution of information, but by its greater capacity enables a more complete knowledge of the state of the line to be had in the controlling office, as well as in all the offices tributary to the dispatching system.

In recapitulation he stated that from small beginnings there is in the world to-day about 100,000 miles of electrically operated roads; electric signalling and electric lighting and heating systems have also been introduced.

The committee on legislation also called attention in its report to the part that the commercial telegraph and telephone has in the business of the country and took the position that Congress should confer on the Interstate Commerce Commission the right to regulate their charges and supervise the service, requiring such improvements in and additions to the present service as business and the convenience of the country demand, including the necessary connection of telephone lines and the establishment of joint rates. State legislation should follow along the same lines. It suggester that general rules should be established either by direct law or order of commission, requiring railroads to provide means by telegraph or telephone, so as to furnish public information in regard to the time of arrival and departure of both freight and passenger trains.

The committee on safety appliances, in referring to the block-system of signalling stated that in the United States for the year ended December 30, 1908, there was an increase of 870 miles of road thus covered, and the increase was entirely in automatic-block signal mileage, the manual mileage being decreased during the year more than 500 miles. It is estimated that this increase would have been materially greater but for the fact that the railroads last year were passing through a period of depression. One significant feature of the matter is the increase in telephone operated mileage, the report of the block signal and train control board for last year showing that the telephone was used for block signalling purposes on January 1, 1909, on 2,357.2 miles more than on January 1, 1908. Referring to the questions which have been raised as to the comparative safety of the use of the telephone and telegraph in the movement of trains, some investigations were conducted by the board, and the result was that they reported that theoretically, telephones are as safe and as convenient as the long-used Morse telegraph, and the experience of many roads during the last two years has confirmed that theory. The only serious question that has every been raised regarding the safety of telephones is in regard to the liability of indistinct transmission of syllables and words, but that is a contingency that must be provided for in any telegraphic system, and with the telephone, as with the telegraph, mistakes are guarded against by good training and discipline and by repeating back all communications. As a matter of fact, the telephone is rapidly displacing the telegraph not only in block-signal work but in train dispatching as well. The question of safety seems to hinge almost entirely upon the personnel and methods in the operation of the apparatus.

The report of the committee on construction and operating expenses of electric railways was presented, which briefly outlined prevailing conditions and made several interesting recommendations.

The report outlines the system of accounts used in Wisconsin and New York and states that the committee did not intend to recommend the adoption or approval of any system, but does recommend that any state that is intending to adopt any system of accounts, in whole or in part, should adopt a plan which harmonizes or is in substantial agreement with the system in force under the jurisdiction of the Interstate Commerce Commission

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and in the states of New York and Wisconsin. Doubtless changes will need to be made in these systems, but these can easily be made, provided the fundamental features of the system in actual operation are not departed from to any great degree.

The association will meet again in Washington next year.

A. F. T.

Indiana Railroad Commission Urges Work on Block Signals.

About seventy-five railroad men, summoned to a conference with the Indiana Railroad Commission on December 10, discussed at length the provisions of the recent law requiring them to install a block signal system on Indiana roads by January 1. A number of objections were raised to the electrically connected block signal because it presented, as the railroad men said, too many dangers of the apparatus getting out of order. The prevalence of opinion was that the manual block, not electrically connected, was the better, because it required for proper operation that the signal men be in perfect touch with one another, while this did no so greatly prevail in the electrically connected system.

It is the purpose of the Indiana Railroad Commission to remedy existing conditions and dangers but an elaborate system of signaling will not be demanded. The new law requires every road earning $7,500 a mile or more to install a system of block signals. There are a variety of systems and it is the purpose of the commission to enforce the installation of the system that is best suited to each individual road—the one which eliminates to the greatest extent the possibility of human error in their operation.

After a lengthy discussion as to the best system of block signaling, the commission agreed to extend the time for installation until July 1st, 1910, and in the meantime it will hold conferences with each road with a view of ordering the kind of block signaling best suited to each individual road.

Long-Distance Wireless Record.

According to R. Falck, of the Pacific Mail Steamship Company, the Korea, one of the vessels of that line, has succeeded in establishing a record by sending a wireless message to an American mainland station from a distance of 4,500 miles at sea.

Wires Over Railroads to Be Improved.

In a circular recently issued by the Indiana Railroad Commission to all telephone and telegraph companies in the state, it calls attention to the frequent accidents caused by the defective wiring of lines crossing steam and electric railway rights-of-way.

To guard against these accidents the commission recommends that in the future all telegraph, telephone, electric light, and all other wires of any kind, constructed over the tracks of any steam railroad within the state, shall be supported by good substantial wooden poles of a size not less than twelve inches in diameter at the bottom and not less than six inches in diameter at the top, or iron or steel poles not less than five inches in diameter at the bottom and three inches in diameter at the top, such poles to be set in the earth to a depth of not less than six feet and to be well tamped. All such wires shall clear the top of the rails of such steam railroad at least twenty-five feet, and shall be fastened to said poles in such manner as will properly hold the said wires in place. In the case of the trolley feed and other wires of any electric railroad extending over the tracks of any steam railroad, the height of such wires above the tops of the rails of such steam railroads shall not be less than twenty-two feet.

1,200-Volt Operation of Shore Line.

The first electric railway in the East to choose the 1,200-volt direct-current system is the Shore Line Electric Railway, running from Ivoryton to New Haven through Saybrook and Guilford, a distance of about fifty-two miles. After a careful investigation of the relative merits of both the 600-volt direct-current, the 1,200-volt direct-current and the single-phase alternating-current systems, the 1,200-volt system was adopted as being best suited to the operating conditions of this line.

The Shore Line Railway is being constructed and equipped in accordance with the most modern railway practice. A power station is located on the Connecticut River near Saybrook and will contain two 1,500-kilowatt twenty-five-cycle, 11,000-volt, three-phase Curtis steam turbo-generators with provisions for two additional units. Power will be transmitted to two stations, one located in the car house at Saybrook and the other at Guilford, each of which will contain three 200-kilowatt, 600-1,200-volt rotary converters. Two machines will be operated in series to supply current at 1,200 volts, and the third will be used as a spare, the switchboard being so arranged that any two of the three units may be operated together in any relation.

Twelve cars will be operated, each equipped with four G E-217 fifty horsepower 600-1,200 railway motors and Sprague-General Electric type M control. This equipment is arranged to operate on both 600 and 1,200 volts, the cars being provided with straight air brakes with CP-29 (twenty-five foot) 1,200-volt air compressors. The entire equipment of the road will be furnished by the General Electric Company.

It is expected that the road will be in operation the early part of next year. Although eleven roads have adopted the 1,200-volt system, the novel methods of construction in this instance will cause the operation of this road to be watched with much interest by railroad operators. As a very high-class service will be maintained and the reliability of service is considered of primary importance, the selection of the 1,200-volt direct-current system indicates the growing favor with which this system is meeting.

Maryland Trolley Lines Unite.

The Frederick Railroad Company, with a capitalization of $1,500,000, has been formed at Frederick, Md., by the consolidation of the Frederick & Middletown Railway Company, the Jefferson & Braddock Heights Railway Company and the Washington, Frederick & Gettysburg Railway Company, all Frederick County lines.

The new company will own about thirty-three miles of railway and will also operate the Myersville & Cateretin Railway Company's line between Middletown and Myersville, under a lease which was held by the Frederick & Middletown Railway Company.

Engineering Work Nearing Completion.

Engineering work for the projected interurban line of the Montana Rapid Transit Company, between Helena and Butte, Mont., is approaching completion. It is anticipated that contracts for construction will be let early in the spring. M. H. Gerry, Jr., chief engineer and general manager of the United Missouri River Power Company, Helena, Mont., is general manager of the new line.

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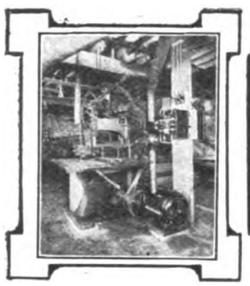
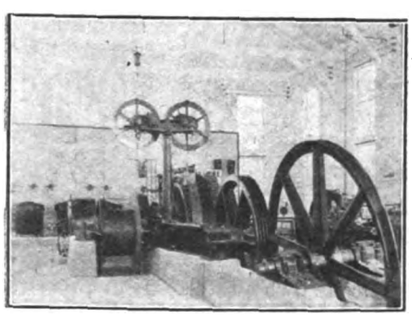


Industrial Power

MODERN APPLICATIONS OF ELECTRIC MOTORS TO MINE HOISTING.[1]

BY LEON M. HALL.[2]

Electricity is to the western miner what the automobile has been to his brother, the prospector, an almost indispensable adjunct in the exploration and development of the "Great American Desert." The applications of electric energy to the mining industry are so numerous and so varied that I shall not at this time attempt to go into detail, but will take up briefly one of the most difficult problems with which engineers have had to deal—namely, the application of the electric motor to mine hoisting.



BALANCED HOIST AT UNION SHAFT, VIRGINIA CITY.

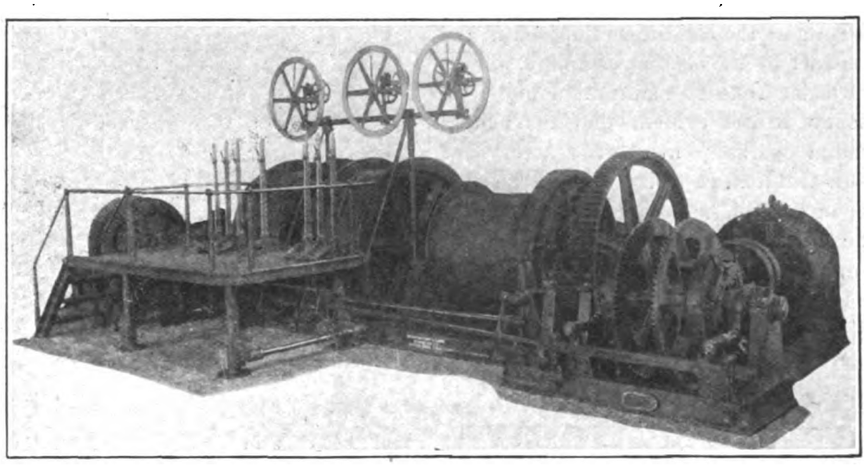
In the consideration of electrical hoisting engines, it might be appropriate to start with a brief discussion of the reasons and conditions which have facilitated the introduction of the electric drive into this immense and ever expanding field of electric application.

Hoisting, with its objectionable peak at the time of starting and acceleration, has always been a disturbing element in a transmission or distributing system, especially so where the hoists are large in proportion to the power-plant capacity or where they are located at the end of a long-distance transmission line. Many methods have been devised to overcome this peak feature, in order to secure a constant load factor, and with just what success I shall endeavor to set forth in the following.

About ten years ago electricity was introduced on the Comstock, and it was my good fortune to be entrusted with the task of applying it practically to the various operations, such as pumping, air compressing and hoisting. The first two worked out admirably, the last mentioned being the one problem that really offered serious obstacles.

The Comstock power contract with the electric company was at this time a very severe one, because it called for a $7.00 rate based upon a peak load of two minutes' duration. Furthermore, the initial generating plant, for all purposes, consisted of only two 750-kilowatt generators, water-wheel driven at the end of a thirty-five-mile transmission line, so that the introduction of electric motors of sufficient capacity to drive the then existing steam hoists was clearly out of the question; in fact, it became a serious question as to the practicability of using electricity at all for this purpose.

Up to this time, the variable-speed induction motor was still in the process of development and it really looked as though we would be compelled to resort to a continuously running induction motor equipped so that it could be connected to the reels by means of friction clutches (such a hoist was then in operation at Mercur in Utah), to use a direct-current generating set or to resort to the generation of compressed air and use it in the existing steam engines. The last mentioned was tried out, but the compressed air plants were entirely inadequate for the operation of the ponderous geared and first-motion hoists in use; in fact, there existed air capacity enough for only the actual mining operations. It meant, then, the installation of enormous compressors or an entire departure from any existing methods.



THREE-DRUM ELECTRIC WINDING PLANT WITH THREE-PHASE INDUCTION MOTORS AT MERCUR, UTAH.

About this time the mines along the Mother Lode were experimenting on lines laid down by C. O. Poole, and they finally succeeded in securing some excellent results by the use of compressed air reheated in the old boiler plants. Many of these installations are still in operation and this method has been carried on successfully in both Tonopah and Goldfield, notably in the Goldfield Consolidated, where they are working under a peak load of one minute.

This method of applying electricity indirectly to hoisting operations has its advantages, particularly to the producer, inasmuch as the peak is eliminated and the load factor is nearly a constant one.

1 A paper presented at the Goldfield meeting of the American Mining Congress, September 27-October 2, 1909.

2 Consulting engineer, 814 Kohl Building, San Francisco, Cal.

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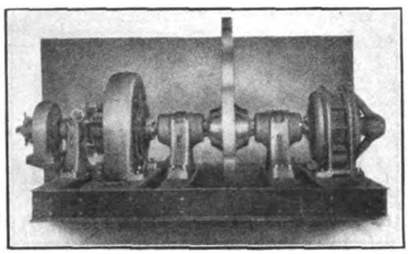
and for properties operating under peak-load conditions it has the attractive feature of keeping the power bill within range of economical operation.

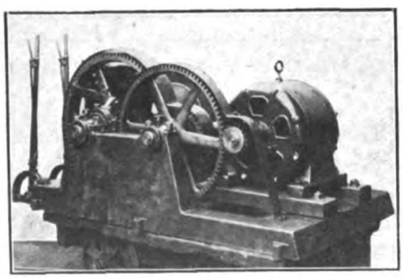
On the Comstock it was finally decided to install electric hoists equipped with the then new variable-speed induction motor. For installations under



MOTOR-GENERATOR FLYWHEEL SET AT KENDALL, MONT.

fifty horsepower, the motor was geared directly to the hoisting drums, but for operations requiring a greater capacity, I adopted a system similar to the Whiting system and known as the balanced-tail rope hoist. This, within the limits of its application and capacity, has proven an unqualified success.

To meet the conditions imposed in the contract by the electric company, and at the same time to maintain a high efficiency, it was evident that the motors should operate continuously at or near their full-load capacity, and, in the matter of control, be designed especially for the work to be performed. For a continuous full-load condition, the work must, of necessity, be constant, or nearly so, at all points in the lift, and the nearest possible approach to this was secured by the adoption of the balanced



ELECTRIC HOIST AT CRIPPLE CREEK (STANDARD IN 1900).

system, where the load is reduced to the weight of the rock alone. Then, to secure the necessary variations in speed, an induction motor with a non-inductive resistance in both primary and secondary was developed by the General Electric Company, the secondary resistance, and consequently the speed of hoisting, being varied by the introduction of a modified form of the ordinary street-car controller.

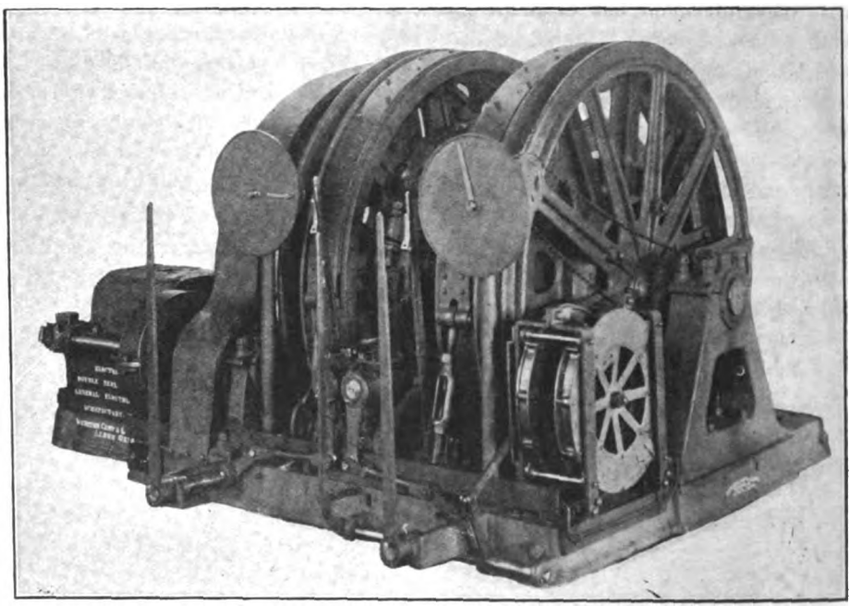
With an equipment of this kind the cages are started slowly and the dip in line voltage is comparatively slight, being about seven per cent at starting, and the time of acceleration eight seconds. By running on the second notch of the controller, one-third of the maximum speed may be maintained for the full length of the shaft without overheating or other serious results.

The hoist itself consists of a main driving drum and an idler around which the rope is wrapped four times, in order to secure the necessary friction for lifting. From the main driving drum, the rope is carried over the head sheaves, each end being attached to the top of a cage. The tail rope is fastened to the bottom of each cage and passes down one compartment under a movable tail sheave, and back of the second compartment to the bottom of the second cage. These hoists have been in continuous successful operation for about eight years, and while they are not adaptable for all conditions of mine hoisting, particularly where many different levels are to be accommodated, they have shown remarkable results in the economy of operation and the cost of power.

For instance, the hoist at the Yellow Jacket, lifting from the 1,200-foot level has, with a seventy-five-horsepower motor, raised 200 tons of ore in less than nine hours. The hoist at the Union Shaft, geared to a 100-horsepower, General Electric, variable-speed, induction motor, is hoisting from the 2,000-foot level at the rate of 1,250 feet a minute, and, during five years' service, has not cost one cent for repairs. The load being balanced, except for the actual rock lifted, the starting torque is low and the surge on the line almost negligible.

To my mind, this system can be varied to suit almost any condition, but, in order to secure the best results, it rests with the engineer to study thoroughly the individual hoisting-engine proposition and to adopt whatever is best suited to meet these conditions.

Where the alternating current is the source of supply, as is almost invariably the case, the most successful and practical method of application to hoisting conditions is through the motor-generator flywheel set. This method is by no means new, but is practically so as applied to mine hoisting on this continent, and, for this reason, the method has not received the consideration that is really due.



ONE OF THE OLDER TYPES OF ELECTRIC HOIST.

For its own protection, in preventing disturbances on its system, a power-producing company must naturally establish a limit beyond which an ordinary induction hoist motor will not be permitted on its circuits. For the heavier hoisting conditions, which are getting heavier with time as the shafts become deeper and the hoisting speed consequently increased, the motor-generator flywheel system adapts itself admirably. While the first cost of such a plant is comparatively high on account of the number of machines employed, economy and perfect control are compensating features, the former more particularly where the operation is semicontinuous.

A hoisting equipment of this character is made up of a shunt-wound, direct-current motor so arranged that it may be geared to any form of hoisting drums or reels, this motor to receive its power from a motor-generator set driven from the main power system. Such a set con-

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sists of an induction motor and direct-current generator, with a flywheel swung between them, and a direct-current exciter unit overhung at one end of the set. The function of this latter machine is to excite the field of the generator and that of the direct-current hoist motor. The speed and direction of rotation of the hoist motor are controlled by varying the field strength of the direct-current generator by means of a rheostatic controller which is conveniently located for operation by the hoist operator.

The induction motor is a variable speed machine. while the direct-current generator is provided with commutating poles and operates with a weak field at all loads. The flywheel is a machined steel casting and is perfectly balanced—so much so that these sets have been known to spin for over an hour after the line current is cut off. The wheel is used to store energy when the hoist is not in operation and is called upon to give up this stored energy when the demand on the line is at a maximum. To obtain this effect, the induction motor is arranged for variable speed work, changes in speed being automatically controlled by the variation of the main line current, which is led through a small three-phase regulating motor operating a water rheostat in series with the secondary winding of the motor.

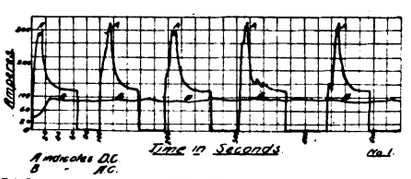

DIAGRAM SHOWING PERFORMANCE OF HOIST OF KENDALL MINE.

The torque which is produced by the full-load value of the main-line current in the windings of the regulating motor is exactly balanced by the weight of the moving parts of the water rheostat, so that there is no change in the resistance that is in series with the rotor winding of the motor-generator set so long as the motor is taking full-load current. If, however, it should demand more or less, there is an immediate movement of the water rheostat, tending to accelerate or retard the speed of the motor generator set to such a point that the induction motor once more takes full load and the movement of the water rheostat is stopped. The voltage of the exciter is maintained at a constant value during the speed variation of the motor generator set by means of a Tirrill regulator.

By reference to the diagram taken for the Kendall Gold Mining Company, it will be observed that the input to the induction motor is practically constant and that the undesirable starting peak has entirely disappeared. The direct-current side shows the characteristic hoisting curve where the peak has been overcome by the stored energy of the flywheel.

The Westinghouse Company has developed a system which is very similar to the one described, a notable example of the same being the hoisting sets built for the El Oro Mining and Railroad Company of Mexico. These sets are located 171 miles from the source of power. The largest of these is of 400-horsepower capacity and has been in operation for one-and-one-half years. This

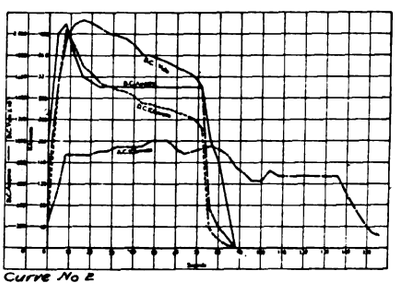

DIAGRAM SHOWING PERFORMANCE OF HOIST OF EL ORO MINE.

generating set is fitted with a 40,000-pound flywheel, nine feet in diameter, mounted between the two machines, the no-load speed of this set being 480 revolutions per minute. This set is used to operate a 400-horsepower direct-current motor that is geared to one of their old steam hoists. The drums are eight feet in diameter and the speed of hoisting 900 feet a minute.

The total load raised is 11,445 pounds and the diagram shown herewith shows plainly the relation between the alternating and direct current while hoisting a bucketful of ore from the lowest level. This set consumes twenty-five kilowatts when running empty, and when the current is cut off, the energy of the flywheel will raise a full load 595 feet. The cost of hoisting with this outfit amounts to only seven cents, Mexican money, per 1,000 foot-tons.

In Europe immense strides have been made in the application of electricity to mine hoisting; in fact, induction motors of 3,000-horsepower capacity are in use and a rope speed of over 3,000 feet per minute is attained. In many cases the control and operation of their hoists is almost automatic, so much so, in fact, that the German Government will allow a speed of 1,980 feet per minute when hoisting men by electricity, while with the old reliable steam hoist the speed is limited to 1,188 feet.

The engineers of this country have awakened to the fact of the flexibility of the electric motor for hoisting purposes. and, while it is now in common use, I am firm in the belief that in the next decade its use will be almost universal.

Some Electrodynamic Storage Problems.[1]

In some early applications of electricity to winding engines, storage batteries have been used for storing up energy instead of a flywheel, but the cost of these, and the difficulties of keeping the contacts of the tapping-off switches in order, have prevented a general introduction of this system. Dynamic storage in some such way as first applied by Ilgner to winding engines, and voltage regulation on what may broadly be called the Ward-Leonard system, have made it possible to satisfy the very severe conditions under which winding engines and rolling mills have to work.

In some special cases winding engines are driven direct by three-phase motors, but the motor to which a reversing rolling mill is mechanically coupled is necessarily a direct-current machine. The motor which supplies power to the variable-voltage generator may be either a direct-current or an alternating-current motor. To make the flywheel effective there must be speed variation. Where the original source of power is continuous current, this is, of course, easily obtained without loss of energy. Where three-phase current is the source of power the usual method is to employ a slip-ring motor and some automatic device for inserting and withdrawing resistance in the rotor circuit, but this means some loss of energy, and for this reason the speed range of the flywheel is generally made smaller than with a direct-current plant.

It is, however, possible also in the case of three-phase plant to avoid the loss of energy in regulating resistances by adopting some kind of cascade working. Such an arrangement has been worked out about a year ago by Messrs. Brown-Boveri. The variable rotor resistances are replaced by a direct-current armature working in a three-phase stator, and

1 Abstracted from Dr. Gisbert Kapp's presidential address to the Institution of Electrical Engineers, London, England, November 11, 1909.

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the power developed mechanically by this armature may either be added mechanically to that of the three-phase motor, or electrically to the supply circuit. In the latter case an additional generator is, of course, required.

A good example of modern English practice in direct-current rolling-mill electrification is the plant supplied by the Electric Construction Company, Ltd., of Wolverhampton, to the steel works of Sir Alfred Hickman, Ltd., of Bilston. The makers have given me the following particulars:

The flywheel set consists of a 2,000-horsepower direct-current motor, two twenty-eight-ton flywheels and two generators capable of giving any voltage between—1,000 and+1,000 volts. The excitation of the motor is adjusted automatically so as to produce a speed variation of the flywheels between 290 and 350 revolutions per minute. The energy given out when dropping from the higher to the lower speed is 46,000 horsepower-seconds. This set supplies power to a cogging and a barring mill. The cogging mill motor works a thirty-inch mill, and when cogging down ingots of three tons weight has to develop 4,800 horsepower, and for two-second periods once an hour, 9,600 horsepower. The barring mill motor works a twenty-four-inch mill, and has to develop 6,000 horsepower, and for two-second periods once an hour, 12,000 horsepower. The maximum speed is 120 revolutions per minute, and the time occupied in reversing from maximum speed in one direction to that in the other direction is six seconds.

As an example of a reversible mill driven by three-phase current I take that supplied by the British Thomson-Houston Company, Ltd., to Dorman, Long and Company, Ltd. It is a cogging mill with rolls twenty-eight-inch centers, and the normal speed is seventy, the maximum speed ninety revolutions per minute. The flywheel set consists of a three-phase, 950-horsepower, non-synchronous motor, coupled to a 1,000-kilowatt, 400-volt, direct-current generator and a thirty-ton flywheel. The speed limits are 400 and 480 revolutions per minute, and the maximum peripheral speed of the flywheel is 295 feet per second. The mill motor is rated at 1,200 horsepower, and has an overload capacity for short periods of 3,600 horsepower. The time required for reversing from full speed in one direction to full speed in the other direction is four seconds. The mill deals with 1,800-pound billets twelve inches square, reducing them to three-inch square bars in fourteen passes. The output is fifteen tons per hour.

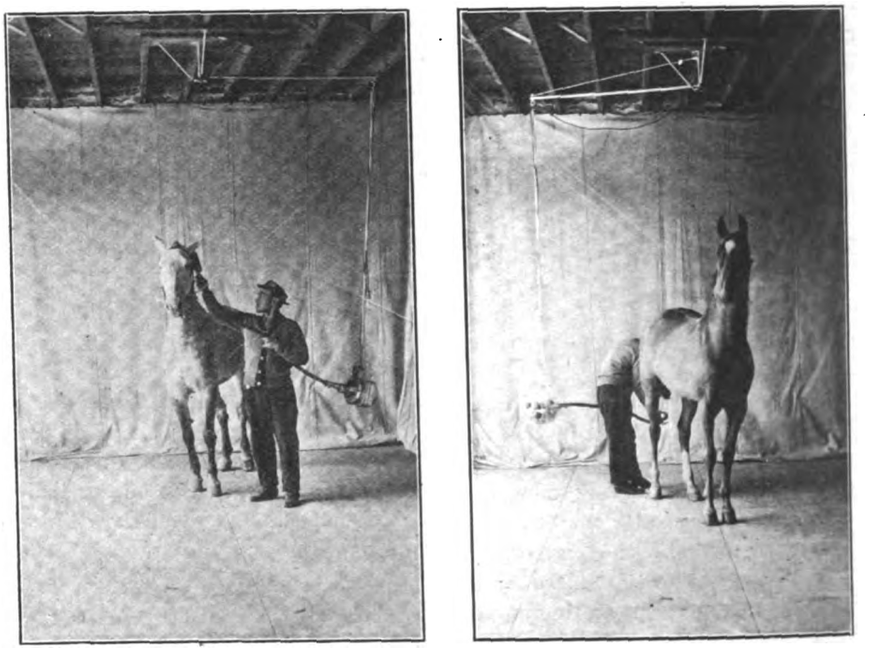
An Electric Groomer and Horse Clipper.

A novel horse-grooming and clipping machine of electro-pneumatic construction has recently been designed which is a remarkable labor-saving device. It consists of variable-speed electric motors operating at from 100 to 5,000 revolutions per minute and equipped with a flexible shaft of piano wire woven into a flexible cable half an inch in diameter.

A friction drive is used for operating a cleaning brush, arranged so that the latter will stop instantly should it accidentally catch the mane or tail. A pneumatic attachment has been devised to utilize the current of air arising from the rapid rotation of the brush to protect the operator from dust and dirt and to deposit the same on the floor.

The cost of electric current for operating this machine is said to be less than $5.00 per month for fifty horses. The machine can be instantly changed from a grooming to a clipping machine and may be run either fast or slow as desired, cleaning a horse wet or dry, and removing anything that can be done with a curry comb and brush in one-quarter the time required by hand.

It will be noted from the illustrations that the motor is suspended from a swinging arm attached to the ceiling, a flexible cord extending from the motor to the support. The current can be supplied from an ordinary incandescent lamp socket. The pneumatic brush removes the fine dry dust that it is impossible to extract with an ordinary brush by hand. It is claimed that from $600 to $1,000 per year may be saved in labor alone in grooming and clipping fifty horses with this device, while the horses are cleaned better than it is possible in any other way.



THE ELECTRIC GROOMER AND HORSE CLIPPER.

An Electrically Propelled Ship.

William P. Dartnell, in acknowledging the presentation (November 15 last) to him of the Denny gold medal of the Institute of Marine Engineers, in England, for his paper on "The Generation and Electrical Transmission of Power for Main Marine Propulsion and Speed Regulation," read before the Institute in July, 1908, said that a cargo boat was being fitted with his Paragon system of electrical propulsion, and that he would be pleased to report the results of the trials of the vessel as soon as they could be ascertained.

Heat Transmission from Electro-Copperplated Copper Sheets.

Experiments which were recently made at the Worcester Polytechnic show that copper sheets which have been electro-deposited with copper possess much greater heat-transmission properties than ordinary copper sheets which have not been so coated. It is suggested that this property may affect the design of condensers, radiators, etc.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

AMERICAN TELEPHONE AND TELEGRAPH.

The American Telephone and Telegraph Company has filed with the Massachusetts Commission a report covering the operation of the company for the year ended June 30, 1909. The income account compares as follows:

	1909.	1908.
Gross	$15,025,518	$14,541,484
Expenses	7,496,508	7,384,980
Net	$7,529,010	$7,156,495
Other income	19,684,657	18,382,448
Total income	$27,213,667	$25,538,943
Charges	7,794,254	7,641,786
Surplus	*$19,419,413	$17,897,157
Dividends	13,970,355	11,801,680
Total surplus	$5,449,057	$6,095,477

*Equal to 8.16 per cent on the $237,788,100 capital stock, as against 9.91 per cent on $180,587,000 stock a year ago.

The Associated Bell Operating Companies of the American Telephone & Telegraph Company, not including the long-distance lines of the American Telephone and Telegraph, report for the month of October and ten months ended October 30as follows:

	1909.	1908.
October gross	$11,811,174	$10,692,178
Operating expenses and taxes	4,753,410	4,611,121
Balance	$7,057,764	$6,081,057
Maintenance and depreciation	3,690,590	2,939,791
October net	$3,367,174	$3,141,266
Interest	621,441	621,390
October surplus	$2,745,733	$2,519,876
Ten months gross	111,645,624	103,465,265
Operating expenses and taxes	45,868,553	44,717,962
Balance	$65,777,071	$58,747,303
Maintenance and depreciation	34,961,784	29,297,426
Ten months net	$30,815,287	$29,449,877
Interest	5,712,912	6,388,316
Ten months surplus	$25,102,375	$23,061,561

The 1908 figures include in expenses for each month 1-12th of the extraordinary provision for depreciation made in December, 1908.

Unexpended portion of provision for the first ten months of 1909 was $10,977,527, not counted as profits but remaining as reserve for future replacement.

H. P. Davison, of New York, and John J. Mitchell, of Chicago, have been elected directors of the American Telephone and Telegraph Company to fill vacancies.

TOLEDO RAILWAY AND LIGHT.

Practically all of the $4,866,000 outstanding four per cent consolidated first mortgage bonds of the Toledo Railway and Light Company, which fell due July 1, 1909, and on which the company is in default as to three interest payments, have been deposited with the bondholders' committee; and seventy-five per cent of the $13,875,000 capital stock is in the hands of the stockholders' protective committee. These committees are working in harmony.

No plan for financial readjustment has been formulated. The new Toledo council will meet in January and at that time it is expected the question of extending the street railway franchises of the company will be considered. Of the present franchises, those for 9.5 miles of street expire in 1910; for forty-two miles in 1914; and for twelve miles in 1915. Until it is known that a renewal of these franchises will be granted no refunding of the present bonded debt of the company can be done.

Arrangements have been made by which the interest on the underlying bonds of the company will be paid when it falls due in January. The time of payment of the five per cent bonds of the Consolidated Street Railway Company, and the Toledo Traction Company was extended from January 1, 1909, to January 1, 1912.

Gross earnings of the company for October were $239,374, showing an increase of $21,300 over last year. Expenses increased about $10,000, and fixed charges $4,000, leaving a surplus for the month nearly $8,000 better than last year.

METROPOLITAN STREET RAILWAY.

The Public Service Commission has rendered a report covering the operations of the Metropolitan Street Railway Company receivers for the eleven months ended June 30, 1909, from which the following is taken:

Passenger fares		$11,689,546
Advertising privileges		221,467
Rent of tracks		10,259
Rent of equipment		44,929
Total revenue from street railway operations		$11,966,203
Maintenance of way and structures		$1,229,774
Maintenance of equipment (including $62,121 renewal of horses, etc.)		1,334,385
Operation of power plant—electric	$708,763	
Credit power sold	(b) 157,903	
		550,860
Horse car stable expenses		185,133
Operation of cars		3,234,348
General expenses		2,046,862
Total expenses of street railway operations		$8,581,363
Net revenue from street railway operations		$3,384,839

NEW YORK CITY RAILWAY.

The Public Service Commission has rendered a report covering the operations of the New York City Railway Company, receiver, lessee of the Metropolitan Street Railway Company for the month of July, 1908, which was in part as follows:

Total revenue from transportation	$1,205,663
Advertising privileges	20,895
Rent of tracks and equipment	1,121
Williamsburg Bridge tolls	848
Total revenue from operations	$1,228,528
Maintenance of way and structures (b)	251,441
Maintenance of equipment (including $9,632 in horse car service) (c)	331,057
Operation of power plant (horse, $32,120; electric, $68,993)	101,114
Power bought, sold or exchanged, not credit (d)	1,719
Operation of cars	373,141
General expenses	209,299
Total expenses of operations	$1,264,333
Net loss from street railway operations	35,805
Net revenue from outside operations	16,203
Total net loss	$19,602

WESTERN UNION'S EARNINGS.

The Western Union Telegraph Company has issued its quarterly statement for the three months ended September 30, 1909, which compares with the returns for 1908 as follows:

	1909.	1908.
Net revenue	$1,929,275	$1,864,955
Bond interest	433,062	433,062
Balance	$1,496,213	$1,431,893
Dividends	747,492	497,820
Surplus	$748,721	$934,073
Previous surplus	17,269,278	14,393,856
Total surplus	$18,017,999	$15,327,929

The preliminary quarterly report (partly estimated) for the quarter ended December 31, 1909, compares with 1908 as follows:

	1909.	1908.
Net revenue	$2,000,000	$1,930,064
Bond interest	433,063	433,063
Balance	$1,566,937	$1,497,001
Dividends	747,492	747,025
Surplus	$819,445	$749,976
Previous surplus	18,017,999	15,327,929
Total surplus	$18,837,444	$16,077,905

The earnings (partly estimated) for the six months ended December 31, 1909, compare with actual figures for the corresponding six months of 1908 as follows:

	1909.	1908.
Net revenue	$3,929,275	$3,795,019
Bond interest	866,125	866,125
Balance	$3,063,150	$2,928,894
Dividends	1,494,984	1,244,845
Surplus	$1,568,166	$1,684,049
Previous surplus	17,269,278	14,393,856
Total surplus	$18,837,444	$16,077,905

WESTINGHOUSE ELECTRIC.

The business of the Westinghouse Electric and Manufacturing Company shows material improvement. In the month of November shipments from Pittsburg and Newark aggregated a total valuation of about $2,500,000. Including other subsidiary companies, the total shipments ran close to $3,000,000, the largest month in some time past.

There is no basis for the report that the Westinghouse Electric and Manufacturing Company proposes to pay off the entire back dividends on the preferred stock. Dividends will be paid off gradually.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Westinghouse Electric and Manufacturing Company's New Repair Department.

The new eight-story building, with approximately 220,000 feet of floor space, devoted partly to the manufacture of detail electrical apparatus and partly to repair work, which the Westinghouse Electric and Manufacturing Company not long ago placed in service, contains a new department, whose entire attention is devoted to the handling of repair work.

For some time past the need of a special department to handle repair work independently of all other work, so as to insure prompt attention and quick deliveries, has been strongly felt, but the crowded condition of the works required the erection of another building before such a department as the management had in mind could be established.

On account of the fact that there was no large space on the company's forty-seven-acre plot unoccupied, it was necessary, in the erection of a new building, to depart from the established two-story type of structure and erect a higher building. The available space was 110 feet wide by 420 feet long, and the building is 70 feet by 400 feet. The distance from the ground to the top of the cornice is 130 feet. The building is of skeleton self-contained steel and brick construction, and is as near fireproof as a building can be made.

Although surrounded on all sides by other buildings, the new building has excellent receiving and shipping facilities. A covered shipping platform on the east side, paralleled by a railroad siding, extends the full length of the building. The ground floor is connected with the rest of the works by a narrow gauge industrial railway system, and the second floor is connected with the surrounding buildings by means of covered bridges.

INTERIOR VIEW OF FOURTH FLOOR, WESTINGHOUSE REPAIR DEPARTMENT.

To facilitate the handling of material from floor to floor one exceptionally large freight elevator and five high-speed combination elevators are employed. They are all electrically operated by means of Westinghouse motors and controlled by automatic elevator controlling apparatus.

The building affords working space for approximately 1,500 people In addition to providing for practically doubling the present output of detail apparatus, it affords ample room for handling in the most expeditious manner a large volume of repair work.

The desirability of having electrical apparatus repaired by a manufacturer is apparent to every user, and the facilities afforded by this new department will no.doubt be taken advantage of by all who have apparatus that needs overhauling and repairing.

In keeping with the well established standards of the company the same high grade and carefully selected material that entered originally into the apparatus will be used in work entrusted to the repair department. Expert workmen, under the guidance of engineers of long experience, perform the work, and repaired apparatus is subjected to the same rigid tests as new apparatus. The facilities of the department enable repairs to be made in the most economical manner, and assure it redelivery in the shortest time consistent with good workmanship.

VIEWS OF WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY'S NEW REPAIR DEPARTMENT, EAST PITTSBURG, PA.

Among several suggested new uses for electrical vacuum cleaners is the grooming of horses. A special suction currycomb is now on the market which can be obtained to the cleaner tube.

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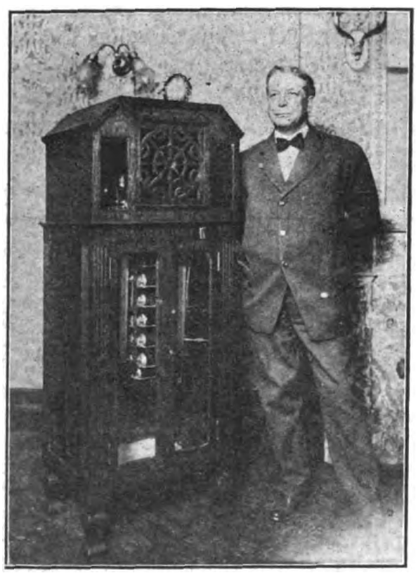
The Multinola; an Electrically Operated Multiple Phonograph.

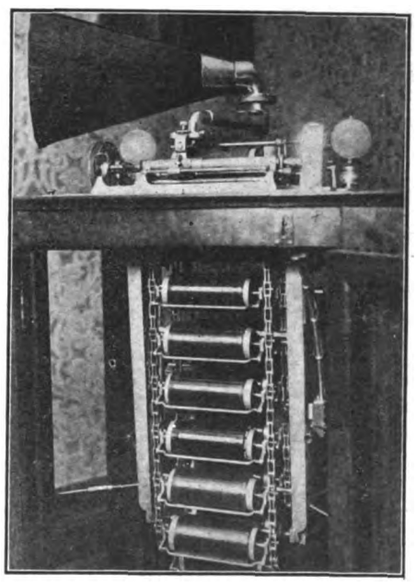
An "automatic continuous multiple phonograph," known as the "multinola," has, for the past few weeks, been attracting attention in New York city, where it was recently exhibited and demonstrated by the inventor, Dr. George S. Iddings, who is shown standing by the side of the instrument in one of the two illustrations shown herewith. Musical experts and others who have been present at the demonstrations have commented favorably on the quality of tone of the new phonographic device, which was characterized as being mellow and soft, yet withal loud and brilliant, and without the harshness usually associated with mechanical talking machines.

The essential improvement in the new machine is said to be in the "speaker." The mechanism of the reproducer differs to a certain extent from those familiar to the trade in the "limiting" and the "float," which are covered by special patents already allowed, it is said, in the face of a severe interference fight in the Patent Office. A "shutter" on the reproducer cap eliminates the "blast" and softens the tone, and which may be regulated at will. The diaphragm of the sound box is of corrugated metal, and a ball or button sapphire point, as may be desired, is used. The amplifying horn is attached to a straightaway tone arm, with only a couple of turned elbows that materially aid in the clear conveyance of the sound.



VIEW OF THE MULTINOLA ELECTRIC PHONOGRAPH COMPLETE.

The mechanical parts of the machine differ materially from those employed on the ordinary slot machine. A drop mandrel, on two endless revolving chains, is controlled by a series of cams and springs. Two governors on the machine bedplate drop the mandrel and wind the springs, which latter are placed in the rear of the record carrier. The record carrier, working on twin endless chains, conveys the record, presenting each of the records in turn as its predecessor finishes playing. By means of a dial any particular record may be selected by number and played; or it may be repeated indefinitely by touching a button. When running regularly, as each record is completed it drops from under the reproducer, descending and taking its place in the carrier, another coming up and presenting itself automatically, with an interval of only about twenty seconds. The records are easily removed or inserted without stopping the machine or interfering the slightest with its operation in any way. The present machine is built to accommodate sixteen records.



MULTINOLA PHONOGRAPH SHOWING LOCATION OF RECORDS.

An electric current from an ordinary electric-lamp socket will operate the multinola, the mechanism being started by inserting a coin or token.

At the meeting of Armour Institute Branch of the American Institute of Electrical Engineers held in Chicago, December 16, Prof. G. M. Marsh presented a paper on "Wireless Telegraphy."

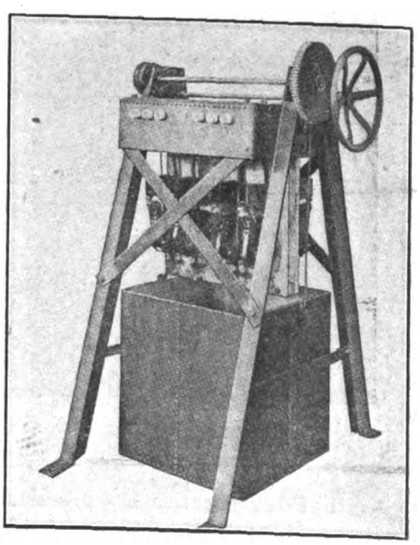
A High Tension Contactor Panel.

A very desirable feature possessed by the electric motor as a source of power is the ease with which it lends itself to remote control, through proper devices.

The panel shown here is designed to control a 750-horsepower 2,080-volt squirrel cage induction motor. This motor drives a centrifugal pump used in connection with a suction dredge to assist in forcing the material through pipes in order that it may be discharged at a distant point. Due to the high voltage, the contactors for connecting the motor to the compensator and to the line after the starting period are oil immersed.

The motor and panel are located at a distance from the dredge and the panel is designed for control from the dredge, as there will be no attendant at the point where the motor is installed.

The overload device on the control panel is so connected that in case the motor becomes overloaded, the control circuit is opened at the dredge and this in turn opens the motor circuit by means of the contactors, thus making it possible in case of a temporary overload to start the motor again from the dredge.



CONTACTOR PANEL WITH OIL RECEPTACLE LOWERED.

This panel is manufactured by the General Electric Company at its Schenectady works.

Electrical Business Good.

A recent report states that November was one of the best, if not the best, month of the year in the matter of business booked by the General Electric Company and also by the Westinghouse Electric and Manufacturing Company.

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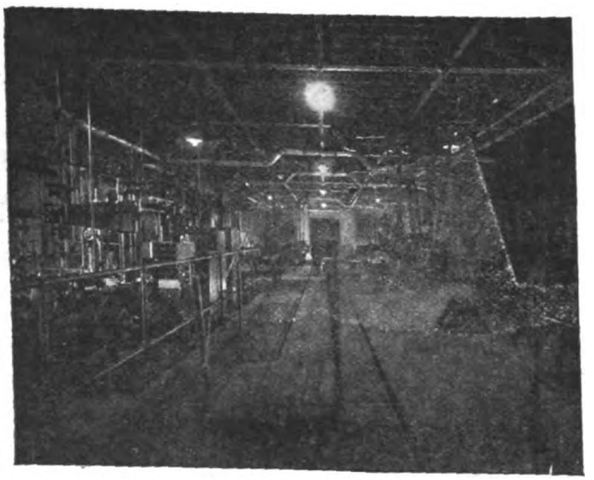
Arc Lamp Illumination for Iron Working Shops.

With the development of the carbon enclosed arc lamp and its general commercial introduction for interior illumination, there has come about an important step in the artificial lighting of large interior areas. This type of lamp has produced an illumination which has enabled the eye to see better, and, therefore, has had a cheerful acceptance as a source of high efficiency in the actual production of light. Another, and probably the most valuable thing which the enclosed arc has accomplished is the practical demonstration of the importance and value of diffusion, and in bringing out the most basic fact of illuminating engineering, which is that the proper utilization of light is quite as important as its proper production.



GENERAL VIEW OF FACTORY SHOWING LOCATION OF LAMPS.

TYPE OF LAMP INSTALLED IN SHOPS.

Arc lighting practice has practically settled on indoor lamps using approximately five amperes and eighty volts at the arc for direct current and six amperes and seventy volts for alternating current. For high ceilings, with little obstruction, the above rating does very well; for low studded ceilings and rooms with objects throwing heavy shadows, enclosed arc lamps give better distribution and more even illumination with a rating of three amperes and eighty volts at the arc for direct current and four amperes and seventy-five volts at the arc for alternating current. Besides this, low voltage lamps should always be equipped with carbon of a smaller diameter, so that the light emitted from the crater tip, which is at white heat, may have a predominating effect.

For very low ceilings, the ordinary length carbon arc gives a somewhat uneven distribution of light, and to meet such conditions a short enclosed arc has now been developed and is being manufactured by the Western Electric Company to meet such demands. These short arcs are 20 inches over all, and have a life of from 80 to 100 hours, which makes them in every way adaptable to circuits which are already operating lamps of the ordinary type.

Next to the choice of an arc lamp for indoor lighting is the laying out of a lighting equipment. As already stated, the one principle to be observed in the economic and efficient operation of any lighting system is a proper utilization of the light. In order to determine the number of lamps for the lighting of any given area, it is not only necessary to know the exact area, height of ceilings and objects to be illuminated, but considerable attention should also be given to surroundings, because very frequently the color decorations and tinting of the walls play an important part.

The following illustrations show alternating current installations at the Western of Alabama Railway Shops at Montgomery, Alabama:

For the inside shop service a 7.5 ampere, 110-volt lamp is used. This lamp shown in an accompanying illustration is trimmed with one solid and one cored carbon, which remedies the unsteadiness resulting when two solid carbons are used, the reason for this being that the resistance of the arc depends upon the current, it being high for a low current and low for a high current. It can, therefore, be readily seen that if the current increases from zero to maximum and then decreases from maximum to zero that the resistance will drop from a high value to a low value and then rise. This pulsation of resistance results in a distortion of the wave forms of the current, so that the real watts divided by the apparent watts is called the power factor of the arc. Since the resistance of the arc, therefore, is affected by the carbons, it can be seen that the power factor of the arc having one cored and one solid carbon is different from one equipped with two cored or two solid carbons.

The purpose of the cored carbon in alternating-current lamps is, therefore, to decrease the arc resistance and permit the establishment of the current through the arc when the electromotive force of the arc is near its zero point.

The other type of lamp which is used for illuminating the train sheds is a six-ampere, 110-volt series, alternating. This lamp when not in service stands cut out, so that when the lamp is switched on and the current enters it a portion of the current is shunted through the starting resistance, thereby energizing the series magnets which open the path of current through the starting resistance. Since the entire current now passes through the series magnets, the carbons are separated and the arc established. When the voltage rises above normal the shunt magnet becomes more strongly energized and by bringing the cut out contacts into engagment short-circuits the arc. The winding of the shunt magnets is such that by connecting the coils in series the lamp can be operated on sixty-cycle circuits, while by connecting the coils in multiple the lamp can be operated on 125-cycle circuits.

An important consideration other than the ones already mentioned in the installing of the arc lamp is the estimating of the capacity for transformers which are used and the wiring of these transformers. The capacity of the transformers to supply constant potential alternating current arc lamps should be based upon the volt amperes required by the lamp and not by the watts. In this way the size of the transformer is obtained such as to operate most efficienctly, and, therefore, enable the lamps to in turn operate with the desired effect. The wiring between transformers and lamps should be heavy enough, so that there is no excessive drop in voltage. Lamps require when starting a current of about ten or twelve amperes, and too great

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a reduction of terminal voltage prevents the lamp from starting. Besides this, the carbons of the alternating-current lamp when allowed to run on very low terminal voltage are apt to glaze, thus covering the carbon tips with a high resistance deposit and causing the arc to be unsteady.

The installation at the Western of Alabama Railway Shops is a typical arc lamp installation, using the latest types of the enclosed carbon arc lamp embodying the features as described. These lamps have been in service for some time, and burn with a regular trim of from 80 to 100 hours. The layout of the system was very carefully planned by the illuminating engineers of the Western Electric Company, which company also supplied the lamps and transformers.

Flaming Arc Lamps to Be Changed in Newark.

The special lighting of Market Street in Newark, N. J., which was described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 20, has caused some controversy between the Market Street Business Men's Improvement Association and the Public Service Corporation of New Jersey. The lamps that were made use of, it will be remembered, were Toerring flame arc lamps. The busienss men protested that the service was not what was expected, and as an outcome of the dispute, it has been decided to substitute fifty-eight pairs of Excello flaming arc lamps. At the same time that these lamps are exchanged the lamp posts will be cut down seven feet, thus making the lamps only two feet higher than those on Broad Street south of Market. The Public Service Corporation is willing to make the change, even though it will be necessary to expend $6,000 to bring it about.

Electric Search Lights for North Carolina.

That the United States Government is more and more keenly alive to the value of electric search lights is shown by the fact that new installations are continually being made. The latest case reported is that of the Cape Fear light house at the mouth of the Cape Fear River in North Carolina. The present thirty-six-inch search light now in use is to be replaced by three sixty-inch projectors. L.

High-Tension Entrance Tubes.

One of the important requirements in high tension transmission systems is that some method be provided for bringing high tension conductors into the station. Appreciating the demand for a reliable, convenient method, the Central Electric Company, Chicago, Ill., is marketing the type of entrance tube illustrated herewith and which fully meets the requirements of high insulation, exclusion of snow, rain, dust, etc.

Fig. 1 illustrates an entrance tube designed for capacities up to 300 amperes

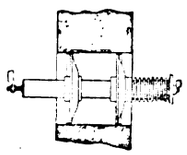


FIG. 1. ENTRANCE TUBE.

at 13,200 volts. This device consists of three elements, a pair of highly glazed porcelain discs, a specially designed porcelain tube and a copper conductor extending the entire length of the tube. The horizontal tube is securely fastened to the supporting discs and this forms a self-contained unit substantial in construction and easy to install. The copper core is provided with terminal lugs at both ends to which the line conductors are soldered.

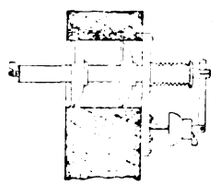


FIG. 2. ENTRANCE TUBE AND DISCONNECTING OUTLET.

The construction adopted insures a weatherproof, air-tight structure which not only has a permanently high insulation factor, but also effectually excludes rain and snow. Another feature of this entrance tube is that it does not afford a place for birds to build nests as is more or less common with the open type of entrance. It also prevents insects from getting into the station.

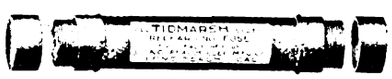
The use of high tension disconnecting switches is rapidly increasing, especially as their value and flexibility is being recognized. To meet the demand for a combined entrance tube and disconnecting switch the combination shown in Fig. 2 has been developed. This disconnecting switch is mounted on a two-inch marble slab, which in turn is secured to the station wall.

By the use of this combination the high tension cannot only be safely brought into the building, but when found desirable or necessary the circuit can be absolutely "killed" at this point. These new entrance tubes will be found of much convenience from a construction standpoint, for it is only necessary to leave a circular hole of the proper diameter into which the entrance tube can be cemented after all the work is completed. The construction adopted eliminates the necessity for skilled labor, as but one thing has to be done; that is to place the device in position and cement the edges.

New Type of Fuse.

A new type of fuse known as the "Tidmarsh" recharging enclosed fuse, which, it is claimed, can be refilled for a price decidedly less than that of a new fuse, is being placed on the market by the Long Beach Electric Manufacturing Company, Long Beach, Cal.

This fuse, shown in the accompanying illustration, is made in all sizes and will fit all cut-out blocks that comply with the dimensions specified by the National Electrical Code. The body is made of fiber tubes and the brass caps are held to the tube by a brass pin. The cap that fits over the fiber tube is threaded and is perforated to let the copper ends of the fuse strips through. These holes are made to correspond with the different sizes of fuse strips. The top cap is attached and screws



NEW TYPE OF TIDMARSH RECHARGING ENCLOSED FUSE.

down over the first cap; thus when the copper ends of the fuse strips are between two caps it makes a mechanical connection without soldering.

The fuse strips are made of ribbon fuse and have two trimmed copper strips soldered to each fuse. These strips are trimmed so that if used in damp places they will not corrode.

Among the advantages claimed by the manufacturers of this type of fuse is that the repairman cannot replace the fuse strip with copper wire without detection. Another advantage claimed is that when the fuse blows out the trouble may be detected by unscrewing a cap at either end and pulling the fuse. If it has been burned out it can be moved about one-half inch; if not the fuse cannot be moved.

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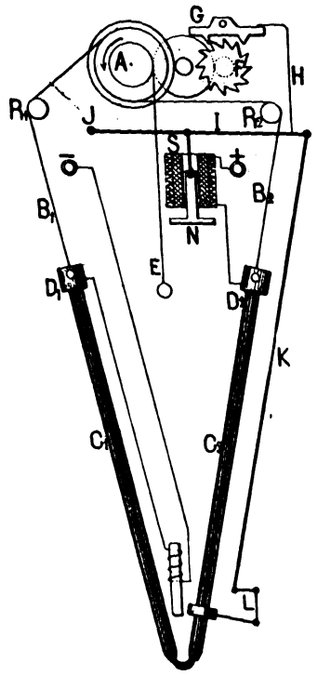
The A B C Flaming Arc Lamp.

The necessity of obtaining light of ever greater intensities from arc lamps tends to generalize the employment of mineralized carbons. A vertical disposition of such carbons is frequently connected with certain drawbacks, and the manufacturers of the A B C lamp have therefore adopted the converging arrangement. This is a little more complicated than the former as it requires, besides the downward, also a lateral movement of one of the carbons in order to start the arc, but it has the advantage of insuring reliable working and a better downward distribution of the light.



MECHANISM OF A B C FLAMING ARC LAMP.

The mechanism of the lamp, which is diagrammatically illustrated herewith, includes a drum A with three grooves. The two outer ones receive cables B_1 B_2, which pass over guide pulleys and support the carbon holders D_1 D_2. The center groove receives a cable E which serves for raising the carbon holder when the carbons are renewed. The drum is connected by gears to a wheel F, which is controlled by the oscillating escapement G. The drum A, which the weight of the carbons tends to turn in the direction of the arrow, can turn only when the piece H is sufficiently raised to permit G to oscillate. The displacement of the piece H is regulated by the core H of coil S and a lever I. The latter is also provided with a rod K which, by means of an angle lever L, produces the lateral displacement of carbon C_2 for starting the arc. The lever is actuated by the electromagnet S, which has two windings, one of fine and one of heavy wire. Upon closing the circuit a feeble current flows through the fine wire, the core of the electromagnet is raised, the carbons approach each other and the arc is started. As soon as this takes place the heavy winding is traversed by the main current. Its action is in a direction opposite to that of the first, the lever I drops, the carbons separate and escapement G is arrested. When on account of the consumption of the carbons the resistance of the arc becomes high, the escapement is released and the carbons drop a little. The lamp is also provided with an electromagnetic blower, which prevents the arc from starting too high. Two lamps may be operated in series on a 110-volt circuit and the carbons last from ten to eighteen hours. The power consumption is from 0.16 to 0.20 watt per candlepower. — *From L'Electricien, Paris, November 13, 1909.*

The Wire and Telephone Company of America Changes Its Name.

Owing to the fact that the business of the Wire and Telephone Company of America, Rome, N. Y., is devoted exclusively to the manufacture of the well-known "Romeoid" bare and insulated electric wires the company has taken steps to change its corporate name and hereafter will be known as the Rome Wire Company.

In addition to the reason given for changing the name the company feels that the new name will be easier to write and speak. Also the company takes pride in the industrial development of the city of Rome and the new name bringing the name of the town first has a significant advertising value.

The management and policies of the company will remain the same.

Street Car Emergency Equipment for Injuries to Passengers.

There is an equipment on the Rotterdam street cars which could well be adopted in the United States at a very small cost. Every car is supplied with a small first aid to injured package. The bundle, carried in the car alongside the register, contains some material for bandages and such things as would be handy in case of minor injuries to the crew, passengers, or pedestrians.

New Pass & Seymour Receptacles.

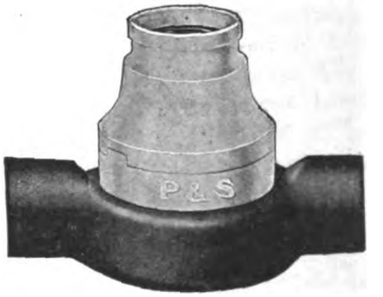
In the new line of porcelain lamp-receptacles manufactured and placed on the market by Pass & Seymour, Inc., of Solvay, New York, there are several features which add greatly to the convenience of installation. Where the key receptacle, shown herewith, is used, it is not necessary to cut the lighting wires or the moulding. The receptacle is mounted directly on top of the mould-

MOLDING TYPE RECEPTACLE.

ing and the wires of the lighting circuit looped over the terminal plates.

The condulet style of socket is made for use with the standard types of Crouse-Hinds condulets and makes an exceedingly neat installation.

Both the moulding and condulet receptacle have been approved by the Board of Underwriters, and are covered in the card of September 24.



CONDULET TYPE RECEPTACLE.

An Electrical Bug and Moth Trap.

Wine growers in the vicinity of Rheims, France, have recently devised a unique way of exterminating the bugs and moths which are so detrimental to their vineyards. A number of posts were placed at intervals of seventy-five feet in parallel rows about seventeen feet apart. On each of these posts was placed a five-candlepower electric lamp and under this was suspended a dish containing water with a top layer of petroleum. When the current was turned on the insects swarmed toward the lights and were killed in great numbers either by the fumes of the petroleum or by dropping into the dish.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, DECEMBER 3.—The event of the week has been the opening of the single-phase railway in the south of London, of which a good many particulars have already been published. The opening was carried out without any ceremony whatever, the trains just being worked into the ordinary timetable, although this has been considerably altered to meet the greater speed of the electric trains. This necessitates the running of several of the steam trains as through trains for certain parts of the route.

Evidence of the great difficulty which is being experienced in Great Britain in introducing electrically-driven road vehicles is seen in the winding up of all the provincial companies which were formed a few years ago for running electric omnibuses. These were formed as affiliated companies of the London Electrobus Company, but the necessary funds have never been forthcoming and all their names have now been struck off the register of joint-stock companies. In his same connection may be mentioned the balance sheet of the Electromobile Company, a concern which is chiefly occupied in hiring out electric vehicles in London for private purposes. The accounts of the company now show a total loss of $32,000.

For many years there has been an outcry on the part of tramway companies that the exactions of local authorities have had the result of bringing the fares down to a point when the profit vanishes. This result has been mainly brought about by the demands of the working men to have lower fares and of concessions to school children to travel at half fares; in some instances universal half-penny fares have been advocated.

As the largest electric-traction company in the country, the British Traction Company has been seriously affected by the prevailing tendencies in regard to fares, and many suggestions have been put forward in order to remedy the position and to resist the claims of the local authorities. Anything in the nature of raising the fares has had to be put out of the question, but a trial is to be given to a new system of fares which has been called the "Fair-Fare System." This consists of having a minimum fare of one penny, but of dividing tramway routes into farthing stages. Whether this will work remains to be seen, but it has rightly been pointed out that whereas it may do so in a purely working-class district, in the case of those districts inhabitated by business men and the better-class population, the worry of being bothered with farthings may well be one which will cause people to travel less by tram-car. However, the system is to have a trial in a large number of places controlled by the British Electric Traction Company, as from January 1, and in order to assist passengers in recognizing the section to which they are entitled to travel, the posts are being distinctively painted and numbered.

An electric supply company in the south of London has adopted a novel plan of demonstrating the uses of electricity in domestic service. This company has opened an "electric home" in the true sense of the word. Many an electric home has been installed at exhibitions and the like, but in all these instances the "home" has been a purely ornamental one. In this case, however, arrangements have been made with a householder to instal his house with electricity from floor to roof, and in return the tenant agrees to allow the house to be inspected at any time, by anyone producing a permit from the electric supply company. Electric power is used for every service in the house, including lighting, cooking, heating, ironing, the sewing machine and so on, and as an advertising method is bound to be exceedingly successful. One hardly knows which to admire the most, the company for putting such an idea into force, or the tenant for his courage in throwing his house open to inspection at all times. But the conveniences which are afforded are certainly worth some sacrifice.

Some time ago the Sydney Corporation had a discussion as to the most suitable speed at which to run its turbo-alternators. This question arose in connection with tenders for two 4,000-kilowatt turbo-alternators, and the engineer recommended a speed of 750 revolutions per minute. Some wiseacre on the council, however, claimed that cheaper machines could be installed running at 1,500 revolutions per minute and at the council meeting at which the matter was discussed, it was decided to refer the matter back to the committee with instructions to invite fresh tenders for machines at the higher speed. Whether this was ever done, I am in some doubt, but it is a fact that a tender from a British firm has now been accepted for machines running at the lower speed, the price not being the lowest.

It was stated in the House of Commons this week that the whole of the supply of arc-lamp carbons for the British Navy is purchased in this country. In this connection it is of interest to note that there is only one firm manufacturing such carbons in Great Britain.

From a remark made in the House of Commons this week, it would seem that the Government contemplates bringing in a new bill dealing with wireless telegraphy, in view of the operation of the Radiotelegraph Convention and the purchase of the Lloyds and Marconi stations.

There are many outward and visible signs that supply authorities—and particularly the London borough councils—are making a strong bid to develop electric heating and cooking, by a rearrangement of tariffs. At Marylebone it has been decided to charge two cents per unit for all supply to apparatus having a 100-per-cent load factor, and at Hampstead a definite standing charge, plus two cents per unit, is offered for any supply for heating and cooking. In the same direction is the offer of the Brighton Corporation to wire any premises for lighting and cooking, etc., free of charge, if the consumer will agree to pay two cents per unit more than if he paid for his own wiring. In this connection it is interesting to note that there is a difference of opinion as to whether the development of lighting in small premises should be at twenty-five volts or at a higher voltage. It is argued, on the one hand, that such premises are never likely to adopt electric heating, whilst those of the opposite view take the stand that whereas, hitherto, electric supply authorities have complained of their bad load factor, by adopting twenty-five-volt circuits, they are depriving themselves of any chance of improving their load factor in as much as this wiring will not do for heating circuits. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, DECEMBER 3.—A recent electrical enterprise in the eastern part of France is the erection of a hydraulic plant by a local company known as the Union Electrique. The new plant is to be located in the Jura region, where the same company is now operating a turbine station of 5,000 horsepower. The present station is being erected for a capacity of 4,000 horsepower, and it is expected to have it finished and in running order about the end of this year. In addition to the hydraulic outfit of the plant there is being installed a steam plant which is to serve as a reserve. These latter machines will have an output of 2,000 horsepower. In connection with the present work there is being constructed a network of power lines of considerable extent, which will cover the part of the Jura region lying around the two hydraulic plants.

In Italy several electric plants are in course of erection as well as extensions of power lines from existing stations to various communes. Among the extensions I note the enterprise carried out by the Filovia company at Coni. It is to erect a power line running between this locality and the town of Peveragno. The current will eventually be used for operating an electric railway. The Murandi firm has secured the rights for a power line running from Camposampiero to Soreggia in order to supply this latter town with current for motors. The Norrembourg firm of Rome recently obtained the concession for a light and power line which is to connect Anticale with Guarino. A carbide works located in the neighborhood of Ascoli is to receive a supply of current from a hydraulic plant. This latter station is situated in the commune of Aqua Santa.

The municipality of Bukharest is engaged in building an electric station of considerable size, this to cost about 2,000,000 francs for the part which is to be shortly finished. However, there are plans already made for a new plant which is to be added to the present one and it will be of still larger output. The cost of the new station is figured at 3,500,000 francs, and it will likely be erected in 1916. In the meantime, the plant which is now in construction will furnish current for the outlying quarters of the city as well as for tramway lines.

The following new companies have been formed at Paris: Hegmann and Billaudel, for storage battery manufacture; Linot et Cie, who will make various kinds of electrical apparatus; the Electric Light and Water Enterprise Company; Simon Brunschwig et Cie, for electrical supplies; Hinaux & Thomas, electrical apparatus; the Power Distributing Company for the Centre of France.

As regards recent projects in France, I note that the Municipal Council of Nuits, St. Georges, is taking measures to have the Dijon suburban traction-line extended to that locality. It is proposed to undertake a further extension of the Roubaix tramway line in the direction of Tourcoing. At Angoulême, the local council is arranging with the light and heating company for a supply of current for lighting and power. The town of Castillon is considering a project for electric lighting. At Angers it is proposed to extend the electric lighting system within a short time. The Municipal

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Council of Saida, Algeria, has recently adopted an electric-lighting project.

The electric stations of Berlin have commenced the use of a coin-operated electric-meter, and it appears to be operating with some success. It seems to give a supply of current without involving any great expense on the part of the consumer, seeing that the company furnishes the meter as well as all the wiring, in this way reaching a class of customers who would not likely use the current otherwise. Added to an ordinary meter is a coin-operated switch, which throws on the current upon introducing a ten-pfennig coin, and the meter commences to register the current consumed, then the switch cuts off the current after the standard amount is passed. By putting in another coin the operation is continued.

A large turbine plant is to be erected in the north of Italy for electric railroad use, and the executive council of the State Railroad, has just approved the project. It will be one of the largest hydraulic plants in the country, and is located at Vado, on the Ventimiglia-Savarna Railway line. The Minister of Public Works has recently approved the plans for the construction of an electric railroad line from Ponte di Nossa to Clusone.

The Rheinfelden plant in Germany is to furnish a considerable amount of current over a power line to the city of Mulhausen. An agreement to this effect has been concluded between the city council and the Rheinfelden company.

The tramway company of Moscow is planning a considerable extension of the lines in the city and suburbs, and this is to involve an outlay of approximately $20,000,000, according to the present ideas. A de C.

LIGHTING AND POWER.

(Special Correspondence.)

ARLINGTON, S. D.—H. P. Mortenson is considering the establishment of an electric-light plant. P.

AINSWORTH, NEB.—The Ainsworth Light and Power Company has been incorporated with a capital of $60,000. P.

COLUMBIA FALLS, MONT.—The North Idaho & Montana Power Company is asking for a franchise in this city. P.

NICKERSON, KAN.—This city has voted bonds for the establishment of an electric-light plant.

DECATUR CITY, IA.—Johnson & Smith have been granted a franchise for an electric-light plant. P.

WATERTOWN, S. D.—Ferris Brothers are about to establish an electric-light plant here to cost $100,000. P.

COLUMBIA FALLS, MONT.—Mr. Farrar has applied to the city council for a franchise for an electric-light plant. C.

NORWALK, CONN.—The Heating and Lighting Company of this city has filed a certificate of incorporation, with $18,700 cash capital.

CONRAD, MONT.—Plans for an electric-light and water-works system will be prepared by C. T. Sacker and C. D. Flaherty, engineers, of Livingston, Mont. C.

RAMONA, S. D.—The Citizens Light and Power Company let the contract to H. P. Mortensen, of Toronto, S. D., for the installation of an electric-light plant for $2,000. C.

SAN DIEGO, CAL.—The city council has accepted the bid of the San Diego Consolidated and Electric Light Company for a five-year contract for street lighting. A.

WAYCROSS, GA.—The city has granted an electric-light, gas and street railway franchise to Burdette Loomis and associates. Franchise requires that work shall begin within sixty days. B.

INDEPENDENCE, CAL.—The trustees have granted permission to J. E. Eibeshutz to construct and operate a system of power lines along the public highways of Inyo County. A.

SANTA FE, N. M.—The Montana Power and Irrigation Company has been incorporated at Santa Fe with a capital of $100,000 by G. F. Flick, F. C. Wilson and J. A. Massie. A.

LOS ANGELES, CAL.—The city council has fixed the date for the bond election for voting $3,500,000 for the development of the Owens River power and $3,000,000 for harbor improvements on February 16. A.

SENOIA, GA.—W. B. Baggarly, H. L. Ware, A. O. Baggarly, J. A. McKnight and others are organizing a company to establish and operate an electric-light plant and will at once petition the city council for franchise. B.

SYRACUSE, N. Y.—The Union Realty Company has obtained a permit for the erection of a lighting and power plant to cost $5,000. Current for power and lighting is to be supplied to several of the down town buildings.

SALT LAKE CITY, UTAH—Contracts amounting to over $27,000 have been awarded for the installation of the new lighting system at Fort Douglas. The plans include the lighting and wiring of all quarters and grounds and the erection of a substation.

GADSDEN, ALA.—The grading for the steel plant extension of the Alabama City, Gadsden and Atalla Railroad Company's line has been completed. This new electric line will extend from Forest Avenue, Gadsden, to the new plant of the Southern Iron and Steel Company. B.

LONG BEACH, CAL.—The Long Beach Electrical Company has been incorporated in this city with a capital of $10,000 by Geo. D. Sweetland, M. L. Gunsel and Bernard Gunsel. The company will engage in a general electrical business in this city and surrounding towns. A.

POMONA, CAL.—If the plans of the city trustees are carried out Pomona will have one of the finest street lighting systems in the West. Steel ornamental arches will be constructed across the streets at regular intervals by the property owners, and the city will pay for the cost of lighting. A.

NEW MILFORD, CONN.—It is reported that Verton P. Staub and E. J. Emmons, representing a party of local business men, have purchased the plant of the New Milford Eectric Light Company. The plant was formerly owned by Mrs. W. G. Black, Levi P. Giddings and L. F. Curtiss of New Milford and the price paid is said to have been about $75,000.

CINCINNATI, O.—Plans have been submitted for the heating, electric-light plant in this city. At a recent meeting the following group of the new city hospital. Director Small approved the plans and will advertise for bids for installing the power plant at the earliest possible moment. This power plant will furnish heat and light and power for the entire group of buildings at the hospital.

PARKERSBURG, W. VA.—This city has been considering the installation of an electric-light plant in connection with the water works, and to that end has had estimates prepared. In the report submitted to the Board of Affairs, $41,000 was given as the cost of construction of the plant and the annual charges, including depreciation, are fixed at $9,660.

BENTLEYVILLE, PA.—The Bentleyville Electric Light and Power Company has organized for the purpose of constructing an electric light plant in this city. At a recent meeting the following officers were elected: President, Charles F. Fisher, Pittsburg; secretary, Dr. E. E. Franch, Ellsworth; treasurer, J. G. McCormick, Bentleyville; manager, Nichol Veeser, Bentleyville.

COBALT, ONT., CANADA.—The Nova Scotia Silver Cobalt Mining Company is putting in a mill equipment on its property. It has recently placed an order with the Allis-Chalmers Company of Milwaukee for complete machinery for a twenty-stamp cyanide plant. This plant consists of twenty 1,500-pound stamps, crushing machines, conveyors, tube mills, and cyanide appliances. All machinery is equipped with electric motor drive.

JACKSON, GA.—The Schott Engineering Company, of Chicago, is now engaged in building the transmission lines from the big power dam on the river to Macon and adjacent points. Steel towers will be erected at a cost of $500 each. It will cost $75,000 to build the transmission lines into Macon. The first line will be run from the dam on the Ocmulgee river through Bibb via Indian Springs and Forsyth into Macon. From Forsyth a line will be run to Griffin and Atlanta.

DENVER, COLO.—Plans have been completed for the reorganization of the Southern Colorado Power Company, taking it out of the hands of a receiver. A new company will be organized, with a capital stock of about $5,000,000, the bonded debt of the old company be paid off, and $1,000,000 be spent on extensions and improvements. The company operates the street railway, gas and electric-light and power systems in Trinidad and furnishes power to manufacturing plants. Funds for paying off the indebtedness have been arranged for. The property will be sold at auction next month and purchased by the stockholders.

MONTPELIER, IDAHO.—The Bear Lake Power Company is adding to its generating facilities. The water is delivered through a pipe line 1,500 feet long with a diameter varying from 40 to 36 inches. There will be installed the following equipment: One hydraulic turbine operating under an effective head of 350 feet delivering 920 horsepower normally and a maximum of 1,180 horsepower. The turbine will be direct connected to a 650-kilowatt, 6,600-volt, sixty-cycle, three-phase generator and governor by an oil-pressure governor. Excitation will be provided by means of a fifteen-kilowatt, 120-volt belted exciter. All the generating equipment will be supplied by the Allis-Chalmers Company, of Milwaukee, Wis.

NIAGARA FALLS, N. Y.—The Niagara, Lockport & Ontario Power Company has closed a contract with the American Locomotive Company to supply power to the latter company's works at Dunkirk, N. Y. Delivery will be made over the power company's transmission lines to Lackawanna and from Lackawanna to Dunkirk over the lines of the Buffalo & Lake Erie Traction Company, which is also a customer of the power company. In addition, the Niagara, Lockport & Ontario Power Company's contract with the Buffalo, Lockport & Rochester Railway has been extended from three to twenty-five years in conjunction with an arrangement by which the power company will use the railway company's 60,000-volt line from Lockport to a point within six miles of Rochester. This line will enable the power company to serve a large number of towns along the line of the railway, including Middleport, Medina, Albion, Holley, Brockport and Spencerport, and will also form a valuable auxiliary to the transmission lines of the power company between Lockport and Rochester.

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RAMONA, S. D.—The Citizens' Light and Power Company has let the contract for installing a $2,000 electric-light plant, to H. P. Mortenson, of Toronto, S. D.

DOMINION, N. S.—The work of installing the electric-light line has commenced, and the city will in the future receive power from the Sydney and Glace Bay Railway Company. The entire cost of construction will be about $3,000.

MILTON, PA.—The Milton Electric Light and Power Company was sold to Whitacker & Deal, of Harrisburg, and they in turn have sold the franchise for lighting to Philadelphia capitalists, who will build a new high-tension power plant and reconstruct the whole system.

JACKSON, MISS.—New York capitalists are negotiating for the purchase of the Jackson Electric Light, Power and Street Railway and the Jackson Gas-Light Company, owned at present by S. T. Carnes and associates, the properties being estimated at one million dollars. The prospective purchasers will have representatives on the ground shortly to examine the properties, it is understood. L.

ROME, GA.—The Stewart-Morehead Company, of Savannah, has purchased the plant of the Raccoon Cotton Mills, at Raccoon, north of Rome, and a stock company will be formed to carry out the company's plans to develop an available waterpower, where electricity will be generated to run the mill, and to sell to nearby towns and consumers for lighting and other purposes. The machinery of the Raccoon mills will be changed, the plant calling for a 5,000-spindle mill.

JACKSON, GA.—Construction work on the transmission lines of the Central Georgia Power Company on the Ocmulgee River, is now under full headway, the Schott Engineering Company, Chicago, Ill., having an adequate force of men in the field to push the work. Right-of-way through several counties to Macon has been secured, 100 feet in width, steel towers to be erected at a distance of 500 feet. The lines to Macon will be completed possibly by the first of the new year. L.

WILMINGTON, N. C.—The satisfactory results derived from the system of lighting the streets by arches, in which were set tungsten lights, during the Taft celebration in November, have induced the city to extend the system, so that the down-town section will be included, and an average of four arches to the block will be used. The material for the new arches has been ordered and by the first of the new year Wilmington will lay claim to being the best-lighted city in the South, with the exception of Atlanta. L.

RICHMOND, VA.—Upon the recommendation of the finance committee of the city of Richmond, the Common Council in regular session has voted an additional sum amounting to $65,000 to be used in the construction of the distributing system of the new municipal electric lighting plant, now in course of completion. This is in addition to $250,000 bonds, the proceeds of which are for paying for the electric light plant proper, and $100,000 for water pumps to be electrically-driven by power from the new power house. At the same meeting several minor contracts for parts of the electric system were approved. The total thus far authorized is $415,000. L.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SIOUX FALLS, S. D.—It is expected that an electric line will be constructed next year to Bridgewater. C.

WAVERLY, IOWA.—Surveyors for the Waterloo, Cedar Falls & Northern Railway are running a line to Denver Junction. C.

IOWA CITY, IOWA.—The Iowa City, Ottumwa & Southwestern Electric Railway Company, of Pierre, S. D., has been incorporated to construct an electric line to Ottumwa. C.

LAUREL, MONT.—French and New York capitalists, represented by Daniel Giles, are considering the construction of an electric line to Red Lodge at a cost of $3,000,000. C.

MILWAUKEE, WIS.—It is proposed to grant the Milwaukee Electric Railway and Light Company the privilege to build a $50,000 terminal in the southwest corner of the state fair park. C.

FOSTORIA, O.—A new electric line is being planned to run to Paulding, and may be in operation by summer. The work will be pushed as rapidly as possible as soon as the right of way is secured.

DENVER COL.—The Denver City Tramway Company has begun improvements that will involve an expenditure of $1,000,000. Work has already been begun on a system of terminal tracks leading to the round houses. Two office buildings and a two-story interurban depot will be under way in a short time.

GREENFIELD, IND.—A company of capitalists headed by Perry J. Freeman is considering the construction of an interurban electric road between this city and Pendleton, a distance of sixteen miles.

LIMA, O.—The work of electrifying the Columbus & Lake Michigan Railway between Lima and Defiance, Ohio, has been started and it is expected that electric cars will be in operation by January 1. The road is owned by the Ohio Electric Railway Company, of which W. Kelsey Schoepf is president.

RED LODGE, MONT.—An electric line between Laurel and this city is under consideration, and Billings, Mont., is ready to subscribe $25,000 to that end. The rest of the necessary amount, $35,000, is to be raised in Carbon County.

UTICA, N. Y.—The Utica Southern Railway Company has been authorized by the public service commission to build a twenty-seven mile extension of its trolley line, from Hamilton, Madison County, to Norwich, Chenango County, through Earlville and Sherberne. The company is authorized to issue $628,000 bonds and $400,000 preferred stock.

BUTTE, MONT.—The St. Anthony Light and Power Company, a Montana corporation operating in Idaho, has transferred its stock to a new corporation called the Idaho Power and Transportation Company. The transfer includes all the stock and $50,000 in bonds, the consideration for the stock being $20,000 in cash and seven notes of $10,000 each, bearing six per cent interest.

TITUSVILLE, PA.—The Titusville Southern Company has increased its capital stock from $250,000 to $1,000,000. It has also been decided to issue $600,000 worth of bonds. The company, composed of New York capitalists, propose to build a street car line from Titusville to Oil City, and from the size of its capital stock evidently contemplates more road building than that between the two towns.

POTTSTOWN, PA.—To further the building of the proposed Phoenixville, Valley Forge, Strafford & Philadelphia trolley line, a meeting of citizens of the former place was held. About $25,000 stock has been subscribed in that town for the project, and it is stated that there are good prospects for the early building of the line, which would give 30,000 people trolley connections with Philadelphia.

ALLIANCE, OHIO—A merger of Northern Ohio electric railway properties is being talked of, and it is believed that such a combination would put the roads on a better paying basis. The railways which may combine are: Lake Shore; Southwestern; Cleveland, Painesville and Eastern; Western Ohio; Eastern Ohio Traction; Northern Ohio Trolley; Youngstown and Ohio River and Stark Electric.

ALBANY, N. Y.—The Westchester Street Railway Company of White Plains, a reorganization of the former Tarrytown, White Plains & Mamaroneck Railway Company, an electric road, was incorporated recently with a capital of $1,000,000. The directors are Richard Sutre, William Greenough, Charles M. Sheafe, Jr., William L. Barnett, John L. Anderson, Frank F. Hall, Edward O. Brown, of New York; John G. Parker, Augustus S. May, of New Haven, Conn.

CHATTANOOGA, TENN.—The Chattanooga Railway & Light Company has been authorized by the Georgia railroad commission to issue $2,000,000 preferred stock, $3,000,000 common stock and $1,600,000 in bonds. As a part of the lines are in the state of Georgia it was necessary for the company to obtain permission before issuing any stock or bonds. J. C. Lightfoot, secretary and treasurer, appeared before the commission in Atlanta in the interest of the company.

WILMINGTON, DEL.—Thomas E. O'Connell, late president of the West Chester and Wilmington Electric Railway Company, has been elected president of the Phoenixville, Valley Forge and Strafford Electric Railway Company. The company intends to build a trolley road to Valley Forge by way of Williams Corner, along the old Valley Forge dam to Strafford, where direct connection will be made with Philadelphia by way of the Philadelphia and Western Electric Railway. The company has capital of $60,000.

COLONIAL BEACH, VA.—Preliminary steps have now been completed for building four miles of electric railroad between Colonial Beach and Classic Beach, and the Virginia rights for the balance of the line have been granted by the corporation commission of that State. A representative of the company states that it is the purpose of the company to build the road four miles long between the points mentioned and have it in operation by the opening of the season next year.

HARTFORD, CONN.—A special meeting of the stockholders of the Farmington Street Railway Company has been called for December 20 to act on the proposal to sell the company's property, rights and franchises to the New York, New Haven & Hartford Railroad Company. It is expected that the deal will be sanctioned almost unanimously by the stockholders. The company operates an electric road from Hartford to Farmington and Unionville. It has for a considerable time had a traffic alliance with the New Haven road, and has run its cars into the center of Hartford over the trolley tracks of the New Haven system.

GUILFORD, CONN.—The Shore Line Electric Railway Company, which is constructing a line to run along the Long Island Sound shore from New Haven to the Connecticut River and up the river to Essex, has completed deals for four-fifths of the land required and is about to commence the necessary condemnation proceedings to acquire the remainder, which is held at very high prices by its owners. The new trolley line from Guilford east is practically finished and the big power house at Saybrook is about ready for the installation of machinery. It is expected that this portion of the line will be in operation early in the spring and that the connection with New Haven will have been completed by midsummer.

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INDIANAPOLIS, IND.—The directors of the Columbus, Greensburg and Richmond Traction Company have elected A. M. Kuhn of this city president of the company and announce that the road will be built next year. S.

CHICAGO, ILL.—The United Railways Company has been incorporated under the laws of Illinois to take over the Consolidated Traction Company. The new company is capitalized at $100,000, subject to a larger issue of certificates, like the Chicago Railway.

STROUDSBURG, PA.—The Delaware Gap Borough Council has granted a franchise to the Stroudsburg & Delaware Gap Street Railway Company to extend its line through the Gap and connect with Portland. This has long been desired for a through line by trolley from Philadelphia to the Gap.

JEFFERSONVILLE, IND.—A mortgage has been filed with the recorder by the Indianapolis & Louisville Traction Company for $600,000 in favor of the Colonial Trust Company of Pittsburg, to guarantee bonds to that amount. The mortgage covers the property of the company from Louisville to Seymour. S.

DANVILLE, IND.—The Terre Haute, Indianapolis and Eastern Traction Company has begun work on the construction of the Danville-Amo extension which will connect with the main line. Bridge material and supplies of all kinds have been distributed and the seven mile link will be rapidly built. S.

RENTON, WASH.—At a meeting of the Valley Improvement Club it was decided to incorporate as the Independent Electric Railway Company for the purpose of building an electric railway from Renton to Kent, along the White River Valley. An estimate fixes the probable cost of construction at $100,000.

YORK, PA.—To offset the shortage of electric power from the York Haven plant, due to the shallowness of the water in the Susquehanna, the Edison Electric Light Company has completed its plant in this city the installation of a 650-horsepower engine and generator. This is counted upon to enable the York Railways Company to restore adequate service.

LAPORTE, IND.—The bonds for the Gary-Hobart-Valparaiso-Laporte traction line, have been sold and there will be no further delay in completing the line. Already considerable grading has been done. This road is being promoted by ex-Senator A. J. Hopkins, of Illinois, and B. A. Mapledoram of New York. This road will connect a large number of thriving towns and cities and with entrance into Chicago will doubtless become a profitable road.

EVANSVILLE, IND.—Charles M. Murdock, of Lafayette, has been elected president of the Evansville & Southern Indiana Traction Company, to succeed H. B. Smith of Hartford City, who died suddenly last September. Mr. Murdock was born in Lafayette in 1868 and succeeded to the traction interests of his father, the late James Murdock. The old board of directors was re-elected. S.

WAYCROSS, GA.—The Burdette-Loomis syndicate has been granted a franchise for the electric, gas and street railway privileges of the city. The work on the plants must be started before the middle of February, and a cash bond of $10,000 binds the company to complete the work as soon as possible. The company is under bond until $100,000 has been put into the combined plants.

LOGANSPORT, IND.—The Logansport & Frankfort Traction Company has been reorganized and merged with the Cleveland Construction Company. The directors announce that the road will be constructed as speedily as possible, and will be known as the "Three C" line because of its crossing Cass, Carroll and Clinton Counties. Substantial subsidies have been voted in aid of the road. W. F. Travis, manager of the Cleveland Construction Company will have charge of the construction work. S.

NEW MILFORD, CONN.—Verton P. Staub and E. J. Emmons, representing a party of local business men have purchased the New Milford Electric Light Company's plant. The plant was formerly owned by Mrs. W. G. Black, Levi P. Giddings and L. F. Curtiss, of New Milford, and the price paid is said to have been about $75,000. Heretofore the company has furnished lighting service only. The new owners are planning to run the plant day and night and sell electricity for both light and power.

OKLAHOMA CITY, OKLA.—The contracts for the grading and bridge work were closed Wednesday by the Oklahoma Railway Company for the construction of a new interurban line between Capitol Hill and Moore, seven miles south of Oklahoma City. The construction will be continued from the terminus of the company's Capitol Hill line at the south end of the Shield's Oklahoma addition. Vice-President John W. Shartel announces that the road will be graded and ready for track in a short time and cars will be running by June 1.

RICHMOND, VA.—The sum of $600,000 will be expended in general improvements by the Virginia Railway and Power Company, of Richmond, according to an announcement made public by President Northrup, in Richmond. In the budget of expenditures made possible by this sum of money, is included a new terminal station in Manchester, across the James River from Richmond, and the putting on of new high-speed motor equipment for the Richmond-Petersburg thirty-mile interurban line, with terminals in Manchester.

CENTERVILLE, IOWA.—Local capitalists have become interested in the construction of a line which will probably run from Sioux City to Mitchell, S. D., through Centerville, S. D., Menno and Olivett. L. F. Phillips of Wagner, S. D., formerly a resident here, has been in consultation with influential men of this section and has a company organized to back the enterprise. The plan will be to have the people along the line subscribe for a six per cent bond issue, secured by the property of the company, subscriptions to be payable to designated trustees and the road to be completed by Jan. 15, 1911.

ANDERSON, S. C.—The property of the Anderson Traction Company has been bought by a syndicate, composed of the Dukes and several prominent citizens of the Piedmont section of South Carolina. Announcement is made by a committee representing the syndicate that it is the intention to extend the Anderson-Belton line from Belton to Greenville, and as soon as that is completed a line will be built from Greenville to Spartanville, and ultimately the line will be extended to Greensboro via Charlotte. It is also stated that the line will be extended southward from Belton to tap the Seaboard Air Line, probably at Abbeyville. A freight service will be given as well as a passenger service, and the line will compete with steam lines. Thus Anderson and Greenville will be given close connection with the Carolina, Clinchfield and Ohio Railroad at Spartanburg, and with the main line of the Seaboard Air Line.

MADISON, WIS.—The Cincinnati Construction Company, recently incorporated to build an interurban line between Madison and Janesville, has made application to the state railroad commission through their attorney, John A. Aylward, for a certificate of conveyance and necessity to lay and operate an electric road between Madison and Janesville, a distance of about 35 miles. An amendment changing the company's offices from Janesville to Madison has also been filed. The route of the proposed road is as follows: Leaving the city limits of Janesville, it will go through the towns of Edgerton and Stoughton, then follow the southern shore of Lake Kegonsa, along the southern end of Lake Waubesa, and thence on to Madison, where it will connect with the tracks of the Southern Wisconsin Railway Company, by which it will enter the city. It is said that the right-of-way of about half the route has been secured and options are held on the remainder of the distance. The company has filed with the railroad commission a map showing the quarter sections through which the surveyed route will pass, and the drainage accommodations. Attorney Aylward states that work will be started as early as possible in the spring and that a large part of the construction material has been contracted for. President Zigler, of the Cincinnati Construction Company, says that no bonuses are to be asked for along the line. This electric road will give Madison interurban connection with Chicago, by the Rockford and Interurban Railway Company's line from Janesville to Rockford, through Beloit. M.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

OMAHA, NEB.—The fire and police board recommend the letting of a contract to the Nebraska Telephone Company for the installation of a fire and police alarm system.

FLORENCE, COL.—After a delay of several weeks, work has been started on the installation of the new telephone system of the Colorado Telephone Company. The new improvements will entail an expenditure of about $20,000.

DECATUR, ARK.—The Decatur Mutual Telephone Company, of Decatur, has filed articles of incorporation, the capital stock being placed at $10,000, of which $5,000 is subscribed. The incorporators are: H. E. Clark, president; J. N. Oglesby, vice-president; J. Burkhardt, secretary; W. S. McGaugh, treasurer; J. F. Dorsett, R. E. Lee and E. M. Plank.

COLUMBIA, LA.—The Home Telephone Company, of Monroe, which recently established an exchange in Columbia, is extending its lines from this point in the direction of the home office, and will connect with Monroe lines in the near future. The line is already in operation as far as Riverton and is being rapidly pushed forward.

TACOMA, WASH.—It is stated that the Pacific Telephone and Telegraph Company will expend $500,000 in improvements during the coming year in this district. C.

GRAND FORKS, N. D.—The Grand Forks and Brenna Rural Telephone Company, Julius Berg, Brenna Township, secretary, has been organized to construct rural lines to connect with the Northwestern Telephone Company. C.

ANGELICA, N. Y.—The residents of Barber and Taylor Hill, near Rushford, have organized what is known as the Barber and Taylor Hill Telephone Company, an independent company, which will connect with the switchboard of the Rushford Telephone Company's exchange, with the same rights and privileges as other subscribers. The contract has been let for the construction of the line, which will be rushed to completion. The following persons are officers of the new company: E. M. Olney, president; Howard Luce, vice-president; William Barber, treasurer; R. A. Taylor, secretary.

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THOMAS, OKLA.—The Farmers' Telephone Company has been incorporated with a capital stock of $5,000. P.

WASHBURN, N. D.—The Independent Telephone Company will build a line to Stanton. Heavy copper wire will be used . C.

WABASHA, MINN.—The Dwelle Telephone Company is making plans for the installation of a new telephone system. C.

MANDAN, N. D.—The North Dakota Independent Telephone Company is to expend $50,000 in constructing new lines.

TULSA, OKLA.—The Calumet Western Telephone Company has been incorporated with a capital stock of $25,000. P.

MILES CITY, ONT.—The Tongue River Telephone Company has been incorporated to construct and operate a rural line to Ashland. C.

DILLON, MONT.—The Independent Telephone Company has been incorporated with a capital of $1,500,000 and will install an exchange here.

BROOKINGS, S. D.—The Brookings County Telephone Company has been incorporated to succeed the Thompson, Caldwell & Wilson Telephone Company.

SAN FRANCISCO, CAL.—The Pacific Telephone Company had on October 1 a total of 349,119 telephone stations, an increase since the first of the year of 31,607 stations or very nearly ten per cent.

RAPID CITY, S. D.—It is expected that the line of the Black Hills Independent Telephone Company will be completed and be installed and in operation by April, 1910. The company is capitalized at $50,000.

LOUISVILLE, KY.—The Central Home Telephone Company, owning lines and exchanges in Kentucky and Southern Indiana, has been sold for $250,000 to E. H. Cady, representing bondholders of Toledo, O.

SALUDA, S. C.—The Delmar Telephone Company has contracted with the Saluda exchange for the construction of a metallic circuit to unite the two systems, enlarging the service available to clients of both exchanges. L.

BELLEFONTAINE, O.—At a recent meeting of the United Telephone Company, of this city, the stockholders voted to increase the stock from $300,000 to $1,000,000. This is done presumably to strengthen the company in its fight against the Bell interests.

ASBURY PARK, N. J.—It is reported that the New York and New Jersey Telephone Company is to erect a modern three-story building in which to install its telephone exchange. The building will also contain the business offices and is to be the district headquarters of the company.

NEW ORLEANS, LA.—A new exchange is being built by the Cumberland Telegraph and Telephone Company in New Orleans, and will be designated as the "Walnut" exchange, with between seven and eight hundred subscribers. The exchange is located at at the corner of Burdette and Zimple Streets. L.

PORTLAND, ME.—The New England Telephone and Telegraph Company is laying an armored cable from Fish Point to Peak's Island, a distance of about three miles. It is estimated that the cable, together with the cost of installation, will cost about $15,000.

SPENCER, N. C.—An effort is being made to secure a franchise for a telephone system in Spencer, and the Merchants' Association has passed a resolution favoring the Bell Telephone Company, on account of its extensive outside connections. Representatives of the Lexington, Concord and Statesville systems are endeavoring to secure the Spencer franchise. The Bell Company already has the field partially covered. L.

MISHAWAKA, IND.—A meeting of the directors of the Home Telephone Company operating in this city, South Bend and surrounding community was held in this city December 2. The work of the year just closing was reviewed and plans made for considerable improvement, extensions, etc., for the coming year. The business session was followed by a banquet at the Mishawaka Hotel. S.

WEST POINT, IND.—The West Point Co-operative Telephone Company has incorporated to build, equip and operate a telephone exchange in West Point, with telephone lines radiating throughout Tippecanoe, Fountain and adjoining counties. L. J. Clemment, J. C. Whitehead, J. F. Martin, Benjamin Turner, S. R. Stover and Charles Turner, directors. This company is in the market for material and equipment for the construction of a new plant. S.

CRAWFORDSVILLE, IND.—There are strong indications that a deal has been made for the consolidation of the two local telephone companies operating in this city. The plan which seems to be borne out by the circumstantial evidence is for the Home Company to take over the Bell Company's local plant and presumably the long-distance business be turned over to the Bell Company. In any event the Home Telephone Company is preparing to build a complete county system and will construct many new lines next year. S.

NEW YORK, N. Y.—The Continental Telephone and Telegraph Company has acquired by purchase the control of a majority of the common and preferred stock of the American Union Telephone Company of Pennsylvania, an independent telephone company operating a system throughout the entire State of Pennsylvania, except the cities of Philadelphia and Pittsburg. The system also covers a part of New York, West Virginia, Maryland and Delaware. It has upward of 20,000 miles of wire, 65,000 subscribers and 243 exchanges. It is understood that with the acquisition of this property the Continental will immediately begin the construction of a new long-distance line from Pittsburg to Harrisburg, the Pittsburg and Alleghany, of Pittsburg, being also controlled by the Continental. At a meeting of the directors recently held the following officers were elected: John A. Howard, president; Samuel W. Harper, vice-president; Charles West, second vice-president; S. R. Caldwell.

FORT VALLEY, GA.—Two telephone companies, the Fort Valley, whose franchise expired four years ago, and a new concern, the Fruit Belt Company, are seeking a franchise in Fort Valley, the former company claiming that under its original franchise it is entitled to a renewal. The new company, owned by Max L. James and associates, in the meantime, has secured a franchise from the town, and has material ready for construction work. The old company, being ordered to remove its poles and wires, secured an injunction to prevent the Fruit Belt Company from interfering with its work, and restraining the town from injuring its business, and asking $5,000 damages for what has transpired. The Fort Valley Company alleges that the city's electric light wires have interfered with its telephone service, and for this and other reasons alleged, the $5,000 damages are sought, and a heated contest is developing. L.

ELECTRICAL SECURITIES.

Since the issuance of the presidential message and the assurance that nothing alarming was contained therein, the market has assumed an aspect which is notably for the better. All have agreed that there must be more definite understanding between the law and the corporations, which if it cannot be brought about by a change in the corporation management, may be effected by changes in the law. At any rate stockholders are assured that there will be but little disturbance, and their feeling of security is reflected in the upward trend of the market.

The increase in the gross earnings of Brooklyn Rapid Transit during November is being continued. For the first week in December the average daily increase in gross was over $6,000, compared with an increase of slightly better than $5,000 last month. In the fiscal period from July 1 to December 4, gross earnings of the company were $9,129,025, an increase of $844,438, or nearly twelve per cent.

The directors of the Philadelphia Company have voted to offer the preferred and common shareholders of record at close of business December 18, the privilege to subscribe at par to 55,200 shares, of the par value of $50 each, of the common capital stock of the company, authority for issue of which was given on August 14, 1906. The privilege to subscribe terminates on December 30, and payment in full for said shares is to be made at the office of the treasurer of the company in Pittsburg, or at the office of the New York Trust Company, 26 Broad Street, New York, on January 3, 1910. The entire new issue has been underwritten by Ladenburg, Thalmann & Company, and the Swiss Bankverein, of London.

DIVIDENDS.

American Telephone and Telegraph Company; quarterly dividend of two per cent, payable January 15.

Butte Electric and Power Company; quarterly dividend of one and one-half per cent, payable January 3.

Duluth-Superior Traction Company; quarterly dividend of one per cent on common, payable January 3.

Electric Securities Corporation; semiannual dividend of four per cent on common, payable January 3.

Manhattan Railway; quarterly dividend of one and three-fourths per cent, payable January 1.

Sao Paulo Tramway; quarterly dividend of two per cent, payable January 3.

Toronto Railway Company; quarterly dividend of one and three-fourths per cent, payable January 3.

Twin City Rapid Transit Company; quarterly dividend of one and three-fourths per cent, payable January 2.

Union Traction Company, of Philadelphia; semiannual dividend of $1.50, payable January 1 to stockholders of record December 10.

United Gas Improvement Company; quarterly dividend of two per cent, payable January 15.

United Traction and Electric Company; one and one-quarter per cent, payable January 1.

Western Union Telegraph Company; quarterly dividend of one and three-quarter per cent, payable January 15.

Wilkesbarre Gas and Electric Company; quarterly dividend of one and three quarter per cent, payable January 1.

The New York State Public Service Commission, Second District, has authorized the Northern Westchester Lighting Company of Ossining to issue $124,000 five per cent gold bonds maturing June 1, 1950. The bonds are to be sold at not less than ninety per cent of their par value.

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NEW YORK.

	Dec. 13.	Dec. 6.
Allis-Chalmers common	15⅛	15¾
Allis-Chalmers preferred	54	54¾
Amalgamated Copper	86⅞	87⅞
American Tel. & Cable	*80	*80
American Tel. & Tel.	142⅞	140¾
Brooklyn Rapid Transit	80¼	80⅞
General Electric	160¼	159
Interborough-Metropolitan common	24½	24⅝
Interborough-Metropolitan preferred	61¾	57¾
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	91¼	92
Mackay Companies (Postal Telegraph and Cables) preferred	76¼	76½
Manhattan Elevated	140¼	139¾
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	123½	123½
U. S. Steel common	90⅞	90¾
U. S. Steel preferred	125½	124½
Western Union	77¾	77¾
Westinghouse common	84½	84½
Westinghouse preferred	130	140

*Last price quoted.

BOSTON.

	Dec. 13.	Dec. 6.
American Tel. & Tel.	142⅞	140¾
Edison Elec. Illuminating	...	249
General Electric	160¼	159
Massachusetts Electric common	15	15½
Massachusetts Electric preferred	76	76¼
New England Telephone	135½	134
Western Tel. & Tel. common	12	12⅛
Western Tel. & Tel. preferred	89½	89

PHILADELPHIA.

	Dec. 13.	Dec. 6.
American Railways	45¼	45
Electric Company of America	12¼	12½
Electric Storage Battery common	57	56½
Electric Storage Battery preferred	57	56½
Philadelphia Electric	13½	12¼
Philadelphia Rapid Transit	28¼	27¼
Philadelphia Traction	88¾	88½
Union Traction	52½	52½

CHICAGO.

Chicago Railways, Series 1	95	95
Chicago Railways, Series 2	30½	31
	Dec. 13.	Dec. 6.
Chicago Subway	4¾	5¼
Chicago Telephone	135½	135
Commonwealth Edison	117½	118
Metropolitan Elevated common	16½	16½
Metropolitan Elevated preferred	53	51½
National Carbon common	102½	97¼
National Carbon preferred	123	120

PERSONAL MENTION.

J. DINSMORE, technical engineer of the Excello Arc Lamp Company, of New York, visited the Chicago office of the company last week.

M. A. GURNEY, who formerly represented the Tungstolier Company in Iowa and the central western states, has been made manager of the Chicago office of that company.

CAPTAIN WILLARD L. CANDEE, president of the Okonite Company, of New York, is drinking the waters at Mt. Clemens, Mich., and enjoying a few weeks' rest.

F. X. CLEARY has assumed the duties of advertising manager of the Western Electric Company, succeeding H. M. Post, who is no longer connected with the company.

J. M. GEORGE has resigned his position as manager for the Southern Bell Telephone and Telegraph Company at Tifron, Ga., to accept the position as chief engineer for the electric-light and water works plant at Moultrie, Ga.

JESSE W. UNDERWOOD, for several years connected with the New York office of the Cutler-Hammer Manufacturing Company, has accepted a position in the Securities Department of Stone & Webster, and will hereafter reside in Boston.

ANDREW CARNEGIE has donated the sum of $100,000 to the Iron and Steel Institute of Great Britain to endow a research scholarship for the purpose of enabling qualified students to conduct researches in the metallurgy of iron and steel.

RICHMOND E. SLADE, for six years treasurer and general manager of the Hartford City Gas Light Company, has resigned his offices, to become general manager of the gas and electric departments of the New Orleans Railway and Light Company, New Orleans, La.

CAPTAIN ROALD AMUNDSEN, discoverer of the Magnetic North Pole, and the first man completely to navigate the Northwest Passage, will, on his voyage of exploration to the Arctic next summer, make magnetic observations for the department of terrestrial magnetism of the Carnegie Institution of Washington.

STEPHEN D. FIELD, the eminent electrical engineer and inventor, was a New York visitor recently from his home in Stockbridge, Mass. Mr. Field's new quadruplex system has recently been put in practical operation over the Western Union Telegraph Company's Havana-Key West cable, and its application has considerably increased the efficiency of the service.

W. C. WEBSTER, manager of the Westinghouse Electric and Manufacturing Company's office in New York city, has resigned his position and will probably terminate his connection with the company about the first of the year. Mr. Webster's experience with the Westinghouse interests have been quite varied and extensive for the past twelve years. His first position was in the sales department at East Pittsburg. He later became assistant vice-president with headquarters in New York, and for the last few years has been the New York manager, having in charge the New York end of the company's business. Mr. Webster, as yet, has made no plans for the future.

DR. R. T. GLAZEBROOK, director of the National Physical Laboratory, Teddington, Middlesex, England, has been awarded the Hughes medal of the Royal Society of London for his researches on electrical standards. Doctor Glazebrook is a past-president of the Institution of Electrical Engineers, London, England, and was formerly principal of the University College of the Victoria University, now Liverpool University. He is one of those true men of science who labor more for the love of their work than for mere monetary reward, for it is a well-known fact that Director Glazebrook could have positions which carry much higher salaries than are paid at Bushy House. It is particularly pleasing, therefore, to be able to record another honor that has been so deservedly given to this eminent physicist and electrician.

FRANK L. PERRY, for many years on the staff of the WESTERN ELECTRICIAN, and well known among the electrical men of the country, has added another exploit to his many victorious achievements. As special representative of the Chicago Electrical Show management, he has prevailed on Uncle Sam's officials in the War Department to exhibit the Wright aeroplane as one of the striking features at the Coliseum next month. The amount of diplomacy and tact that were needed to secure this consent can hardly be imagined, but Mr. Perry's persistency and resourcefulness won out in the end, after he had, with the aid of several Chicagoans, appealed to the President of the United States. Mr. Perry's special study of wireless telegraphy in connection with aeroplanes served him materially in his mission to the powers at Washington.

NEW PUBLICATIONS.

PROCEEDINGS OF THE MICHIGAN ELECTRIC ASSOCIATION—The proceedings of the sixth annual convention of the Michigan Electric Association have been published in book form. The convention was held in Detroit on August 17 to 19 last. The bound volume of the proceedings, consisting of 126 pages, gives in full all of the papers presented and the discussions on them. Reports of the various committees are also included.

PROCEEDINGS OF THE OHIO ELECTRIC LIGHT ASSOCIATION—The Ohio Electric Light Association has published in book form the proceedings of its fifteenth annual convention that was held at Toledo, O., on July 13, 14 and 15, last. This book of 134 pages gives in full all the papers that were presented with the discussions upon them. A membership list of the association is also included, as well as a full list of the officers and committees.

IRON ORE DEPOSITS IN CANADA.—This report on the iron-ore deposits along the Ottawa and Gatineau rivers, in Canada, by Fritz Cirkel, M. E., has recently been published by the Mines Branch of the Canadian Department of Mines. After describing in detail various iron-ore deposits in the townships of Hull, Templeton, Wakefield, Bristol, Grenville and others, Mr. Cirkel concludes that many of these would yield ores which could in all probability be treated profitably in the electric furnace. It is stated in the report that this mehod of reducing the iron ores can compete with the blast furnace for the production of pig iron, when electrical energy can be developed at a low cost. An appendix to the report gives a synopsis of the waterpowers, both developed and undeveloped, in the region under consideration. These data have been compiled from the latest authoritative sources available. The report is well illustrated.

PROCEEDINGS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION—The complete proceedings of the thirty-second convention of the National Electric Light Association, which was held at Atlantic City, N. J., June 1, 2, 3 and 4, 1909, have been published in book form and constitute three bulky volumes comprising nearly 2,300 pages. The first volume is devoted to the general sessions and contains all of the papers, reports and discussions that were presented at these meetings. It also contains a complete list of the membership in the various classes as it existed at the time of the convention. The second volume contains the full proceedings of the technical and commercial sessions. The third volume gives in detail the proceedings of the accounting sessions and of the executive sessions, including in the latter the full reports of the executive and public policy committees. Each of the volumes also contains a very excellent author index and synopsis of the papers that were presented. The great bulk to which the annual convention proceedings of the association have grown is an excellent indication of the growing importance of the association and of the rapid extension of its work. The papers and reports that were presented, with discussions, make these volumes the most complete and up-to-date publication in book form of the central-station industry.

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INDUSTRIAL ITEMS.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has recently received an order from the Bear Lake Company, of Montpelier, Idaho, for twenty-six transformers varying in size from two to 100 kilo-volt-amperes.

THE NATIONAL-ACME MANUFACTURING COMPANY, Cleveland, Ohio, is mailing samples of a steel stud of special form, which, it is claimed, was made on an Acme automatic screw-machine in twenty-five seconds and with less than seven seconds of labor.

THE FANCLEVE SPECIALTY COMPANY, Jamaica Plain, Mass., manufacturers of fittings for conduit, cable and molding construction, is distributing a very attractive calendar for the year 1910. The calendar contains a reproduction of a painting, entitled "The Trail of Sunset."

GEO. CUTTER, South Bend, Ind., is distributing a circular devoted to a number of specialties, among which are streethood sockets with a two-story flange for use with deep top and shallow top hoods; spring suspended sockets for delicate filaments; many-light hoods; tungsten streethoods and tungsten street brackets.

THE ARNOLD COMPANY, 191 La Salle Street, Chicago, Ill., is mailing an interesting postal card, showing views of the Burnside Foundry Plant of the Featherstone Foundry and Machine Company. These four pictures are illustrative of some of the best features of the plant, which was constructed by this well-known engineering firm.

HUBBARD & COMPANY, Pittsburg, Pa., have recently distributed a booklet devoted to transposition methods. Taking the view that the transpositions of toll lines must be mechanically strong, must take account of possible breakages of insulators, loosening of tie wires, etc., in addition to being electrically correct, this booklet shows diagrammatically the proper transposition of toll lines, and describes and illustrates the apparatus for accomplishing this.

THE TOLTEC PORTLAND CEMENT COMPANY, of Kansas City, Mo., has ordered from the Allis-Chalmers Company, of Milwaukee, the following induction motors and equipment for its plant at Hidalgo, Mex.: Five 150-horsepower motors of special design for driving tube mills, two 150-horsepower motors to be belted to line shafts, two 110-horsepower motors for pulverizers, three smaller belted motors and one complete twenty-horsepower single-drum hoist.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, has recently distributed a bulletin, No. 371, devoted to adjustable speed motors. This publication discusses briefly the operating characteristics of these motors which are particularly adapted for machine tool operation, and also for other classes of work, such as operating printing presses, pumps, blowers, elevators, etc. In addition to the descriptive matter, several illustrations of Triumph motors driving various machines are shown.

I. P. FRINK, 551 Pearl Street, New York, N. Y., designer and manufacturer of lighting specialties, is distributing booklet No. 59, entitled "Frink's System of Bank Illumination." According to the booklet this system is a practical application of the optical laws governing refraction and reflection. The perfect diffusion eliminates all glare and shadows and the symmetrical appearance obtained is very pleasing. To further emphasize this, the booklet contains views of a modern bank in which the Frink system has been installed.

THE AMERICAN FLAMING ARC LAMP COMPANY, 148 Purchase Street, Boston, Mass., is distributing an attractive catalogue devoted to the "American" flaming arc lamps and a price list of lamps, globes, carbons and repair parts. The former publication contains a detail description of the lamp, including the electrical and mechanical specifications. In addition illustrations showing the various details of construction and the distribution of light. The latter publication contains the latest revised prices on all parts and supplies.

H. G. McFADDIN & COMPANY, 38 Warren Street, New York, N. Y., are distributing two circulars devoted to "Emerald" electric desk and piano lamps. The desk light reflector is constructed so as to distribute light over the entire desk. The supporting arm is easily adjustable to the various widths of desk tops and the clamps are felt lined. The piano lamp is equipped with an ornamental base which holds the lamp securely. Both lamps are of standard finish and the illustrations contained in the booklets show the various styles of these lamps.

THE DIAMOND RUBBER COMPANY, Chicago, Ill., announces that its complete stock of rubber covered wires and cables which has been carried for some time by its branch, located at 211 Lake Street, has been transferred to the regular Chicago Branch of the company, located at 1523-31 Michigan Avenue, Chicago. This stock includes practically the complete line—thirty per cent para, red core and black core, lead encased cables, igniter cables, etc. W. I. Morrow, formerly of the Akron office, is in charge. Prompt shipments can be made direct from Chicago.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a new twelve-page booklet, entitled "Holiday Suggestions." This booklet describes a complete line of Christmas-tree outfits, toys, vibrators, electrical heating devices, etc. A new folder sent out by the same company deals with the Pittsburg type transformer fuse block for use on 2,200-volt circuits. This folder should be found of considerable service to central station managers in that it gives the proper size of fuses to be used with different sizes of transformers at both 1,100 and 2,200 volts.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is distributing the December issue of *The Emerson Monthly*, which contains, *inter alia*, a description of the Perry electro-pneumatic, water-supply system, and a remarkable offer to send samples of the Emerson type 732 D A motor (one-half horsepower ventilated direct-current motor), in regular stock winding on thirty days' trial to responsible electrical dealers and central stations anywhere in the United States. Such samples are subjected to return in good condition for full credit, if returned promptly at the end of the trial period.

THE PETTINGILL-ANDREWS COMPANY, Boston, Mass., has just distributed the December issue of "Juice," its monthly publication devoted to electrical material. This number is an exceptionally interesting one, containing descriptions and illustrations of numerous electrical devices for Christmas. Special space has been given electrical toys and miniature fruit and flower electric lamps for decorating purposes. In addition to the foregoing this publication contains an interesting editorial entitled "Spilling Tea," and an interesting and instructive article by G. E. Palmer entitled "The Factors of Economical Meter Testing."

THE SPRAGUE ELECTRIC COMPANY, New York, N. Y., is distributing a bulletin known as No. 110, devoted to continuous current direct-driven, type S generators for lighting and power. A distinctive feature of these machines is the use of a soft steel casting for the magnetic yoke, the generators having been designed so as to use to advantage the superior magnetic qualities of steel. The bulletin describes the design and construction of the type S generator in detail and contains, in addition to illustrations of the various details of the machine, several views of these generators installed in prominent power plants.

THE PARTRICK, CARTER & WILKINS COMPANY, of Philadelphia, Pa., the old-established manufacturer of annunciators, burglar alarms, bells and other electrical house goods, has removed its general offices and salesrooms from Twenty-second and Wood Streets to 122 North Eleventh Street. The factory will remain where it is, and the moving of the offices and salesrooms will give largely increased factory space. Offices and salesrooms will now be more centrally located for the convenience of architects and others who desire to show the apparatus in practical operation to their clients. The firm is also selling agent for the line of fire alarms, district boxes, etc., made by the Viaduct Electric Company.

THE DIELECTRIC COMPANY OF AMERICA, Belleville, N. J., is distributing an attractive catalogue entitled "New Ideas in Underground Transmission." This publication describes the Dielectric system of underground transmission for power and lighting circuits, which consists of a wooden box or trough, in which the conductors are supported on special porcelain insulators and surrounded with a special "Dielectric" compound. It describes in detail the properties of this compound and mentions a few of the many points of merit of the system. Illustrations showing the construction and application of the system are shown. Orders have been placed to double the capacity of the plant as there are sufficient orders on hand to keep the present machinery busy until next October.

THE PARKER-CLARK ELECTRIC COMPANY, of New York city, announces the retirement of W. G. Clark from his connection with the company and the election of Dr. George N. Miller to the office of president and director. In order to be in close touch with the laboratories, the offices of the company have been moved from the Singer Building to the Lincoln Square Building, 1966 Broadway. Prof. H. C. Parker continues at the head of the laboratory work and, with the advent of the new chief executive, active preparations are being made to place the company's products on the market at once. The Helion resistors developed by this company undoubtedly meet a definite need in the electrical heating field. Anticipating a large demand for these resistors, the company plans to start a factory for their manufacture as soon as a suitable location can be selected. Work will also be vigorously prosecuted on the Helion incandescent lamp, which is now nearing perfection, with the idea of offering it to the public this coming spring. The company is also preparing to manufacture immediately the Helion naval lamp to meet the large demand for an incandescent lamp which will stand the shock of firing large guns on board men-of-war. The Helion filament is said to meet these demands admirably; even should the glass globe enclosing the filament be broken, the filament will burn in the open air for an indefinite period without apparent deterioration.

DATES AHEAD.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

Wisconsin Electrical Association. Annual convention, Milwaukee, Wis., January 19 and 20, 1910.

Toledo Electrical Show, Coliseum, Toledo, Ohio, January 31-February 5, 1910.

San Francisco Electrical Exposition, January 29, February 5, 1910.

Philadelphia Electrical Exposition, Philadelphia, Pa., February 14-26, 1910.

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RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) December 7, 1909.

942,046. PROCESS OF GENERATING AND STORING OZONE. Frank M. Ashley, New York, N. Y. Continuation of application filed September 21, 1905. This application filed December 15, 1906. Oxygen is converted into ozone by an electric treatment in an ozonizer, special precautions being taken to prevent expansion of the product during storage in a suitable receptacle.

942,050. MOTOR-CONTROLLING DEVICE. Thomas E. Barnum, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company. Filed March 14, 1907. Contact segments are carried by each of two insulated drum segments on the controller shaft. Rotation of the shaft causes the contact segments to engage alternately with contact fingers so as periodically to change the circuit connections of the motor.

942,068. ELECTRIC FURNACE WITH RAISED CHARGING-PIT. Alois Helfenstein, Vienna, Austria-Hungary. Filed June 12, 1909. Broad slots or openings in the furnace roof are made gastight.

942,091. HARMONIC SIGNALING SYSTEM. Ray H. Manson, Elyria, Ohio, assignor to Dean Electric Company. Filed February 8, 1906. The effect of the main source of current in an electrical transmission system is accentuated by sharply varying periodic waves of electromotive force impressed on the circuit.

942,110. ELECTRIC FURNACE. Frederick T. Snyder, Oak Park, Ill., assignor to Electric Metals Company. Filed Sept. 25, 1906. Has special cooling features for the walls and electrodes.

942,131. TIME-CONTROLLED SMOKE-PREVENTER. Bradford L. Ames, Boston, Mass. Filed February 28, 1908. A contact device, actuated by a clock train, closes an electric operating circuit at the end of a predetermined time interval.

942,143. CATENARY SUSPENSION SYSTEM FOR THE TROLLEY WIRES OF ELECTRIC RAILWAYS. Kalman von Kando, Vado Ligure, Italy, assignor to George Westinghouse, Pittsburg, Pa. Filed October 2, 1908. An insulator is secured to a supporting arm, and an intermediate member, carried by the insulator, adjustably secures the suspension wire.

942,156. GRID RESISTANCE. Henry J. Wiegand, Milwaukee, Wis., assignor to The Cutler-Hammer Manufacturing Company. Filed March 29, 1909. A reinforcing strip placed over the edge of the grid has portions bent around lugs on the grid to secure it.

942,157. VAPOR ELECTRIC APPARATUS. Howard I. Wood, Schenectady, N. Y., assignor to General Electric Company. Filed January 18, 1904. A mica-supported filament extends between the electrodes.

942,186. MAGNETIC CLUTCH. Henry W. Ravenshaw, Hanwell, England. Filed Feb. 28, 1907. A pinion gears with teeth on the outer ring of an intermediate element consisting of two concentric rings of magnetic material secured together by a flexible ring of nonmagnetic material. The electromagnetic and its keeper are annular in form.

942,187. MAGNETIC CLUTCH. Henry W. Ravenshaw, Hanwell, England. Filed January 14, 1908. Similar to the preceding.

942,188. MAGNETIC CLUTCH OR BRAKE. Henry W. Ravenshaw, Hanwell, England. Filed March 17, 1908. A magnetizing coil surrounds slidably mounted intermediate elements in part mounted on a boss connecting the driving and the driven shaft.

942,195. SIGNAL-CONTROLLING APPARATUS. Winthrop M. Chapman, Needham, Mass., assignor to Electric-Railway Signal Company. Filed April 25, 1908. Contacts are arranged to be closed by the trolley of an electric car, other contacts by the wheels of the car, and a signal-controlling circuit is closed by the closure of both sets of contacts.

942,196. APPARATUS FOR CONTROLLING ELECTRIC MOTORS. Harry E. Dey, Jersey City, N. J., assignor to Ben T. Cable, New York, N. Y. Filed August 6, 1908. The relative strength of the field magnets of two dynamoelectric machines (one with a stationary and a rotary element and the other with both elements rotary and having one rotary element connected mechanically to the rotary element of the first machine) is varied and controlled, and a counter resistance is operated with the load.

942,197. APPARATUS FOR CONTROLLING ELECTRIC MOTORS. Harry E. Dey, Jersey City, N. J., assignor to Ben T. Cable, New York, N. Y. Filed August 8, 1908. In a similar arrangement to the preceding, the series winding of the field magnet of each machine is placed in the circuit of the armature of the other machine.

942,198. APPARATUS FOR CONTROLLING ELECTRIC MOTORS. Harry E. Dey, Jersey City, N. J., assignor to Ben T. Cable, New York, N. Y. Filed May 21, 1909. The relative strength of the field magnets of the various motors to be controlled is varied and controlled by a rheostat operated by a pilot motor. The rheostat is also operated with the load so as to be restored thereby to its normal position.

942,208. DUPLEX CABLE TELEGRAPHY. Isidor Kitsee, Philadelphia, Pa. Filed May 20, 1908. Renewed April 29, 1909. The receiving apparatus comprises a transformer the primary of which is associated with the line and the secondary of which controls the receiving instrument. A third winding on the transformer is associated with the transmitter to neutral the effect of transmitted impulses in the secondary winding.

942,240. PLURAL-LAMP-HOLDING DEVICE. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company. Filed August 5, 1907. Electrical contact and lamp-holding devices are carried by insulating blocks secured respectively to radial legs on the main supporting member.

942,241. PLURAL LAMP-SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company. Filed December 28, 1907. A base carrying an inner contact is removable independently of the outer contacts.

942,242. PLURAL-LAMP-HOLDING DEVICE. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company. Filed December 28, 1907. Each of a number of metallic strips connects mechanically and electrically a pair of sockets.

942,243. METHOD OF MILKING COWS. Franz M. Berberich, Kiel, Germany. Filed November 25, 1908. The flow of milk is promoted by subjecting the cow to a slight electric shock.

942,248. AUTOMATIC SELF-INDICATING FUSE. Frank B. Cook, Chicago, Ill. Filed March 1, 1909. Fusing of the conductor releases a coil spring which operates a plunger.

942,264. BRUSH-HOLDER. Austin Kimble, Chicago, Ill., assignor to Kimble Electric Company. Filed March 22, 1909. The brush is thrown away from the moving contact member by means of a spring which is automatically released when the brush has worn away by a predetermined amount.

942,279. STORAGE BATTERY. David P. Perry, Chicago, Ill., assignor of two-thirds to William Morrison, Chicago, Ill., and one-third to M. A. Lumbard, Des Moines, Ia. Filed October 12, 1903. A metallic cell contains a horizontal cylindrical reticulated negative electride, a positive electrode concentrically within the negative electrode, a cylindrical conductor concentrically within the positive electrode, and a suitable electrolyte.

942,308. IRON HEATED BY ELECTRICITY. John Collicott, Salt Lake City, Utah. Filed June 8, 1909. The heating units are pivotally secured to the interior of the chambered base, the base being provided with a perforated covering.

942,325. ELECTRIC GENERATOR. Gustav A. Huber, New York, N. Y., assignor to Huber Automatic Magneto Signaling Company. Filed February 10, 1908. Connected to the armature is a ratchet wheel co-operating with a swinging pawl which is actuated by a lever.

942,328. IGNITER FOR INTERNAL-COMBUSTION MOTORS. Howard A. Johnston, Toronto, Ontario, Canada. Filed September 27, 1907. One electrode is a cup-shaped member and the other a wire extending from without the cup to within sparking distance of the rim thereof.

942,332. ELECTRIC CONDUCTOR. Isidor Kitsee, Philadelphia, Pa. Filed April 10, 1908. The resistance of each of two conductors comprising together a composite conductor is half or less than half of the resistance between the conductors.

942,334. MECHANICAL CODE-SIGNALING DEVICE. Fritz A. Meissner, Manchester, Va. Filed December 11, 1908. A telephonic apparatus has a circuit closer which can be introduced into various points on a plate having parallel rows of circuit breakers therein.

942,335. INSULATING-SUPPORT FOR HIGH-TENSION CONDUCTORS. Ralph D. Mershon, New York, N. Y. Filed February 5, 1908. A framed structure has insulating members for resolving mechanical forces originating in the conductor into components. Connections between these members and the conductor-carrying means are designed to transmit to the respective members substantially only forces in one direction.

942,349. PROCESS OF PRODUCING FERRO ALLOYS. Edgar F. Price, Niagara Falls, N. Y., assignor to Central Trust Company of New York. Filed June 1, 1907. The charge is smelted in an electric furnace in which the zone of reduction is surrounded and embedded, and the electrodes protected from oxidation and cooling, by a considerable body of the charge. The waste gases are withdrawn laterally in different directions beneath the surface of the charge.

942,350. ELECTRIC FURNACE. Edgar F. Price, Niagara Falls, N. Y., assignor to Electro Metallurgical Company. Filed January 27, 1908. A stack is disposed above the bath and between the vertical series of electrodes so that the air current flowing to the stack passes around and between the electrodes.

943,378. VAPOR ELECTRIC APPARATUS. Leonard E. Dempster, Schenectady, N. Y., assignor to General Electric Company.

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Filed March 19, 1904. A filamentary conductor initially connects the several mercury electrodes, and means are provided for nonsimultaneously breaking the connections at the working surfaces of the respective electrodes.

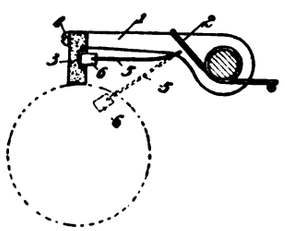
943,379. METHOD OF MANUFACTURING DYNAMO-BRUSHES, ETC. Georg Egly, Berlin, Germany, assignor to Gebruder Siemens Co., Charlottenburg, Germany. Filed January 25, 1907. Triturated silicon is intimately mixed with powder carbon, and the molded product is heated in an atmosphere of nitrogen.

942,382. MOTOR-CONTROLLER. Austin Kimble, Chicago, Ill., assignor to Kimble Electric Company. Filed September 7, 1909. A series of stationary contacts mounted within the motor end cap are successively engaged by contact members secured on the inner face of a rotating ring seated and slidably retained within a groove located in one face of an annular disk the flanges of which are attached to the motor frame.

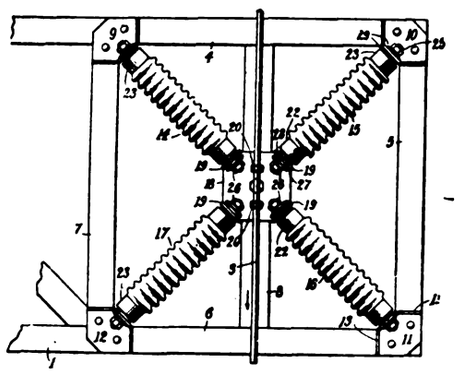
942,396. ELECTRIC DRILL. Purd J. Lincoln, Birmingham, Ala. Filed November 18, 1908. The drill rod is direct-connected to the spindle of an armature rotatable within field coils comprising a central coil, a coil on each side of this, and an end coil for each of the side coils. Means are provided for introducing the central coil and two end coils into an electric circuit alternately in series with the respective side coils to actuate the armature.

942,398. APPARATUS FOR PRODUCING PERFORATED MUSIC-RECORD SHEETS. George Machlet, Jr., Elizabeth, N. J. Filed October 10, 1903. Electrically operated punches are actuated by means of a system of music keys.

942,401. PORTABLE TELEPHONE. Otto L. Mulot, Brooklyn, N. Y. Filed October 12, 1908. Describes a form of desk telephone.



942,264.—BRUSH-HOLDER.



942,335.—INSULATING SUPPORT FOR HIGH-TENSION CONDUCTOR.

electromagnet in the first circuit controls a means for closing the second circuit, and the electromagnet in the second circuit likewise may close the third circuit.

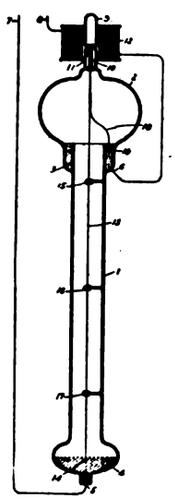
942,513. SINTERING APPARATUS. Robert Palmer, Larchmont, N. Y., assignor to General Electric Company. Filed February 10, 1909. Describes an arrangement of co-operating, water-cooled, electrically operated clamps.

942,544. ELECTRIC TRANSFORMER AND GOVERNOR. Edward R. Cliff, New York, N. Y. Filed March 5, 1908. Describes an inclosing case for the operative parts of a transformer and governor.

942,550. CONTACT DEVICE FOR SELF-PLAYING MUSICAL INSTRUMENTS AND OTHER APPARATUS. George H. Davis, West Orange, N. J. Filed February 4, 1905. A wire selector finger co-operating with a contact bar or roll over which travels a perforated web, has a loop between its ends whereby its free end may yield in the direction of the travel of the web.

942,555. ELECTRIC RESISTANCE APPARATUS. Max Hankin, Brussels, Belgium. Filed January 5, 1909. A closed conducting metal envelope is packed with particles of a resisting material, into which project two terminals, one from each opposite end.

942,620. ELECTRIC TELEGRAPHY. Joseph A. L. Dearlove, London, England. Filed March 1, 1909. Describes a system of duplex telegraphy.



942,378.—VAPOR ELECTRIC APPARATUS.

943,433. ALARM APPARATUS. Harry R. Bretney, Indianapolis, Ind., assignor to John Wocher, John T. Dickson and James S. Cruse, Indianapolis, Ind. Filed January 11, 1909. Is electromagnetically operated.

942,463. METHOD OF AND MEANS FOR REGULATING THE SPEED OF ELECTRIC MOTORS. Robert H. Rogers, Schenectady, N. Y., assignor to General Electric Company. Filed August 5, 1908. One of two cumulatively wound field windings of the motor is maintained open when the motor is heavily loaded and the other is closed when the motor is lightly loaded.

942,468. AUTOMATIC SIGNALING SYSTEM FOR RAILWAYS. George H. Sloane, Boston, Mass., assignor of one-half to Herbert B. Waters and Harold Plimpton. Filed May 26, 1908. Describes an electric block-signaling system.

942,472. ELECTRIC LIGHTING. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company. Filed April 21, 1900, Serial. Renewed July 23, 1906. The color of the light from an arc existing within a transparent or translucent envelope is modified by introducing into the arc a color-modifying substance in the condition of a salt of one of the general class of acids forming, or capable of forming, the envelope.

942,488. CONTROLLER FOR ELECTRIC AUTOMOBILES. Henry P. Dodge, Toledo, Ohio. Filed June 5, 1909. Two parallel series of electrical contacts are carried by one of two relatively movable members, and a single contact piece, carried by the other member, may be moved into alinement with either of the series of contacts.

942,491. ELECTRIC SWITCH. William L. R. Emmet and Edward M. Hewlett, Schenectady, N. Y., assignors to General Electric Company. Filed February 14, 1901. Means are provided for breaking the connection between a contact member and its actuator and leaving the latter restrained upon the occurrence of predetermined electrical conditions.

942,508. ELECTRIC CIRCUIT-CONTROLLING RELAY. Burnett Menkin, New York, N. Y. Filed February 3, 1909. There are three electrical circuits, two receiving current from a common source and each including an electromagnet, and the third, which is normally open, including a translating device. The

942,623. AUTOMATIC CUT-OFF. Paul Dixon, Atlanta, Ga. Filed December 20, 1907. A continuously movable (when set) automatically controlled means operates at a predetermined time interval by the movement of another automatic means moving in the opposite direction.

942,646. ELECTRIC IGNITING DEVICE. Joseph A. Jeffery and Benjamin A. Jeffery, San Francisco, Cal. Filed August 15, 1906. The exposed area of either of the terminals is restricted to a limit where the proximity or surface contact therewith of a medium of lesser conductivity will be sufficient to carry the current without heating such medium to disintegration.

942,647. ELECTRICAL CONTACT DEVICE. Charles F. Jenkins, Washington, D. C. Filed August 21, 1908. A movable contact piece may be retarded and suddenly released as it approaches each of several fixed contact pieces.

942,676. SIGNALING SYSTEM. Fae E. Smith, Ames, Ia. Filed July 24, 1908. Describes a signal system for electric trolley railways.

942,704. METHOD OF SECURING METAL CONTACTS TO CARBON ELECTRODES. Stephan Benko, Budapest, Austria-Hungary. Filed July 8, 1909. The head of the electrode is heated to a temperature above the melting point of the metal, whereupon it is impregnated with molten metal, the metal being absorbed by the heated carbon.

942,710. CONNECTION-ROSETTE FOR ELECTRIC WIRES. James L. Burton, Plainville, Conn., assignor of one-half to Frank A. Champlin, East Long Meadow, Mass. Filed July 25, 1908. Eccentrically grooved and ribbed members engage together through contact pieces, and fuse clamps are secured to one of the members.

942,729. ELECTROLYTE AND METHOD OF ELECTRO-DEPOSITING NICKEL. Adward F. Kern, Knovxille, Tenn., assignor of one-half to Percy S. Brown, New York, N. Y. Filed September 7, 1909. A solution containing fluo-silicate of nickel is electrolyzed, using an anode of nickel.

942,730. FLAMING ARC LAMP. George L. Martin, Brooklyn, and Arthur W. Schreiner, Evergreen, Long Island, N. Y., assignors

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to said George L. Martin. Filed February 17, 1909. Describes a feed mechanism for flaming arc lamps.

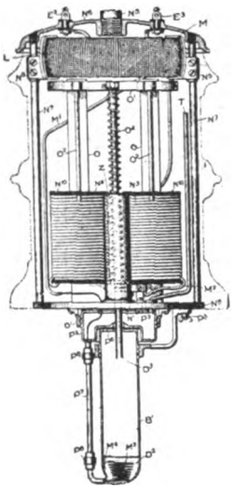
942,763. SIGNALING APPARATUS FOR TELEPHONE SYSTEMS. Roscoe C. Welty, Omaha, Neb. Filed June 2, 1908. Describes a party telephone-line system.

942,787. FLEXIBLE CONDUIT. Charles H. Miller, West Pittsburg, Pa., assignor to Safety-Armorite Conduit Company. Filed July 25, 1907. A nonmetallic flexible conduit for electric wires has an inner layer with a smooth interior face, and a tubular braided or woven fabric surrounding the inner layer and saturated with a fireproofing substance.

942,788. CONDUIT FOR ELECTRIC WIRES. Charles H. Miller, West Pittsburg, Pa., assignor to Safety-Armorite Conduit Company. Filed July 25, 1907. The inner lining of woven or braided strips has its weft and warp spirally wound in opposite directions.

942,789. FLEXIBLE ELECTRIC CONDUIT. Charles H. Miller, West Pittsburg, Pa., assigner to Safety-Armorite Conduit Company. Filed July 25, 1907. The inner composition-covered fabric is inclosed by a spirally wound wooden strip impregnated with a fireproofing composition, this wooden strip being inclosed by a wrapping and the whole inclosed by a waterproofed woven or braided fabric.

942,790. FLEXIBLE CONDUIT FOR ELECTRIC WIRES. Charles H. Miller, West Pittsburg, Pa., assignor to Safety-Armorite Conduit Company. Filed July 25, 1907. The innermost tube is airtight and watertight and is surrounded by a helical paper wrapping, this in turn being wrapped with muslin impregnated with an adhesive composition, the whole being finally covered by a braided or woven tubular fabric.



942,472.—ELECTRIC LIGHTING.

942,807. TELEGRAPHIC REPEATING APPARATUS. William E. Athearn, New York, N. Y., assignor to American Telephone and Telegraph Company. Filed June 12, 1909. The repeater comprises two transmitting sections, a primary relay operated by a transmitter and in turn operating a secondary relay, and circuit-controlling means for the secondary relay.

942,814. MULTIPLE TELEGRAPH. Stephen D. Field, Stockbridge, Mass., assignor to the Western Union Telegraph Company. Filed June 17, 1909. A differentially wound relay has its differential windings one in a main line and one in an artificial line of the system, and another relay has its coils connected to the main and artificial lines in bridge relation with respect to the first relay and having an inductive capacity greater than that of the main and artificial line coils of the first relay.

942,815. RELAY. Stephen D. Field, Stockbridge, Mass., assignor to the Western Union Telegraph Company. Filed June 17, 1909. There are three electromagnets, one a main magnet for the movably mounted armature, one a holding magnet for the armature, and the third an auxiliary magnet acting upon the armature in the same direction as the holding magnet.

942,844. AUTOMATIC TELEGRAPH. Louis M. Potts, Baltimore, Md., assignor to the Rowland Telegraphic Company. Filed July 6, 1905. A progressive contact-maker connects the main-line transmitter into each of several groups of electric circuits (for operating the transmitter) successively, and a primary controlling device consists of a prepared sheet having code impressions thereon arranged in a series of groups of transverse lines, each group of lines of impression corresponding to a line of matter to be transmitted and each adapted to control a separate group of the circuits.

942,861. GAS-ANALYZER FOR FURNACES. Cyprien O. Mailloux and Henry J. Westover, New York, N. Y. Original application filed February 7, 1907. Divided and this application filed April 22, 1907. A directing valve is moved electromagnetically.

942,867. MAGNETIC CLUTCH. Henry W. Ravenshaw, Hanwell, England. Original application filed February 28, 1907. Divided and this application filed March 29, 1909. The magnetic circuit is completed out through an intermediate element (located between the annular electromagnet and its annular keeper) and back through the shaft.

942,871. VAPOR ELECTRIC APPARATUS. Howard I. Wood, Schenectady, N. Y., assignor to General Electric Company. Filed December 17, 1903. A conductor, having one end resting on a vaporizable electrode, may be subjected to the influence of an intersecting magnetic field.

942,874. ELECTRIC HEATER. George E. Stevens, Lynn, Mass., assignor to General Electric Company. Filed May 29, 1907. The fluid is delivered to the heater under pressure, the flow of fluid and the circuit of the heater being controlled by means operated by the fluid pressure.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 13, 1909:

487,703. ELECTRIC METER. Chas. W. Ayton. New York, N. Y.

487,735. CONDUIT FOR ELECTRIC RAILWAYS. John W. Hayden, Fort Wayne, Ind.

487,755. ARMATURE FOR ELECTRO-MAGNETIC MACHINES. Robert Lundell, New York, N. Y.

487,795. MULTIPLE-SWITCHBOARD SIGNAL. Giles Taintor, Keene, N. H.

487,796. SYSTEM OF ELECTRICAL TRANSMISSION OF POWER. Nikola Tesla, New York, N. Y.

487,813. ELECTRIC-RAILWAY TROLLEY. Adolf Worner, Buda Pesth, Austria-Hungary.

487,816. AUTOMATIC SAFETY DEVICE FOR DYNAMO-ELECTRIC MACHINES. Francis B. Badt, Chicago, Ill.

487,834. MANUFACTURE OF SECONDARY-BATTERY ELECTRODES. William W. Griscom, Haverford, Pa.

487,839. GALVANIC BATTERY. Harry T. Johnson, New York, N. Y.

487,846. CASING FOR BASES OF INCANDESCENT LAMPS. Geo. R. Lean, Boston, Mass., and Chas. B. Burleigh, Chelsea, Mass.

487,852. MULTIPLE-SWITCHBOARD CIRCUIT. Alfred H. McCulloch, Boston, Mass.

487,853. MULTIPLE-SWITCHBOARD BUSY-TEST CIRCUIT AND APPARATUS. Jas. J. McQuarrie, Boston, Mass.

487,854. BUSY-TEST APPARATUS FOR MULTIPLE SWITCHBOARDS. Jas. L. McQuarrie, Boston, Mass.

487,881. AUTOMATIC SWITCH. Nelson Newman, Springfield, Ill.

487,890. MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS. Casimir Pauthonier, Boston, Mass.

487,904. SIGNALING DEVICE FOR RAILWAYS. Zdenko Krulis, Chicago, Ill.

487,936. AUTOMATIC KEYBOARD-OPERATOR. Henry S. Prentiss, Elizabeth, N. J.

487,981, 487,982 and 487,983. PRINTING TELEGRAPH. Chas. L. Buckingham, New York, N. Y.

487,984. SYNCHRONOUS MULTIPLE-TELEGRAPH. Chas. L. Buckingham, New York, N. Y.

487,985 and 487,986. PRINTING TELEGRAPH. Chas. L. Buckingham, New York, N. Y.

487,996. ELECTROLYTIC APPARATUS. Thomas Craney, Bay City, Mich.

488,002. LIGHTNING ARRESTER. Wm. R. Garton, Keokuk, Iowa.

488,012. ELECTRIC GAS-LIGHTER. Lucien M. Kilburn, Council Bluffs, Iowa, and Scott Van Etten, Omaha, Neb.

488,013. ELECTRIC BELT. Ole Kjorstad, Eau Claire, Wis.

488,016. ARMATURE FOR ELECTRIC MACHINES. Benjamin G. Lamme, Pittsburg, Pa.

488,022 and 488,023. ELECTRIC RAILWAY TROLLEY. David Mason, New York, N. Y.

488,027. ELECTRIC COUPLING. John J. Purcell, Washington, D. C.

488,033. SPRING JACK SWITCH. Chas. E. Scribner and Ernest P. Warner, Chicago, Ill.

488,034. MEANS FOR PREVENTING INDUCTION IN CABLES OF MULTIPLE SWITCHBOARDS. Chas. E. Scribner, Chicago, Ill.

488,035, 488,036 and 488,038. MULTIPLE SWITCHBOARD SYSTEM FOR TELEPHONE EXCHANGES. Chas. E. Scribner, Chicago, Ill.

488,041. ELECTRIC MOTOR. Imle E. Storey, Boulder, Colo.

488,053. TEST CIRCUIT FOR MULTIPLE SWITCHBOARDS. Oro A. Bell, Brooklyn, N. Y.

488,123. ELECTRIC SAFETY CUTOUT. Henry S. Keating, London, England.

488,138. ELECTRIC SIGNAL-CIRCUIT. John V. Young, Boston, Mass.

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CONTENTS.

EDITORIALS:
The Waterpower Problem ... 1219
Cost of Power Production in Two Central Stations ... 1220
Some Features of Telephone Service ... 1221
Chicago Electric Club ... 1222
New York Subway Plans ... 1222
American Exposition in Berlin ... 1223
Henry L. Doherty ... 1223
Kings County Electric ... 1223
Fifth Annual Convention of the National Commercial Gas Association 1224
An Electric Clock ... 1225
Pittsburg Section, American Institute of Electrical Engineers ... 1225
Brooklyn Rapid Transit Pension Plan ... 1225
New York Elevated Business Improving ... 1225
The Chicago Electrical Show ... 1226
Peat Fuel for Large Electric Plant ... 1227
National Electric Light Association's Commercial Programme Committee Meets ... 1227
Westchester and Portchester Roads to Unite ... 1227
Opening in Germany for Electrical Hearing Devices ... 1227
American Institute of Electrical Engineers, New York Meeting, December 16 ... 1228
Plans for Copper Merger ... 1233
Morgan Gets Telephone Lines ... 1233
Meat Curing by Electricity ... 1233
Interstate Railways Company ... 1234
System of Accounting for Small Central Stations ... 1234
The Hydroelectric Department and Auxiliary Steam Plant at Lansing, Michigan ... 1235
CENTRAL STATION PRACTICE:
A 2,750-Volt Direct-Current System ... 1240
Heat Losses in a Power Station ... 1243
A 500,000-Volt Transmission Line ... 1243
Record-Breaking Copper Production ... 1243
ELECTRIC LIGHTING AND ILLUMINATING ENGINEERING:
An Exemplary Boulevard Illumination ... 1244
Electricity versus Gas for Train Lighting ... 1246
INDUSTRIAL POWER:
The Resicza Iron and Steel Works ... 1247
An Improved Single-Phase Motor ... 1249
Application of Electricity to Propulsion of Naval Vessels ... 1250
FINANCIAL REPORTS OF ELECTRICAL COMPANIES ... 1251
INDUSTRIAL SECTION:
The 110,000-Volt Circuit Breakers on Lines of Southern Power Company ... 1252
Tough Tungsten Lamps Pass Safely Through a Railroad Wreck 1253
Quick Switchboard Shipment ... 1253
Voltmeter for 200,000 Volts ... 1253
Printing Press Controllers ... 1254
Wayne Bell-Ringing Transformer ... 1254
An Electric Fireless Cookstove ... 1255
Maximum Demand Meters ... 1256
Electric Drive in Automobile Works ... 1256
Japanese Government Buys More American Telephone Apparatus 1256
CURRENT ELECTRICAL NEWS ... 1257
RECORD OF ELECTRICAL PATENTS ... 1264

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THE WATERPOWER PROBLEM.

One of the most engrossing topics that has aroused public attention during the year now rapidly drawing to a close is the development of our western water powers. The public press has been filled with a multitude of conflicting views on the subject and a number of our otherwise extremely judicious public officials have taken an exaggerated view of the problem.

In as much as the electrical fraternity is largely involved in the development of water powers, it was most fitting that the American Institute of Electrical Engineers should have lent its influence to educating the public to the true status of the problem and to a more considerate attitude toward those who are trying to place the waterpower resources of the country at the disposal of the public. There could not have been a more happy selection than that of Mr. Henry L. Doherty, who is at the same time both a capable engineer and financier, to present a concise and yet comprehensive summary of the difficulties attending the development and operation of hydroelectric plants.

Mr. Doherty's paper, an abstract of which with the discussion on it is given on other pages of this issue, is a series of pithy and pertinent comments on various aspects of the problem. The paper as a whole must be read several times and studied in great detail in order to discover the full significance of the numerous points raised. Only a few of his comments will receive mention here.

One of the important features brought out is the great need of a steam-driven plant as an adjunct of any hydroelectric development that aims to make the most of the opportunities at hand. A good example of the value of such a plant is that of the Michigan Power Company at Lansing, Mich., a description of whose system is given in another part of this issue. Here the steam plant was used to supply the needs of the rapidly growing power market until the first hydroelectric development was completed and ready to run at substantially full load. The steam plant serves to carry peak loads throughout the year, especially the heavier winter load, and to supply central-station steam heating. It will also carry an increasing part of the load due to the expansion of the market beyond the capacity of the hydroelectric plant until the development of another such plant is justified. Mr. Doherty even suggests the advisability of even running the auxiliary steam plant merely as

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a reserve to insure reliability of service from the system, and he proposes the running of steam turbo-generators as synchronous motors, ready, at a slight drop in voltage or frequency, to open the steam valves of the turbine so as to pick up the load as a generator. This plan, with Mr. Doherty's scheme of penalties for interruption in the service, indicates that he protests too strongly concerning the unreliability of transmission lines; on the other hand, it must be remembered that he looks on this feature from his standard of reliable service, which is extremely high.

Another important aspect of the problem is its relation to the public. The general belief that waterpower projects net thirty to forty per cent on the investment is based on the distorted prospectuses of several unscrupulous promoters. Actually about three per cent seems to be the average return, and there are altogether too many hydroelectric companies in the hands of receivers. It is unfortunate that the former erroneous figures should have been impressed on government officials so strongly and have inspired them to throw hindrances in the way of development of the numerous water powers in our great West. It is to be hoped that the American Institute of Electrical Engineers' discussion of last week will have some influence with them in pointing out the numerous difficulties there are in the way of making any hydroelectric project a reasonably attractive investment and to show the importance of wisely developing the waterpower resources of the West as a most judicious way to conserve its fuel resources.

COST OF POWER PRODUCTION IN TWO CENTRAL STATIONS.

Opponents of the centralized management of public utility corporations are fond of citing figures showing wide differences in the operating results of plants under the same control. They enjoy pointing out that the size of the organization does not necessarily determine the degree of operating economy attainable. The small plant of moderate means sometimes surpasses its more costly neighbor in efficiency, and again, the station run by purely local engineering skill not seldom generates power at a lower cost than a plant of about the same size which happens to be operated by a large syndicate. Such are the arguments on behalf of individualized operation, so far as they deal with the broad subject of manufacturing costs. Doubtless it is true that the effect of local conditions is in the main more important in the records of a central station than the location of its management, and yet striking similarities in practice and results now and then come to hand from plants under the same general control and handled in accordance with a well-fixed policy.

The past year's station records from two such plants are interesting on account of their similarity. Both installations are located in the same state, and are handled by local managers responsible to the main office of the controlling syndicate. The methods of administration are the same in each case, and the engineering problems of each company are under the jurisdiction of the home office staff. One station had an average normal capacity during the year of 3,650 kilowatts, and the other was rated at 2,000 kilowatts. The first and larger plant was equipped with four water-tube boilers having an aggregate rating of 1,910 horsepower; it had three compound condensing engines of about 2,000 horsepower combined rating, and a horizontal steam turbine of 2,000 horsepower capacity. There were the usual direct-connected alternators for 2,300-volt service, and seven auxiliary engines having a total rating of 214 horsepower. The latter were used in the operation of various pumps, cooling tower, fan equipment, exciters, etc., and the fuel in the station was handled by automatic stokers that were engine-driven. The force required to operate this station the year through included five engineers, two oilers, two steam fitters, three firemen, and two switchboard men.

The second and smaller station was equipped with five water-tube boilers having a total rating of 1,250 horsepower. There were three direct-connected alternators of the 2,300-volt, three-phase, revolving-field type, each being driven by a vertical cross-compound condensing engine. The total engine rating was 3,000 horsepower, the largest machine being rated at 1,500 horsepower, and the smallest at 600 horsepower. In the second station the water conditions did not require the use of a cooling tower, and the plant was hand-fired. There was one steam-driven exciter, the rest of this equipment being motor-operated. The station payroll covered the following men: four engineers, three oilers, three firemen and two helpers.

The larger of these plants burned bituminous coal and coke breeze, the former costing $4.08 per ton delivered at the station and the latter, $1.75 per ton. Over 6,000 tons of the former and over 1,000 tons of the latter were consumed. The total energy generated and delivered at the switchboard of the station was 4,715,000 kilowatt-hours, and the total sales were 3,548,000 kilowatt-hours. The power sales of the company were 881,000 kilowatt-hours, and the maximum load during the year was 1,650 kilowatts. The load factor of the station, or the average output for the year divided by the maximum, was thirty-two per cent. The average load on the bus bars was 530 kilowatts.

The smaller station burned bituminous coal and coke, at respective costs per ton of $4.89 and $4.07, delivered at the power house. About 3,700 tons of coal and 2,850 tons of coke were used during the year. The output at the busbars was 4,006,000 kilowatt-hours, and the total sales were 3,788,000 kilowatt-hours. This company sold more than half its output for electric motor service, a total of 2,316,000 kilowatt-hours being billed to power customers. The maximum load was 1,510 kilowatts, and the average load for the year 458 kilowatts, making the load factor

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thirty per cent. The similarity of the load factors illustrates the danger of assuming that a plant without a large power load cannot produce under as favorable conditions as another with a heavy motor service. Given two plants in the same territory, the one with the larger day load of motor installations would tend to show the better economy, other things being equal, but in this particular case the company without the large and valuable power load enjoys the patronage of a highly diversified territory, including in its area several thickly populated suburban cities drawing upon the plant for a varied service at all hours of the day.

The detailed operating results at the two stations are unusually close, practically the entire difference in the final cost being due to the higher price of fuel per ton in the smaller station. The total cost of manufacture at the switchboard of the larger plant, excluding fixed charges, was $50,800, or 1.08 cents per kilowatt-hour. The smaller station turned out its current at a total cost of $49,600, or 1.24 cents per kilowatt-hour. In the former case the fuel cost per kilowatt-hour was 0.57 cent; and in the latter, 0.74 cent. The labor cost per kilowatt-hour was practically the same in each plant, being 0.31 cent in the larger installation and 0.30 cent in the smaller one. The smaller station had the advantage of a somewhat simpler arrangement of apparatus, especially in connection with the auxiliaries and switchboard installation. In the larger plant the fuel cost for the year was $26,780 against $29,670 in the smaller station; and the wages cost in the larger plant was $14,812 against $12,105 for the smaller outfit. The oil and waste, water, building and plant repairs, were 0.20 cent in each case, per kilowatt-hour generated.

These figures indicate that the standards of operation in one station tend to control the service of the other. It is probable that the use of the steam turbo-alternator in the larger station helps to maintain the station economy at good figures during times of light load, since the efficiency of such units tends to approximate more nearly to a straight line from half load to full rating than is the case with the steam engine. The similarity of the labor requirements, the maintenance of about the same class of equipment in each plant in point of modernity, and the active co-operation among the managers of the syndicate to advance the interests of the organization as a whole no less than those of the local properties are significant. The primary cost of coal is the one issue of importance in comparing these two installations, judging from the past year's results. A practical difference of one-sixth of a cent per kilowatt-hour in fuel cost means an added cost of nearly $7,000 per year on a 4,000,000 kilowatt-hour output. Without an investigation of the fuel conditions on the ground, it is difficult to point out how the coal cost can be reduced at the smaller plant, if at all. Possibly a study of the fuel combustion conditions would indicate an opportunity to use other mixtures of coal at a lower price.

SOME FEATURES OF TELEPHONE SERVICE.

The address of Mr. Bernard E. Sunny, president of the Chicago Telephone Company, delivered before the Chicago Electric Club last week and reported on other pages of this issue, indirectly answers a question which perhaps many are not familiar with, namely, why telephone rates are higher in large cities than in smaller ones.

It was demonstrated that as an exchange grows the cost of furnishing under any particular class of service, the unlimited use of the entire system, or plant, to each patron increases, and that an increase in the charge is necessary.

In buying electric light, the consumer knows he is getting it for so much per kilowatt-hour. In buying gas, he knows he is getting it for so much per thousand cubic feet. In fact, when buying anything except telephone service the purchaser and seller both recognize a unit. The telephone company does not sell the telephone instrument, neither does it rent it to the subscriber. In any exchange where there is a flat rate for the unlimited use of the entire plant, the company places this plant, consisting of switchboards, central office apparatus, underground conduit, cables, poles, wires, etc., all at the subscriber's disposal, and places the instrument in his office or residence in order that the subscriber may be able to avail himself of the different uses of the plant.

In an exchange with a small number of subscribers the cost of the plant is not very great and its construction is simple. The switchboard is inexpensive and easily maintained, not requiring the services of experts. The poles are small and the cables, if any, are not only small but of short length. No underground construction is necessary. As the exchange increases in size, these conditions gradually change and in due course of time it is necessary to have underground conduits and cables, multiple switchboards, power plants, and highly paid expert attendants.

To illustrate: A switchboard for an exchange of 300 lines or less can be purchased at from $1.50 to $3.00 per line, while a switchboard with a maximum capacity of 10,000 lines, but equipped for only 6,000 lines, and with fifteen sections installed, would cost about $120,000, or $20 per line, and one fully equipped for 10,000 lines and twenty-five sections would cost about $250,000, or $25 per line. Thus it would seem that on this one item alone the cost in a large exchange is ten times greater than in a small one.

Illustrations could also be made comparing the cost of underground conduit and cable, underground distribution in the central part of the city, the cost of real estate, of taxes, of salaries, of damage and compensation, of bad debts and forced reconstruction due to abnormal growths. In fact, practically all items of furnishing service in a large city increase as compared with the cost of similar items in a small town, and when the unlimited use of the entire plant is furnished at a flat rate this rate must necessarily be larger per station as the city grows and it should not be overlooked that the value of the service and its efficiency increase just as rapidly.

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Chicago Electric Club.

The regular meeting of the Chicago Electric Club on Wednesday, December 15, was a decidedly successful one both in point of attendance and interest, the speaker on this occasion being Bernard E. Sunny, president of the Chicago Telephone Company, Chicago, Ill.

As an indication of the conditions to be found in the early days, Mr. Sunny read the list of rules and regulations printed in the telephone directory of 1878. These rules, which required the calling party to wait ten minutes before repeating a call if unsuccessful in obtaining the desired party, and which specified various rings of the signal bells for different purposes, etc., afforded much amusement.

In 1878 Chicago was served by two telephone companies, namely, the Bell Company and the Western Union Telegraph Company, which was also engaged in the telephone business at that time. Each of these companies had in operation one exchange. Reasonable progress was made during the succeeding years until 1882 when the two existing companies were consolidated and the present Chicago Telephone Company organized.

That the growth of the telephone business in Chicago since that time has been phenomenal was demonstrated by statistics presented by the speaker, showing that there are at present 205,000 telephones in use with over thirty exchanges.

To accommodate subscribers in various financial circumstances, and also for the purpose of classifying according to the needs of the subscribers, the telephone service is divided into the following classes: Ten-party lines, four-party lines, two-party lines, single-party lines and private branch exchanges. Each division, with the exception of the ten-party lines which are now almost obsolete, represents 85,000, 31,000, 43,000 and 4,375 subscribers, respectively. The latter figure represents the number of private exchanges, to which an average of forty separate lines are connected.

There are over 52,000 lines in the business district, and these are divided among the three downtown exchanges as follows: Main office, 13,500; Central office, 22,350; and the Harrison office, 17,705. These stations are in turn connected to each other by trunk lines the number of these being proportionate to the flow of traffic and to the direction of the flow.

During the average day approximately 1,300,000 calls are handled, which necessitates the services of 3,750 operators. The average speed in answering calls is four seconds, although this varies greatly according to the nature of the call, and the total time required to complete a telephone connection is about twenty-five seconds.

To show that the efficiency of the service has increased in proportion to its growth, Mr. Sunny gave some statistics which are indeed interesting. For the average day 78.5 per cent of the calls handled are completed satisfactorily; thirteen per cent receive the busy signal; three per cent receive the wrong number; and 1.5 per cent are unable to be connected due to errors on the part of the subscribers.

Another interesting phase of the subject which demonstrates the greater efficiency of the service now as compared with that of a few years ago is the number of complaints reported. During the present year, out of 1,250,000 cases received by the general manager, upon investigation resulted in there being only 452 cases of actual trouble. The speaker gave figures showing the increased amount of trouble reported from lightning during heavy storms in the summer, and also demonstrated the damaging effects of heavy storms in the winter. The former is being overcome to a large extent by the installation of efficient protective devices which, with few exceptions, have performed their functions entirely satisfactorily.

Other interesting data given was that the busiest part of the telephone day is between ten and eleven o'clock in the morning, the operators handling during this hour about ten per cent of the entire day's business. The number of requests for the time of day has reached 60,000 in a single day, the larger per cent of these calls coming in between seven and eight o'clock in the morning.

Regarding the question of a public service corporation's having a monopoly on the business, Mr. Sunny agreed with Samuel Insull's ideas expressed at a previous meeting of the club and reported in these columns to the effect that such corporations should have a monopoly. He also stated that the Chicago Telephone Company is a municipally controlled monopoly, its bookkeeping department being under the direction of the City Comptroller and its service being under the supervision of the Commissioner of Public Works. By reason of an ordinance passed not long ago the city has reserved the right to purchase the telephone company in ten years and again in fifteen years after the date of passing the ordinance. Also after thirty months from the date of the passage of this ordinance the city will appoint a committee to regulate the service of the telephone company for a period of five years, and it was the speaker's opinion that this committee, co-operating with the telephone company, would establish a system of rates which would be fair to the subscriber, fair to the telephone company, and would result in the general betterment of the entire service.

Following this interesting address and upon the invitation of President Frederic P. Vose, several men prominently associated with the telephone business in the earlier days, recited incidents in connection with this subject. Among those who were heard was Chas. W. Price, Kempster B. Miller, and J. W. Johnson.

Mr. Miller stated that an important and interesting feature of the growth of the telephone business was the fact that the telephone company every year installs 25,000 additional telephones—this amount being equal the total number of instruments in service ten years ago.

New York Subway Plans.

A plan for a belt subway line to cost $130,000,000 has been submitted to William R. Willcox of the Public Service Commission by E. J. Farrell and John J. Hopkins. The line is to surround Manhattan and the Bronx, extending under the East River to Brooklyn, there to connect with the Fourth Avenue subway now being built and later, when practicable, by way to Fort Hamilton and the Narrows to Staten Island, and also by a Fifty-ninth Street crosstown under the East River into Queens, reaching several Long Island points.

Under the plan the proposed subway system is to be built in about twenty-four sections of about one mile each, and with four tracks, which will run around the two Boroughs of Manhattan and the Bronx.

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American Exposition in Berlin.

As previously mentioned in these columns America is to have a comprehensive and representative exposition in Berlin in 1910. Manufacturers and business men throughout the country are displaying a lively interest in the undertaking and applications for space have been received by the American committee from many states. The indications are that every branch of American progress will be shown at the exposition.

It is but natural that the United States should seek to hold an All-American Exposition in Europe; for our export trade in that direction has reached splendid proportions and it is constantly increasing. Our exports to Europe for the year 1908 reached the enormous sum of $1,270,016,773. It is also easily seen why the projectors of the exposition selected Germany as the country in which to hold it, for that country alone received $274,178,712 of our export trade, nearly one-fourth of the total amount going to Europe. It is often asserted of Berlin that that city is the commercial heart of the mainland of Europe.

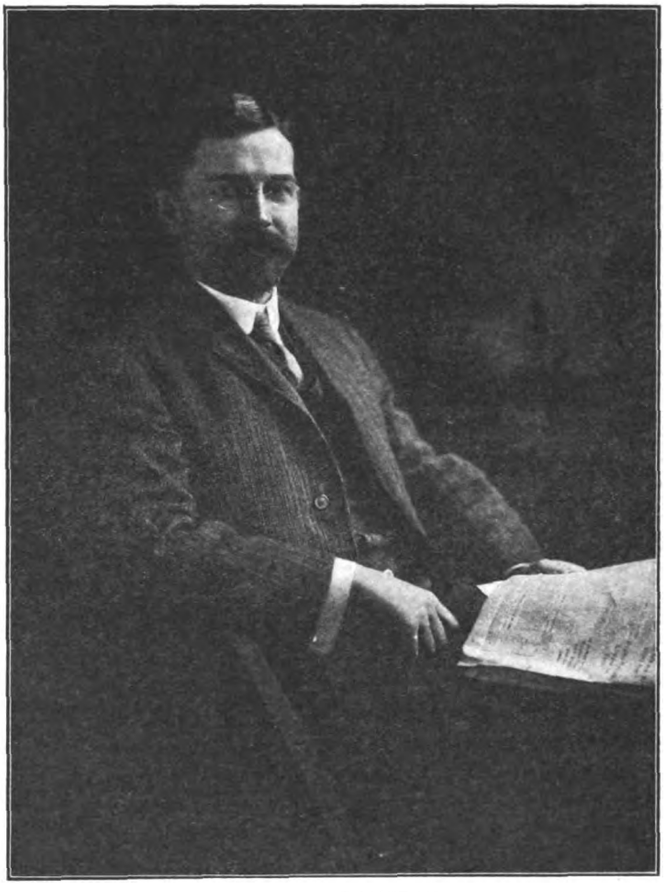
Electricity is fast taking the place of manual labor in the mining industries and the construction of electric railroads is becoming general. In the mines, hoisting, pumping, drilling, ventilation and the transportation of workmen will be done hereafter by electricity. Foreign manufacturers will hardly be able to meet the increasing demand for electrical machinery and other products necessary to the industry so that the United States had an exceptional opportunity for a lucrative business. The export of electrical machinery to Europe in 1908 was $1,855,644.

Impetus has been given the exposition enterprise by the recent appointment of former Governor David R. Francis, of Missouri, to the office of first vice-president of the American committee. Mr. Francis was president of the St. Louis World's Fair in 1904 and the success of that great exposition was largely due to his management.

There has just been issued by the American committee, whose office is at 50 Church Street, New York, an attractively arranged prospectus of the exposition, which, in addition to outlining the objects and advantages of the enterprise, contains many photographic views of the Exposition Palace and portraits of the distinguished sponsors of the undertaking.

Henry L. Doherty.

Henry L. Doherty has long been a familiar figure at conventions and meetings of those who have to do with public service corporations. Resourceful, energetic and farseeing, he is one of the most enterprising of a host of strong men who have developed the electrical and allied fields of public service at a remarkable rate. Mr. Doherty is an engineer, inventor, manager, executive and banker. His early career was one of varied experience along engineering and managerial lines. He formed the firm of Henry L. Doherty & Co., in 1905. He invented several pieces of gas apparatus, cement-burning apparatus, fuel-using processes, and has probably given the subject of methods of charging for public utilities more study and developed it further than any other one man in the country. He is president of the American Gas and Electric Company, Denver (Colo.) Gas and Electric Company, Lincoln (Neb.) Gas and Electric Light Company, and is either president or director of a dozen others. In 1898 he was winner of the Beall gold medal of the American Gas Light Association. He is a member of many of the leading engineering and scientific societies, and of the Lawyers, Lotus, Democratic (N. Y. city), Denver (Denver), Minnesota (St. Paul), Commercial (Lincoln), Columbus (Ohio) clubs. He is a ready and forceful writer and speaker, and has contributed a number of classical papers to the proceedings of the National Electric Light Association and the American Institute of Electrical Engineers. On December 16 he delivered an important address on the development and operation of hydroelectric plants before the last-mentioned organization.



HENRY L. DOHERTY,
Who delivered an important paper on development and operation of hydroelectric plants, before the American Institute of Electric Engineers, New York, December 16.

Kings County Electric.

The Kings County Electric Light and Power Co. has filed with the New York Public Service Commission an amended application for approval of an issue of convertible debenture bonds for $5,000,000. In the original application the company stated that $2,500,000 was to be used for immediate construction work and improvements, and $2,500,000 to reimburse the company's treasury.

In giving an explanation for the latter item it was stated that an equal amount had been expended from the surplus of the company, including the money that had been deposited by consumers on meter deposits, amounting to nearly $100,000. Commissioner Maltbie questioned the power of the commission in regard to approving a bond issue for such purposes, and suggested that the company make an amended application dividing the two items. This has been done and a hearing set for December 27. This company controls the Brooklyn Edison and the Amsterdam Electric Light and Power Company.

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FIFTH ANNUAL CONVENTION OF THE NATIONAL COMMERCIAL GAS ASSOCIATION.

NEW YORK CITY, DECEMBER 14-21.

Madison Square Garden, New York city, was the scene of one of the greatest displays of gas appliances ever made in this or any other country, on the occasion of the fifth annual convention of the National Commercial Gas Association, from December 14-21.

The National Commercial Gas Association held its fifth annual convention for four days beginning the 14th, and on Friday evening of the 17th there was a joint meeting with the Illuminating Engineering Society.

There were seventeen papers read and three set speeches at the general assembly on Tuesday evening. The president, J. D. Shattuck, was in the chair at all of the sessions, which were held in the Concert Hall and well attended.

The subjects of the papers were classified as follows: Lighting (5), New Business (3), Management (2), Gas Engines and Water Heaters (3), Advertising (1), Miscellaneous (3).

The papers which will probably be of interest to the electrical fraternity included one on street lighting, by E. N. Wrightington of Boston, Mass. This gives a rather belated answer to the criticisms which have been heaped upon gas for public lighting in that city during the past year.

From the discussion it was evident that a mistake had been made in attempting to light the much-traveled thoroughfares by means of low-pressure gas in competition with the modern electric arc lamp.

The paper which produced the greatest discussion, entitled "The Best Policy to Follow to Increase Gas Sales in a Town Where Both Gas and Electric Companies are Under One Management," was prepared by ten men and presented by the editor, Clare N. Stannard, of Denver, Colo.

The conclusion of the editors that the electric end should carry all of the lighting in the better class of residences and business buildings was the chief point of argument, and it seemed to be the consensus of opinion that unless consumers were given the opportunity to use either gas or electricity that they would not be satisfied. In summing up Mr. Stannard agreed that all houses should be piped for gas lighting as well as for the fuel appliances.

In the paper entitled "Advertising to Sell Gas," T. R. Elcock, Jr., pointed out the lines along which this feature of publicity could best be handled.

The arguments in favor of gas engines in competition with either central stations or isolated steam plants as presented by W. W. Cummings, of Boston, Mass., told their end of the story very well.

The importance of good will as an asset was well brought out in the paper on "Increasing Gas Sales to Existing Consumers" by Glenn C. Chamberlain. He described the results of a year's work at Grand Rapids, Mich.

JOINT MEETING.

The technical sessions concluded with a joint meeting with the New York Section of the Illuminating Engineering Society. H. Thurston Owens delivered an illustrated lecture on "Street Lighting Fixtures." The views covered the practice abroad[1] as well as at home. He showed the large use of flaming arc lamps and the fixtures upon which they are hung in the large cities abroad, and closed with a short review of what is going on at home. He stated that during the period from 1905 to 1907 there had been an increase of nearly 40,000 public lamps in the 158 cities of over 30,000 population in the country, or over nine per cent. The greatest increase was in electric lighting, with over 17 per cent.

At the end of the period there were some 40,000 open flame gas lamps and nearly 45,000 open arc lamps, so that there is still room for considerable improvement.

The lecture was followed by a description of the lighting in the new sales rooms of the Consolidated Gas Company of New York City by V. R. Lansigh and C. B. Rowe, which was read by the latter.

One of the features of the installation was a set of small booths papered in different colors and all lighted with the same size lamp so as to bring out the marked difference in illumination due to absorbtion.

THE GAS SHOW.

The garden, canopied in pink and white and lavishly lighted, was indeed a credit to the association.

Only general illumination was provided, the units consisting of six clusters of Humphrey five-burner inverted arcs having thirteen lamps to each cluster, and twenty-eight of the same type, five to each cluster, a total of 218 arc lamps. Around the balcony between each girder there were arches of single Reflex burners, some 500 being used.

The arrangement of the booths was somewhat different than is usually the case, as there were five aisles instead of three, which gave more room for the crowds. There were nearly 200 booths and over half as many exhibitors. Expressed on a percentage basis the goods exhibited are as follows: Stoves, 33; fuel, 18; water heaters, 8; lighting, 21; miscellaneous, 20. The exterior of the building was lighted by both Humphrey and Welsbach inverted arcs.

NEW OFFICERS.

The following officers were elected for the ensuing year:

President, E. N. Wrightington, Boston.

First vice-president, H. B. McLean, New York.

Second vice-president, C. H. Graf, Indianapolis.

Third vice-president, A. V. Wainwright, New York.

Treasurer, P. S. Young, Newark.

Secretary, L. S. Bigelow, New York.

An important feature of the gathering which was neither technical nor social was a meeting on Tuesday evening, when George B. Cortelyou, president of the Consolidated Gas Company, and T. N. McCarter, president of the Public Service Corporation of New Jersey, made excellent speeches.

Mr. Cortelyou spoke of the friendly relations which now exist between the public service corporation and the public, and showed that this was of vital importance to them both.

Mr. McCarter called attention to the dangers of municipal ownership and of management by commissions.

Five-Cent Rate in Pasadena.

The Southern California Edison Company, consequent on the passage of an ordinance in Pasadena, Cal., compelling the charging for electric-lighting service by meter measurement only, has issued a new scale of rates. For 100 kilowatt-hours per month the maximum charge is five cents per kilowatt-hour, or four cents when 2,000 kilowatt-hours are used each month.

[1] See Electrical Review and Western Electrician, November 13.

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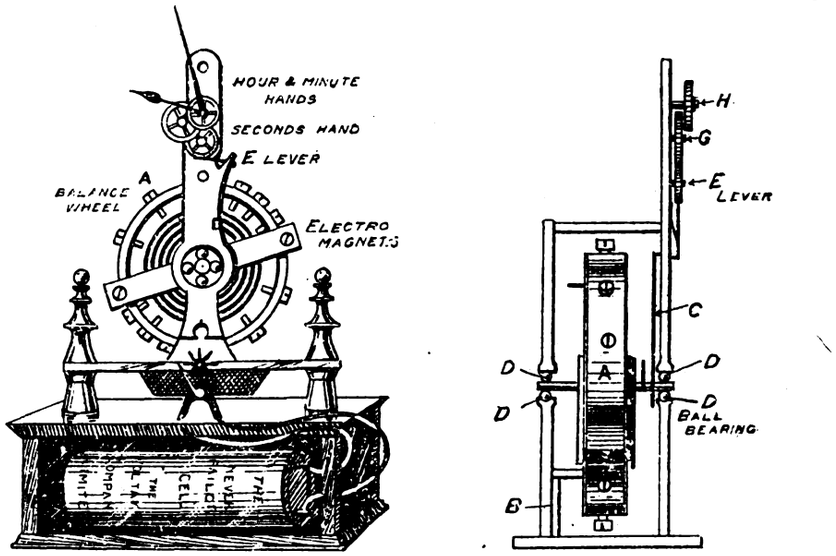
An Electric Clock.

The electric clock invented by a Mr. Kutnow, which was mentioned in a previous issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN as having been exhibited before King Edward of England, is described and illustrated below, the description and diagrams being taken from the *English Mechanic and World of Science,* a well-known English semipopular mechanical and scientific journal.

The construction of the clock is extremely simple, as may be seen from the accompanying diagrams, and it is claimed that the clock will run for 1,000 hours and that it will go in any position. A single dry cell is fixed under the clock, from which one wire is connected to the plate of iron which runs horizontally at the base of the clock. Above this plate hangs a large wheel, constructed like the balance-wheel of a watch, which just clears the plate as it rotates. At the back is a spring similar to the hairspring of a watch. This wheel has a small magnet running through its center, which is magnetized by the electric current, and pulls its end on the surface of the wheel round towards the horizontal plate below. The point, then, is to utilize this pulling power of the magnet just at the moment that it will give the necessary impetus to the wheel. This is effected by a thin strip of steel, *B,* which is connected with one terminal of the battery; the other, as previously explained, being connected with the horizontal plate below the wheel. As the wheel swings round, this strip of steel comes in contact with a knob, through which the current passes, whereupon, the magnet becoming charged, the point is pulled down sharply to the horizontal plate. Passing over this, the magnet is demagnetized, and the wheel swings on till the force of the oscillating spring brings it back again. The oscillation is timed, and can be regulated by the spring behind to take exactly a second each way. The movement is conveyed directly by a lever to the second hand, and the minute and hour hands are connected in the usual manner.



PERSPECTIVE AND SIDE VIEWS OF THE ELECTRIC CLOCK.

Pittsburg Section, American Institute of Electrical Engineers.

The Pittsburg Section of the American Institute of Electrical Engineers held its regular monthly meeting for December in the lecture hall of Carnegie Institute, on December 14. A paper was presented by E. B. Tuttle and W. V. Read, of the Central District and Printing Telegraph Company, on "Telephone Transmission and the Oscillograph." Mr. Tuttle exhibited oscillograms showing the character of current waves produced by different types of transmitters, the effect of a cable in the subscriber's loop and in the inter-office trunk line.

The phase shift produced by a loaded cable was shown both for the current and voltage waves at the two ends of the circuit. Mr. Tuttle has succeeded in obtaining oscillograph curves of telephone speech currents which are capable of accurate analysis to the ninth harmonic. One thing made very evident in the paper was the fact that the even harmonics are fully as important as are the odd harmonics.

S. P. Grace and R. A. L. Snyder, of the Central District and Printing Telegraph Company; H. W. Fisher, of the Standard Underground Cable Company, and B. P. Rowe, of the Westinghouse Electric and Manufacturing Company, discussed the paper and stated that they considered the results given to be of very great importance to the telephone industry.

Brooklyn Rapid Transit Pension Plan.

Announcement has been made that the Brooklyn Rapid Transit Company has decided to inaugurate a pension system for its veteran employes. The details of the plan have been approved by the board of directors, and within a short time the scheme will be in working order.

A regular schedule has been decided upon. Any employe who has reached the age of seventy years, whether incapacitated or not, and any employe who has reached the age of from sixty-five to sixty-nine years and who has become incapacitated, and has made application or has been recommended for retirement, will be entitled to receive fifty per cent of his average monthly pay in the ten years immediately preceding retirement, if he has been in continuous service thirty-five years or more. If his service is between thirty and thirty-five years, continuously, this pension will be adjusted at forty per cent. If the continuous service is between twenty-five and thirty years, the pension will be adjusted at thirty per cent. Further provision is made for employes under sixty-five years of age and of thirty years' continuous service, who have become incapacitated. These last may also be admitted to the pension provisions.

New York Elevated Business Improving.

The Interborough Rapid Transit Company has given figures which show that while traffic on the subway has steadily increased since it was opened, the patronage of the company's elevated lines has not fallen off, but will surpass all previous records this year. The banner year with the elevated was 1904, the year before the subway was opened, when it carried 286,534,195 passengers. If the increase for the present year keeps up in proportion the figures for 1904 will be beaten this year by more than 5,000,000.

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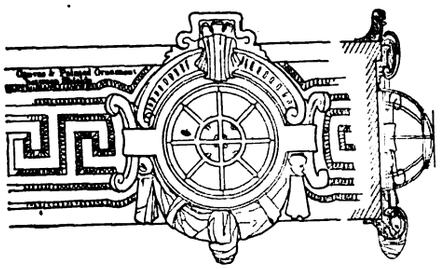
THE CHICAGO ELECTRICAL SHOW.

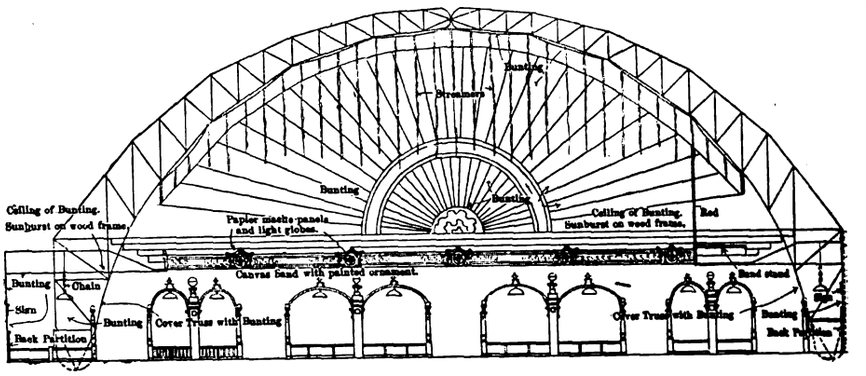
ILLUMINATION AND DECORATIVE FEATURES.

The plans for the 1910 electrical show, which will be held at the Coliseum, Chicago, Ill., January 15 to 29, under the auspices of the Electrical Trades Exposition Company are proceeding apace. With the returns just in it is evident that in point of space contracted for the show will be a record-breaker and that a truly representative exposition of electrical and kindred devices will be maintained. A number of features of extraordinary interest will be shown; notably the Wright aeroplane, the property of the United States Government, in charge of the Government wireless and aeroplane experts, the model garage, and the lecture room where the Commonwealth Edison Company will make demonstrations of all manner of electrical devices.



DETAILS OF BALCONY FRIEZE AND SHIELD TRANSPARENCY.

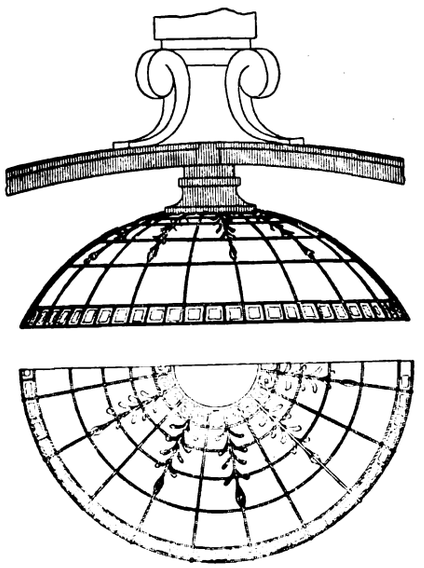
In point of illumination and decoration the Chicago show has always set a mark which has established new degrees of effectiveness. The plans for the coming show, it is expected, will develop a lighting and decorative scheme which will far excel the remarkable spectacles which have heretofore been worked out. The scheme this year will be essentially decorative and spectacular, and still the illumination of the objects exhibited, and, in fact, the flux of light over the entire illuminating plane will have a higher value than heretofore. The light intensity will be softened by the use of multicolor effects, and the enlarging of a familiar stage picture will give the overhead decorations a strikingly picturesque appearance.



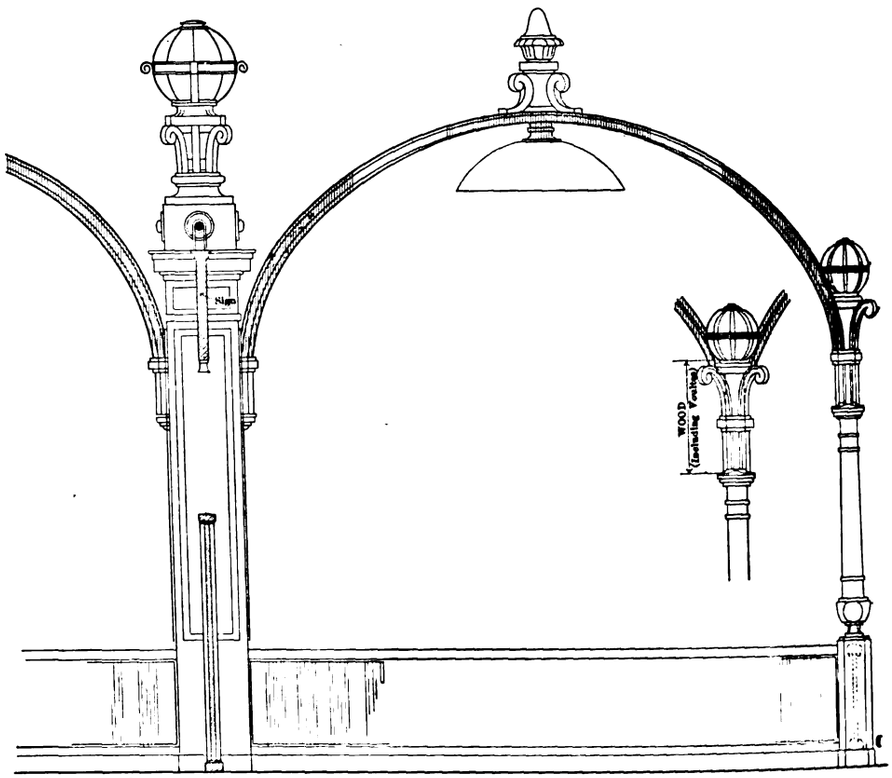
DETAILS OF LIGHTING ARRANGEMENT AND CEILING DECORATION.

Over each booth there will be a continuous arched truss, the apex of the crossing arched members being directly above the center of each booth. Over the larger spaces there will be a cluster of five 100-watt tungsten lamps with Holophane diffusing reflectors partially surrounded by an art glass dome. Over the smaller spaces there will be a similar light cluster equipped with five sixty-watt lamps. On the corner posts of the spaces there will be a sixty-watt lamp inside of the art glass effect, and on the taller posts intercepting the loops there will be a 150-watt lamp enclosed in the art glass effect.

The side spaces will be illuminated by similar tungsten lamp sets and art



DETAILS OF FIXTURE OVER CENTER OF BOOTH.



TYPICAL CROSS SECTION, SHOWING LIGHTING ARRANGEMENTS FOR BOOTHS.

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glass domes. These fixtures, however, will be suspended by chains from cranes extending from the balcony.

Extending all around the balcony rail which flanks the exhibition space on every side, there will be a canvas frieze which will be painted in symbolic representations, with a shield and transparency in art glass effect spaced at every twenty-two feet. Behind each shield there will be placed six sixteen-candlepower carbon lamps. The windows throughout the building will be shielded by heavy paper covering to exclude all outside light.

The entire canopy of the dome will be covered with dark colored bunting, shutting off the roof trusses and steel work, and a continuous effect of a gold and silver sea will be created by gold and silver tinsel streamers. At each end of the Coliseum the rays from a battery of Ryan scintillators will throw out a flood-light effect, giving the dome an appearance of an iridescent and scintillating mass of color. The scintillators will be so arranged and focused that every portion of the floating tinsel will be flooded with light.

It is expected that the model garage, which will be installed by the Commonwealth Edison Company, will prove of great value in demonstrating to the central-station visitors the practicability of building up a valuable service in the charging of vehicle batteries. The lecture hall will also present a valuable opportunity for the householder to become acquainted with the methods of operating domestic appliances and with the economies which can be secured through the utilization of electric utensils.

Peat Fuel for Large Electric Plant.

Peat fuel will be used in an electric station being erected in Germany. The new plant is being installed in the region to the southwest of Oldenburg, and it lies in the vicinity of extensive peat fields from which the supply is to be secured. The electric plant is laid out on a large scale, and when completed it will be one of the largest in the country. It is to furnish current over a network of power lines which will cover the entire Duchy of Oldenburg, within a radius of 40 miles.

Probably the new station will be completed about the end of next year, and in the meantime measures are being taken to find out about what amount of current will be taken.

National Electric Light Association's Commercial Programme Committee Meets.

The first meeting of the commercial programme committee of the National Electric Light Association was held at the offices of Henry L. Doherty & Company in New York city recently to formulate plans for the next convention. There is a strong sentiment in favor of a curtailment in the length of the commercial programme next year, so that the principal topics of interest may be taken up and discussed widely. With this in view, therefore, fewer papers will be presented, and no effort will be spared to bring out a thorough discussion from all members.

The committee will hold its second meeting in Chicago during the fifth annual Electrical Show, as the guests of H. M. Byllesby & Company.

Westchester and Portchester Roads to Unite.

The New York city Board of Estimate has approved the application of the New York & Westchester Railway to consolidate with the New York, Portchester & Boston Railway under the former name.

The application has been before the board for a year. During that time construction work in the Bronx has been held up, although pushed vigorously in Westchester. Both companies are now owned by the New York, New Haven & Hartford.

Francis Lynde Stetson appeared for the petitioners, and assured the board that haste would be made in giving swift transportation between One Hundred and Thirty-second Street, the Bronx, and all parts of Westchester. The route, as agreed upon, is from Portchester along the Sound shore to Mount Vernon, where another branch from White Plains will join the Sound line, and the two combined will parallel the New Rochelle branch of the New Haven to Lincoln Avenue and One Hundred and Thirty-second Street.

Authority is given to abandon such portions of the routes of the two companies as are not necessary to form a continuous route from the Harlem River in New York city to Portchester, Westchester County, with a branch line from One Hundred and Seventy-seventh Street to Throgg's Neck, and another from Mount Vernon to White Plains, or to Elmsford, in case the application to abandon that portion of the line from White Plains to Elmsford should hereafter be denied. The construction of the consolidated railroad as a single road is approved.

The Commission has denied the company's application so far as it requests the abandonment of a portion of its route from Classon's Point to Throgg's Neck.

Opening in Germany for Electrical Hearing Devices.

An American consular officer in Germany reports that electrical hearing devices consisting of an earpiece and sound receiver have not been produced by German manufacturers and are apparently unknown in that market. He states that dealers in this class of devices express a lively interest in the subject and furnishes the names of two firms that would like to secure samples for distribution, to be tested as to practicability. Before attempting to introduce this article the firms are anxious to know whether or not it is protected by a German patent. If this is not the case, it would be useless to build up a trade, which could be easily diverted by German manufacturers who might produce the same article at a lower price. Inquiries should be addressed to the Bureau of Manufacturers, Washington, D. C., quoting File No. 4207.

Governmental Supervision of Electrical Supplies at Guatemala.

As the outcome of the special legislation giving the Guatemalan Government direct supervision of all electrical enterprises, a Presidential decree of October 21, 1909, allows the importation of electrical supplies only on written permission granted by the War Department upon application.

The decree also requires such enterprises now existing to furnish to competent authority the description and destination of all orders for material placed before the promulgation of the present law.

Electrical Enterprise in Australia.

It is reported that no less than twenty suburban municipalities in the neighborhood of Melbourne, Australia, are promoting a scheme for the erection of electric-lighting and power stations. The services of an expert are to be employed to make a report on the cost of the venture.

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AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

PRESENTATION AND DISCUSSION OF MR. DOHERTY'S PAPER — "COMMENTS ON THE DEVELOPMENT AND OPERATION OF HYDROELECTRIC PLANTS."

The 241st meeting of the American Institute of Electrical Engineers was held in the Engineering Societies Building, New York city, on Thursday evening, December 16, 1909. Directly after President L. B. Stillwell had called the meeting to order Secretary R. W. Pope announced that at the meeting of the Board of Directors held in the afternoon seventy-four Associates were transferred to the grade of Member. The meeting was held under the auspices of the high-tension committee of the Institute and was devoted to the presentation and discussion of a paper entitled "Comments on the Development and Operation of Hydroelectric Plants," by Henry L. Doherty.

In introducing the author of the paper, President Stillwell referred to a conference held two weeks previously with one of the prominent officials of the Federal Government, who is giving attention to the subject, the latter having remarked that he had examined the waterpower prospectuses of certain well-known banking firms, in which it was stated with positive conviction that profits of thirty and forty per cent were certain. On the other hand, if we look around us we find a large number of the more important waterpower developments which have been attempted in the last five years in the hands of receivers. The president of one of the electric companies said that he thought three per cent would be probably about the average return which the hydroelectric developments thus far have received upon their investment. True conservation demands the most prompt possible utilization of our water powers consistent with due regard to the rights of the people as a whole.

Mr. Doherty then presented his excellent paper, an abstract of which follows:

Near the beginning of his paper Mr. Doherty stated that there is probably no other class of securities which deserves so well the support of the public as those issued by companies owning and operating successful waterpower properties, and having a permanent and relatively non-competitive market. All of our waterpower plants will tend to grow more and more valuable, as it is improbable that fuel will ever sell at a lesser cost, and more than probable that the cost will gradually increase. Almost every other class of industrial or investment property is apt to depreciate at a much greater rate, and be subjected to greater seen and unforeseen risks. Compared with almost every other class of investment, a waterpower plant is far preferable. The source of supply is, in the main, perpetual, although in some instances somewhat modified by timber operations and changes in meteorological conditions.

Probably the greatest stroke of statesmanship of the last national administration was the interest aroused in the conservation of our natural resources. Unfortunately, the efforts of the administration were either largely misdirected or very generally misunderstood in regard to water powers. Immense amounts of power are daily going to waste. The tendency of the Federal Government, and of many of the state governments, seems to be directed toward obstructing rather than encouraging the development of water powers. The most pressing need in the matter of the conservation of our natural resources lies in the direction of conserving our various sources of fuel supply. Every undeveloped water power means a constant unnecessary fuel consumption. Governments, both state and national, should remove as far as possible every unnecessary obstacle to waterpower development. Rights of eminent domain should be given universally to waterpower projects. Encouragement, and perhaps direction, should be given which will insure the development of the greatest possible portion of the total energy available from our streams.

Combination projects for both irrigation and power can often be made highly profitable where commercial success for either project alone would be impossible. It is therefore necessary that the engineer who has the responsibility of determining the value of prospective power developments should be proficient in the engineering of irrigation—and it is probably impossible fully to cover the field of hydroelectric engineering as well. This opens up to this Institute a necessary field of work which even now seems somewhat strange and a few years ago would have been entirely remote. Power and irrigation projects, wherein the power must be generated at one point and transmitted to another point and there provide irrigation by means of pumping, is alone worth serious consideration. The present state of the art in electrochemical processes is a factor which makes possible the profitable development of many water powers. Still further developments along electrochemical lines may add materially to the value of waterpower projects which now have no available market. Special attention should be paid to processes which do not require a continuous supply of current, thus permitting the utilization of power from water which would otherwise run to waste.

Failure to realize expectations in regard to cost of development, amount of power to be sold, existence of market (or of market at the price anticipated) and reliable service, have played an important part in the retardation of development of waterpower projects. It would contribute much to the ease of developing the now unused water powers if these difficulties could be overcome, or if the public could be made to understand the degree of risk and the cause for the existence of the risk. The engineering investigation to determine the cost of a hydroelectric power proposition, and the exact amount of power available, is often a very expensive matter. There is no reason why waterpower projects, with reliable stream gaugings covering a number of years, cannot be estimated, as to cost of construction and earnings, to a degree of accuracy closely approaching that which now pertains to the construction and earnings of modern office buildings, or similar enterprises. After a proper examination has been made of a proposed waterpower plant, where the behavior of the stream is a matter of reliable record for several years, an enterprise of this character can safely be undertaken on a very narrow margin of profit. If, however, the investing public is offered a proposition for which a return of ten per cent is estimated by conservative operators, based on careful and complete investigation, while other operators offer investment in a project for which they promise forty per cent, the ten per cent proposition is apt to go begging, even though it be well known that the source of the forty per cent proposition is not of a character to warrant the investment of real money.

The problem of reliable service from long transmission lines is much further from solution that all of the other problems that have done so much to contribute obstacles to rapid development. Good engineering talent and other proper precautions will insure that the cost of construction shall be no greater than that promised. The best of engineering talent does not seem, however, able to promise for a transmission line the same continuity of operation that can be secured from a steam plant located at the point where the power is to be used, and this introduces many serious obstacles to the development of our waterpower projects. The importance of continuity of service varies in degree with almost every customer served. To some industries a mishap which causes even a fall in voltage or a change in frequency may be a serious matter.

There have arisen many matters that deserve further thought and consideration by the engineers who are brought in contact with waterpower work, not only for their own benefit, but also for the education of the investing public and the power-purchasing public. Some of these are:

1. Methods to insure against interruptions or to lessen the harmful effect of interruptions.
2. Equipment to insure against interruptions or to lessen the harmful effect of interruptions.
3. Penalties for interruptions of service or insurance against interruptions.
4. Methods of charging.
5. Classes of service which can be advantageously supplied.
6. How to develop the market selected.
7. How to figure the amount of power it would pay to develop.
8. Calculations on depreciation.
9. Methods to determine the accuracy of engineer's estimates.

As to the first, with reliable reverse circuit-breakers, the tying in of several hydroelectric plants offers some insurance against interruptions. If central-station companies are to be supplied, it might sometimes be commercially practicable, where the reachable market greatly exceeds the capacity of the plant, to run the transmission lines to several central stations, with the idea that no one of the stations will attempt to take more than a portion of its base load, and will always have some steam apparatus in operation, the capacity of which can be quickly increased to take care of any interruption of service from the hydroelectric plant. In one case, arrangements were made several years ago to install a large steam turbine in connection with a relatively small waterpower plant, the generator of the steam turbine being designed to run as a motor while the vacuum on the turbine blades was maintained to reduce the windage loss, with the governor of the turbine so arranged that the slightest reduction in speed would cause the steam valves to open and the turbine immediately to pick up the load.

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In regard to the second point, equipment, it is customary on all important transmission lines to use either two circuits on the same pole-line or two circuits each on its own pole-line, the latter being preferable. Perhaps greatly added reliability could be secured by the use of extra conductors on each pole-line, with effective switching apparatus that would enable the extra conductor to be brought into use as quickly as possible. The use of storage batteries is the first thing that occurs to one as a protection against interruptions, but their high investment cost and high cost of maintenance make them practically prohibitive when used purely to prevent interruptions of service. Gas engines would be almost ideal, but the high investment charges make them practically impossible. However, they have been adopted in some instances. A gas engine can be put into operation with marvelous rapidity, the time required being fixed by the time the electrical generator can be energized. Gas storage can be provided at a cost of approximately fifty dollars per 1,000 cubic feet, with no operating stand-by loss. Where producers are used, if the fires in the producers are maintained in proper condition, no storage capacity is needed; and perhaps no other similar class of apparatus can be run with such a small stand-by operating charge as a gas producer. Unfortunately, however, a gas-engine power station represents such a high first cost that, in spite of the higher efficiency of the gas engine and the lower stand-by losses of the gas-generating apparatus, the commercial cost for purely relay service is higher than for steam equipment.

If provision must be made for protection to service, a modern steam equipment offers about the lowest commercial cost. The boilers chosen should be able to have their fires withdrawn without causing leaks, and boilers should be chosen having the least stand-by loss in relation to their maximum capacity. This means a boiler of either very high capacity or very low radiation and ventilation losses. It is Mr. Doherty's opinion that for this class of service the internally fired boiler deserves careful consideration, but perhaps only in a modified form. This type of boiler, however, would be apt to be limited before other limiting features were reached by the lack of flue-gas conductivity of its fire tubes, which could be compensated for by a high draft pressure, but better compensated for by a modification in design. If boilers are not to be run on bank, but are to be fired up if an interruption occurs, the methods to be used for quickly starting the boilers are of great importance. The use of oil for fuel probably insures the greatest speed in starting up, but this fuel is often prohibitively expensive. It is, however, possible to use oil simply as an auxiliary in the starting of the boilers and then substitute coal, either hand-fired or machine-fired. Powdered coal is almost the equivalent of oil or gas, and is ideal for the class of service under consideration. It probably costs more to powder fuel than to burn it, as received, with machine stoking; but for relay service, while the operating cost per ton of coal handled would be more, the investment charge would probably be far less; and a great gain would be made in the speed of starting as compared with ordinary coal fires, and a much greater economy of labor could be secured.

In the choice of steam engines the steam turbine would seem to be the only one worth consideration. The low first cost of steam turbines, including building, foundations, etc., should alone be enough to warrant their adoption.

As regards the third point, Mr. Doherty gives some facts from a recent negotiation for the purchase and supply of power between a central-station company and a hydroelectric supply company, the question of continuity of service being given serious and detailed consideration. The central-station company was not desirous of collecting any penalties, but insisted that it should have service of such degree of reliability that no serious damage should result from such interruptions as might occur to the business it then held, and that would enable the same rapid development of the business as then obtained to be continued. It was concluded that any interruption, regardless of the length of such interruption, was harmful, and that the longer this interruption continued the more serious it became. It was also decided that one or more interruptions to the service immediately following the first interruption would prove more disastrous than if these interruptions were evenly distributed throughout the year. As insurance against excessive interruption was being sought, and as the only insurance possible was that to be obtained through operation of the steam plant, it was decided that insurance should be obtained by running the steam plant (fully energized and ready to instantly take the load in case of interruption to the hydroelectric service) at such times and for such lengths of time at a stretch as might be necessary to insure against interruptions coming oftener than at certain intervals. For example, to take an extreme case of the simplest form, suppose it had been decided that no interruptions of any kind whatsoever were permissible more than twice in any twelve months. Then after any interruption the steam plant would be run for six months, ready to take the load at any time in case of failure of the hydroelectric supply. This would insure only two interruptions per year; for if another interruption occurred after the end of the six months, the steam plant would be run another six months, thus completing the year with only two interruptions.

Regarding the fourth point, so many different methods of charging have been used that it is not surprising that even those skilled in the art are not familiar with all the deviations or the reasons for them. The individual user cannot afford to pay more than the value of the service to him. The cost to him of supplying his own requirements will depend on (*a*), the maximum capacity he may demand, regardless of when this demand may occur, and (*b*), the total amount of current generated. His investment will be influenced by certain preparatory charges; and, generally speaking, the larger the capacity installed the less the cost on a unit basis of capacity. While not always recognized, the cost of operation will be influenced, not only by the load-factor, but by the form of the load curve. The cost to the supplying company depends primarily on the demand of the consumer at the time of the hydroelectric company's simultaneous peak. Noncoincidence of maximum demands is, however, a legitimate source of profit to any supplying company.

In central-station practice large numbers of consumers are eventually developed having so small a current consumption and maximum demand that what might be termed the "consumer charge" assumes so much greater importance that it cannot be neglected. In fact, the condition has been reached where a large group of our central-station consumers requires a greater investment and maintenance expenditure for meters alone than is required for the generating equipment necessary to supply them. The capacity cost to supply many consumers is far greater to the hydroelectric company than would this same cost be if the consumer supplied himself. On the other hand, the cost for current to the hydroelectric company is generally very small compared with the cost to the consumer were he to supply himself. The capacity the consumer should pay for should generally be based upon his absolute maximum peak experienced at any period throughout the year. Any other method of arriving at the capacity charge is apt to lead to great inequities.

In referring to the fifth point, Mr. Doherty gave the following illustration: The cost of service from an individual steam plant might be represented by 100,000 units per kilowatt of capacity plus 100 units for each kilowatt-hour, while the cost of service from a hydroelectric company might be as much as 400,000 units per kilowatt of capacity plus ten units per kilowatt-hour, being a relation in the first case as 1 is to 1,000 and in the second case as 1 is to 40,000. In spite of this great discrepancy in the relation between the fixed and output factors in the two cases, there is, nevertheless, the same cost of service at approximately thirty-eight per cent load-factor. With a load-factor of less than this the cost of service from the steam plant is the lesser, and at more than thirty-eight per cent load-factor the cost of service from the hydroelectric plant is the lesser.

By securing a number of consumers of a diversified character, even though more transmission lines are necessary, a good load-factor can often be secured in spite of the fact that the individual consumers may have poor load-factors. And by getting consumers to adapt their operations to the ability of the hydroelectric company to supply—that is to say, by using some form of what is now called "limited service"—this same end can be realized. Rational methods of charging, properly explained so they can be understood both by consumers and by prospective consumers, will do much to contribute to a good load-factor.

The future situation in the hydroelectric supply business will, however, eventually be that of the market greatly exceeding the supply, and the natural remedy will be the installation of steam plants by the hydroelectric companies to enable all possible available water to be used. Central-station steam-power plants have been made a success in competition with individual steam plants, and the success of steam plants in connection with hydroelectric plants should be even more pronounced.

Regarding the sixth point, Mr. Doherty said that many disappointments have been due to failure to develop the available market, or by tardy development of this market. A completed plant with an undeveloped load can create a deficit of expected earnings which will require many months of subsequent operation to wipe out. The transmission lines should be completed at the earliest possible moment, regardless of when the hydraulic generating plant can be put in commission; and if steam plants can not be taken over from prospective consumers to give in the aggregate enough capacity to carry on the development of the load, a relatively small steam plant in connection with the initial development of the waterpower plant should be installed new, and be added to as rapidly as required to insure a proper load when the hydroelectric generating station is placed in commission.

Delays in securing business are often due to the inability of industrial establishments to change over their equipment until a natural period of shutdown occurs; and failure to take advantage of one of these natural periods may defer the time of getting this business for a matter of many months, or perhaps years. The financial inability or indisposition of industrial plants to equip themselves with drives often occasions a serious retardation in the development of the expected load, and many power companies would find it greatly to their advantage to finance the expense for their customers to use electric power even though compelled to take long deferred payments and more or less risk.

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As to his seventh point, it was the author's belief that eventually hydroelectric companies will develop and sell all of the power that can be generated economically. To do this, in the absence of extensive reservoir capacity, will necessitate a heat-engine auxiliary plant to supplement the hydraulic plant during low-water periods. Let us assume a hydroelectric development having simply a dam from which the water immediately enters the turbines and is immediately discharged to the river below the dam without any expensive canals, flumes, etc. In this character of development, hydraulic apparatus can be installed for carrying the peak load at a very much lower cost per kilowatt of capacity than by the use of steam. Not only this, but in this character of development all inequalities of load should be taken care of in the hydraulic plant; and if it is necessary to run the steam plant, the steam load should be run for such time, and at a uniform rate, as will secure the most economic generation of steam power. Steam plants or steam units can be started up and shut down only at considerable expense, while water units can be estarted up and shut down at practically no expense. In the character of development used above as an example, with a market which far exceeds the water supply, and where fuel is relatively high, the hydraulic capacity installed can be equal to the maixmum four days' supply of the stream.

Relative to the eighth point it was noted that practically all of the present assumptions for depreciation are too high. Figures applied to depreciation are used in a general sense without regard to what the plant consists of. The character of construction will largely influence the rate of depreciation. It is manifest that a plant having ten per cent of its investment in wooden poles and twenty per cent of its investment in a masonry dam will have a higher rate of depreciation than the plant which has only two per cent of its entire investment in wooden poles and over fifty per cent of its entire investment in a masonry dam.

Regarding his ninth and final point Mr. Doherty said that checking and rechecking plans by the same, or other, engineers may not disclose the omissions or errors, while complete independent reports by two or more separate engineering corps, and the comparison of these reports, will practically insure against all omission and all miscalculations, making it possible to do the development work for the cost anticipated with a realization of all the power and the expected market at the price predicted.

In conclusion the author stated that the Institute can do valuable work: By educating the public to the recognition of the value of hydroelectric securities; by such consideration and discussion as will bring about a proper attitude on the part of the public officials toward the development of our water powers; by papers and discussion on the methods of planning and developing which will insure that existing streams will be developed so as to realize more nearly their maximum economic possibilities; by papers and discussion on projects collateral to hydroelectric development; by encouraging frank and open discussion of past errors and their causes; by the consideration of methods and equipment to insure continuity of service and of penalties for and insurance against interruptions; and by educational work on methods of charging, rates of charging, and factors which go to make up the cost and value of service, coupled with the endeavor to standardize all terms of expression.

The spirited discussion, which followed the presentation of the paper, was under the leadership of Ralph D. Mershon, chairman of the high-tension committee. An unusually large number of members had contributed written discussion, so that the speakers were limited to seven minutes each.

Past-President Henry G. Stott opened the oral discussion by considering the question of the use of a steam plant as a reserve, and what proportion that steam plant should be, to get the most economical results. If we could take an ideal condition, such as the lighting of a large city, we would probably not end by wanting all our power from a hydraulic plant. We would find it possible to generate part of that power—and for many reasons—from a steam-power plant. There is only one type of steam plant to consider, and that is the steam-turbine plant. Mr. Stott thinks that type could be modified so as to cut the investment charges in two. There is only one problem we have in hand, and that is the fixed charges. The operating charges are almost negligible, compared to the fixed charges. The suggestion was made by the author of the paper that powdered fuel should be used, but there is no furnace found which will stand powdered fuel. The heat generated is so intense that no grate can stand it. Another point on which he differed from Mr. Doherty was as to holding the steam plant in reserve, he believing it better to operate it every day during peak loads. He considered the problem as based on a series of load curves representative of a large city, and which combined a lighting load, a railroad load and an industrial power load. Summing up his conclusions Mr. Stott showed a curve illustrating the average cost of power with different combinations of hydraulic and steam plant. The best combination in winter he stated as sixty per cent hydraulic and forty per cent steam. In the summer he said that forty per cent hydraulic and sixty per cent steam gives the best results.

S. E. Doane had prepared an extended discussion of most of the features covered in Mr. Doherty's paper. He thought that the mild language used in stating the importance of speedy development in water powers as a means of conserving our natural resources is entirely inadequate. Attention should be called to the value of nitrogen in maintaining the fertility of the soil. Coal burned under our boilers yields no nitrogen for fertilization, while the coal distilled for gas making and the coal carbonized for coke in modern ovens yields appreciable amounts of nitrogen in the form of ammonium sulphate. Thus the fuel saved by the utilization of our water powers means not only a direct fuel saving, but also the conservation of the material from which fertilizers may be produced. The fixation of atmospheric nitrogen by means of electricity is a fruitful field for the utilization of cheap water powers. Mr. Doherty seemed to imply that the investigating engineer is frequently to blame for errors in the construction of hydroelectric properties. This is not so commonly the case, however. Many disappointments have been due to mismanagement and tardy action on the part of others. As to matters dealing with rates of charge, it should be remembered that all electrical supply companies are furnishing not simply energy, but a service as well. The expense in providing this service to each consumer bears no uniform relation to the energy furnished him. Therefore, a charge purely upon the basis of the energy supplied results in unjust inequalities between consumers. Mr. Doane did not concur in the belief that the Scotch type of boilers promises greatest economy for the reserve steam plant. As to the method suggested for insurance against interruptions of service, it would seem to be necessary to consider the time of day or night when the interruption ocurs. In the development of a suitable market for the power the engineer and commercial man must work together. Mr. Doane advocated that complete surveys of every stream capable of yielding power be undertaken by the federal or state governments and that these surveys also include the nature of development necessary in order to secure the maximum power from each stream. In his conclusion Mr. Doane criticized the author somewhat for being too concise and not giving the authority for many of his very important statements.

Dr. Cary T. Hutchinson submitted a written discussion of the paper in which he dwelt particularly on the subject of depreciation of hydroelectric plants as compared with steam-driven plants. The heavy depreciation of the latter is due to the fact that all the machinery used is subject to very great wear and tear and also because the type of steam generating plants

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changes very rapidly. The end of the changes in these types has not yet been reached. In modern hydroelectric plants the case is quite different. The construction is of a kind very much less subject to wear and tear, and the efficiency of conversion is much higher, so that there is not such a wide margin for improvements. The depreciation due to obsolescence in the hydroelectric plant should therefore be small. The writer submitted a number of valuable tables, giving first the cost of modern medium-head hydroelectric systems; the depreciation of such a system; the depreciation in detail of the power house equipment, transmission line and substation; interest charges of steam and waterpower generating plants; cost of energy per kilowatt-hour at various annual load-factors, and finally the selling price of the energy from the waterpower plant with six per cent on the investment for profit. In the table of fixed charges which included interest, insurance, taxes, depreciation and obsolescence, the total for the steam plant was given as seventeen per cent, and that for the hydraulic plant as nine per cent. Hydroelectric plants usually labor under a number of disadvantages. The most important one of these is lack of flexibility. Another is the necessity of insuring the continuity of service against interruptions due to low water periods and to possible failures of the transmission lines. This latter requires the establishment of an auxiliary steam plant. To sum up these features it is evident why so many hydroelectric plants have been total failures from a financial viewpoint. In other words, they are so burdened with capital charges and costs that do not enter directly into the productive capacity of the plant that competition with modern steam plants is in many cases rendered impossible. The remedy would seem to be a total change in the methods of financing such propositions.

Harold W. Buck spoke of the general government. There has been a great deal circulated during the past year which has given entirely false impressions about the fabulous value of water powers as they exist in nature. As a matter of fact, a mountain stream in a wilderness itself has practically no value whatever. It is only when it is combined with a very large expenditure of money, ranging perhaps from $100 to $200 per kilowatt, combined with the expenditure of a great deal of brain power, and with much ability in management, financiering and engineering, that this natural geographical situation called a water power has a value. The value only in a smaller degree is contributed by the water, merely falling in its level. When a water power is developed and is successful, it is successful only in a reasonable degree. At the present time, and probably for many years to come, competition will exist with various forms of heat engines. The people have come to believe that a water power is an absolute monopoly. The government also assumes that the water powers will for all time continue to be the only source of power. This hardly semes to be justified. The energy of the water power is merely the converted energy of the sun. It is quite possible that other sources of utilization of the sun's power may develop in future generations. The attitude of the government is such that we are trying to preserve our water powers for the sake of posterity. It may be that when posterity gets here it will not want the water powers at all, and in the meantime we have lost a great opportunity. The government also has adopted a discriminating attitude against water powers as distinguished from other natural resources.

John Martin took up in his remarks the relation of waterpower development to the conservation of our natural resources, speaking particularly of California, where he has spent the last fifteen years in waterpower development work. In that state there are wet and dry seasons—sometimes eight months without a drop of rain—and an engineer must, in order to show wisdom in his installation, install a capacity equal to the minimum flow of the stream. Notwithstanding the difficulties to be encountered, in all the installations he had made he had yet to find the year when they should experience a shortage of water for the installations made. The government is attempting to make charges for the utilization for power purposes of water stored on government lands. When that land is disposed of by the government, its right of control ceases, but it proposes to charge for the use of the water, and thereby conserve the natural resources for the benefit of the people. If it would give the use of the water power away, and would fix a minimum charge for the power, that a company could demand of the people it serves, it would then be conserving some of the rights of the people; but a man securing a water right and wanting to develop a power plant, is like a man who wanted a horse and buggy, and first bought the whip. The greatest difficulty the Californians have encountered in trying to finance their enterprises has been the great desire on the part of greedy capitalists to listen to dishonest reports from engineers, who either do not know or would not tell the truth, and as the result there have been very many failures. As to compensation for interruption of service, Mr. Martin maintained that no hydroelectric transmission plant can afford to assume an uncertain euement of risk on the basis of the calculations Mr. Doherty had stated. If the pole line should break down at midnight and were not repaired until morning, it would be necessary to run the steam plant for the rest of the year for that interruption, which might not have caused the railway company any inconvenience whatever. The question of depreciation is largely a question as to how well the plant is maintained. As to the methods of insuring against interruptions, or lessening the harmful effects of interruptions, Mr. Martin read a communication from Mr. Downing, who told how the large power system is handled.

P. M. Downing, engineer of operation and maintenance of the Pacific Gas and Electric Company, communicated a short description of the load-dispatching system in use by that company. On the load dispatcher rests the responsibility of keeping the voltage normal and seeing that the fluctuations of load are properly taken care of among the different power houses. He has absolute control over the service from each power house and over each transmission line. Without his order no line changes can be made. An important part of his duty is the re-establishing of service after an interruption, with the least possible delay. The system comprises about 1,600 miles of 60,000-volt lines. Trouble on any line is liable to affect the entire system. If the trouble is far enough removed from the stations, the generators may not be thrown out. By the system of switching in use, when trouble occurs the different power houses are immediately separated, leaving one or more running

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together with such lines and load as they can carry. A great aid to the dispatcher is a board showing diagrammatically every generating station, substation and transmission line, also every switch in any of these stations or on the lines. The switches are represented by dummies which are adjusted to show whether the switch is open or closed. In a system of the size of the one considered, which has about 125 oil switches and 350 air switches, a board of this kind is an imperative need.

W. M. Ryerson said many of the features connected with hydroelectric plants had been dwelt on before, but this was the first time the whole matter has been treated. As to rates Mr. Doherty cannot mean that it is not legitimate for a supplying company to make special rates for the off-peak business. Regarding depreciation, in the state of Wisconsin the public service commission insists that the public utilities set apart a depreciation fund, and has even ordered a company to raise its rates to provide for this.

Julian C. Smith gave the results of seven years' operation of the Showinigam system. This comprises a system about 100 miles long having two separate pole lines and a large receiving station, where some ninety-five per cent of the power is taken at a voltage of about 50,000. All the power is delivered through synchronous-motor sets. Therefore the interruptions are more numerous than on many other systems. The table gives a classification of both the locations and causes of the disturbances. The main causes of troubles are carelessness or ignorance of operators, lightning, and breakdown of machinery. The number of troubles due to the latter two causes are decreasing each year, however.

D. B. Rushmore stated that he must dissent from some of the opinions expressed in the discussion that water powers cannot be made reliable. Not all water powers are reliable, it is true, but there are water powers with very long transmission lines which are delivering a continuous service which very closely approximates that of a steam station. In the early forms of construction, with long wooden flumes on the side of the mountain, exposed to rolling rock, with long pole lines, depreciating rapidly, the systems were necessarily subject to great interruptions. On the other hand, taking the Great Western Power Company's 100,000-volt plant as an example, since its inception that plant has been practically free from line troubles, as any well-constructed line now ought to be. From the engineering point of view, until we get to pressures above 150,000 volts, and until we get to very much longer distances, there are no engineering features which are going to limit waterpower development and power transmission; but the financial features are the principal points which are of interest in this connection. We all realize that we are going to have governmental supervision of some form with regard to the development of the natural resources, and we are all sure, when this supervision actually comes that we are going to have assistance and not retardation in that development. A small waterpower plant, especially with an uneven load curve, should in the present day never be considered without connection with a steam auxiliary, for a waterpower plant naturally runs best on a very even load, and in almost all cases the load curve shows very great peaks. When we compare hydroelectric installations with steam installations, where we often have complete underground service, we can see that there is always a somewhat weak link in the chain, but that link is being so strengthened that some of the most modern hydroelectric plants are running without more than one interruption in three months, and that is to be considered a very satisfactory service, for in a steam plant we are not entirely free from a shutdown and from disturbances which very seriously interrupt the service, although, fortunately, these do not often occur.

Written communications were also contributed to the discussion by a number of other members, but on account of the lateness of the hour these were referred to by name only. Among these were discussions by H. F. Parshall, of London, England; J. F. Vaughan, of Boston, Mass.; W. H. Gardiner, of New York, N. Y.; H. A. Storrs, of Denver, Colo.; E. C. Brown, of New York, N. Y.; M. H. Collbohm, of Madison, Wis.; J. H. Wilson, of Berlin, N. H.; James Lyman, of Chicago, Ill.; Carl Schwartz, of New York, N. Y.; Clarence P. Fowler, of Edgewood Park, Pa.; Chas. H. Baker, of New York, N. Y.; E. P. Roberts, of Cleveland, Ohio; Robert A. Ross, of Montreal, Canada, and Calvert Townley.

Mr. Doherty was called on to conclude the discussion, which he did by first concurring in Mr. Doane's remarks on the incidental manufacture of ammonium sulphate from the gas producer and coke oven and its use for fertilizer. Such fertilization would provide double the average production of the wheat lands of the United States. One can safely assume that if all our coal were gasified in coke ovens or retorts, it would add at least $500,000,000 to the fertility of our soil, and considerably over $1,000,000,000 to our farm products. As to the seeming discrepancy in his paper, while in one place he had said that below thirty-eight per cent the steam plant operates at lesser cost, and above the waterpower plant at a lesser cost and later that it was possible to put in water turbines, even though they were only run 100 hours each year, it must be remembered that we cannot take our average investment cost for a hydroelectric company, in figuring what we can do in the way of additional installation and equipment, because our main preparation expense is often work on the river, perhaps producing no physical property, or that which cannot be seen, such as the blasting out of a channel or something of that sort. With that type of simple development mentioned, namely, simply a dam across the river and the water flowing directly to the turbine, and from the turbine to the river below, while the total cost for the water power and transmission lines might be as much as $400 per horsepower, perhaps the additional cost of adding waterpower units might not be over $35 a horsepower. Therefore we would have only to figure fixed charges on an additional $35, as the investment for each additional horsepower. The country is now influenced by the belief that our water powers are being controlled, or that an attempt was being made to control these water powers, by a so-called trust. Mr. Doherty has no doubt one can induce the public to abuse anything which it believes is going to result in control by a trust. That is an awful bugaboo, and it is the same with the watering of stock. The public has been taught to believe that the capitalization beyond the actual cost of any property means the watering of stock. Mr. Doherty does not see why the cost of a property need represent its capitalization; he cited a hypothetical case where an investment of $1,000,000 re-

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sulted in a plant worth $2,000,000; its capitalization should therefore have been $2,000,000, provided there is no misrepresentation of the facts. On the other hand, if we assume that a thing which cost $1,000,000, and had proven a failure—in fact, had proven its inability to earn interest on a single dollar—we could not contend that it is worth $1,000,000 because it cost that much. In other words, the cost of a thing does not represent its real value. The public has a well-developed case of hysterics over water powers as one of our natural resources and the growing fear that some one would develop these and reap a profit, while very little has been said about the other natural resources, all of which have proved equally or more profitable than water power.

Plans for Copper Merger.

Plans for the consolidation of the copper interests in which the Guggenheims are dominant have been formally announced.

The Utah Copper Company, which has been one of the largest producers, increases its stock from $7,500,000 to $25,000,000 and becomes the nucleus of a consolidation of the several companies. The stockholders in the Nevada Consolidated Copper Company and the Boston Consolidated Copper and Gold Mining Company will receive shares of the Utah Copper Company in exchange for their present holdings.

The consolidation now effected is the first result of the policy adopted by the big copper producers last summer of making a united effort to keep a better balance in the copper market.

Morgan Gets Telephone Lines.

In a statement made a short time ago Clarence Brown, counsel for James S. Brailey, Jr., said that J. P. Morgan and Company were the purchasers of the United States and Cuyahoga telephone companies. It has been contended by the independent telephone that the Bell company was purchasing these lines.

Fire Alarm Service for Los Angeles.

Fire alarm stations and equipment costing approximately $180,000 are either under way or planned for immediate construction in the city of Los Angeles, Cal. A fire alarm system costing $35,000 is to be installed in the University district. A.

MEAT CURING BY ELECTRICITY.[1]

BY J. C. LINCOLN.[2]

The gentlemen who have interested themselves in the electric meat-curing problem have been working on it for a good many years. After a great many failures, and some successes, it was definitely settled in 1906 that bacon could be cured by electricity in much less time than it was cured by the old methods, and that the cure was certain. In many of the experiments in the preceding eight or ten years some of the meat would turn out very good; some of it would be spoiled. But by the date above mentioned the reasons for the troubles had been discovered and eliminated one by one, and for the last three years the electric curing of meat has been carried on as a commercial process.

In the electric curing of meat wooden tanks are employed. The dimensions of the tanks adopted as standard are fourteen feet long, four feet wide and four feet high, holding approximately 4,000 pounds of meat; different lengths, of course, can be used. At each end of the vat are placed a number of porous cups approximately six inches in diameter, and a little deeper than the depth of the vat. Inside each porous cup is a graphite rod; fastened to each rod is a wire for making electric connection between the graphite electrode and the wire carrying the current from the dynamo to the vat.

The vat and porous cups are filled nearly to the top with ordinary pickle. Electricity, either direct or alternating current, is sent into the electrodes. The current passes through the electrodes into the brine which fills the porous cups. The current passes through the porous cups into the pickle of brine which fills the vat, and through the vat filled with meat to the porous cups and electrodes at the opposite end.

The pickle used in the vat is the same as that used in the old cure; made up with sugar and salt, saltpeter, etc., and is of the same density. In fact, the work has been done with the same pickle that was used in the old-style method, and experience shows that this same pickle is well adapted for use with the electric cure.

The meat is laid in the empty vat between the porous cups in layers, separated by wooden racks, it being necessary to use the racks for separating the meat so that the process of cooling may not be retarded. After the vat is filled with meat packed in this way it is filled with pickle, and the current is turned on. Approximately thirty-five volts at thirty-five amperes is used for a vat of the dimensions given. The meat is left in the electric bath until cured, which in case of bacon, is three to four days, hams twenty-five to thirty-five days, the extra time in the latter case being necessary on account of the thickness of the lean meat.

There is a slight heating effect due to the passage of the current, on account of the electric resistance of the vat, which would tend to increase the temperature of the brine. In order to keep the brine temperature down to about thirty-eight degrees Fahrenheit, a circulation of the brine in the vat is produced, cold brine being delivered at one end of the vat, warm brine flowing off at the other end, flowing through a cooling coil, or into a vat in which is placed a cooling coil. In actual practice the temperatures of the cold brine flowing into one end of the vat, and the warm brine flowing off at the other end, do not differ by more than one or two degrees Fahrenheit.

At the end of the time required for the cure, pickle is drawn off from the vat, the meat is removed, the vat is refilled with new meat, and the old pickle, together with enough of new to bring the pickle up to proper saturation, or to replace what the meat has absorbed, is replaced in the vat, the current is again turned on for another three or four days, and thus the process of curing goes on. The meat itself is washed after being removed from the vat, and is hung up and smoked in the ordinary way, and shipped either in bulk or after being canvassed.

The most noticeable difference between the electric process and the old process of curing meats is in the great saving of time effected by the electric process. This saving of time means, of course, a much smaller floor space required in the curing room in order to handle a given quantity of meat. This, of course, means a decreased investment for a plant in the first place, and decreased amount of refrigeration required, decreased interest on the cost of meat while it is being cured, and decreased overhead charges.

1 Abstract of a paper presented at the third annual convention of the American Meat Packers' Association, at Chicago, Ill., October 18, 1909.

2 A director of the Electric Meat Curing Company, Cleveland, Ohio.

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In a general way it is fair to say that the electric curing of meat will enable more than twice as much meat to be handled with the same plant as is handled at the present time. With some kinds of meat, curers can do much better than this. And this means that the items of interest, insurance, plant deterioration and overhead charges will be practically cut in two in a plant using the electric process. Or, to put it another way, a plant with the electric process can handle as much meat as a plant using the present process of twice the size.

A remarkable thing about the electrically-cured meat is its unusual keeping quality. Another peculiar property of electrically-cured bacon is the fact that the flies which lay the eggs which later develop into skippers do not alight on this meat. Experience seems to show that this is the case, but up to this date I am unable to find any satisfactory reason to explain this fact.

Another point of advantage is the fact that the pickle used in the electric process does not deteriorate. I am told that, in the old process, after pickle has been used once or twice, it is thrown into the sewer. At the plant in Cleveland where demonstrations are being carried on, the same pickle is being used which they started with April 1, 1909. This pickle is just as pure and sweet as it was when it was first made up. Of course, some of the ingredients contained in the pickle, such as salt, sugar, etc., are absorbed in the meat, and it is necessary to replace the salt, sugar, saltpeter, etc., in the pickle that has been absorbed by the meat during the curing process. The pickle is renewed in this way occasionally, so as to keep it up to its standard.

Last but not least of the advantages of the electric process is the quality of the meat. A great many of the people who are eating this meat like its flavor better than that of the bacon cured by the old process. The fat in this meat does not frizzle up to the extent that the fat in meat cured by the old process does. The meat has a somewhat fresher taste, and to my palate at least there is more of a nutty flavor.

Additional apparatus required to operate the electric cure is very slight for the ordinary packing house. There are very few packing houses at present in the United States which do not have electric current, and none of them which do not have means for producing refrigeration. The amount of power required by the vat in which meat is being cured is approximately one kilowatt for each vat. Assuming that electric power costs one cent per kilowatt-hour—and this figure is ample unless additional apparatus has to be installed to furnish the electricity for the vats—the cost of operating each vat would be twenty-four cents per day; and for turning out the batch of meat for each vat of three or four thousand pounds would amount to something less than a dollar. The cost of the cooling of the vat during the process of the electric cure would be fourteen cents per day, assuming that refrigeration costs fifty cents per ton per day.

It will thus be easily seen that the cost of the electricity, plus the additional refrigeration, does not nearly amount to the cost of the old process incurred in the loss of pickle and the cost of labor in handling the meat from one vat to another several times during the process of the cure, to say nothing of the decreased size of plant and decrease of overhead charges where the new process is used.

In the discussion that ensued, Mr. Lincoln said that direct current was no longer used in the electric meat-curing process. Alternating current of sixty cycles is now exclusively employed, as this gives no trouble from electrolysis of the pickle as was the case with direct current. The action of the electricity in the process was not completely understood, although the results were positive and satisfactory. There appeared to be a sort of mechanical action tending to drive the pickle into the meat, thus hastening the cure. President Ryan, although not desirous, he said, of advertising any particular process, remarked that as far as the palatability of electric-cured bacon was concerned, a piece of it which he had sampled a month previous, was, in his opinion, as sweet as any bacon he had ever tasted.

Chicago, Joliet & St. Louis Railway to Enter Chicago.

The Chicago, Joliet & St. Louis Railway Company now holds a license for entry into Chicago and according to newspaper reports will bring passengers into the heart of the city over the tracks of the Metropolitan West Side elevated. This service will probably be inaugurated before the summer of 1910.

Interstate Railways Company.

Arrangements have been made by the Earle readjustment committee of the Interstate Railways Company to pay the charges and expenses of the Philadelphia Trust Company for acting as depository of interstate bonds under the plan of the former reorganization committee, which has since dissolved. The bonds have been held by the Philadelphia Trust Company, under the instruction of Edward B. Smith & Company, managers, pending the payment of the depository expenses and also the fee claimed by Edward Smith & Company, as managers.

After the depository expenses have been paid by the Earle committee, demand will be made on the Philadelphia Trust Company by bondholders for the release and delivery of their deposited bonds. It is understood that if the Philadelphia Trust Company does not then deliver the bonds that suit will be brought to compel such release. The main object is to cancel the Philadelphia Company receipts now listed on the Stock Exchange, so that the Real Estate Trust Company receipts can be listed.

System of Accounting for Small Central Stations.

Working with the consent of the Public Service Commission, E. C. Scoebell, chairman of the committee on accounting of the Empire State Gas and Electric Association, has completed a system of accounting for the smaller gas and electric companies of New York State. The committee has evolved a system which is simplified to the needs of the companies that do not need a more elaborate system required by the commission of the larger public service corporations.

The need for this small system was indicated by the announcement that ninety per cent of the gas and electric companies in the state of New York are in receipt of less than a $10,000 yearly income.

Sale of Quebec-Jacques Cartier Electric Company.

Conditions of the sale of the Quebec-Jacques Cartier Electric Company by the American Light and Traction Company to the syndicate of Montreal men, which is going to run all the public utilities of Quebec under the name of the Quebec Light, Heat and Power Company, have been settled, and the first payment has been received by the American Light and Traction Company.

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THE HYDROELECTRIC DEVELOPMENT AND AUXILIARY STEAM PLANT AT LANSING, MICHIGAN.

THE SYSTEM OF THE MICHIGAN POWER COMPANY.

The first epoch of a comprehensive plan for the development of the power of the Grand River in the vicinity of Lansing, Mich., is marked by the completion of the first development of several power sites owned by the Michigan Power Company.

In the present hydroelectric development together with the new auxiliary steam plant ample capacity has been provided to serve both Lansing and East Lansing with electric light and power service for the present, but as soon as required by the demands of the increasing power market it is the intention of the company to develop additional power sites which it owns at Dimondale, Grand Ledge, Eagle and Portland, and these will ultimately furnish a total of 18,000 horsepower when fully developed to their normal capacity.

HYDROELECTRIC PLANT.

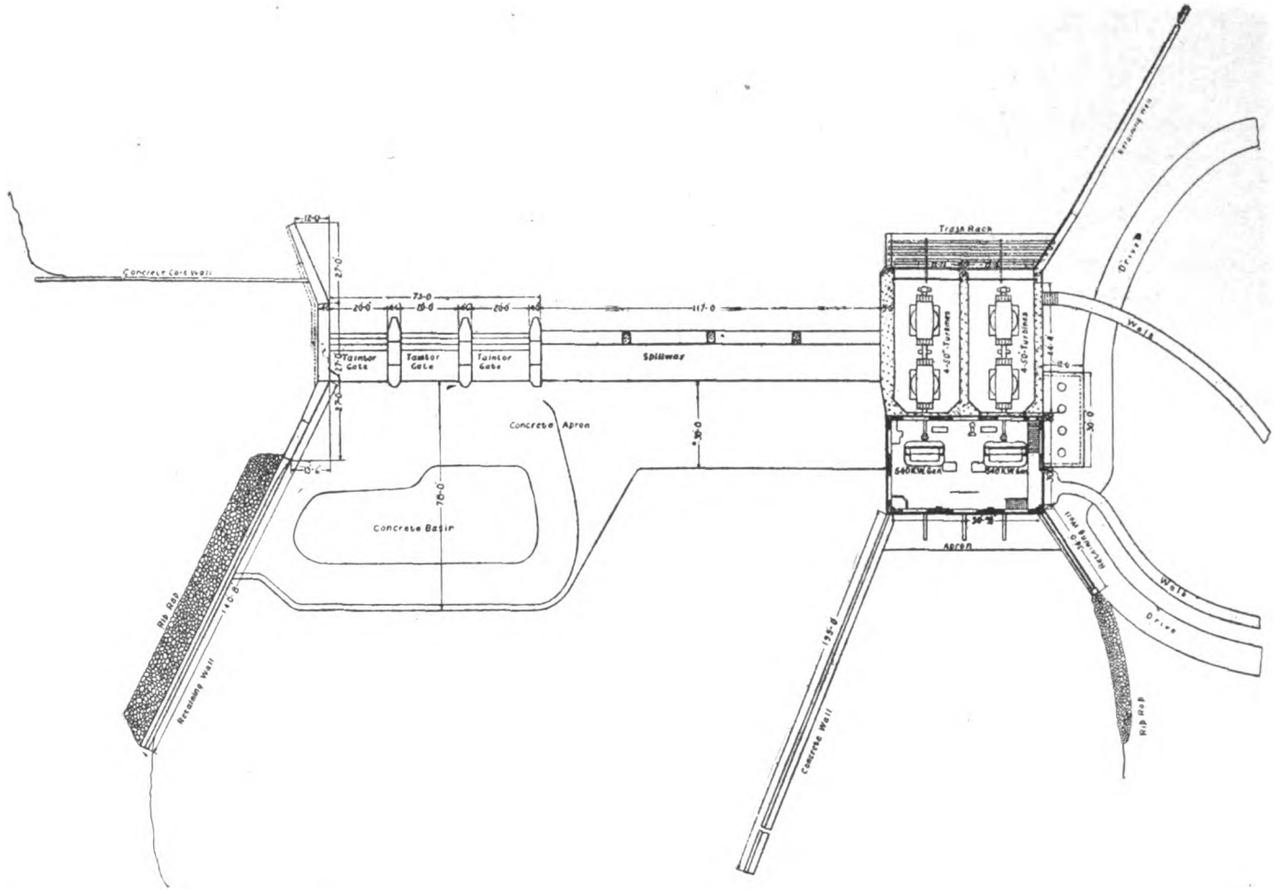
The hydroelectric development described in this article is located one and a half miles up stream, but within the city limits of Lansing and not more than a half dozen blocks from a connected load which nearly equals the total capacity of the plant.

By the construction of a fifteen-foot dam at this point there was created a reservoir nine miles long with an average width of about 1,000 feet. The expense involved of overflowing several hundred acres of valuable river bottom lands was considerable and in addition to this it was found necessary to raise several steel bridges and approaches to the same. However, the improved boating facilities above the dam and the creation of practically constant water level have met with the hearty approval of the abutting property owners.

The construction of the dam is of solid monolith design with steel reinforcing where necessary. It is built upon a solid rock foundation which was found quite close to the surface of the river bed. The dam contains a spillway 100 feet long and three twenty-foot tainter waste gates located at one end. The power house is located at the opposite end of the spillway. Earthen embankments with concrete walls extend from the waste gates at one end of the dam and from the power house at its opposite end to the high ground on either side of the river, making the complete dam 600 feet in total length.

A steel foot bridge is constructed across the spillway to facilitate reaching the gate operating mechanism and for the accommodation of the public in crossing the river. The flood gates are hand operated, but can be easily handled by one man. A reinforced concrete apron extends seventy-eight feet downstream from the waste gates and thirty feet from the toe of the spillway and effectually prevents the undermining of any part of the dam. Concrete walls are provided to prevent the discharge from the waste gates washing the banks and to divert the waste water from the tail race during the flood seasons.

The power plant building is constructed of reinforced concrete to a height well above high water, the superstructure being pressed brick with a



PLAT OF THE HYDROELECTRIC DEVELOPMENT, INCLUDING THE DAM AND POWER HOUSE, OF THE MICHIGAN POWER COMPANY, AT LANSING, MICH.

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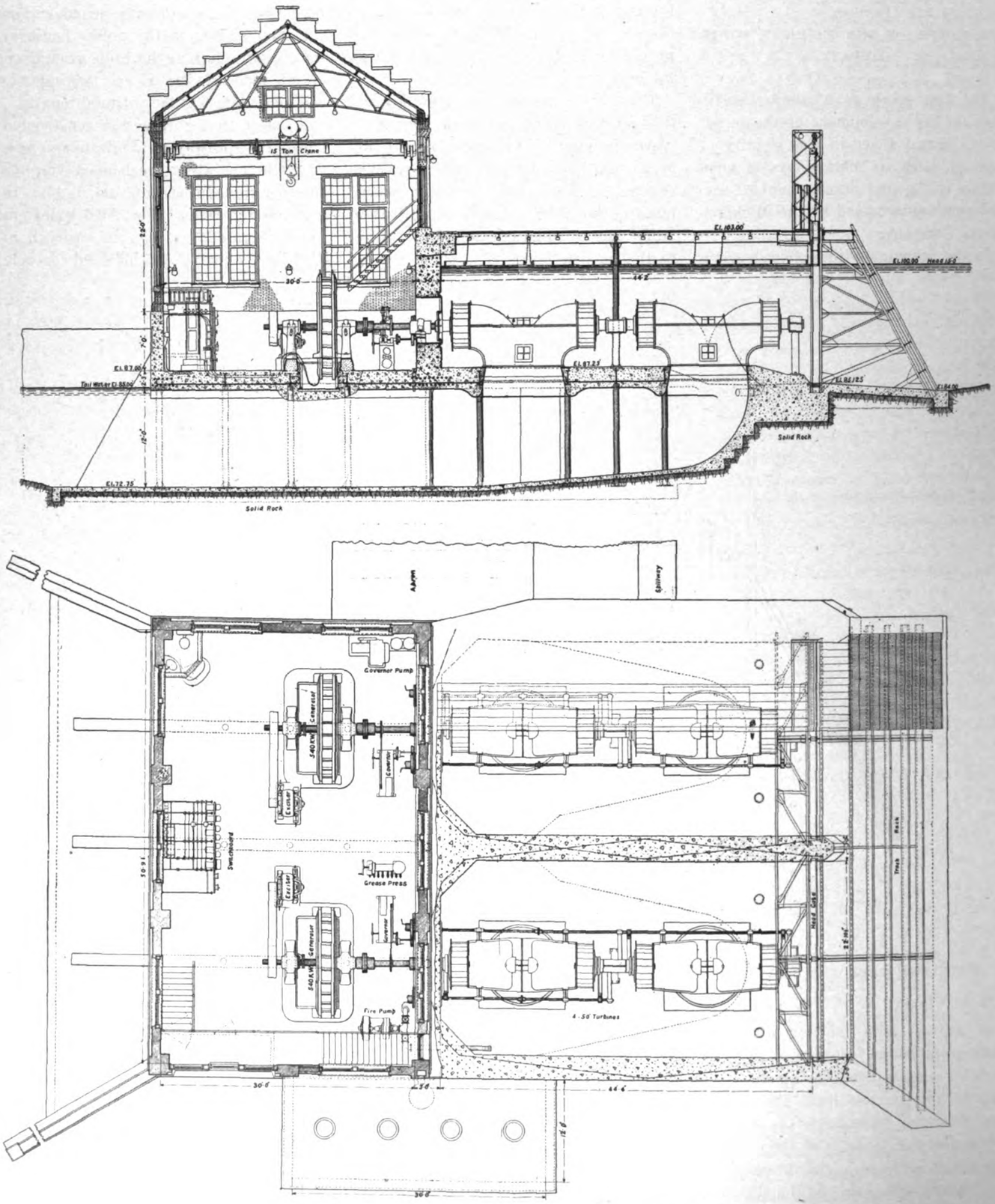
steel-trussed tile roof, the whole combination presenting an attractive appearance. The power house is provided with a fifteen-ton hand-operated crane.

In the plant the power equipment consists of two duplicate waterwheel units placed in separate compartments from either of which the water can be withdrawn to facilitate making repairs or inspection without interfering with the operation of the other unit. Each unit consists of four fifty-inch Samson horizontal turbines set in pairs, each pair with a center discharge. Each pair of wheels is fitted up with a counterbalance flow which effectually prevents air from being drawn into the turbines during low water, and at the same time



CROSS-SECTION AND PLAN OF HYDROELECTRIC PLANT.

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does not interfere with the flow of the water into the turbines. Each unit of four turbines is connected by a nine-inch shaft to a 540-kilowatt, 4,000-volt, star-connected with grounded neutral, sixty-cycle, three-phase, revolving field, General Electric alternator, operated at a speed of 120 revolutions per minute. Each group of turbines is capable of delivering 1,000 horsepower with a normal head of fifteen feet.

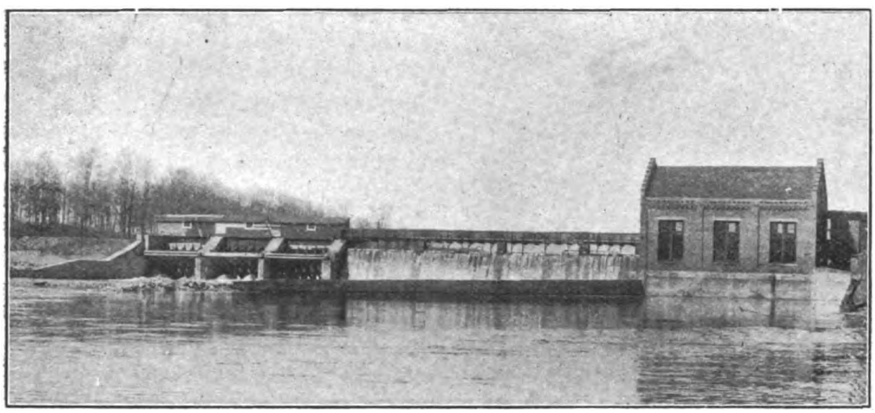
Each unit has its speed regulated by a Lombard oil-type governor, the two governors being supplied by one induction-motor-driven triplex pump. Each governor is equipped with an electrically operated synchronizing device controlled from the switchboard. The turbine gate shafts are equipped with pin clutches by means of which the gates of either pair of wheels can be closed, thus making it possible to operate the remaining pair of wheels during light loads at more nearly their full capacity and thereby increasing the efficiency of operation. The waterwheel shaft bearings are lubricated with grease which is forced through an individual pipe for each bearing by means of a grease compressor located at a convenient point in the generator room.

The lower parts of the generator frames are protected from any possible leakage into the generator room by steel pans constructed to fit the inside of the generator bases and which extend to a height of twelve inches above the floor line. All cables are encased with lead and made moisture proof and run through iron conduits, all ends of which extend ten inches above the floor line, thus preventing any possible damage by water on the generator room floor.

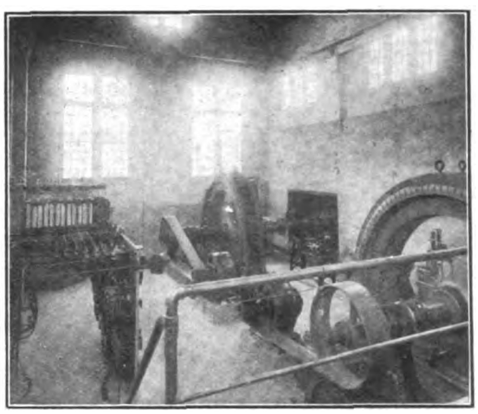
The switchboard is of standard construction and supplied with a full complement of instruments and meters. There is an equipment of oil switches and a Tirrill voltage regulator. The high-tension bus-bars are provided with a bus-tie switch located so that each generator can be operated on entirely independent circuits if desired.

The accompanying illustrations show the general construction of the plant. The head gates are made in sections and can be easily handled by one man by means of a small traveling hoist mounted on a permanent steel track. It will be noticed that the two units are arranged with their shafts parallel to the stream, this being found necessary to avoid dismantling an old steam auxiliary plant, which had to be kept in operation during the construction of the new hydroelectric plant.

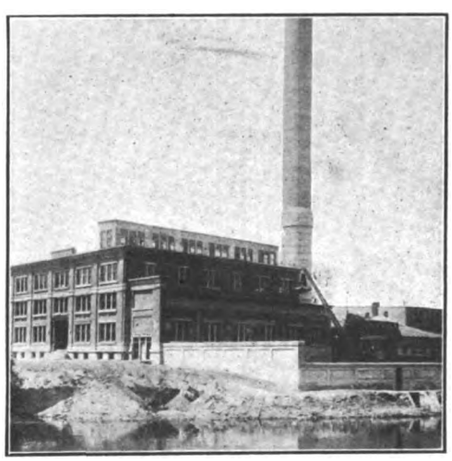
A feature of the design is the structural steel-work of the penstock and generator room floors which with its supporting columns practically carries the entire load, the reinforced concrete acting merely as a filler and protection for the steelwork. The safety and reliability of this plant have been shown by several months of very satisfactory service, during which time some severe tests have been imposed.



DAM AND HYDROELECTRIC POWER HOUSE, LANSING, MICH.



INSIDE THE GENERATOR ROOM.



GENERAL OFFICES AND AUXILIARY STEAM PLANT.

AUXILIARY STEAM PLANT.

The flow of the Grand River is subject to extreme fluctuation, and although the low-water period during some years is of very short duration, yet it has been found advisable to provide auxiliary steam power up to a capacity of about three-fourths of the normal rated capacity of the waterpower development, and in addition thereto, to provide sufficient steam plant capacity to take care of the increase in the power demand until such a time when the growth of the power market reaches a point where the investment in an additional hydroelectric development will prove to be profitable.

The company's new steam plant is located on the river bank at the foot of Ottawa Street within two blocks of the center of the business district of Lansing. In addition to serving as an auxiliary electric generating station, the steam plant furnishes steam for a central-station heating system covering the entire central district of the city west of the river. When it is found necessary to supply electricity from the steam plant during the heating season one or more steam turbines are operated non-condensing and exhaust directly into the steam-heating system with a back pressure varying from four to six pounds per square inch, except, however, during times when but a small amount of steam is required, in which case steam from the auxiliaries is used for supplying the heating system. If this is insufficient, additional steam may be taken from the intermediate stage of one or more turbines through connections provided for that purpose, and each of these turbines kept in operation in connection with its condenser. The company is now supplying steam heat for about 175,000 square feet of radiation and this service has proven to be

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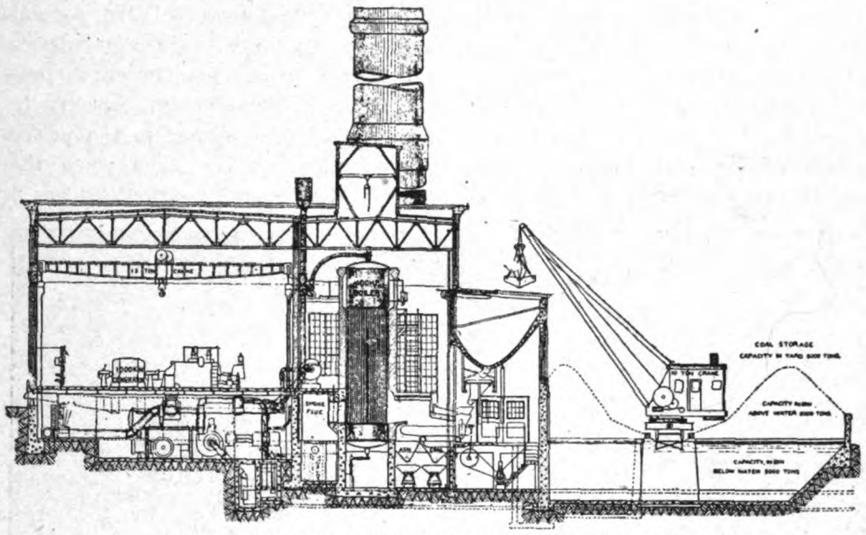
a very profitable branch of the company's business.

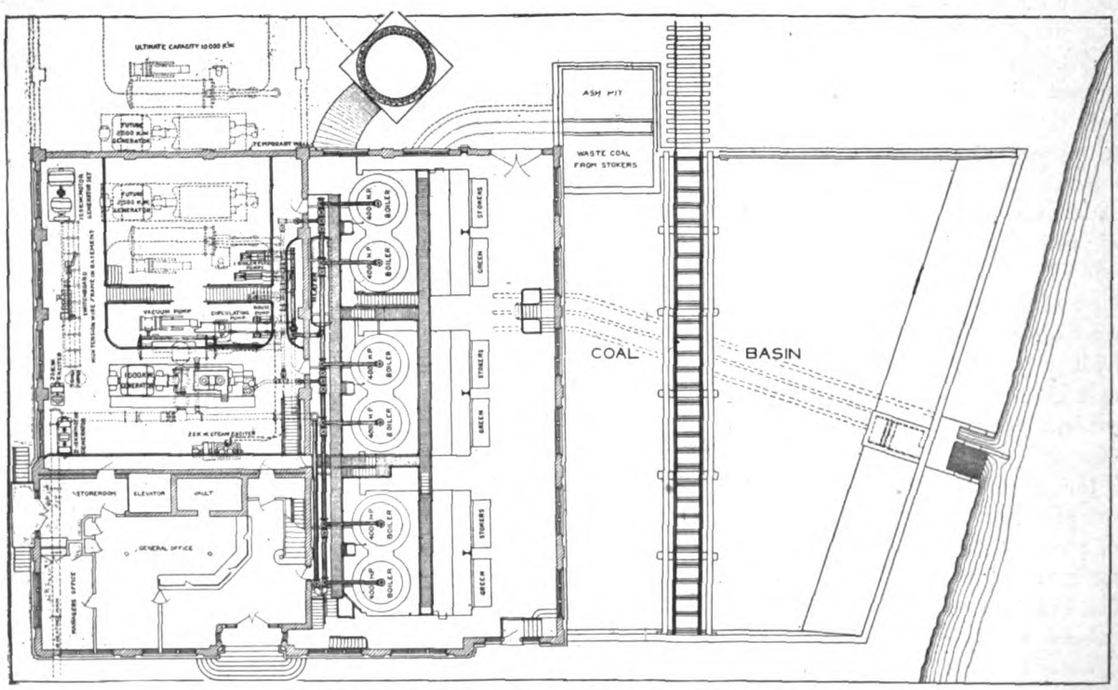
The steam power plant building is a substantial concrete steel and brick structure and is entirely fireproof. The exterior is faced with chocolate-colored paving blocks trimmed with concrete. The concrete cornices and belt courses are provided with electric lighting conduits laid in the concrete with appropriate openings for receiving incandescent lamps, thus providing excellent outline lighting, which has proven to be very attractive and forms a valuable advertising feature in connection with the boosting of the electric lighting business. The front of the power house has the appearance of a four-story office building. Two floors of the front end of the engine room are devoted to the general offices of the company and the lower and upper floors for store-room purposes. The building is supplied with elevator service and all the usual conveniences, including a shower bath for the use of power station employes.



CROSS-SECTION THROUGH AUXILIARY STEAM PLANT.

Throughout, the power house and its equipment are designed for future extension to an ultimate capacity of 10,000 horsepower. At present there are six 400-horsepower Wickes water-tube boilers, equipped with Green Engineering Company chain-grate stokers; this combination of boilers and stokers is found to be absolutely smokeless. The boilers and piping are constructed to operate at 165 pounds working pressure, but the piping is arranged for operating any number of boilers at low pressure if desired, valves being provided for dividing the steam header at any suitable point. A six-inch auxiliary steam header is provided and constructed to form a loop in connection with the main ten-inch header. Condensation from the high-pressure piping and steam separators is automatically returned to the boilers by means of the Damon-Zimmerman patented system, in which no pumps, traps, steam loops or other devices except check valves and piping connections are required.

The smoke flue and connections to the boilers are constructed of reinforced concrete built in sections and provided with proper expansion joints to prevent cracking. The design of the smoke connections with easy bends and baffles for properly distributing the gases in the flue, represents improvements which have been found highly efficient. The chimney is 203 feet in height above the boiler-room floor, twelve feet in diameter and of reinforced concrete construction. All boiler-feed water passes through a Wilcox automatic water weigher and all coal is discharged into a traveling scale hopper and is weighed before being burned, thus making it convenient to conduct continuous boiler tests.



PLAN OF GENERAL OFFICES AND AUXILIARY STEAM PLANT.

A novel feature of the design of this plant is the method of delivering coal into the elevated coal bunkers. This work is done with a locomotive crane which is provided with a special forty-four-boom and is capable of hoisting coal at the rate of twenty tons per hour directly from coal cars or from the submerged storage basin and delivering it into the elevated bunkers without the use of conveyors, or other auxiliary apparatus.

This same locomotive crane also

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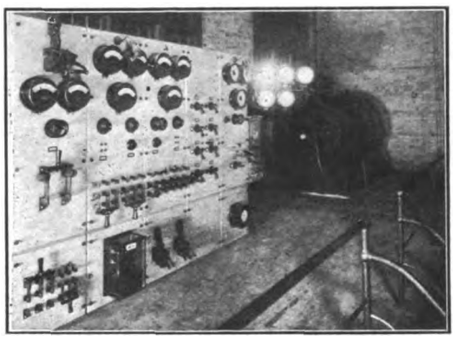
serves for handling the ashes after these have been delivered into the ashpit shown on the accompanying plan. Ashes are taken from the steel hoppers located below the stokers by small steel cars operated on a narrow gauge track and automatically delivered into the ashpit mentioned above. This system of coal and ash-handling apparatus has proven to be very satisfactory and has many advantages over any other system. The submerged coal storage basin has a capacity below the water line of 3,000 tons and about an equal amount of coal can be stored in the basin above the water line. The efficiency of storing coal submerged in water has been found by several authorities to amount to an average saving of about six per cent in addition to which advantage there is absolutely no possibility of spontaneous combustion.

The first 1,500-kilowatt maximum capacity Westinghouse-Parsons turbo-generator unit equipped with a C. H. Wheeler surface condenser with steam operated auxiliaries, has been in service several months and has been found to operate very satisfactorily when exhausting against a back pressure of from four to eight pounds, and it is capable of developing more than its normal rating of 1,000 kilowatts under these conditions. A 2,500-kilowatt normally rated Westinghouse-Parsons turbo-generator unit, capable of developing a maximum of 3,750 kilowatts, is now being installed in connection with a Westinghouse-LeBlanc condenser.

In addition to the main generating units there is also in operation one motor-generator set, consisting of a 225-horsepower, 4,000-volt induction motor and a 125-kilowatt, 600-volt, direct-connected generator for supplying a group of 500-volt elevator motors which are located in the vicinity. There is also a forty-five-kilowatt motor-generator set, consisting of a 440-volt induction motor driving two 22.5-kilowatt, 125-volt generators connected to a three-wire system, supplying a circuit of small direct current fans and motors.

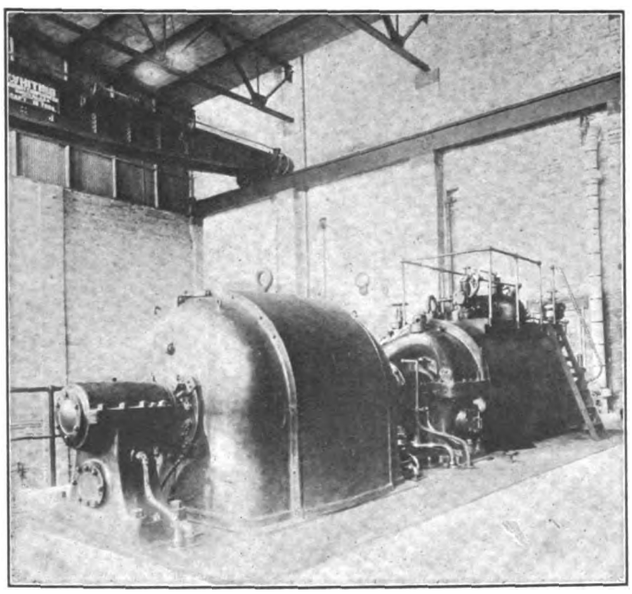


SWITCHBOARD AND MOTOR-GENERATOR IN AUXILIARY STEAM PLANT.

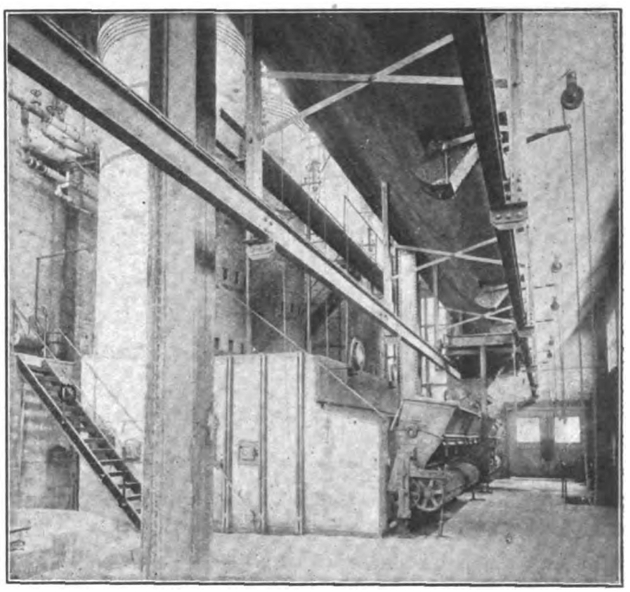
The switchboard consists of six standard marble panels containing all necessary instruments, meters, Tirrill voltage regulators and switches, also circuit-breakers for the direct current circuits, and one panel containing remote-control switches and signal lamps. All 4,000-volt alternating current switches are of the solenoid operated oil type and are mounted on a steel framework located in the basement below the main switchboard together with all series and potential transformers and field rheostats. The small wiring of the switchboard is practically all run in conduit, and all generator and switchboard cables are lead-covered and taped with fireproof tape. All outgoing circuits, both alternating and direct current, are run underground from this plant to the fire limits of the business district.

The engine and generator room is served with a fifteen-ton hand power traveling crane. The entire plant is provided with ample and permanent iron stairs and runways providing easy access to all parts of the equipment. The coal bunkers are of the suspended design constructed of reinforced concrete. The openings over the bunkers are closed or opened with an operating device from the boiler-room floor.

The construction of both the hydro-electric and steam auxiliary plants of this company was done on force account under the supervision of and from plans and specifications designed by W. H. Zimmerman, consulting engineer, First National Bank Building, Chicago, who was also general manager of the property until its completion.



Turbine Room.



Boiler Room.

VIEWS IN THE AUXILIARY STEAM PLANT AT LANSING, MICH.

Municipal Plant Loses Money.

The municipal electric-lighting plant at Grove City, Pa., shows a deficit of $1,433.11 for the first year of its existence from October, 1908, and this notwithstanding the payment of $3,600 by the borough itself for sixty electric lights. The initial cost of the plant was $25,000 which was borrowed at five per cent. The expenses for the year totaled $5,990.10, the receipts $4,556.99.

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CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

A 2,750-VOLT DIRECT-CURRENT SYSTEM.[1]

BY A. H. BARRINGER.

The transmission of energy becomes a remarkably simple matter when direct current is employed, and given that the generators, rotary transformers, and apparatus could be brought to a sufficiently high voltage without the cost becoming prohibitive, and that they could be guaranteed as reasonably reliable and durable, then undoubtedly direct current would be an ideal agent. But the difficulties have proved so many, and the risks of installing such plants so formidable that, except for a few isolated instances, direct-current systems of any size operating at over 1,000 volts are practically unknown. Moreover, the results obtained from the few in operation can scarcely be called inviting enough to encourage such enterprise in this field.

Before going into details of the particular system under review, it may be as well to give a brief description of the district which it is operating.

Twickenham is one of the southwestern suburbs of London. It is chiefly residential, as are the other towns along that part of the Thames, and, except for a few sawmills and the like, and the National Physical Laboratory, there are no power users. This lack of day load is probably what influenced the designers to run direct current in the first instance. Twickenham is so scattered that there has been constant trouble in keeping the low-tension network balanced and up to standard pressure. The area supplied at present is about twenty-five square miles, but the company has powers which will eventually treble that total.

The low-tension mains, comprising about sixty miles of complete three-wire, are all linked up into one network, fed at suitable points by rotary transformers, and, of course, largely from the central. The generating station is situated in about the center of Twickenham, about two miles from one end of the district now operated, and between six and seven miles from the other. The transmission is by direct current at 2,750 volts, with future intentions of making it three-wire at 5,500 volts.

Generating Station Equipment.—The present high-tension equipment consists of two 200-kilowatt, 2,750 volt generators and one 100-kilowatt, 2,500; 500-volt, rotary transformer, with booster attached for raising the low-tension side for transforming up, so that whilst during the day one high-tension set is run, supplying the two principal substations and the home rotary transformer, during heavy loads the home rotary transformer is taking current from the low-tension board and transforming up. This has saved installing another generating set.

Generators.—The generators are four-pole, direct-current, running at 475 revolutions per minute. They are shunt wound, with shunt separately excited at

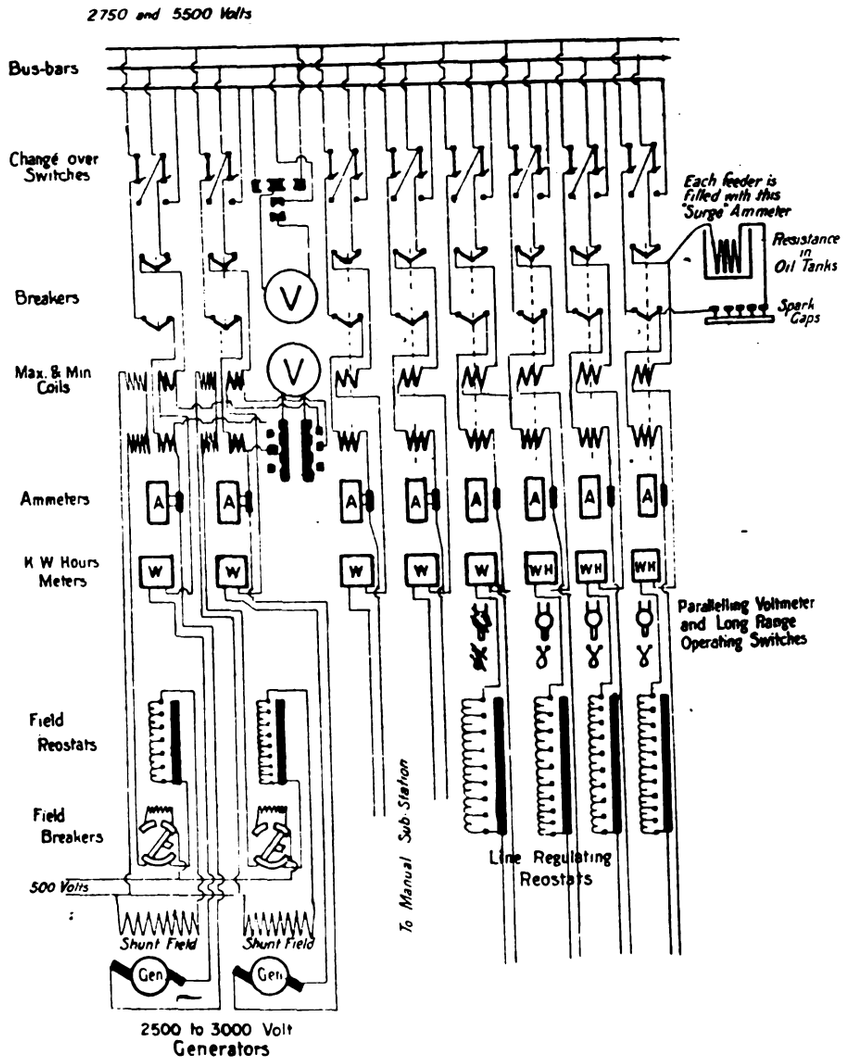

FIG. 1. SWITCHBOARD AND GENERATOR ARRANGEMENT.

1 A paper read before the Electrical Section of the Canadian Society of Civil Engineers, December 9, 1909.

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50 volts. These machines have now been running for about five years, and it is a curious fact that, although they have continually been in trouble from flashing over and other causes, the armatures have never had even a new former. For two years each machine was running without a break for eighteen hours on each alternate day.

Switchboard.—The switchboard (Fig. 1) consists of nine panels. They are of iron throughout, with mica washers and bushings. There are two generator panels, six feeder panels, and a voltmeter panel. The circuit breakers are double-pole air-break, and are ranged along the top, with a slate division between each set. Immediately behind are the change-over switches, and above these the bus-bars. The generator switches are fitted with maximum and minimum cut-outs, the minimum coil being fed from the 500-volt shunt circuits. The feeder cut-outs are simple overload. At the bottom of the generator panels are the field rheostats and field breakers. Five of the feeder panels are fitted with line-regulating resistances, long-tension operating switch, and paralleling voltmeters for running the automatic substations. The method and connections are shown in Fig. 2, and will be referred to later. Each feeder is fitted with a surge arrester, consisting of a series of spark gaps in series with an oil tank resistance. These arresters were installed after one of the lines had been twice broken down on charging. Lastly, the voltmeter panel, which, as will be seen from the figure, has two electrostatic meters, and a plugging arrangement for paralleling and for plugging on to the three bars.

Transformers. — The rotary transformers (Fig. 2) are two-pole machines of overtype design, with double-wound armatures running in a single field, and have copper brushes. They run 500 revolutions per minute, and have a fixed ratio of 5 to 1. The regulating is done by the resistance in the high-tension circuit. They are started up as series motors, and for this purpose are fitted with a small series field, which works in conjunction with a short-circuiting switch. The actuating solenoids of this switch are connected in series with the shunt-field circuit, which in its turn is connected straight across the low-tension end of the transformer. These switches are so adjusted that, when the low-tension pressure equals about 450 volts, the series field is cut out. The transformer bearings have small oil pumps working off a cam on the shaft ends, as well as the usual oil rings. These oil pumps have proved somewhat of an expensive luxury, as will be shown later. The figure is of the home transformer, and shows the method of attaching booster necessary to make up-transforming possible.

Substations. — There are at present four substations, and these form what is perhaps the most interesting part of the system. One of them, the Teddington, is a manual, equipped with two 100-kilowatt transformers, high-tension and low-tension switchboards, and a 1,000 ampere-hour battery. This is arranged after the same pattern as the generating station, but it is the automatic stations which will most likely prove the more interesting. Each of these is equipped with a transformer of 50 or 100 kilowatts, a set of balancers worked by a time switch, and a distance-operated, single-pole, low-tension circuit-breaker. The only high-tension apparatus is the short-circuiter and a pair of switch fuses for isolating purposes. The Molesey station differs in that it has a 600 ampere-hour battery and a small low-tension switchboard, but it is so arranged that it is worked automatically with the battery floating. A man cycles out every morning to put the battery on charge, and again in the afternoon to take it off.

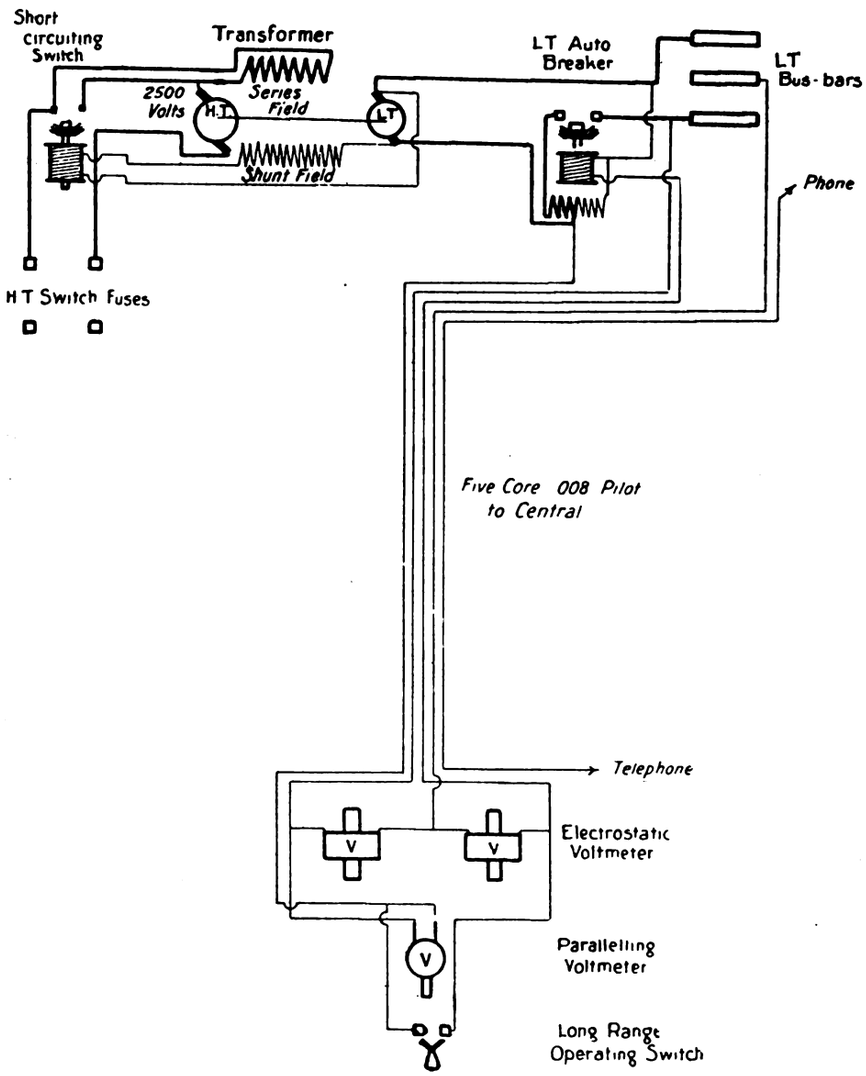

FIG. 2. SUBSTATION ARRANGEMENT WITH OPERATION FROM CENTRAL.

The other stations are visited only about two or three times a week.

The regulation of these stations is done from the central by means of the line resistance, and for starting up, etc., a five-core .008 armored pilot cable is run back from each (Fig. 3, substation arrangement). Coming to the method of connection, it will be seen from Fig. 2 that the actuating solenoid of the low-tension auto is connected from the opposite pole of the transformer and

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through the "firing switch" at the central. From the firing switch another line is run back to the transformer side of the auto. Being on this side is important, as, were it on the other side, the switch could be operated whether the machine was running or not. As it is, when the machine is shut down there is no potential across the firing switch. This same line also serves for the paralleling voltmeter, whilst for the other side of this meter another line is taken from the busbar side of the auto. Across these lines the electrostatic pilot voltmeters are connected, the fourth line in the cable serving for their neutral and the fifth for the telephone.

Some Operating Troubles. — Taking the substations first, the most frequent cause of trouble has been the high-tension brushes. These, as has been explained before, are copper, and when the commutator gets rough they have to be literally soaked with oil to prevent them wearing down between visits. Sometimes, too, they slip. Except for burning up the brush holders, this never does any actual damage, and it is amusing to note that invariably the first intimation of such a state of affairs is received from a policeman, hastily despatched by the alarmed residents in the neighborhood. So far as actual damage is concerned, the oil pumps and the low-tension autos have been the worst offenders. The weakness in the oil pumps is a sight glass fitted on the pipe leading into the bearing cap. These glasses occasionally crack, the oil is pumped out onto the floor, and central is probably notified by the breakers coming out through the shaft seizing.

Coming to the switches, it is necessary first to give a description of their action. The solenoid plunger operates the switch through a ratchet and pawl arrangement. When thrown in, the switch is held by contact friction, the exciting current is broken, and the plunger falls back to its original position. Next time the solenoid is excited the switch is pulled out, and so on alternately. The trouble is the pawl springs. These are only light spirals, and often break. When this happens the switch is only partly throw in—to be exact, just into the carbon ends. Naturally, in a short time the switch resembles an arc light, and, unless the operator notices the jumpy or falling load, he is not aware of anything untoward until the policeman arrives or the switch burns out.

Then there are the short-circuiting switches. These are designed to fall out by gravity when the machine is shut down, but occasionally they will stick up, and then the machine cannot be started until someone is sent down to pull it out. Another peculiarity of these switches is sometimes in evidence on starting up. If the pressure is higher than usual, or the starting resistance is cut out too quickly, the inductive effect set up by the series field is so considerable that a surge is started in the shunt, and the short-circuiting switch is thrown violently in and out for twenty, or perhaps thirty, times before the machine begins to revolve.

There are six transformers installed, and whilst being subjected to all manner of strain through short-circuits, etc., they have never been known to flash over. This may be due to the copper brushes. The chief trouble found with them is in the armatures and series coils. The latter, unless kept scrupulously clean from copper dust, are liable to break down to earth. So far the system is not grounded on one side, and on one occasion the series field of an outlying transformer broke down to earth when the other side of the system was grounded in one of the generator ammeters. The writer's head was about three feet from the ammeter when it went, and the resultant display has founded a lasting impression.

There is one transformer in particular which seems to have an unfortunate penchant for discharging across the field air-gap. The armature has been twice burnt out, probably through this, and the last time it was rewound it discharged so badly that it could not be run. There was a continuous stream of sparks right along the armature tunnel. It was found that the only measure to stop it was a coat of insulating paint on the pole-pieces. A standing menace which has been active on one occasion is the danger of losing the shunt-field. This has been provided for in so much that it is made foolproof by dispensing with lifting attachment on the low-tension brushes. What is likely to happen if the field is faulty was seen on the home transformer on the first starting up of the plant. Somehow a faulty connection in the shunt-field circuit was overlooked, and when the current was switched on the machine built up in speed until the binders burst. An idea of the speed attained may be gathered from the fact that when the current was switched off the armature took well over five minutes to come to rest. Pieces of the debris were found on top of the crane.

A serious drawback to these transformers presents itself in time of mains trouble. The low-tension network pressure is 480 volts, and, in time of a bad short-circuit, this may fall as low as three, or even two hundred, volts. The transformers will not come down as low as this, and to switch them in at, say, 400 volts is simply to throw the breakers out. The only way is to catch them speeding up, but then the series field is not cut out. Once, in very desperate straits through a dead short on an 0.5 feeder, a transformer was switched in in this manner as a last recourse, in the hope that the short-circuiting switch would act on load. But the hope was misplaced. In five minutes the machine was on fire, and the fire brigade was down squirting chemical extinguishers over it.

Coming now to the generators, as has been previously stated, the chief trouble is in commutation. This remark must not be misunderstood, for, when every thing else is right, the commutation leaves nothing to be desired. But it is when there is outside trouble that the generators behave badly. A transformer burning out, or a short-circuit on the mains, and sometimes even a big jump in the load, will cause them to flash over. Beyond burning off a belt or pitting the commutator no harm is done to the machines. But it is awkward in other ways, for if two machines were running in parallel, and one went, undoubtedly the other would go too. As was remarked earlier, it is the intention in the future to run it as a three-wire system, with two machines in series, and if ever that is tried the results will be very interesting.

The switchboard has not so far given any trouble, except for voltmeter panel blowing out. At first there was a little difficulty in breaking the shunt-field current. The switches are single-pole, and threw a high resistance across the shunt when breaking. They are enclosed in an iron frame, and the arc on breaking would sometimes ground the low-tension system. Finally, after an operator's arm had been burnt, they were inclosed in asbestos boxes.

Summing up, the most inefficient part of the system is in the method of regulation. When, as is nearly always the case, one station is taking a comparatively heavy load, then the high-tension pressure must be run 100 or 200 volts higher than would suffice for the other

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stations. Consequently, this energy has to be absorbed in the regulating rheostats, and entails a very serious loss. Apart from this, the transformer efficiencies are very high.

Finally, a word on the mains. These are, of course, in all cases underground, and, except for the troubles referred to, due to the surging, there was only one fault developed on the high-tension system in five years. The cables are 0.5 two-conductor concentric, paper-insulated, with lead sheath and outer steel wire armoring. The method of laying is to draw them into earthenware conduits. They cannot be spoken too highly of.

Perhaps, though it is foreign to the paper, a few concluding remarks on the low-tension system of mains will be allowed. The experience with these has been so remarkable that it is felt to be justified, and, as underground mains seem destined to come on the tapis here sooner or later, it may prove of interest.

The low-tension mains are of what is known as the solid system. The cables are coated with vulcanized bitumen, the only other protection being a covering of thick braid. They are laid in wooden troughs, supported on wooden bridges, the troughs then filled solid with bitumen, and a layer of tiles put on top.

These mains have been an endless source of trouble. The troughing rots, the bitumen cracks, and the water gets through to the cables. Sometimes a "short" will burn away as much as fifty feet of cable. But the most remarkable thing is that the mains have been opened and not a vestige of copper found for as much as eighteen feet, yet at the same time a motor had been working beyond the break.

There have been as many as three breakdowns in a day, and for a year the average mains faults have not been less than four a week.

Electropneumatic Dispatch Tubes.

The Italian Government is having installed in each of the cities Rome, Naples and Milan, a system of pneumatic dispatch tubes to connect the railroad station, stock exchange, and general postoffice. Each of the installations is to be operated by electric motors and air compressors, a duplicate power plant being provided in every case to act as a standby. The leading Italian cities have always been very progressive in establishing systems of quick interchange of mail parcels.

Heat Losses in a Power Station.

In a paper by F. H. Carson, entitled "An Investigation of Heat Losses in a Power Station," published as an excerpt from the proceedings of the Institute of Civil Engineers for the past session, particulars were given of the heat losses in a works comprising two stations, each of 2,300 kilowatts capacity, and run in conjunction with each other. One station, says *Engineering News*, has nine high-speed, reciprocating, direct-current units of 120 to 550 kilowatts capacity, three similar alternating-current units of sixty to 200 kilowatts capacity, six Lancashire boilers with sprinkling stokers and two economizers. The second station has three 775-kilowatt, high-speed, reciprocating-engine units, six Lancashire boilers with sprinkling stokers, etc. The tests reported were made during 168 hours in November, 1907, and the heat balance is summarized as follows:

	British Thermal Units.	Percentage.
Heat energy in the coal (as used)	$6,287 \times 10^6$	100
Converted into useful work	339×10^6	5.39
Rejected to chimney	842×10^6	13.36
Radiation and leakage from steam pipes	135×10^6	2.15
Rejected in hot ashes (combustibles)	256×10^6	4.07
Losses (net) by auxiliary processes	189×10^6	3.10
Rejected (net) in condensing water	$3,187 \times 10^6$	50.62
Rejected by blow-down valves of boilers	8×10^6	0.13
Evaporating and superheating grate jets	87×10^6	1.38
Losses unaccounted for (radiation of boilers, brickwork, including errors of observation) being balance	$1,244 \times 10^6$	19.80
Total	$6,287 \times 10^6$	100.00

A 500,000 Volt Transmission Line.

With the purpose of studying enormously high voltages, says the *Scientific American*, a short experimental transmission line has been built in Sweden which is adapted to operate at 500,000 volts. A special form of transformer is used to furnish this high electromotive force. Circulating oil is used for insulation between the high-tension and low-tension windings. The line is supported on insulators of the suspended type; hung at a distance of eleven feet apart. Tests of the surface discharge showed that a wire of ten square millimeters (0.0155 square inch) cross section would discharge at 35,000 volts; of twenty square millimeters at 50,000 volts; of 100 square millimeters at 200,000 volts, and of 250 square millimeters at 390,000 volts. As the tension was raised to 480,000 volts, the noise grew very loud and sparks leaped from the isulators. At night the glow of the discharge could be seen 2.5 miles away.

Mechanical Stokers Utilize Cheap Fuels.

In his recent presidential address to the Leeds Local Section of the (British) Institution of Electrical Engineers, W. M. Rogerson had the following to say on the subject of mechanical stoking:

"As far as the boiler house is concerned, probably the most notable fact is the lower and cheaper qualities of bituminous coal that are now being burnt, and this is attributable to the great success of mechanical stokers. With hand firing it is not practical to have a longer length of grate than seven feet, but with mechanical arrangements grates can be made as long as ten feet and even fourteen feet, so that with low grade and dirty fuel the exaporation possible with a high grade fuel can still be maintained."

Record-Breaking Copper Production.

According to the November report of the Copper Producers' Association, some records for copper output are again broken. Production in November was at the rate of 4,053,945 pounds daily, as compared with 4,021,216 pounds per day during October, making a total monthly production of only about one per cent lower for November than for the longer month of October.

The exports for the month of November were 55,266,595 pounds, which were from 15,000,000 to 20,000,000 pounds in excess of European consumptive requirements, possibly more, as some copper went into warehouses on the Continent. During the current month the exports are likely to be even larger.

Calcium Carbide Factory in Mexico.

Calcium carbide for lighting purposes will form the chief product of the chemical and steel works soon to be installed in Mexico City, Mex. The plant will have an initial cost of $1,000,000 gold, an ouput of 3,000 tons of carbide yearly and consume more than 500 horsepower of electric energy from the Necaxa power plant.

The Effect of Bark on Timber Preservatives.

As a result of some recent investigations by the United States Government it has been shown that before creosoting timber it is necessary thoroughly to peel off the thin inner bark of the wood if the preservative is to be absorbed by the timber to produce its maximum effect.

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ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

AN EXEMPLARY BOULEVARD ILLUMINATION.

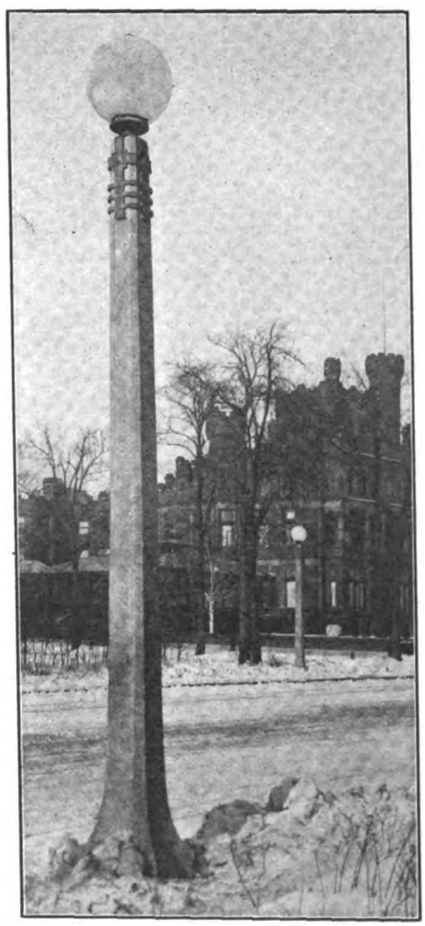
LIGHTING OF LINCOLN PARK BOULEVARD, CHICAGO.

There is no branch of public outdoor lighting for which the requirements are as exacting as the illumination of parks and boulevards. Owing to the absence of other fixed light sources, all the lamps that are installed become extremely conspicuous both by day and night. This means that the lighting installation must satisfy the art critic as well as the illuminating engineer, for whatever movement for a "city beautiful" there may be in the community it surely is expected to find its expression in the park system.

In the city of Chicago the park system is divided into three sections corresponding to the divisions of the city. The large parks are connected by a belt of boulevards, of which Lincoln Park Boulevard is an important part of the not yet quite completed link between the north and south sides. On this boulevard the traffic, which consists chiefly of automobiles, is quite dense and is bound to increase to many times its present magnitude when the boulevard is carried over the Chicago River to join Michigan Boulevard in the down-town district.

Lincoln Park Boulevard now extends from Ohio Street, on the south, to North Avenue, at its northern end, where it enters Lincoln Park, Chicago's most popular public park and the only large park on the North Side. The length of this boulevard is one and one-half miles. The northern part of it was formerly known as the Lake Shore Drive since it follows the shore of Lake Michigan for about three-quarters of a mile. Along this portion of the boulevard are many of the finest residences and apartments in the city. At Chicago Avenue the boulevard passes between the old Chicago waterworks and the water tower, both well-known landmarks of the city. South of this the boulevard continues for a half-mile along what was formerly known as Pine Street; this portion is somewhat narrower, but is lined on both sides with fine old homesteads.

The Lincoln Park Commissioners, to whom is entrusted the control of the North Side park and boulevard system,



NEAR VIEW OF LAMP AND CONCRETE COLUMN, LINCOLN PARK BOULEVARD, CHICAGO.

have recently changed the lighting of practically all this system from the old direct-current open arc lamps to sixty-cycle enclosed series arcs. This change was made coincident with the change of the old lighting plant in Lincoln Park to a substation, equipped with the latest apparatus and receiving 12,000-volt, three-phase current from the Sanitary District of Chicago. It was felt by the Commissioners that, in view of the importance of Lincoln Park Boulevard in the belt-boulevard system, the change in its lighting should be much more thorough than a mere substitution of lamps. Therefore, after a careful study of all aspects of the problem to determine which system of lighting would give the most uniform and brilliant illumination accompanied by freedom from glare and that would meet all the artistic requirements of the situation, it was decided to adopt the Daniels Boulevard Lighting System for the illumination of this great highway.

This system was devised by W. E. Daniels, formerly superintendent of the electrical department of the South Park System of Chicago. Its main feature consists in the use of a compact arc lamp entirely enclosed by a highly translucent and diffusing glass globe mounted on top of an ornamental standard. For this particular installation it was decided to make use of reinforced concrete columns for the lamp standards. This decision was reached because it was believed that this type of standard would present a less conventional and yet more dignified appearance and result in lower maintenance charges.

The concrete columns were designed by H. M. West, superintendent of the Lincoln Park System, and they were manufactured by Lincoln Park employees directly under his supervision. A good general view showing the details of their design is shown in one of the accompanying illustrations. The column is of the obelisk type and is fourteen feet high from the ground level to the base of the globe. To the center of the arc the height is fourteen feet and eight inches. A sub-base four feet deep and fourteen inches square is made integral with the column. The columns are made in a horizontal mold in the following manner:

At the base of the mold a crushed granite grout is first laid and plastered

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part way up the sides. Inside this outer layer is placed ordinary Portland cement and crushed limestone concrete in which are placed a number of steel reinforcing rods. A two-inch iron pipe fifteen and one-half feet long is imbedded in the center. When the mold is practically full, a layer of the granite grout is placed on top and the upper side is then clamped on under pressure, thus squeezing out some of the material and completely filling all the edges of the mold. After setting about thirty-six hours, the top and sides of the mold are removed and the surfaces that are exposed are smoothed off. After about two more days' setting the column is rolled off the bottom of the mold and allowed to rest several more days. The surface of the column is finally washed with muriatic acid to remove the cement, thus leaving a finished surface of granitic pebbles. This surface, it is believed, will not only stand the weather very satisfactorily, but will improve in appearance with age, giving the columns the effect of being made entirely of granite.

The columns were hauled by derrick wagons from the place in the park where they were molded to their various locations along the boulevard. In setting the columns, after the hole is dug out and the concrete foundation laid to exact level as indicated by the surveyors, the column is mounted upon this foundation by means of a derrick. Concrete is then filled in around the sub-base until the entire base extends about three inches beyond the lower edge of the column at the ground level. The weight of each of these columns as molded is 2,000 pounds. They have been found to withstand very rough handling. In one instance an automobile run into one of them partly upsetting it with its foundation, before the latter had become completely set, without cracking the column at any point.

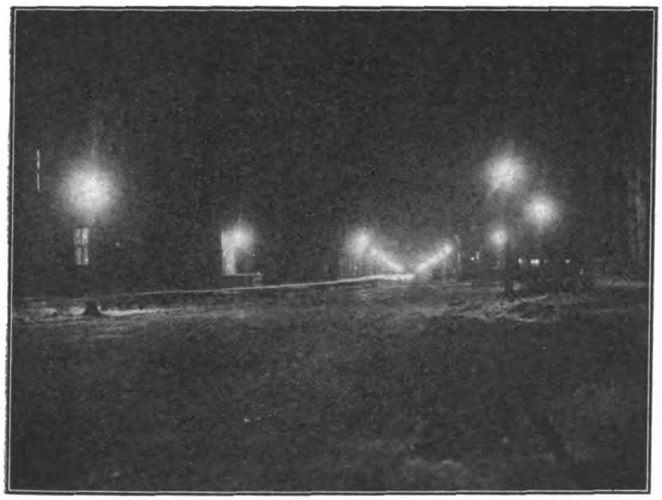
At the top of each column is placed a bronze grille cap which has a verde antique finish. This fits over the pipe which forms the core for the wires. Into the top of this pipe is screwed a bronze holder for the lamp. This has a similar finish and firmly locks the cap in place. The cost of the concrete columns as molded, not including the cost of erection, was $14.00 apiece. The bronze grille and holder at the top of each column cost $14.50.

The lamps used in this installation are seven-and-one-half-ampere series alternating-current inclosed arc lamps, manufactured by the Jandus Electric Company, of Cleveland, Ohio. They are supplied with constant sixty-cycle current and receive about seventy-two volts across the arc and eighty volts across the lamp terminals. The inner globe is seven and one-half inches long and fits about the arc so as to make the arc chamber practically air-tight, thus giving a long life to the carbons between trims. Surmounting the column is a twenty-inch glass globe which fits over the entire mechanism of the lamp, except for a small chimney of two inches diameter at the top which provides ventilation for the coils. This chimney, however, is very inconspicuous so that the lamp appears to be entirely inclosed by an unbroken globe.

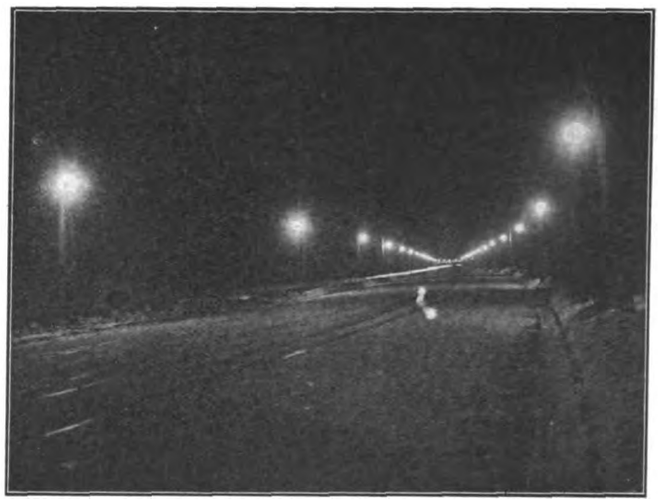
Both the inner and outer globes are made of Alba glass, manufactured by the Macbeth-Evans Glass Company, of Pittsburg, Pa. This glass is very strong and diffuses the light excellently without cutting it down appreciably. The lamps are suspended in a trunion mounting so that they can be swung out at the lower end. In trimming the lamps, which is done by means of a tower wagon, the outer globe is removed, the lower portion of the lamp swung sideways, the inner globe then removed and the carbons replaced.

In the present installation there have been placed on Lincoln Park Boulevard 140 lamps of this type. They are placed directly opposite each other, an equal number on each side of the roadway. The average spacing is 100 feet between lamps. The roadway north of Chicago Avenue is forty-five feet wide, and that south of this point is only thirty feet. The general effect of the illumination is shown very well by the two accompanying night views. The streaks near the ground in these pictures were caused by headlights of automobiles. A marked feature of this lighting which has been noted both by pedestrians and automobilists is the uniformity of the light distribution and the absence of glare. There is no doubt that from all points of view it is one of the best lighting installations for a boulevard that has ever been installed.

The Lincoln Park Commissioners have also made use of the same type of column and lamp for the lighting of the beach drive along the eastern border of Lincoln Park. In this case the lamps are placed in one row on one side of the driveway. There are thirty-



Looking South from Chicago Avenue.



Looking South from North Avenue.

NIGHT VIEWS ALONG LINCOLN PARK BOULEVARD, CHICAGO.

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one lamps in this installation. There are also four lamps of this general type on the boat-landing of the south refectory, but the lamps in this instance are multiple lamps. It is the intention of the Commissioners eventually to replace all of the lamp standards in Lincoln Park by concrete columns of the type described. There have been erected in Stanton Park, one of the smaller parks of the system, thirty concrete columns surmounted by five sixty-watt tungsten lamps in a twenty-inch Alba glass outer globe.

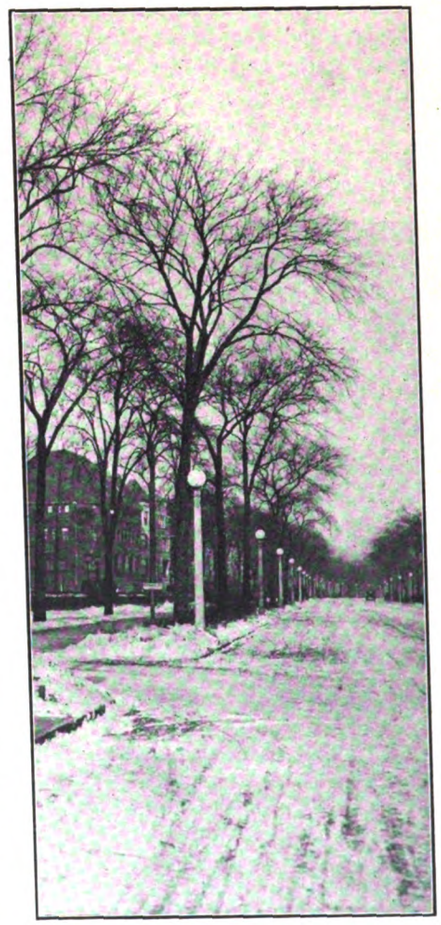
Most of the data on which this article is based were kindly furnished by E. C. Rutz, superintendent of the electrical department of the Lincoln Park system, and by C. W. Beach, of the Chicago office of the Jandus Electric Company.

Electricity versus Gas for Train Lighting.

In the issue of December 3 the *Electrical Review,* of London, England, takes the above topic as the subject for an excellent editorial article, from which the following is taken:

Of all the uses to which electricity is particularly well adapted, there are few that are more conveniently and appropriately served by that agent than the lighting of railway trains. As was pointed out some years ago, in connection with one of those periodical disasters which cannot be averted even by the utmost exercise of engineering skill and foresight, one of the most valuable attributes of electric lighting for trains is its complete immunity from fire risk. In the instance to which reference is made, the horrors of the collision were intensified manifold by a conflagration resulting from the use of gas for lighting the train, which rendered the rescue of some of the victims impossible. It is bad enough to be battered and maimed, without the added torture of roasting to death before the eyes of one's helpless relatives and friends.

There is another factor, however, which acts much more quickly, and much more effectively, than such considerations as the interests of passengers, the influence of the Board of Trade, or the pressure of public opinion: and that is, the interests of the railway companies themselves. One way of bringing this home to them was recently exemplified in striking fashion on a French railway, where gas was employed as the illuminant. As the result of a derailment, a number of mail cars were set on fire by escaping gas; twelve postal employes were seriously burnt, the mails were completely destroyed, and the cars reduced to ashes. The value of the registered letters and postoffice orders destroyed amounted to more than $120,000, apart from the cost of the cars. On another occasion, two new cars caught fire through an escape of gas whilst leaving the depot and were destroyed; each of them cost $14,000. Thus in a short period the railway company lost $148,000, a loss wholly and solely due



ANOTHER VIEW ALONG LINCOLN PARK BOULEVARD, CHICAGO.

to its choice of gas instead of electricity for lighting. The company is liable to suffer similar losses at any time, and it is difficult to realize how any railway manager in his senses can accept this risk for the sake of a slight supposed advantage in running cost, which may or may not be justified by the facts.

Leaving on one side the unquestionable advantages of electricity on the score of safety from fire risk, is it the fact that it is inferior to gas in point of cost? We have made it our business to inquire into this question, and have obtained authoritative data as to the actual cost of lighting with compressed coal-gas and inverted mantles, as used upon a certain French railway. Taking the cost of gas at $1.08 per 1,000 cubic feet, and assuming that the mantle maintains its full candlepower throughout its life, the cost per candlepower-hour is about 0.02 cent. In English towns the cost of gas will be in the neighborhood of one-half of the price just given above, and this correction would reduce the total cost per candle-hour by one-third; but against this can be set at least an equal falling-off in the average candlepower of the mantle, which leaves the cost per candle-hour, under British conditions, at 0.02 cent. The weight of the storage tanks and pipes amounts to considerably over a ton for an installation of twelve lamps of twenty-five candlepower each, and they add some four square feet to the transverse section of the coach offering resistance to the air.

On the other hand, using metallic-filament lamps, which have a life of about ten times that of the gas mantles, and maintain their candlepower practically unaltered throughout their lives, and allowing outside figures for the depreciation of plant, interest on capital, maintenance, and cost of additional fuel used on the locomotive, the total cost per candlepower of an electric lighting system on modern lines does not exceed 0.022 cent. Charging stations are done away with; any coach can go anywhere, at any time, and no loss of time is incurred in charging. The weight of the equipment for the same duty is less, and the air-resistance is reduced. The lamps, instead of having a minimum candlepower of twenty-five candlepower, can be of ten candlepower, or less, and can be distributed or arranged so as to give the best results, or put in series to give a dim light when passengers wish to sleep. By adopting recent improvements, the cost of the system can be materially reduced below the figure quoted—which, in fact, is in excess of actual results obtained on British trains.

Therefore, not only for its safety, but also for its economy and convenience, the electric system is far in advance of even the most up-to-date system of gas lighting, and any railway company that adopts the latter is committing a grave error, which will be remedied only at great cost to the shareholders. In America the tendency today is to abandon gas in favor of electricity.

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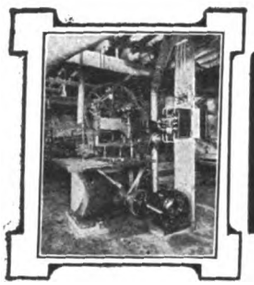


Industrial Power

THE RESICZA IRON AND STEEL WORKS.

AN INTERESTING DESCRIPTION OF AN ELECTRICALLY DRIVEN HUNGARIAN FACTORY.

In the mountains of Southeastern Hungary, in the V indicated by the Servian and Roumanian frontier lines, is Resicza. It is a small place, so far as cities go, but it represents in its population one of the most interesting iron and steel works in Europe. What Krupp is to Germany and Le Creusôt to France, so Resicza is to Hungary. A grade of steel is being turned out in these Hungarian works the equal, it is claimed, of the best in the world. The force actually employed at Resicza numbers about 6,000 men. The total force employed in all the shops and works of the company, having in mind only Hungarian territory, is 18,000. The name of the concern controlling the Resicza works is The Privileged Austro-Hungarian State Railway Company.

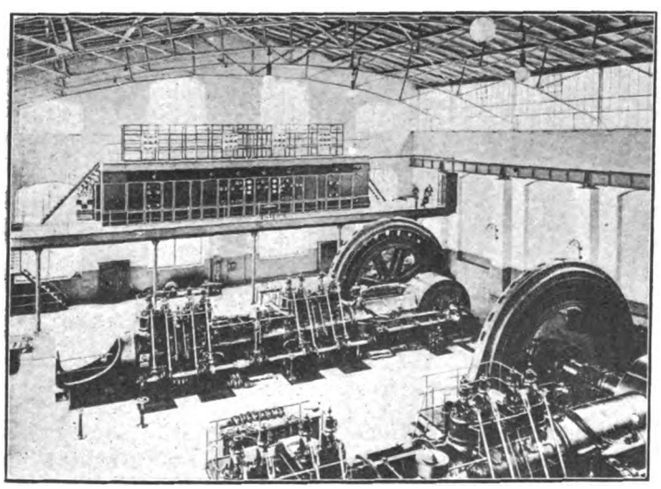
Resicza is essentially a steel-making plant, although the manufacturing end of the business is an important one. At the present time the annual production of steel is about 100,000 tons, the largest part of which is produced by the Martin-Siemens open-hearth process. The Bessemer plant produces 20,000 to 25,000 tons of Bessemer steel annually by means of three converters, each of ten tons capacity. Fluid pig iron is cast in these converters direct from the smelting works, and the steel produced is largely used for rails.

The annual output capacity of raw iron at Resicza is about 65,000 tons, but this production, it is stated, will shortly be increased to 110,000 tons. The iron ore at Resicza is worked up at present in three blast furnaces, one having a capacity of 120 tons per day and two having a capacity of seventy tons each per day. A new blast furnace, now in process of building, is designed for a capacity of 250 to 300 tons per day. This new furnace is the design of Julien Kennedy, of Pittsburg, Pa. Arrangements for the building of this Kennedy furnace were effected, it is said, through Kennedy's European representative located in Brussels. There are five open-hearth furnaces in the steel works.

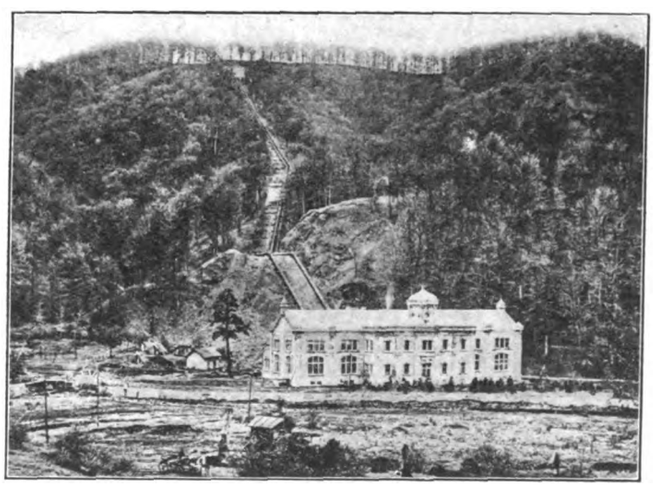
It is the practice at Resicza to fill thirty-five small ingot molds at one pour, the entire thirty-five molds being carried in a frame, the design of Georg Marton. One of the furnaces handles thirty-six molds.

Resicza has been utilizing blast-furnace gas for the past thirty-five years, and today a large proportion of the power availed of is furnished by gas engines. Both blast furnace and gas producer are used. The gas-producer system employed is of the Kerpely design. In all there are fourteen gas producers in service for the steel-making plant. In one central station there are four gas engines, each of 1,650 nominal horsepower, running at ninety-seven revolutions per minute. The engines were built by Léng, of Budapest, after the Erhardt system; the generators, by the Union A. E. G., Vienna. These electrical generators are generating alternating three-phase current of 20.8 periods, 5,500 volts, 1,100 kilowatts. All four engines are running in parallel, and parallel with a second hydroelectric central station of 6,000 kilowatt-amperes capacity. These gas engines are giving little trouble and are very economical.

Resicza employs the Veith system for washing gas, supplemented by an additional washing through the medium of the Theisen system. From the Theisen washers the gas goes direct to the gas engines without recourse to gas reservoir. In case the blast-furnace gas gives out at any time the gas engines can be run on producer gas, but ordinarily the producer gas is utilized only



GAS-DRIVEN GENERATORS AT RESICZA.



HYDROELECTRIC PLANT AT RESICZA.

The above description is an abstract of a report by Special Agent Capt. Godfrey L. Carden (*Consular Report* No. 3649). The photographs from which the illustrations were made, were kindly loaned by the Bureau of Manufactures, Washington, D. C.

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for the furnaces. The producer gas, when used for power-generating purposes, must naturally first be washed.

There are eight Belleville boilers in service and, in addition, there are ten boilers in use similar in type to the Babcock & Wilcox. These latter boilers were made in Resicza With the exception of three Worthington pumps, all the pumps in service have been built at Resicza. The air compressors, furnishing the air for the blast furnaces, are supplied with motors from Siemens & Halske. There are four of these motors attached to as many compressors, of 280 horsepower each. There are also two horizontal compound steam-driven blowing engines of 650 horsepower each. A turbo-compressor, with a capacity of 1,000 cubic metres (35,316 cubic feet) per minute, and directly driven with a 2,000 horsepower electrical motor, will furnish the necessary air to the new blast furnace.

In the Resicza rolling-mill plant the heavy mills, such as blooming mill, the structural-iron mill, and the heavy-plate mill, are driven by two sets of electric motors, each capable of yielding a maximum of 10,000 horsepower. There is also a steam engine of 4,000 horsepower which is held in reserve. The electrical engines permit of reversing from maximum to maximum in eight seconds. The maximum number of revolutions is 150 per minute. These engines are used in connection with the manufacture of rails, plates and blooms. The diameter of the largest roll in the blooming mill is one metre (3.28 feet), and the ratio of gears is one to two. The mills are all reversible from both sides of couplings. The motors yield 2,000 horsepower effective, and give 10,000 horsepower through the help of a flywheel, after the system Ilgner. The circumferential speed of the flywheel is ninety metres (295 feet) per second. The speed of the motor generator, which gives energy for the reserving motors, is 410 revolutions per minute.

In addition to the central power station, operated by gas engines, Resicza is using 4,000 horsepower from a hydro-electric station, distant not more than three miles from the center of the works. The waterfall at this station is 217 metres (712 feet) in length. Three turbines are installed, each yielding 2,500 horsepower, working in connection with Pelton wheels, and equipped with automatic regulators. The generators yield 5,500 volts three-phase current of 20.8 periods per second, running at 312.5 revolutions per minute. The generators were built by the Siemens-Schuckert Works of Nürnberg.

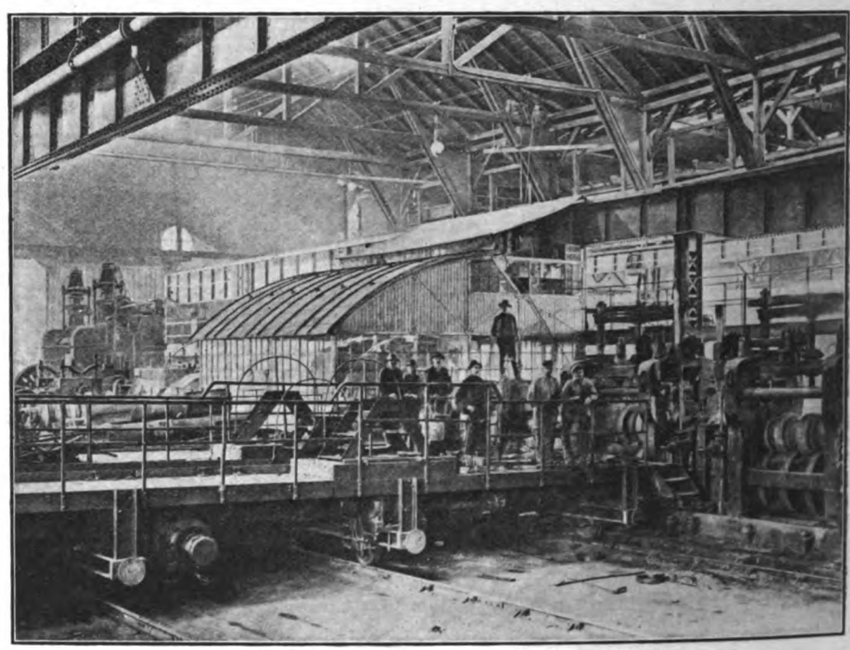
In addition to the foregoing rolling mill, mention should be made of the sheet-plate mill, which is being operated with Ganz motors of 900 horsepower, 500 volts three-phase current. These motors are coupled direct to roller shafts and afford a speed of fifty revolutions per minute.

There is also at Resicza a three-high rail mill, equipped with three sets of rolls, steam-driven. This mill is German built, but is said to be in reality of English design. The reversing mills were also built by Germans; that is to say, the mechanical part of the mill is German in all respects, except the electrical equipment. There is at present at Resicza an old rolling mill which is referred to as the merchant mill, the equipment of which is to be entirely torn out and replaced with new mills, operated by steam and electric drive. There is required for the new equipment 4,000 horsepower. It is said that Resicza is desirous of receiving this millwork from American sources. With this object in view, inquiries were recently made of one American firm.

The tire mill at Resicza produces tires from 500 to 2,500 millimetres interior diameter, and is turning out probably as fine work as can be found anywhere in Europe. In the United States, Bethlehem, Midvale, Chrome and Latrobe may be said to be doing work similar to Resicza, but in Hungary, Resicza is the only source for steel tires. There is no denying that the tire work at Resicza is most skillfully handled. The equipment for the tire shop is practically all English. On entering the tire mill one can hear what appears to be an unmistakable sound of many wonderfully toned bells. The sound comes from workmen knocking off heat scales from numerous locomotive tires, but the ring from the hammers gives unmistakable evidence of the splendid quality of the steel. Resicza supplies practically all tires used in high-speed equipment on the Hungarian railways.

In the car-wheel molding department, German molding machines are used. The loading cranes for loading rails were supplied by Simmering, of Vienna. Two heavy cold saws in the rail department were furnished by Heinrich Ehrhardt, of Düsseldorf. Wagner and Company, of Dortmund, have supplied a heavy punching machine for splice bars, one double punch of 400 tons pressure, and five rail milling machines. Sack, of Rath, has supplied one very heavy double punch of 500 tons pressure. The frame for this punch was made at Resicza. Shultz & L. Gobel, of Vienna, have supplied a punch machine, and it is said that this last mentioned Austrian tool is liked better than the Wagner or Sack punches.

The manufacturing works at Resicza are concerned largely with equipment for railway bridges and iron construction, ship and engine parts, and at the



THE ROLLING-MILL PLANT AT RESICZA.

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present writing there are extensive orders in hand for field-artillery equipment. Resicza has been called upon during the past five years to supply stem and stern frames and other pieces for the Armstrong Works of England, and for Ansaldo, of Genoa, Italy, for use in warship construction. In the machinery department the number of machine tools approximates 350. These machines are almost without exception driven by electric power derived from overhead shafting. This electric drive is by three-phase induction motors of 20.8 cycles, 500 volts.

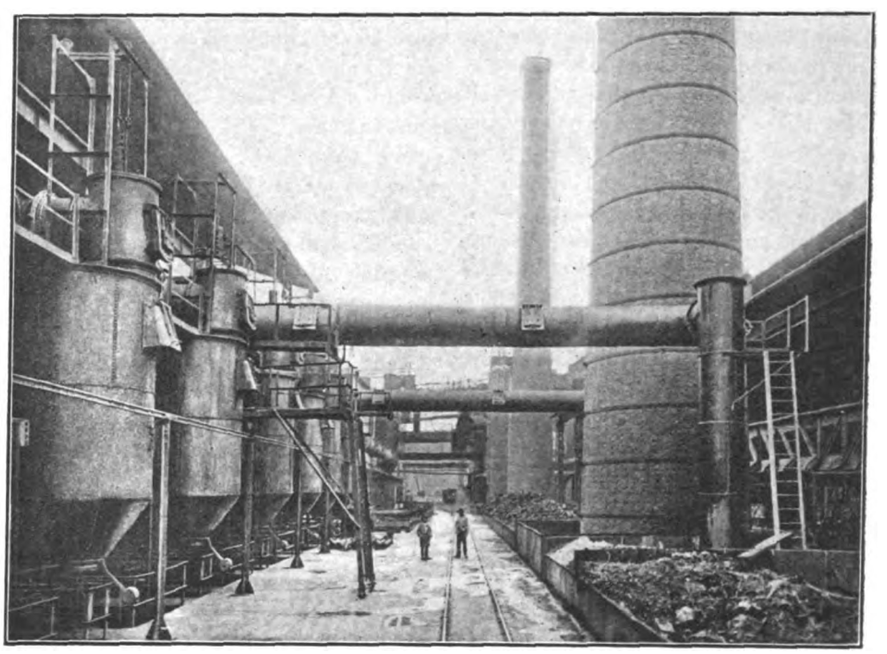
There are some excellent tools of American make in evidence, but the number is very small. There are, however, three Gisholt turret lathes. These machines are working up and finishing off projectiles. It is stated that a Gisholt representative visited Resicza and spent some time in the works giving instructions relative to these machines, and, so far as is known, Gisholt's engineer is the only American machine-tool man whom the Resicza officials can recall having visited that establishment. The Gisholt machines are liked in principle, but it is said that the size of the machines in use is regarded as somewhat light for the heavy duty imposed.

There are four grinders from the Landis Tool Company, of Waynesboro, Pa. These Landis machines are highly appreciated. Two of the vertical drills in use were made by Prentice Brothers Company, Worcester, Mass., and one No. 2 and one No. 3 milling machines from the Cincinnati Milling Machine Company, Cincinnati, Ohio. Pratt & Whitney, of Hartford, Conn., are represented by a thread-milling machine, and Gould & Eberhardt, of Newark, N. J., are in evidence with a gear cutter. These appear to comprise all the American machine tools in service at Resicza.

In the forge department there are plate-cutting shears from Sack, of Rath, Germany. Resicza has made all rolls for its rolling-mill installation. In the forge department there is one hydraulic press of 600 tons power, furnished by Breurer, Schmumacher and Company, of Kalk, near Cologne. The same German firm has supplied the horizontal hydraulic press employed in forming the larger sized projectiles.

At the present time Resicza has in hand an order for projectiles of twenty-one, twenty-four and thirty-two centimetres. These shells are built of open-hearth steel, Martin process. The furnaces in the forge department are blast operated. Resicza is making both cast-drawn and forged-steel projectiles. All projectiles which are hardened are also drawn as a preliminary to the operation.

The main machinery building is employing at present about 1,400 men. The greatest number of machine tools from any one firm in this building is probably from Vulkan. Vulkan has furnished a great variety of machines, but the Vulkan lathe is the one type of tool most in evidence. There are a number of vertical millers of Vulkan manufacture, closely resembling the Becker design. There are some German vertical millers in evidence which also seemed to be built on Becker lines.



THE GAS-PRODUCER PLANT AT RESICZA.

Alfred Herbert (Limited), of Coventry, England, has placed some sensitive drills, and Zimmerman, of Chemnitz, has provided a number of heavy lathes. One heavy tool of the lathe type was noticeable, apparently English in build, but without the name of the maker showing. Whitworth, of Manchester, England, has supplied a heavy lathe, and Ernst Schiess has installed a large-sized planer. Vulkan has supplied some cold-steel saws, as has also De Longdoz and also Deneffe, both of Belgium.

Among other foreign tools in use were slotters from Loewe and Vulkan; heavy vertical millers from Kendall & Gent, Manchester, England; shapers, vertical millers, boring mills, planers and gear cutters from Vulkan; traveling cranes from Ganz; vertical miller from Fairbairn, of Leeds; a heavy vertial miller from De Fries; thread cutters from Zimmerman, milling machine from Buckton, of Leeds, and a radial drill from Whitworth. Both the Deutsch-Niles Werk and the Globe Pneumatic Engineering Company (Limited), the latter of London, have supplied pneumatic tools.

The annual output of iron ore from all the mines of the Privileged Austro-Hungarian State Railway Company is about 200,000 tons.

An Improved Single-Phase Motor.[1]

A remarkable improvement in single-phase motors has been devised by Mr. Deri, and practically developed by Messrs. Brown-Boveri. Mr. Deri's motor may best be explained by reference to the original so-called repulsion motor, invented very early in the history of alternating current engineering by Elihu Thomson. In this motor the rotor is of the same type as the armature of a continuous current motor, but the brushes are short-circuited on each other, and are mechanically so arranged that the brush axis may be set at various angles to the axis of the stator field.

If set at ninety degrees (electrical), no current passes through the rotor, and if set co-axially, the rotor takes a maximum current, being, in fact, the short-circuited secondary of a transformer. In both these extreme positions no torque

1 Abstracted from Dr. Gisbert Kapp's presidential address to the Institution of Electric Engineers, London, England, November 11, 1909.

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is exerted, but in an intermediate position a torque is exerted, and if the rotor is allowed to run, the current is reduced and the power factor increased.

Mr. Deri employs two sets of brushes, one being fixed in the polar axis of the stator, and the other so adjustable as to include different angles with the fixed brushes. In a two-pole motor there are thus four brushes required. The movable brushes are not shorted on each other, but each is shorted on its corresponding fixed brush. If the fixed and movable brush are in line and bearing on the same part of the commutator, no current passes through the armature. If their angular distance is 180 degrees, the armature winding acts as the shorted secondary of a transformer. In neither case is a torque exerted. If, however, the angular distance between fixed and movable brush is intermediate between no degrees and 180 degrees, a torque is exerted, and if the armature is allowed to run the current decreases and the power factor increases.

The effect of shifting the brushes is analogous to changing the impressed voltage on an ordinary continuous-current series motor, and thus by adjusting the brushes the torque and speed may be regulated. This property renders the Deri motor valuable in all cases where delicate speed regulation is essential. It is largely used for working passenger lifts and other hoisting machinery, and also for driving ring-spinning frames, the speed regulation in the latter case being automatic. The result of automatic speed regulation is an increased output from the ring-spinning frames. Another application is for electric-railway working. An important point in these motors is their perfect commutation.

Applications of Electricity to Propulsion of Naval Vessels.[1]

Two distinct methods of electrical propulsion of ships, both adapted to battleships of the design of the *Arkansas* and *Wyoming*, are described. These are designated by the author as follows: (1) "Combination drive," in which generating units with motors, and low-pressure turbines on propeller shafts are used together and separately for different conditions; (2) "electric drive," in which propulsion is effected wholly and solely by electric motors.

Combination Drive.—With the "combination drive" it is proposed to use twin screws and to install upon each propeller shaft a low-pressure turbine and an electric motor. There would also be installed in each engine room a high-speed, steam-turbine, generating set. The capacity of the generators and motors would be such that they would be capable of delivering, at 20.5 knots, two-fifths of the total power required for propulsion. The remaining three-fifths of the power under these conditions would be delivered by the low-pressure turbine which at such a time would receive steam exhausted from the generating unit. This low-pressure turbine would also be fitted with two reversing stages, similar to those which would be adopted with direct turbine drive. The low-pressure turbines would also be so arranged that they could take high-pressure steam from boilers through separate nozzles and with such supply they would act as fairly efficient high-pressure turbines. With such high-pressure steam supply the ship would make a speed of about 19.0 knots with the same steam requider for 20.5 knots with the combination drive. When the ship is running at about 20.5 knots all the steam would pass to the low-pressure turbine. When the ship operates at speeds below fifteen knots the low-pressure turbine would not be used at all, the power being delivered to the propellers entirely by motor and being all generated by the high-speed turbine. At speeds between fifteen and 20.5 knots, a part of the steam would pass to the condenser through the low-pressure turbine and part through the lower stages of the high-speed turbine. The design of the generating unit provides for a valve by which any desired number of third stage nozzles can be closed and by this means the division of steam between the low-pressure stages of the high-speed turbine and the low-pressure turbine can be controlled.

In this combination drive, the electrical apparatus acts simply as a speed-reducing bond between the generating turbines and the propeller shafts. The motors are not used for reversing and are of the squirrel-cage induction type. The voltage is low and the arrangement of generator and motor constitutes the simplest known means of electrical power transmission.

Since in a warship it is desirable to operate efficiently at low speed as well as at high, the motors proposed in this case are so arranged that they can be connected either for twenty-eight or forty-two poles. In the higher-speed ranges the twenty-eight pole connection is used, and in the lower-speed ranges the forty-two pole connection.

In this arrangement, the electrical apparatus with high-speed turbine constitutes an auxiliary, the purpose of which is to improve efficiency under all speed conditions and particularly to adapt the ship to economical operation at cruising speed.

This combination drive is proposed by the author as a sort of a stepping stone between the purely mechanical drives at present in use, and a purely electrical drive,—this with a view to overcoming the doubts and fears of those who might object to too rational a change in existing practice. This design also allows for substitution of high-pressure turbines for the motors to change over to a high-pressure Curtis drive, if desirable.

Electric Drive. — With "electric drive" it is proposed to install two motors on each propeller shaft. One of these is arranged with pole-changing switches for varying the speed. The other is adapted only to the smaller number of poles used with high speeds, and is arranged with a resistance connection so as to be suitable for producing the high torque desirable in quick changes of the ship's directions. The generators are designed to give a very uniform efficiency through wide ranges of load and speed. The maximum voltage generated is about 2,200 volts.

The armature resistances for the motors used in reversal of the propellers, would be connected to the motor through collector rings, and the resistance would be cut out by short-circuiting the collector rings so that no current would pass through the brushes except when the resistance was in use.

A comparison of the weights of the all-turbine, combination, and electric drives, is given by the author as follows: Turbine (Parsons) drive, 484.7 tons (excluding piping, bearings, shafting, valves, and auxiliaries); combination drive, 520 tons; electric, 354 tons.

The weight of boilers proposed for the ships under consideration, is 555 tons, and the author estimates that with electric drive this can be cut down by 108 tons if allowance is made for the saving in steam consumption at 20.5 knots as indicated by his figures. The author further estimates that with electric drive an increase of sixty-nine per cent in the cruising distance may be obtained.

[1] Abstract of a paper by W. L. R. Emmet, presented at the seventeenth general meeting of the Society of Naval Architects and Marine Engineers, held in New York, November 18 and 19, 1909.

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FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

NEW YORK TRACTIONS.

The New York Public Service Commission for the First District has issued the following statistics in connection with passengers carried and revenues derived from operation in traction lines of New York during the month of September, 1909:

	Fare passengers Aug., 1909	Fare passengers Aug., 1908	*Tot. rev. per st. ry. oper. Aug., 1909
Hudson & Manhattan	$3,082,924	$933,509	$159,436
Inter. Rap.-Tran.	44,381,238	38,128,312	2,286,234
Brooklyn Rapid Transit System:			
Brooklyn Union "L"	12,365,251	11,338,903	646,262
Sea Beach	261,777	73,361	13,881
So. Brooklyn	836,076	694,859	46,142
Total "L" service	$13,463,104	12,107,123	$706,285
Brooklyn Hgts.	12,306,543	11,319,570	621,027
Brooklyn G. Co. Sub.	2,150,170	2,163,151	111,827
Coney Island & Groves	124,808	117,391	6,552
Nassau Electric.	7,265,245	6,466,422	373,488
Total B. R. T. system	35,309,872	32,173,657	$1,819,180
‡Third Avenue System:			
Dry Dock and E. Broadway	$926,025	$970,893	$50,588
42d St. M. & St. N.	2,680,588	2,092,402	136,647
Third Ave. & Kingsbr.	4,412,731	3,873,196	260,813
South Boulevard	177,128	138,297	8,856
Union Railway	3,513,393	2,921,926	179,223
Westchstr. Elec.	893,764	658,386	44,816
Total	$12,603,629	$10,655,100	$680,945
Manhattan & Bronx surface roads:			
Metro. St. Ry.	$23,703,796	$22,681,395	$1,203,088
Central Park, N. & E.	1,008,903	920,479	53,500
Second Avenue	1,467,610	$.....	76,274
28th & 29th St.	34,460	$.....	1,749
Total Man.	$26,214,769	$23,601,874	$1,334,611
City Island	17,474	†.....	828
Pelham Park	28,291	†.....	1,170
New York City Interboro	355,367	246,965	16,556
Total Man. & Bronx	$26,610,901	$246,965	$1,353,165
Brooklyn & Queens surface roads:			
Coney Island & Brooklyn	$2,800,876	$2,152,609	$137,157
Long Isl. Elec.	318,504	301,926	17,825
N. Y. & L. I. Traction	711,231	634,127	35,549
N. Y. & Queens Co.	1,757,125	1,637,037	91,910
Ocean Electric	200,165	221,536	10,563
Van Brunt St. & E. Broadway	143,953	140,599	4,135
Total Excluding B. R. T.	$5,931,854	$5,087,834	$297,139
Richmond Electric roads:			
Richmond St. & R. R.	$611,281	$550,973	$31,373
South Beach	15,985	13,688	799
Staten Isl. Midl'd	540,872	491,718	27,367
Total	$1,168,138	$1,056,359	$59,539
Grand total all costs	$129,088,556	$112,483,610	$6,655,639

*Totals in this column exceed revenue of all companies regarded as a single system by reason of inter-company payments for power, rent of tracks, etc.
†Not reported.
$Operated by Metropolitan Street Railway in September, 1908.
‡Exclusive of the Tarrytown, White Plains & Mamaroneck and the Yonkers Railroad.

NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY.

In accordance with the new law placing telephone companies in Massachusetts under supervision of the Highway Commission, the annual report of the twelve months to June 30 last of the New England Telephone and Telegraph Company has been filed. The income account as of June 30, 1909, and 1908 compares as follows:

Gross, $11,031,289, inc. $577,305; operating expenses, $8,306,472, inc. $240,804; net, $2,724,816, inc. $336,500; other income, $260,004, inc. $29,159; total net, $2,984,821, inc. $365,660; charges, $161,035, dec. $200,272; balance, $2,823,786, inc. $565,932; dividend, $2,194,639, inc. $292,771; surplus, $629,147, inc. $273,161.

On June 30 last there were 3,832 stockholders in the company, of whom 3,401, or eighty-nine per cent, are residents of Massachusetts, owning 136,519 of the 356,244 outstanding shares. The American Telephone and Telegraph Company, the parent company, owns 208,058 shares.

This compares with 3,700 stockholders on June 30, 1908, of whom 3,275, or eighty-eight per cent, were residents of Massachusetts, owning 135,651 of the 355,095 shares.

SCHENECTADY RAILWAY.

The report of the Schenectady Railway Company, for the quarter ended September 30, 1909, compares as follows:

	1909.	1908.
Total operating revenue	$296,163	$264,272
Total operating expenses	160,017	169,114
Net operating revenue	$136,146	$95,158
Taxes accrued	12,788	8,891
Operating income	$123,357	$86,266
Other income	3,399	4,184
Gross income	$126,757	$90,450
Total deductions from gross income	23,809	26,780
Net corporate income	$102,947	$63,670

UNITED TRACTION, OF ALBANY.

The report of the United Traction Company (Albany) for the quarter ended September 30, 1909, compares as follows:

	1909.	1908.
Total operating revenue	$554,360	$520,679
Total operating expenses	312,803	302,187
Total net revenue from operation	$241,557	$218,492
Taxes accrued	33,000	28,736
Operating income	$208,557	$189,755
Other income	50,034	40,014
Gross income	$258,591	$229,769
Total deducted from gross income	94,732	70,140
Net corporate income	$163,858	$159,629

WASHINGTON WATER POWER.

The Washington Water Power Company has rendered a report to the New York Stock Exchange for the year ended October 31, 1909, as follows:

Receipts	$2,735,738
Expenses and taxes	1,459,666
Net receipts	$1,276,072
Allowance for depreciation	268,600
Balance	$1,007,472
Interest	356,090
Available for dividends	$651,382

BOSTON & WORCESTER.

The Boston & Worcester Street Railway Company has issued its report for the year ended September 30, 1909. The general balance sheet as of October 1, 1909, compares as follows:

ASSETS.

	1909.	1908.
Property investment	$4,776,528	$4,646,118
Cash	92,026	115,113
First mortgage discount	.....	59,000
Accounts receivable	14,436	34,841
Cash to secure bonds	.....	.....
Supplies on hand	89,416	82,242
Prepaid interest and insurance, etc.	9,074	10,460
Total	$4,981,480	$4,947,774

LIABILITIES.

Capital stock	$2,025,000	$2,025,000
Fnuded debt	1,970,000	2,016,000
Notes payable, held by Boston & Worcester Electric.	600,000	535,000
Notes payable	267,482	267,365
Accounts payable	51,082	43,561
Interest accrued	24,860	19,655
Taxes accrued	40,183	39,775
Profit and loss surplus	2,873	1,418
Total	$4,981,480	$4,947,774

The income account of the Boston & Worcester Electric Companies, the holding company, for the year ended September 30, 1909, compares as follows:

	1909.	1908.
Dividends received	$60,748	$121,486
Other income	35,757	20,197
Total income	$96,505	$141,661
Interest, etc.	20,090	5,303
Surplus	$76,415	$136,358
Dividends	67,872	135,744
Surplus	$8,542	$614

NORTHERN CALIFORNIA POWER.

The Northern California Power Company, Consolidated (succeeded Northern California Power Company November 1, 1908) has issued its first annual report for the year ended October 31, 1909. The income account compares with the earnings of the company before its reorganization for the years ended February 29, 1908 and 1907, as follows:

	Oct. 31 1909	Feb. 29 1908	Feb. 28 1907
Gross earnings	$432,715	$297,062	$214,830
Profits on store account	1,114	3,516	10,113
Total earnings	$433,829	$300.578	$224,943
Expenses and fixed charges	259,202	165,099	128,690
Surplus	$ 74,627	$135,479	$96,244
Dividends	110,000	40,000	60,000
Net surplus	$ 64,627	$ 95,479	$ 36,244

For the eight months, March 1, 1908, to October 31, 1908, gross earnings amounted to $245,375 and surplus after charges 5139,840.

TARRYTOWN, WHITE PLAINS & MAMARONECK.

The Tarrytown, White Plains & Mamaroneck Railroad Company reports gross earnings for the quarter ended September 30, 1909, of $49,988, against $45,977 last year; net income amounted to $3,706, against a deficit last year of $1,254, and there was a deficit after charges of $1,979, against a deficit of $5,198 last year.

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INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

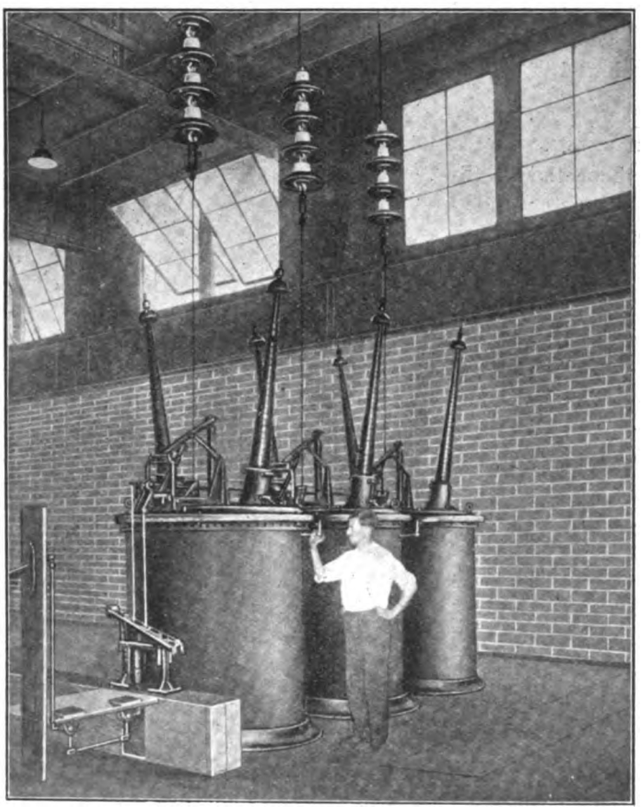
The 110,000-Volt Circuit Breakers on Lines of Southern Power Company.

Four groups of 110,000-volt oil circuit-breakers were recently put in service by the Southern Power Company on its high-tension transmission lines in the vicinity of Charlotte, N. C. This installation is unique as being the first in which switching apparatus is called upon to break currents of this extreme potential, although several similar plants are now under construction and will shortly be in operation.

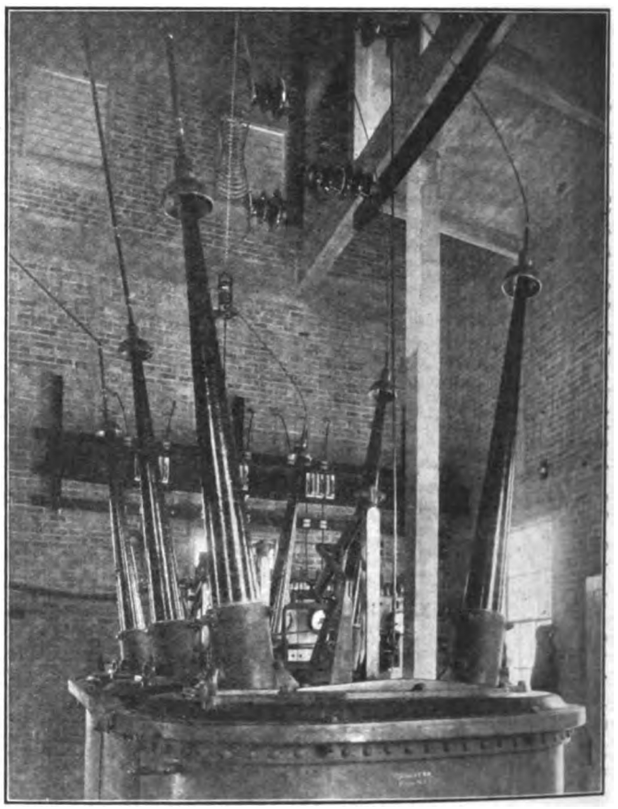
As shown in the accompanying illustration, a feature of the construction of these circuit-breakers is the isolation of each pole in a separate tank. Each pole is thus entirely independent of the others except for the pull-rod which operates the contacts. This rod is released by the tripping mechanism shown at the left of the tanks, allowing the contacts to open by gravity. The forty-seven-inch break thus interposed into each phase occurs in the center of the tank, in oil free from any possible sediment or moisture. By the arrangement of the operating mechanism, gravity assists in making a quick break during normal operation, while in case of any injury to the circuit-breaker parts the circuits naturally tend to fall open.

A double break is made at each pole, spring-seated butt contacts assuring a firm closure. A small double pole, double throw switch operated by the contact mechanism provides a simple telltale, indicating the position of the breaker contacts, by lighting a red or green lamp. The tanks are of welded seam boiler steel, filled with oil and fitted with a thick lining of specially treated insulation which encloses the contacts. The terminals are of the condenser type, and allow the line wires to be brought in directly from overhead.

The 110,000-volt breakers for the Southern Power Company are of both the hand and electrically-operated types. They are normally closed by energizing the operating solenoid from a low voltage local circuit, but may also be hand-operated by a lever handle through a simple mechanical connection. Series relays, mounted on suspension insulators and inserted directly in the line, are provided for automatically tripping the circuit-breakers in case of overload. A wooden rod transmits the movement of the relay armature on the suspension insulator to the latch mechanism, providing a simple and quick-acting mechanical release effected directly by the line current.



110,000-VOLT WESTINGHOUSE CIRCUIT-BREAKERS DURING INSTALLATION.



WESTINGHOUSE CIRCUIT-BREAKERS INSTALLED ON SOUTHERN POWER COMPANY'S LINES.

In the case of the Southern Power Company's lines not only is the voltage interrupted remarkable, but the magnitude of the currents being successfully handled under these severe conditions marks a step in the design of high-tension control apparatus. In this connection it is interesting to note the rated limit of operation of these 110,000-volt circuit-breakers; viz., that they shall successfully interrupt any short circuit that may occur on a transmission system of 120,000 kilowatts capacity.

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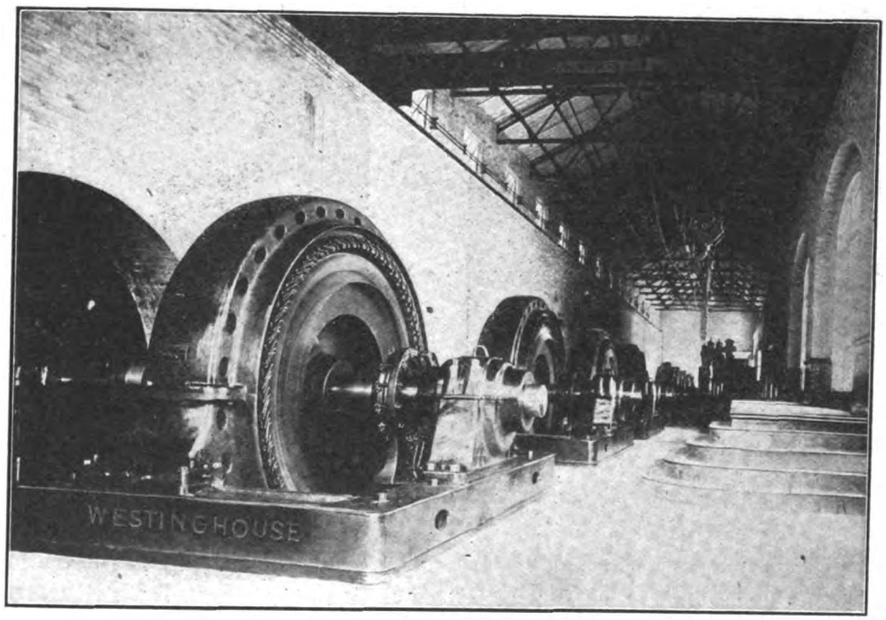
Fiften breakers of type and construction similar to the 110,000-volt apparatus will also be installed by the Southern Power Company for controlling its 88,000-volt transmission circuits. These breakers will be electrically operated and have their tripping coils energized from series transformers "built-in" around the terminals and mounted as part of the tank case as shown in the accompanying illustration. This disposal of the series transformers contributes to the compactness and self-contained character of the breaker group, avoiding all external transformer or relay devices and the incidental wiring.

The 44,000-volt lines of the same company are controlled by five sets of breakers of form similar to the high voltage apparatus already described for



GREAT FALLS GENERATING STATION, SOUTHERN POWER COMPANY.

operation on the lower voltage transmission lines.

The 110,000-volt, 88,000-volt and 44,000-volt circuit-breakers described in the foregoing are of the type GA design, developed and manufactured by the Westinghouse Electric and Manufacturing Company. Elsewhere than the Southern Power Company these breakers are now in use controlling lines aggregating 200,000 kilowatt capacity, and ranging in potential from 44,000 to 88,000-volts in the plants of the Idaho-Oregon Power Company, Boise, Idaho; Spokane & Inland Empire Railroad, Spokane, Wash.; Niagara, Lockport & Ontario Power Company, Niagara Falls, Ont., and Societa Industriale Italiana, Milan, Italy, besides a number of installations yet incomplete.

Tough Tungsten Lamps Pass Safely Through a Railroad Wreck.

The collision between a Pennsylvania eastbound passenger train and an idle locomotive that occurred just outside Jersey City on the morning of November 6th resulted in comparatively few injuries to the passengers, due to the fact that the strong frames of the passenger cars resisted crushing. The damage to engines and cars, however, was considerable. One of the steel passenger coaches jumped the track and turned over on its side, denting in the steel plates about eighteen inches.

In the lighting equipment of this car were nine General Electric tungsten lamps. It is interesting to note that after the wreck, when all the lamps were taken out and tested, these tungstens were found to be in perfect condition—a further proof of the rather remarkable strength and durability of the tungsten filament when specially adapted for train-lighting service.

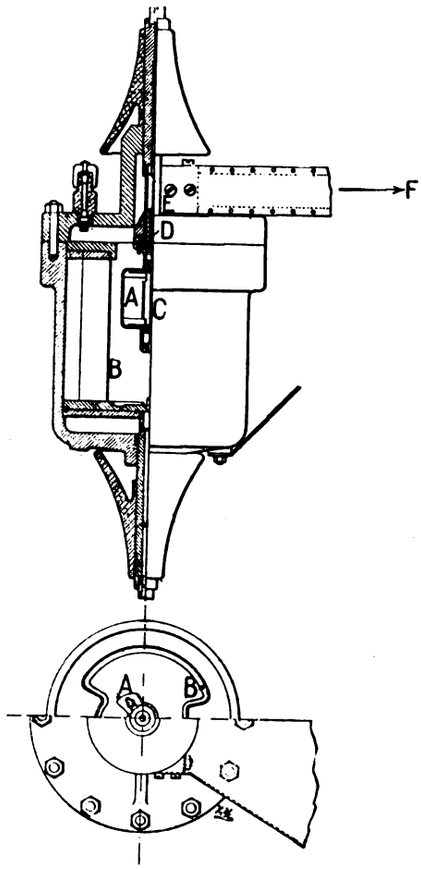
Quick Switchboard Shipment.

A fire at Bass, Mich., destroyed the switchboard of the Bass Telephone Company. The Kellogg Switchboard and Supply Company, of Chicago, received the order for a new board at 10:35 Friday, November 26, and shipped the board complete on the first train Saturday, for Bass, which left at 10:30 a. m.

Exports of copper for the week ended December 16 were 5,475 tons. Since December 1 they were 14,661 tons, against 13,364 tons for the same period last year.

Voltmeter for 200,000 Volts.

E. A. Watson has succeeded in constructing a voltmeter permitting the measurement of tensions up to 200,000 volts. Air compressed to fourteen atmospheres constitutes the insulation in this instrument, as oil would not be suitable for currents of such high pressures. The movable equipment of the apparatus is contained in a cast-iron receptacle, the cover of which is so arranged that the interior pressure con-



200,000-VOLT VOLTMETER.

tributes to keeping it closed. In order to prevent luminous discharges the needle *A* of the electrometer is made of thin copper sheet without sharp angles or corners. The shape of the needle and of the fixed part *B* of the apparatus have made it possible to obtain a graduation that is nearly proportional to the tension. The distance between the movable and fixed parts of the instrument increases with rising tension, reaching a maximum of two centimetres. The tension necessary for perforating a layer of air compressed to fourteen atmospheres is 400,000 volts per centimetre. A mirror is attached to the steel axle *C* and a ray of light projected on the same is reflected on a graduated scale *F*. The torsion exerted on the movable part is quite strong and

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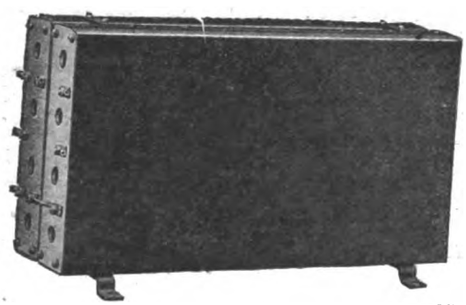
is compensated by a spring *D.—From L'Electricien (Paris), October 30.*

Printing Press Controllers.

The General Electric Company has developed a complete line of CR controllers designed to meet the requirements and severe service of small direct-current electrically operated printing presses. In their design special attention has been given to such necessary features as no-voltage protection, overload protection, push button stop and jog, ruggedness of construction, and accessibility.

All the controllers in this line have no-voltage protection. This consists of a contactor mounted in the lower left-hand corner of the slate front. The CR 169 has been designed so that upon failure of voltage the starting arm returns automatically to the off position. In addition the controller arm is provided with a moveable armature which may be adjusted so that the motor can be run only at a certain predetermined speed. All the other controllers of this line have been so designed that the contactor opens when the voltage fails and the contactor cannot be closed until the controller handle has been returned to the off position.



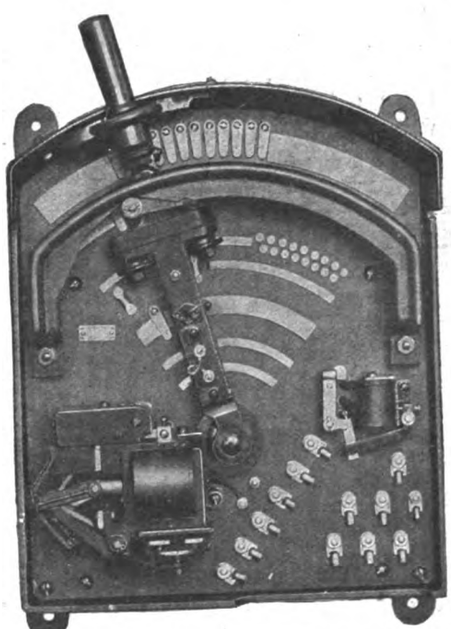
ARMATURE RESISTANCE FOR PRINTING PRESS CONTROLLER.

Since the armature circuit is made and broken by the contactor and not on the switch contacts, there is no arcing on the contacts. This eliminates the burning of the contacts which would necessarily result in roughening the surface, causing imperfect contact and the rapid destruction of the contact segments. The contactor is provided with a strong magnetic blow-out which extinguishes any arc that may result when the armature circuit is opened.

When the overload release is supplied in addition to the no-voltage release, it is so connected that when it operates it will de-energize the contactor coil, opening the contactor and thus breaking the armature circuit.

In many installations it is desirable to have push buttons located at various points around the press for stopping the motor, or for "inching" the press when necessary. Some of the controllers have, therefore, been designed to have both push button stop and jog, while others have the stop feature only.

If the push button is closed while the motor is not in operation the contactor will close, providing the switch arm is in the starting position, completing the armature circuit through the regulating resistance. This will start the motor which will run very slowly, as long as the push button is held closed. If the push button is closed while the motor is running, the contactor coil will be de-energized, thereby opening the motor circuit and stopping the motor. The same push button can therefore be used for jogging or stopping the motor. Each controller which has the stop and jog feature is furnished with two buttons; but any number of buttons may be installed.



PRINTING PRESS CONTROLLER WITH COVER REMOVED.

Standard form P resistance units are used throughout. In the controllers having a field regulating resistance, the units are assembled upon the back of the slate front, while the armature resistance, whether for starting or regulating duty, is assembled in a separate box. When a dynamic brake is supplied the resistance is in most cases external, but in some controllers it is self-contained.

The controllers are provided with renewable segments for armature control, while button contacts are used for field control. The starting resistance is designed for starting duty only while the armature regulating resistance is designed for continuous operation, as various speed changes are obtained by varying the amount of resistance in the armature circuit.

Wayne Bell-Ringing Transformer.

The transformer shown in the accompanying illustration is made by the Fort Wayne Electric Works, Ft. Wayne, Ind., for the purpose of utilizing alternating current for ringing electric bells, annunciators and similar apparatus. The transformer is built for 110-volt circuits, and has a secondary winding with taps brought out so as to obtain four, eight and twelve volts, depending upon the connections.

WAYNE BELL-RINGING TRANSFORMER.

In electric bell wiring, due to the fact that frequently the bell wires are run along the floor and are apt to be short-circuited, this transformer is designed so that it will run several hours on dead short circuit without danger of burning up. This feature makes the transformer especially valuable for this class of work. It is also designed so as to have ample capacity for ringing large size bells. The efficiency of this device is exceedingly high for a transformer of this size. The core losses are so small that it is a difficult matter to measure them, running approximately .4 watt.

The primary leads consist of two rubber-covered flexible cables brought out through an insulating piece, and this piece is anchored inside the case, preventing any injury to the winding, due to pulling of the leads. The secondary terminals consist of three binding posts giving three combinations of voltages.

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This is the maximum combinations which can be obtained through this number of binding posts.

The casing is of cast aluminum with a heavy coat of black japan, making it very ornamental. This allows the transformer to be installed in places where the appearance of the dry cells would not permit of them being placed. The casing is so built as to have an air space between the body of same and the wall upon which it would be mounted. The core and coils are thoroughly impregnated and the same care and quality of material is used in the construction of transformer as in the large high-voltage transformers. It is in every way a thoroughly built transformer and only the best material and workmanship enter into its construction.

An Electric Fireless Cookstove.

A new form of electric cooker, invented by Sebring Phelps and called the "electric fireless cookstove" has recently been put on the market by The Electric Fireless Cookstove Company, of Hastings, Mich. The makers of this electric stove guarantee that provided their directions are correctly followed, the cost of electric cooking with this stove is much cheaper than cooking with gas,—for electric power at four cents a kilowatt-hour as compared with gas at $1.00 a thousand cubic feet.

The illustrations given herewith show two views of the "Favorite," one of the several types of the electric stoves made by the firm. This is a two-element stove, but with the use of the lower or floor case it is claimed that as large a dinner can be cooked as with a four-hole gas stove with oven. Practically no attention is required between the operations of putting the food in the stove and the taking out of the same when it is fully cooked.

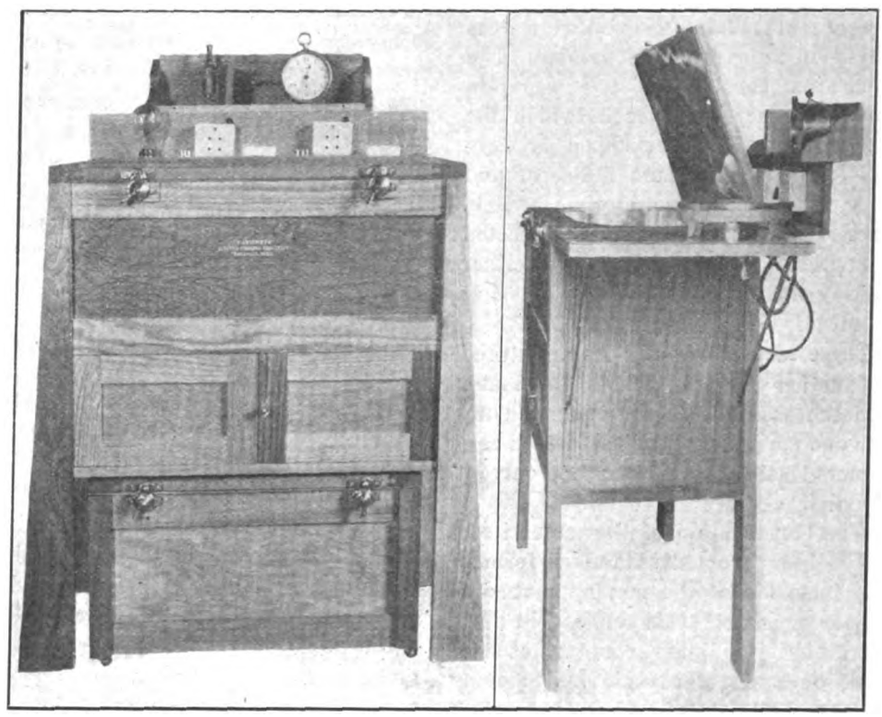
The following account, abstracted from an article in the *Hastings* (Mich.) *Banner*, November 10, 1909, gives some idea of the possibilities and method of operation of the electric fireless cookstove:

"An hour and a half before we came to Mr. Phelps' workshop, he had heated to a high degree one of the cooking elements by which the cooking is done. This element is raised to a high temperature by turning on the electric current from fifteen to thirty minutes according to the temperature desired. The cooking element was placed, after heating, above a chicken which was to be cooked. The heat from the element, from which the current was now shut off, had been cooking a chicken in the cooker for upwards of an hour before our arrival. When we came on the scene, the cooking was well-nigh completed.

"The cooker we saw had two heating elements. Mr. Phelps next, for thirty minutes, turned on the current for the second heating element. Then Mrs. Phelps brought out a tin of biscuits. This was placed in the cooker, the heating element being placed above, but not in contact with, the element. No current was used at all from this time on; but in fifteen minutes by the watch the biscuits were nicely baked in the cooker by the heat from the element.

"The cooking and baking were both going on in the same space in the cooker. This space was lined with asbestos underneath a bright metal cover. We were served with a delicious chicken sandwich which had been prepared from the biscuit and chicken cooked in the same space in the cooker, both baking and cooking going on at the same time. The electricity was used for thirty minutes in one case and for but twenty in the other. The meter told the expense, which was much less than what it would have cost for gas in a gas range."

The results of a series of tests by Mr. and Mrs. Sebring Phelps, showing the comparative costs of electricity (in the fireless cookstove) *versus* gas (in a gas stove) are given below. A guarantee is offered by the makers that these figures can be duplicated by anyone using the electric fireless cookstove, provided that their directions for the operation of the stove are followed, and that the voltage of the circuit is regular and constant.



FRONT AND SIDE VIEWS OF ELECTRIC FIRELESS COOKSTOVE.

The stoves are all built of white oak, thoroughly seasoned, and nice enough for a dining room, as may be noted from both of the accompanying illustrations.

Kind of Food	Feet of gas used	Watts of electricity	Time in minutes required for cooking: Gas	Time in minutes required for cooking: Electricity	COST: Gas @ $1.00 per 1000.	COST: Electricity @ 4c a kw.-hr.
6-lb. roast.....	71	500	125	180	$0.071	$0.02
12-lb. goose.....	107.5	1000	210	210	.1076	.04
2 apple pies.....	27	507	25	35	.027	.02028
2 pans biscuits...	15.6	394	14	12	.0156	.01576
4 loaves bread....	32.3	665	60	90	.0323	.0266
1 loaf cake.....	22	266	35	35	.022	.016
3-layer cake.....	15.5	446	15	10	.0155	.0178
1 rice pudding ...	20	266	35	35	.02	.016
8 quarts boiled potatoes	14	258	56	56	.014	.0103
Squash	7	133	35	45	.007	.00532
Cabbage	separate		60			
Tomatoes	15	346	20	60	.015	.0138
Sweet corn.....	utensils		20			
				Totals	$0.3470	$0.20186

Saving of electricity over gas $0.14.

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Maximum Demand Meters.

To the Editors:

Our attention has recently been drawn to an article in your journal (Vol. 55, No. 3, p. 110) on "The Compilation of Load Factors." In this article it is stated that no cheap and efficient maximum measuring instrument suitable for alternating-current circuits is on the market at the present time. We shall be much obliged if you will kindly allow us to contradict this statement through the columns of your paper, as we ourselves among other firms have been manufacturing such an instrument for some time past.

Under the circumstances a description of our maximum demand meters may be of interest to your readers. The apparatus consists of two separate parts, the meter proper in which the ordinary counter mechanism is combined with a maximum indicator and scale, and an automatic time switch. These two separate parts are connected electrically; they can be mounted either side by side, or one above the other, as required.

These meters are also manufactured in another form in which the meter and the time switch are combined under one cover. This latter form is constructed solely for alternating-current circuits.

The construction of the meter itself only differs from the standard form in the inclusion of the maximum recording mechanism. This consists, in addition to the ordinary counter mechanism, of a circular scale and moving pointer. The pointer is operated by a carrier which in turn is set in motion by a tooth wheel on the counter gearing shaft. The tooth wheel is coupled to the carrier by means of the armature of an electromagnet fixed at the side of the apparatus. At regular intervals (for instance, every fifteen minutes) the time switch momentarily short-circuits the current in the magnet coil, whereupon the coupling is disconnected and the carrier is brought back to the zero position by means of a spring. The maximum indicator, however, remains in the highest position which it had previously reached; it will be set in motion again as soon as the current exceeds its former maximum value.

The apparatus is equally suitable for either direct or alternating-current circuits.

Allgemeine Elektricitaets Gesellschaft.

Berlin, Germany, November 29, 1909.

Electric Drive in Automobile Works.

In line with the ideas of all progressive manufacturers the automobile makers of the country are rapidly installing motor drive for the various machines in their shops. One company alone, the Allis-Chalmers Company, has furnished considerable electrical apparatus to the automobile manufacturers in the neighborhood of Detroit, Mich., some items of which follow. The Everett - Motzger - Flanders Company, Detroit, Mich., has purchased three 300-kilowatt generators with exciters, four 100-kilovolt-ampere oil-filled water cooled transformers and sixty-four induction motors. This company uses a 30 horsepower motor running at 850 revolutions per minute as standard, and thus has to carry but few repair parts.

The Oak Park Power Company at Flint, Mich., owned and operated by the General Motors Company and which furnishes power to the numerous plants of the company, has recently installed two 1,000-kilowatt steam turbine units with direct coupled exciters, one non-condensing, the other condensing, with turbo jet condenser and motor generator exciter set; two 200-kilowatt alternators with exciters, twenty-one transformers and a large number of motors.

The Weston-Mott Company of Flint, Mich., has purchased a large number of induction motors. It has adapted a 40-horsepower motor running at 850 revolutions per minute as standard, and one of these usually drives a group of machines.

The Kelsey Herbert Wheel Company of Detroit has put in three transformers and six induction motors.

The Rapid Motor Vehicle Company, Pontiac, Mich., has put a central generating station in operation. This consists of two 20 and 40 by 42 inch engines direct connected to 600 kilowatt, sixty cycle, three-phase, 240-volt generators. Excitation is furnished by a forty-five kilowatt induction motor generator set or by a forty-kilowatt engine exciter set.

The American Motor Castings Company has installed a 100-kilowatt engine generator set and six induction motors.

The Brush Runabout Company, Detroit, Mich., has purchased three 100-kilowatt transformers and twenty induction motors. This company has adopted twenty-horsepower motors running at 850 revolutions per minute as its standard.

It has been found that motor drive helps to reduce factory cost to a considerable extent, and it is quite probable that many other automobile manufacturers will be following the example set by those mentioned, where electrical operation is not already used.

Japanese Government Buys More American Telephone Apparatus.

Another telephone-switchboard order from the Far East has been placed with an American firm of manufacturers. The Western Electric Company has secured a contract from the Japanese Department of Communications for the equipment to extend the service in the capital city of Tokyo. This board is of the sort used by the Bell companies in this country and in general use abroad. It is a common-battery switchboard of the most up-to-date type.

This firm also contracted recently to supply the Chinese government the equipment for the first two modern telephone exchanges in the empire, to be located in the city of Pekin.

Electric Cooking versus Gas.

Some elaborate researches have been made in Germany, says *The Electrical Engineer*, of London, Eng., with reference to the comparative cost of cooking by electricity and by gas. It appears from the average of a very large number of experiments made under varying conditions that if the cost of a kilowatt is more than half as great again as that of a cubic metre of gas (thirty-five cubic feet) the gas is the cheaper heating agent. Otherwise electrical heating is the more economical. It is claimed that the use for which electrically generated heat is least suitable in the household is for boiling water.

Independent Telephone Rates Raised.

As a consequence of fear of raise of rates, the minority stockholders of the United States and Cuyahoga Telephone companies have filed petitions for a receivership. Their move, however, was anticipated by B. H. Mahler, a director of the United States company, who raised the rate to more than double that asked by the Bell company. Mr. Mahler, it is reported, will head the Cuyahoga and United States Telephone companies if they are taken over by the Bell interests.

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Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, DECEMBER 11.—The approach of a general election has once more raised the question of protection in relation to the electrical industry in Great Britain. In the ordinary course of events, the Institution of Electrical Engineers steers clear of politics, although there are many members who hold the view that the Institution is being managed on too severely scientific lines, and that it ought to take a more active interest in commercial matters. However, be this as it may, political questions are strictly taboo at the meetings of the Institution ,and as a rule there is little opportunity for the politicians of the Institution to have much to say there. On Thursday, however, the Council allowed a paper to be read which made comparisons between the electrical industry in Germany and in England, and, as was inevitable, it gave the opportunity for the introduction of politics. Emile Garcke, of the British Electric Traction Company, made a rousing speech in favor of tariff reform as a solution of many of the difficulties under which the industry is now suffering. He was severely rebuked by Gisbert Kapp, the President, who vetoed any further remarks of a similar character. Nevertheless, several other speakers managed to air their political views, and there was just a danger of some feeling being exhibited. The Council of the Institution is strong in its determination to remain strictly impartial on this matter. As this attitude is being persisted in, much against the will of a certain section, it is quite possible that an attempt will be made to form a society which will take in hand the commercial aspect of affairs. An Electrical League was mooted in the summer but nothing further has been heard of it: the idea, however, will probably be revived under the circumstances of a general election.

The London Electric Supply Act of 1908, which authorized agreements between the electric-supply authorities of London, is already bearing good fruit. A spirit of reasonableness seems to have taken possession of both municipalities and companies. Joint meetings of officials of companies and municipalities are being held to discuss technical matters, and a scheme has now been formulated for appointing a committee containing members from both sides to supervise the preparation and publication of publicity matter in relation to electricity supply. The idea is to produce literature suitable for all parties, in large quantities, and so save expense.

A somewhat daring method of advertising electricity supply has been adopted by the municipal electric engineer at St. Pancras, London. This consists of fixing large models of incandescent lamps, motors, etc., on the lamp posts. To anyone with a specially fine aesthetic taste, the idea might appear revolutionary, but the commercial spirit is seizing all our station engineers in no uncertain manner, and as the end is justifying the means, it is not likely that the residents will complain.

The Electrical Contractors' Association is already showing activity in regard to those municipalities who have given notice to apply for powers next session to carry out wiring work, etc. The Association has warned these municipalities that unless they promise to carry out this class of work through a contractor, they will oppose the bills when they come before Parliament.

Ever since the Edinburgh Corporation went in for an electric supply undertaking the Electricity Committee has always refused to offend the tastes of their rate payers by running the stations condensing. In this way, of course, they have dispensed with the use of cooling towers. The Corporation possesses two generating stations which have now become quite filled with plant. The consulting engineer has reported that the only alternative to the expense of a new high-tension generating station outside the town, is to convert the existing stations to run condensing and to install exhaust-steam turbines. At any rate, the scheme is now before the Council, and some English towns are to be visited where condensing plant is in use. It may be mentioned that the Edinburgh undertaking is probably the most successful of any electric supply works in the kingdom.

It is reported that the United Wireless Telegraph Company of America has decided to build works near Liverpool. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, DECEMBER 9.—One of the large mining companies in France, known as the Boucher du Rhone Company has recently completed a large plant for use at the Aygalades mines in the Mediterranean region. Here is installed a substation of some size, and it receives current over a power line from the Brillanne hydraulic plant. There are erected two transformer posts and two substations with rotary converters in order to supply current for the mine for lighting and electric locomotives. At present there are ten of these nine-ton locomotives in operation at the mine, each carrying two sixty-horsepower motors. Motors also drive a cable drum plant for taking out the material. At the company's shops located at Madrague, in the neighborhood of Marseilles, there is installed a transformer post for operating the various motors of the shops.

The new hydraulic plant which is in the course of erection in the southern part of Austria in the region of Fiume, will be one of the largest in Europe, as it is intended to give 80,000 horsepower. It is installed by the Adriatic Electric Company, with the use of French capital for the most part. The station is to supply an extensive network of power lines, taking in the city of Trieste as well as Agram and Pola. Current will be used for locomotives which it is proposed to introduce upon some of the sections of the Austrian state railroads.

Orders have already been placed for a part of the material for the great turbine plant which is now being built at Rjukan, Norway. This includes five three-phase alternators to be built by the Brown-Boveri firm. These machines are of 17,000-kilowatt capacity and work on 10,000 to 15,000 volts. The same number of 14,000 horsepower turbines has also been ordered. The present outfit is one-half of the ultimate capacity of the station.

Measures are being taken to adopt the electric system on the Metropolitan lines in the city of Vienna. It is estimated that the undertaking will involve an outlay of $10,000,000. The Siemens-Schuchert Company are likely to obtain the contract for this work. As regards the operation of the lines, it will no doubt be carried on by the municipality.

The city of Parma, Italy, is considering a project for the building and operation of several sections of city and interurban traction lines. A. DE C.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

LARGE POWER PROJECT—A company has been organized at Woodstock to harness the Staunton river at Brookneal, two miles from Lynchburg, Va. The plant, it is estimated, will deliver 5,000 horsepower. The president of the company is M. Coffman, cashier of the Shenandoah National Bank. L. T. Stoneburner, secretary and treasurer. The capitalization of the company is limited to $1,000,000, on which a charter fee of $750 has been paid.

POWER PLANT FOR MEXICO.—The Mayo River Power and Land Company has made surveys for a dam across the Mayo River in western Chihuahua, Mex. This dam, which will be the first of several, is to be located abouty fifty-six miles above Navajoa, Sonora, on the new Southern Pacific railroad. About 25,000 horsepower will be developed by the first dam, but the amount will be considerably increased when the subsequent dams are built.

WORK TO BEGIN ON TUM TUM ROAD.—A. Arnston, general manager of the Tum Tum Railway at Vancouver, Wash., has announced that work will start on the road about the first of January. A section four miles long between Ridgefield and Tum Tum Mountains will first be constructed and will be finished before July 1. Sixteen miles of the total forty-five will be in operation within a year. Power will be furnished by a hydroelectric generating plant.

COLORADO RIVER DAMS IN CONSTRUCTION—Preparations are being made to replace the $1,600,000 granite dam across the Colorado River, which was washed out in 1906, with a reinforced concrete structure. At the Marble Falls on the Colorado River a dam is at present being built and power will be supplied to Austin, San Antonio and other cities. Approximately 25,000 horsepower will be developed and it will be distributed within a radius of 100 miles. A large dam across the Llano River has just been completed and the hydroelectric plant is supplying light and power to the city of Llano.

TO DAM THE DIX RIVER.—The Madison Electric Power Company of Richmond, Va., is promoting a plan for the development of power from the Dix River near Burgin, Ky. It is the intention of the company to construct an immense dam in the river below the bridge at Camp Dick Robinson. The base of the dam is to be 156 feet, 150 feet high and 500 feet long. The estimated cost of the undertaking will be $1,000,000, and it will require one year to complete the work. When completed, the power plant will have a generating capacity of 25,000 to 30,000 horsepower, which will be sufficient to supply a number of surrounding towns with light and power.

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NEW POWER PLANT FOR MENOMINEE RIVER—There is a project at present under way for damming the Menominee River near Marinette to secure power for the mills of the Menominee and Marinette Power Company. The company which is promoting the scheme is capitalized at $1,000,000 and makes a claim that 6,000 horsepower will be developed. The company is backed by Harry J. Brown, Elmer Grimmer and other well-known men.

POWER PLANT FOR THE OCONEE RIVER.—A company is to be formed for the development of an estimated 4,000-horsepower waterpower on the Oconee River, near Athens, Ga., those interested being Capt. James White, J. Y. Carithers and others, of the Athens Electric Railway System. The power generated will be utilized in operating an addition to the Star Thread Mills at Barnett Shoals, on the Oconee, doubling the mill's capacity, while power will also be developed for a new $500,000 cotton mill to be erected. The total development will represent over a million dollars. Extensions to the Macon Street Railway System will furthermore be supplied with power from the new hydroelectric development, which will be one of the largest in this section of Georgia.

LIGHTING AND POWER.

(Special Correspondence.)

PLAQUEMINE, LA.—J. H. Pugh has purchased the franchise and property of the Plaquemine Electric Light and Power Company. P.

SAN ANTONIO, TEX.—Ira C. Rinehart is organizing an electric light and power company for this place, to put in a plant to cost $105,000. P.

EVANSVILLE, IND.—Hal C. Kimbrough, of Muncie, Ind., and associates, have applied for a franchise for a heat, light and power plant in Evansville. S.

SULPHUR, OKLA.—The Swanson Electric Company, which recently purchased the plant of the Sulphur Light and Power Company, is rebuilding the entire plant.

HARTFORD, WIS.—The new electric power plant of the Kissel Motor Car Company here has been put into operation. It will be used to operate the company's factory. M.

DECATUR, ILL.—The Progressive Light and Power Company has been incorporated with a capital of $100,000, to generate and sell electricity. The incorporators are: W. H. Suffern, R. I. Hunt and F. M. Ives.

HOUSTON, TEXAS.—The distributing lines of the entire lighting system inside the fire limits of the city are being placed in underground conduits. The installation is being made by Ford Bacon and Davis of New York city at a price of approximately $300,000.

SYRACUSE, N. Y.—The Wayne County Electric Company, capitalized at $100,000, has been sold by Syracuse capitalists to William T. Morris and associates, of Penn Yan. The company supplies lighting in Lyons and Clyde.

SEYMOUR, IND.—The city council has granted a franchise to the Indiana Public Utilities Company, of which W. B. Hotten is secretary, for the erection, equipment and operation of a new and up-to-date electric light plant. S.

FREEPORT, ILL.—The Commonwealth Electric Company has been incorporated by Charles E. Gregory, Richard Armstrong and C. R. Norwood, all of Chicago. It is proposed to have the lighting plant in operation by spring.

NEW ORLEANS, LA.—An ordinance has been passed permitting the reorganization of the Consumers' Electric Company. An additional investment of approximately $1,000,000 will be made when the new company is formed.

MADISON, WIS.—The Hustisford Electric Light and Power Company of Hustisford has filed articles of incorporation here. The company has a capital stock of $40,000. The incorporators are E. J. Dehne, O. E. Dehne, and C. W. Erdman, Jr. M.

FRESNO, CAL.—Articles of incorporation have been filed by the Coalinga Water and Electric Company, with a capital of $2,000,000, to supply water and power to Coalinga and the oil fields. The directors are: W. C. Kerckhoff, A. C. Batch, K. Cohn and A. G. Weston.

DELPHI, IND.—The city council has granted a franchise to the Fort Wayne & Wabash Valley Traction Company to furnish light and power to the citizens of Delphi. The minimum rate for residences is seventy-five cents a month, the company to furnish meters for all consumers.

JACKSON, ALA.—It is reported that the Jackson Electric Light and Power plant, owned by Frank Jones and General Carnes of Memphis, has been sold to F. B. Prout and H. H. Carson of the General Electric Company and local capitalists. The price paid is given at $1,000,000.

SALEM, ORE.—State Engineer Lewis will grant the application of W. B. Winans for a permit to appropriate the waters of Hood River for power purposes. Mr. Winans has projected an electric railroad for the Hood River Valley and plans to develop 20,000 horsepower to operate the line.

OLD TOWN, ME.—The Kennebec Development Company has been organized for the purpose of generating and supplying electricity and gas for lighting, heating, mechanical and other purposes, with $200,000 capital stock. The officers of the company are: O. H. Briggs of Providence, R. I., president; E. H. Green of Waterville, treasurer.

REDDING, CAL.—The Sacramento Valley Power Company of this city has given a deed of trust to the Central Trust Company of San Francisco to secure the payment of bonds amounting to $500,000. The company virtually mortgages all its water rights, real estate, power lines, power houses, machinery and property of every description.

ONAGA, KAN.—The Onaga Heat, Power and Light Company has been granted a charter by the state board at Topeka, with Peter Gurtler, president, and L. L. Omeara, secretary. Ground also has been purchased for the location of the building and contracts let for the machinery. It is expected that the plant will be in operation by January 1.

TACOMA, WASH.—Articles of incorporation of the Cle Elum Traction Company have been filed with the county auditor by Frank S. Farquhar and M. E. Farquhar. The object of the company is to construct transportation lines within and without Cle Elum and Roslyn in Kittitas County and to establish branch lines. The capital stock is $300,000.

REDDING, CAL.—The Sacramento Valley Power Company has completed the survey of its pole line from Redding through Red Bluff, Tehama and Corning to Chico. Material for the construction of the line is being delivered at Redding, Red Bluff and Chico, and construction crews have begun building south from Redding, north from Chico and in both directions from Red Bluff.

SEYMOUR, IND.—The city council has been enjoined temporarily from entering into a contract with the Indiana Public Utilities Company for street lighting. The injunction was secured by the Merchants Electric Light Company, whose contract has expired. The Indiana Public Utilities Company is proposing to build and equip a new plant and the fight has been very bitter. S.

HAMMOND, IND.—Plans for an electric light plant to cost a quarter of a million dollars are now in preparation for C. H. Geist, owner of the present plant in this city. The new plant will have 12,500 horsepower whereas the present plant that supplies Hammond with electric light has only 4,000 horsepower. The power company is to furnish the Gary and Interurban Railway Company with power.

NORWICH, CONN.—The Falls Company, Norwich, Conn., has completed the installation of the two water-wheels at its dam on the Yantic River, and will erect a new power house for its electric generator for the purpose of supplying its mill with electricity. After the water passes these wheels it will be again utilized at the lower dam of the company to turn the wheel of the mill proper. About 200 horsepower will be generated to operate twenty-two machines in the picker room.

DELPHI, IND.—The City Council has granted to the Fort Wayne and Wabash Valley Traction Company a fifty-year franchise, under which the county seat of Carroll County will be supplied with electric current for lighting and power from the Fort Wayne station, ninety-five miles distant. The work of making connections will begin at once, and until the new station at Lafayette, some fifteen miles west of Delphi, is completed, all the current for Delphi will be supplied from the Fort Wayne station.

YORK, PA.—A movement has been started here to build a municipal lighting plant. The light committee of city councils has been instructed to secure estimates of the cost of lights in other cities, and also the cost of the erection of a municipal plant. This action has been taken because the company which has been furnishing light to York has submitted a bid $11 per lamp in excess of last year's, and will not sign a contract for less than five years. It is estimated that a plant erected by the city would cost about $200,000.

SYRACUSE, IND.—The Syracuse Power and Light Company has filed articles of incorporation with a capital stock of $30,000. The object of the company is to supply cities, towns, communities, farmers and places of amusement with light, heat and power. Joseph P. Dolan, Lewis A. Neff, Herman D. Boozer, Charles Crow and A. B. Dolan are the incorporators. The above corporation is constructing a power dam in Elkhart River and will generate electricity to be transmitted to towns, cities, farmers and communities in Elkhart and Kosciusko counties. S.

ALBANY, N. Y.—The East Creek Electric Light and Power Company has asked the Public Service Commission for authority to execute a mortgage upon all its property for $3,000,000, and to issue bonds to the amount of $2,080,930, and capital stock to the amount of $550,000. The company now has its water power at East Creek, Herkimer County, and supplies electricity for light and power at St. Johnsville, Fort Plain, Canajoharie, Nelliston and Palatine Bridge. It has been offered a contract with the Fonda, Johnstown and Gloversville Railroad Company for the furnishing of a large amount of the power for that railroad company, and the proceeds of the sale of stock and bonds, outside of the refunding of outstanding bonds, is to be devoted to the extension of its water power.

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KIMBALL, W. VA.—The surveys have been completed for the construction of a power house to light and furnish water for the city. It is estimated that the combined plant will cost $100,000.

RHYOLITE, NEV.—Leonard Davis, general manager of the Buckeye Mill and Mining Company, at Fish Springs, will put in an electric plant on Birch Creek to furnish power for the mill now being installed there.

CHIHUAHUA, MEX.—The Guanajuato Light and Power Company has increased its capital from $6,000,000 to $12,000,000. This increase was demanded by the extension of transmission lines and erection of new plants.

WILMINGTON, DEL.—The Wilmington City Electric Company has purchased a 1,500-kilowatt turbine generating set, which has been recently placed in operation. The contract price of the machine was about $20,000.

LOS ANGELES, CAL.—The City Council has passed a resolution calling for $3,500,000 to be issued in bonds for constructing works for generating and distributing electricity for purpose of supplying the city with light, etc.

LYNN, MASS.—An appropriation of $30,000 has been made by the city for improvement of the municipal lighting plant. Two 100-kilowatt turbine-driven generating sets will replace the four arc lighting machines now in use.

RICHMOND, VA.—An additional appropriation of $65,000 has been made to complete the construction of the overhead system in connection with the municipal power and lighting plant. The original bond issue was $350,000.

PALO ALTO, CAL.—Plans have been completed for a new street lighting system for which $3,500 has been voted. The principal streets are to be lighted with arches containing twelve lights each and spaced about 100 feet apart.

MONROE, WIS.—It is reported that a controlling interest of the Monroe Electric Light and Power Company is to pass into the hands of parties represented by H. A. Smith of Chicago. The change will take place about January 1.

AMHERST, WIS.—A new water wheel which will generate about ninety horsepower, or double to the amount formerly obtained, has been installed at the electric light plant at Amherst. A new concrete flume has also been built. M.

INDIANAPOLIS, IND.—The city council has passed an ordinance requiring the railroads to pay thirty per cent of the cost of arc lights placed over railroad street crossings. The railroads are quite willing to comply with the ordinance. S.

BUFFALO, N. Y.—The City Hall lighting plant was put into operation a short time. The generating machinery consists of one 50-kilowatt, one 75 and one 150-kilowatt generator. Work on this installation was carried out under the direction of J. J. O'Leary.

EVERETT, WASH.—The Granite Falls Electric Company of Granite Falls has filed a petition with the Board of County Commissioners of Snohomish county, asking for a franchise to construct and maintain upon the roads of the county an electric transmission line.

YORK, PA.—The new 750-horsepower engine and generator have been installed in the powerhouse of the York Railways Company. President W. T. Bay Stuart says that there will be no future trouble and that all public power demands will be supplied. O.

PESHTIGO, WIS.—The Northern-Hydro Company, which is to supply electric power to Manitowoc and Two Rivers, has placed a trust deed for $5,000,000 on its property. It is understood that the American Trust and Savings Bank, of Chicago, has furnished the money. C.

SAN DIEGO, CAL.—The San Diego Consolidated Gas and Electric Company has been awarded the contract for lighting the streets for a period of five years beginning with June 1, 1910. The present rate is $7 per month per lamp whereas the new rate is $5 per lamp per month.

SUPERIOR, WIS.—A mortgage for $100,000 has been filed by the Northern Power Company. The mortgage is held by the Great Northern Power Company, a Minnesota corporation. The mortgage was made to reimburse the Great Northern company for improvements made on behalf of its subsidiary.

SACRAMENTO, CAL.—Articles of incorporation of the Western Consolidated Coal, Gas and Electric Company have been filed recently. The company is capitalized at $7,500,000, and is now operating in Arizona. It intends to develop extensive coal claims near Stone Canyon, Cal., but may supply power and light to any part of the state.

SPOKANE, WASH.—Contracts for doubling the capacity of the Nine Mile power plant of the Inland Empire system have been let to the Westinghouse company and the American Wheel Company, and when complete the station will have a capacity of 20,000 horsepower. The machinery will be installed as rapidly as it arrives on the ground.

CHARLESTON, N. C.—The Consolidated Company is inviting bids from the General Electric Company and the Westinghouse Electric Company on a 1,000-kilowatt steam turbine, to take care of its lighting business; the same to be delivered within the next five or six months. This step is necessary to take care of the increased lighting and power business.

REDDING, CAL.—The Sacramento Valley Power Company, which operates three power houses in this county, has executed a deed of trust to the Central Trust Company of San Francisco to secure the payment of bonds for $500,000. The proceeds of the bond issue will be used for the extension of the company's power wires to various points in the Sacramento Valley.

NOBLESVILLE, IND.—The White River Light and Power Company, whose hydroelectric plant will be completed in about two weeks, is making a large number of contracts to furnish power to factories and industries requiring cheap power. The company is contracting to furnish power and light at five cents per kilowatt-hour. This remarkably low rate is attracting a number of industries to Noblesville. S.

ALBANY, N. Y.—The Floral Park Light, Heat and Power Company, has recently been incorporated to carry on operations particularly in the counties of Nassau and Suffolk. The capital stock is placed at $10,000, and the directors are William C. Baker, Charles A. Lockwood, E. B. Lockwood and Charles E. Twombly of Jamaica, William L. Wood and R. W. Kellogg, of Hollis, and John Ebbers of Union Course.

FT. WAYNE, IND.—Certain cars now in operation by the Ft. Wayne & Wabash Valley Traction Company are being commended very highly by passengers on account of their excellent lighting system. The company has equipped these cars with a new light which is an adapation of the tungsten and promises to be a great success. The filaments are short and heavy to prevent breakage from the jar of travel. Numerous inquiries are coming to the management relative to the success and durability of the light. S.

FT. WAYNE, IND.—President J. Levering Jones of the Ft. Wayne and Wabash Valley Traction Company, in an open letter addressed to Mayor Hosey, asserts that the city is operating its electric light plant at a big loss, and as the traction company is one of the largest taxpayers he protests against it being taxed to maintain a competitive plant on a losing basis. Mr. Jones asks that experts be appointed to inquire into and report on the matter of the municipal plant being a losing proposition. The advocates of the municipal plant charge the traction company with conspiring to discredit the municipal system and subsequently buying it in and thus secure a monopoly of lighting in the city. S.

ELECTRIC RAILWAYS.

(Special Correspondence.)

CHIPPEWA FALLS, WIS.—It is reported that C. R. Brant, of Madison, Wis., and his associates are considering the construction of an electric railway to La Crosse, via Galesville. C.

BOZEMAN, MONT.—The Gallatin Valley Electric Railway Company will build a twenty-five mile extension from Bozeman, Hot Springs northward through Belgrade to the Dry Creek territory. C.

MEDORA, N. D.—The Northern Pacific Railway Company has a crew of engineers at work in the Bad Lands with a view to the electrification of a considerable portion of the road near Little Missouri. C.

EAST TROY, WIS.—John I. Beggs, of the Milwaukee Electric Railway and Light Company, states that work on the extension of the electric railroad to Fayette, Elkhorn and Delavan will be started in the spring. C.

REDWOOD CITY, CAL.—Preliminary surveys are being made for an electric railway from this city to La Honda. The main backer of the proposed railroad is A. Schiling, of the Stauffer Chemical Company.

CLARINDA, IOWA.—W. S. Farquhar, I. H. Taggart, Jos. A. McKinley and others have incorporated the Iowa & Southwestern Railway Company, with a capital stock of $300,000, to build an interurban to Blanchard, Iowa. C.

MILWAUKEE, WIS.—The Milwaukee Western Electric Railway Company has been granted permission to construct a line to Beaver Dam, Wis., a distance of fifty-six miles, with a division from Sussex through Pewaukee to Waukesha. C.

ST. LOUIS, MO.—J. M. Longenecker, acting for the minority bondholders of the Toledo & Indiana Railroad, has purchased that road at public sale for $1,006,000, or $99,000 more than the appraised value. The sale cancels an issue of $2,000,000 of stock.

MINERAL WELLS, TEX.—At a meeting held at the Crazy Wells $21,000 was raised to aid in building an interurban railway between this city and Fort Worth. A bonus of $60,000 is to be raised and held by trustees until the road is in actual operation.

ZANESVILLE, OHIO.—The survey of the Zanesville & Meigs Valley traction line has been completed and the financial end of the company will be arranged in a short time. It has been announced by officials of the road that the contract will be let by May 1.

BRIDGEPORT, CONN.—Twenty large double-truck closed trolley cars which are being built at Worcester for the Connecticut Company for use in the Bridgeport district will be delivered in January. The contract involves an expenditure of $132,000.

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IOWA CITY, IOWA.—The Commercial club has raised $20,000 towards the construction of an interurban road to Davenport. C.

PASADENA, CAL.—The Pasadena Rapid Transit Company has secured all the right-of-way for their line between here and Los Angeles. The surveys have been completed and all that remains is the letting of the contract.

SANTA BARBARA, CAL.—The council has granted the petition presented by Atorney H. C. Booth, of the Santa Barbara Consolidated Railway Company, for a franchise for an electric street railway on State and Sola streets of this city.

SHEBOYGAN, WIS.—The Sheboygan Light, Power and Railway Company is planning to install a steam turbine of 1,500 horsepower at its plant at Sheboygan. The plant now can generate 2,500 horsepower. It was established about five years ago. M.

OAKLAND, CAL.—It has been announced that the Northern Electric Company will secure an outlet on San Francisco Bay and enter into competition with the Southern Pacific and Santa Fe systems for the interior traffic of the bay cities.

LOS ANGELES, CAL.—A meeting of the stockholders of the Los Angeles-Pacific Company will be held on January 6 to vote upon the issue of $20,000,000 in bonds, the proceeds to be used for improvements and extensions of the company's lines.

DELPHI, IND.—The Logansport, Frankfort & Indianapolis Traction Company has asked the commissioners of Carroll County for a franchise to construct an interurban line on the Michigan road through Washington, Burlington and Carrollton townships. S.

EVELETH, MINN.—E. M. Prindle and W. M. Prindle, of Duluth, have applied for a franchise to build an electric line between Virginia to this city. The company proposes to run passenger cars, with accommodation for freight, baggage and United States mail.

JANESVILLE, WIS.—The Janesville Street Railway Company has been sold to a corporation of New York capitalists, represented by Thos. F. Nolan, who will reorganize and reconstruct the entire system, increasing the trackage from five to ten miles and will put on new cars.

BINGHAMTON, N. Y.—As a result of a conference the railroad between Sayre and Towanda, Pa., is practically assured. The Towand interests by which the road will be built have already subsvcribed $200,000. When completed, this road will connect Elmira, Corning, Waverly and Binghamton.

RICHMOND, IND.—The Commissioners of Wayne County have refunded to the Terre Haute, Indianapolis & Eastern Traction Company $4,780 taxes paid to the county listed on the item of "cash on hand." The Supreme Court held that the cash on hand was included in an item covered by the State Tax Board, and should not be included by local tax boards. S.

MARTINSVILLE, IND.—The city council has refused to renew the franchise of the Capital Traction Company, which proposes to build a traction line encircling Indianapolis connecting Martinsville, Danville, Lebanon, Frankfort, Noblesville, Greenfield and Franklin —all county-seat towns. The council promised to renew the franchise as soon as the company commenced work on the road. S.

DENVER, COLO.—It has been announced that construction of the line from Grand Junction to Fruita would begin in a short time and that the road would be in operation by June 1. The line will be fifteen and one-half miles long and the newest type of interurban cars and electric locomotives will be used. The power question has been solved by the $60,000 addition to the electric light plant now under erection.

HOOPPOLE, ILL.—Arrangements have been completed by J. J. Burns of the Burns Construction Company, which is building the Tampico-Hooppole line, for an electric line from Tampico to Sterling and from Hooppole to Geneseo. The middle section from Tampico to Hooppole is completed to within three and a half miles from Hooppole, and this short remaining stretch will be completed as fast as the work can be done.

FREDERICK, MD.—A company with a capitalization of $1,500,000 will probably be formed from the consolidation of several trolley lines at present operating in this vicilnty. The roads involved are the Washington, Frederick & Gettysburg Railroad Company, the Frederick & Middletown Railway Company and the Jefferson & Braddock Heights Railway Company. It is expected that extensions will follow such a combination.

CHEHALIS, WASH.—Articles of incorporation have been filed by the Pe Ell & Columbia River Railway Company. The company proposes to run an electric railroad from Pe Ell southerly to tap the Columbia River near Cathlamet. They propose to use all the prerogatives of a common carrier, both as to handling freight and carrying passengers. The incorporators are W. C. Yeomans, Charles L. Yeomans, C. A. Doty and F. B. Hubbard.

AUSTIN, TEX.—A charter has been filed by the Oklahoma, Red River and Texas Railway Company, of Clarksville, Red River County. The charter calls for an eighty-mile road between Blossom and Mineola, through Lamar, Red River, Hopkins, Franklin and Wood counties. The incorporators are C. P. Moore, Frank Miesch, James T. Brown, J. L. Skinner, John T. Upchurch, John Miesch, E. L. Canterbury, W. H. Dickson and Roscoe Johnson.

NORWALK, O.—There is a rumor at present that the northern and eastern Ohio interurban railway companies intend to merge their interests. The combinations if carried out will include the following: Lake Shore Electric, the Cleveland, Southwestern & Columbus, the Northern Ohio, the Youngstown & Ohio River, the Youngstown & Southern, the Stark Electric, the Cleveland, Painesville & Eastern, and possibly the Western Ohio and the Eastern Ohio.

LAWTON, OKLA.—A franchise has been granted to the Lawton and Fort Sill Electric Railway Company which proposes to construct a street railway line in Lawton and an interurban to Fort Sill and Medicine Park, a distance of twenty miles. The company paid the expense of the election and has up a cash forfeit of $5,000 in case the line is not in operation in twelve months. Col. David L. Sleeper and Simon Smith of Oklahoma City and W. H. Pattie of Tulsa are the builders.

MONTICELLO, IND.—Arrangements are being made to hold elections in four townships in White County to vote on the proposition of levying a subsidy tax in aid of the construction of an interurban road by the Indiana Northwest Traction Company. The line, as proposed, will start at Battle Ground, where it will connect with the Fort Wayne & Wabash Valley traction line, and extend to Monticello, Rensselaer, Hammond and Chicago Heights, with a branch line from Monticello to Logansport. S.

TOLEDO, OHIO.—An order was recently made by Judge Manton of the Toledo common pleas court, confirming the sale of the Toledo Urban & Interurban Electric railway, the Toledo & Findlay Railway Company. The road was sold last August to George Harvey for $400,000 and turned over to the reorganized company, which embraced the Toledo Urban & Interurban Electric Railway and the Toledo, Bowling Green & Southern. Suits which were filed to set aside the sale have been withdrawn.

SCOTTSBURG, IND.—The preliminary survey of the route between this city and Madison for the construction of a road by the Cincinnati, Madison & Western Traction Company, has been completed. Men interested in the enterprise from Pittsburg, Cincinnati & Madison went over the route last week and announced that the road will be built at once. They also decided to build a large terminal station in this city at a point where the new road will connect with the Indianapolis & Louisville line. S.

HARRISBURG, PA.—A charter application of the Phoenixville Valley Forge & Strafford Street Railway Company has been approved by Governor Stuart. The new line will be ten miles long, connecting Phoenixville with Strafford by way of Valley Forge. The capital is $60,000 and the incorporators are Thomas E. O'Connell, of West Chester, president; Senator O. E. Thomson, John A. Dismant, C. F. Boden, Samuel W. Deininger, A. W. Kley, H. H. Gilkyson, Jr., E. C. Meir and I. E. Miller, Phoenixville.

PEORIA, ILL.—Another interurban is being promoted from this city, this is the Joliet, Peoria and Galesburg, which is being promoted by H. H. Haines and is alleged to have the backing of J. P. Morgan interests. While in Rock Island the promoter who is the president of the Hampton Traction Company, operating several lines in the state of Pennsylvania, stated that his company considers Illinois a favorable state to build in. The line will be first built between Peoria, Joliet and Rock Island and later build to Galesburg. V.

DES MOINES, IA.—Articles of incorporation have been filed by the Iowa & Southwestern Railway Company, which proposes to build an interurban from Clarinda, in Page County, to Blanchard, Ia., by way of College Springs. The capital stock of the company is $300,000. The incorporators are: W. S. Farquhar, I. H. Taggart, Joseph A. McKinley, O. C. Wetmore, A. M. Abbott, J. M. Rumbaugh, J. N. Miller, A. F. Galloway, W. N. Dewhurst, John H. Walkinshaw, Ed F. Rose, G. William Richardson, C. M. Henn, V. Graff and T. E. Powers. The head offices of the company will be at Clarinda, Ia.

SAN FRANCISCO, CAL.—The Oregon Short Line Railway Company has completed the purchase of the San Francisco, Idaho & Montana railroad, in which Salt Lake capital was interested, and which was organized to build an electric line from Caldwell, Ida., south to Jordan Valley, Oregon, thence southwest via Duncan and south to Winnemucca. The contract which was awarded to D. M. Brogan of Vail, Ore., by the original promoters will be completed under the supervision of Oregon Short Line engineers. A new line which is being built along the Snake river will be extended by the Oregon Short Line to make connection with the line just purchased. This Snake River line was originally projected from Buhl to Nyssa.

SPARTA, WIS.—The construction of an interurban line between Sparta and Winona, Minn., via La Crosse, has been practically assured by the granting of a fifty-year franchise to the La Crosse Water Power Company by the La Crosse City Council. The electric road will be about fifty miles long and will cost about $3,000,000. Under the franchise granted at La Crosse, steam may not be used at any time as a motive power, the construction will be under the board of public works and the city engineer, not more than seven cars of freight may be hauled at one time, and several other restrictions are stipulated. It is stated that the power will be obtained from the Hatfield dams. W. J. Ferris is president of the company which will build the road. M.

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TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

MARLIN, TEX.—The city has granted a franchise to the Independent Telephone Company. P.

MANDAN, N. D.—The North Dakota Independent Telephone Company has been incorporated with a capital of $50,000. P.

PARK RIVER, N. D.—The Park River Telephone Company has been incorporated with a capital stock of $20,000. P.

PAXTON, NEB.—The Paxton & Elsie Telephone Company has been incorporated with a capital stock of $5,000. P.

CAMP CROOK, S. D.—The Belle Fourche Rural Telephone Company is building a line down the Little Missouri River to Camp Crook. C.

WINONA, MINN.—The Northwestern Telephone Exchange Company is planning the installation of a new toll board in the exchange building. C.

NOONAN, N. D.—Henry J. Kotschevar, Rolf Reite and Albert H. Makee, all of Noonan, incorporated the Mutual Telephone Company; capital $15,000. C.

FAIRVIEW, PA.—The Fairview Independent Telephone Company has recently been incorporated by Job Morley. The company is capitalized at $10,000.

MARTIN, N. D.—A. H. Nikolaus, G. Kalk, Karl Schauer, all of Martin, have incorporated the Sheridan County Telephone Company, with a capital of $20,000. C.

RUGBY, N. D.—John Richey, Brazil, N. D., A. B. Fox, Brazil, N. D., and W. E. Fox, Rugby, N. D., incorporated the Western Telephone Association with a capital of $20,000.

WHITEFISH, MONT.—The Big Bend Light and Power Company will take charge of the local telephone system formerly owned by Carl Green. The central office will be moved, a 200-drop switchboard installed and a 200-pair cable put up. C.

NEWTON, IA.—The Jasper County Telephone Company has been merged with the Iowa company after several months of negotiation. A new switchboard to cost $15,000 will be installed.

INDIO, CAL.—The Corona Mutual Telephone and Telegraph Company has filed its articles of incorporation here. The incorporators are: J. B. Hooch, Andrew Lindberg and O. M. Grizzle of Corona. A.

PORT LAVACA, TEX.—The Port Lavaca Telephone Company has begun construction work on its twenty-five mile line to Port O'Connor. It is expected that the line will be in operation in a very short time.

KINGMAN, IND.—Articles of incorporation have been issued by the Secretary of State to the Kingman Telephone Company. The capital stock is $10,000 and the incorporators are C. L. Steinbaugh and J. W. Black.

TOLEDO, OHIO—The Lima Telephone Company has just taken over the Delphos Home Telephone plant at Delphos, O. D. J. Cable, president of the former company, announces that there will be changes in the management of the newly acquired concern. H.

VERMILION, O.—It is reported that the Vermilion Telephone Company, operating the independent exchange here, has consummated a deal whereby it will take over the Bell exchange and franchise. Long distance connections wilil be made with both the United States and Bell lines.

FOLSOMVILLE, IND.—The Folsomville Farmers' Mutual Telephone Company, has been incorporated; capital, $10,000. The company proposes to build, equip and operate a telephone exchange and system in Folsomville and throughout the surrounding communities, A. M. Fisner, Robert Perigo, P. D. Cannon, J. W. Roberts, Robert Skelton and W. N. Boyd are directors. S.

GUTHRIE, OKLA.—On complaint of telephone expert Player, the corporation commission cited ten local telephone companies at Ardmore, Atlus, Custer City, Billings, Weatherford, Hastings, Jennings, Kingfisher, Nowata and Marshall, to appear January 11 and show why they should not be fined for contempt for failure to submit additional data asked in connection with their reports.

INDIANAPOLIS, IND.—William Fortune, president of the Indianapolis Company and vice-president of the New Long-Distance Telephone Company, has made a statement to the effect that a controlling interest of these properties had been purchased by the Morgan syndicate of New York. Mr. Fortune states that the properties will continue independent and that the companies will pursue the same policies as in the past. He advises the people that the properties of both companies will be developed and extended during the coming year so as to almost double the present capacity and that excellent service will be given. Mr. Fortune says that the transfer will prove wonderfully advantageous to the Independent companies in Indiana and that nothing will be left undone for want of finance. S.

JACKSON, MISS.—The Mississippi Home Telephone Company is pushing work with all possible despatch on its long-distance lines into Jackson and it has been announced by officials that connections with Jackson will be made by January 1. One of these lines is between Jackson and Meridian and construction forces are now at work on it near Lake, Miss. A three-circuit system will be installed and an automatic switchboard will do away with a central-system. Toll stations will be established at all of the towns between Meridian and Jackson. The Mississippi Home Telephone Company also has a line in progress of construction between Jackson and Hattiesburg which will be completed by the time the corporation has its Jackson local exchange in readiness for service. B.

ELECTRICAL SECURITIES.

The year-end requirements on the money market have had a somewhat restraining influence on the market during the past few weeks and although there have been many fluctuations, they were within rather narrow limits. Owing to the cases of the Standard Oil and American Tobacco companies, which are still pending in the Supreme Court, there is as yet considerable uncertainty which is detrimental to speculation and which it is feared may in some degree retard business activities. On the whole, however, prospects are very favorable, and still further increase in the values of securities may be expected.

The annual meeting of the Interborough-Metropolitan Company will be held on January 18 in New York City. Books closed December 24 and reopen January 18.

Chicago Railways rehabilitation expenditures on December 1 were $22,000,000. November earnings increased seventeen per cent, equaling the best previous month since the company was formed.

The Massachusetts Railroad Commissioners have approved the issue of Norfolk & Bristol Street Railway Company $50,000 twenty year five per cent equipment bonds.

The American Telephone and Telegraph Company has notified the Chicago Stock Exchange that capital stock of a par value of $255,284,000 is outstanding and convertible bonds not exchanged to amount of $4,735,000 outstanding.

The annual meeting of the stockholders of the Minneapolis General Electric Company will be held January 3.

Williams, McConnell & Coleman are offering the bonds of the Empire District Electric Company, which owns light and power companies in Missouri and Kansas. Estimates of earnings for 1911 show approximately four times interest requirements. The company has favorable franchises and operates in a developing territory.

Notwithstanding the fact that the law does not give the Texas State Railroad Commission jurisdiction of electric railways where they do not transport freight, that body has agreed to approve the bond issue of the Galveston-Houston Interurban Electric Railway Company in order to overcome any technicality that might stand in the way of the sale of the bonds.

At the annual meeting of the Massachusetts Electric Company it was voted to issue gold coupon notes to the amount of $5,000,000, payable at such time and at such rate of interest as the trustees may deem expedient. Of the proceeds, $3,500,000 will be used to retire a similar issue maturing January 1, 1910; the balance will be used for the general purposes of the companies. Trustees were re-elected.

Negotiations have been closed for the placing of a large block of Mahoning & Shenango Railway and Light first consolidated refunding mortgage five per cent bonds. The present issue, which amounts to $3,800,000 is being handled by Lee, Higginson & Company and Blair & Company, who are offering the unsold balance at ninety-seven and interest, yielding nearly five and five-eighths per cent. The bonds are redeemable at 105 and interest on any interest date, and constitute substantially a closed mortgage.

It is stated that the Chicago-Milwaukee Electric bondholders will take the road from the receivers in January and operate under new management. According to advices from Chicago, the net earnings in the last fiscal year were about $159,000, or over one per cent on the outstanding $15,000,000 of bonds. The $10,000,000 of Wisconsin Division bonds are held largely in Canada. The $5,000,000 of Illinois Division bonds were originally held in the Netherlands, but nearly all the Dutch holdings have recently been secured by Canadian and American interests.

N. W. Harris & Company, E. H. Rollins & Sons and Perry, Coffin & Burr have purchased $2,000,000 Southern California Edison Company general mortgage five per cent bonds, due November 1, 1939. This company owns and operates the electric and gas properties formerly owned by the Edison Electric Company of Los Angeles, serving in addition to Los Angeles, Pasadena, Redlands, Riverside and other cities, the total population served being approximately 600,000. The bonds will be offered for sale by the bankers in the near future.

DIVIDENDS.

American Cities Railway and Light Company; one and one-half per cent on both common and preferred, payable January 1.

Boston & Worcester Electric Companies; $1 per share on preferred stock, payable January 1.

Chicago City Railway Company; quarterly dividend of one and one-half per cent, payable December 30.

Cincinnati Gas and Electric Company; quarterly dividend of one and three-sixteenths per cent, payable January 1.

Cincinnati Traction Company; quarterly dividend of one and one-half per cent, payable January 1.

Duluth Edison Electric Company; regular quarterly dividend of one and one-half per cent, payable January 1.

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Massachusetts Lighting Companies; quarterly dividend of one and one-half per cent, and an extra dividend of one-quarter per cent, payable January 15.

Manila Electric Railroad and Lighting Corporation; one per cent on common stock, payable December 31.

Northwestern Elevated Railroad Company; quarterly preferred dividend of one per cent, payable January 18.

Otis Elevator Company; quarterly dividend of one and one-half per cent, payable January 15.

Reading Traction Company; a dividend of seventy-five cents per share, payable January 1 to stockholders of record December 14.

Tri-City Railway and Light Company; regular quarterly dividend of one and one-half per cent, payable January 3.

United States Light and Heating Company; semi-annual dividend of three and one-half per cent on preferred.

Westinghouse Electric and Manufacturing Company; quarterly dividend of one and three-quarter per cent on preferred, payable January 15.

NEW YORK.

	Dec. 20.	Dec. 13.
Allis-Chalmers common	15	15⅛
Allis-Chalmers preferred	54½	54
Amalgamated Copper	88	86⅞
American Tel. & Cable	*80	*80
American Tel. & Tel.	142	142⅞
Brooklyn Rapid Transit	80	80¼
General Electric	159¾	160¼
Interborough-Metropolitan common	24⅛	24½
Interborough-Metropolitan preferred	60½	61¾
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	91	91¼
Mackay Companies (Postal Telegraph and Cables) preferred	77	76¼
Manhattan Elevated	139	140¼
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	123½	123½
U. S. Steel common	92½	90⅞
U. S. Steel preferred	125¼	125½
Western Union	78⅛	77¾
Westinghouse common	82¼	84½
Westinghouse preferred	133	130

BOSTON.

	Dec. 20.	Dec. 13.
American Tel. & Tel.	142	142⅞
Edison Elec. Illuminating	249	...
General Electric	159¾	160¼
Massachusetts Electric common	15½	15
Massachusetts Electric preferred	79	76
New England Telephone	137	135½
Western Tel. & Tel. common	12¾	12
Western Tel. & Tel. preferred	92	89½

PHILADELPHIA.

	Dec. 20.	Dec. 13.
American Railways	46½	45¼
Electric Company of America	12⅜	12¼
Electric Storage Battery common	56	57
Electric Storage Battery preferred	56	57
Philadelphia Electric	13½	13½
Philadelphia Rapid Transit	27½	28¼
Philadelphia Traction	89	88¾
Union Traction	52¾	52½

CHICAGO.

	Dec. 20.	Dec. 13.
Chicago Railways, Series 1	103	95
Chicago Railways, Series 2	32½	30½
Chicago Subway	4¾	4¾
Chicago Telephone	135	135½
Commonwealth Edison	118	117½
Metropolitan Elevated common	19	16½
Metropolitan Elevated preferred	58	53
National Carbon common	103	102½
National Carbon preferred	123	123

PERSONAL MENTION.

H. SMITH of the Chicago General Electric Company has purchased an interest in the Monroe Electric Light and Power Company, and will attend personally to the management of the company.

V. J. DIEFENDERFER, formerly manager of the Birmingham office of the Allis-Chalmers Company, has resigned to accept a new position. Mr. Diefenderfer is at present with the Hardie-Tynes Manufacturing Company, of Birmingham, Ala., as the sales manager.

W. C. WEBSTER, who has for several years been New York manager of the Westinghouse Electric and Manufacturing Company, has recently resigned his position with that company. Mr. Webster formerly acted as vice-president of the Westinghouse company and has for some time been their New York representative.

O. S. MORE has resigned his position in the engineering department of the Western Electric Company. He will succeed B. F. Bailey, chief engineer of the Fairbanks-Morse Electrical Manufacturing Company, of Indianapolis, Ind., who has joined the faculty of the University of Michigan.

L. A. CROWELL, head of the lamp department of the Westinghouse Electric and Manufacturing Company, recently addressed the Consolidated Electric Lighting Company Association at Montpelier, Vt., on the subject of "Tungsten Lamps." Mr. Crowell gave an interesting and detailed account of the methods of lamp manufacture which are used by his company.

JOSEPH E. WAYNE, of Philadelphia, was recently appointed superintendent of the York Railways Company to succeed F. P. Newman, who has become General Manager of the Johnstown Traction Company, at Johnstown, Pa. Mr. Wayne was born in Philadelphia and is probably the youngest railway superintendent in the country. He spent three years with the New Jersey Public Service Corporation, drilling himself for the responsible position which he afterwards accepted with the United Railroads of San Francisco, California. After remaining there for three years he came to York and became general superintendent of the York Street Railway, afterward resigning to accept the position of superintendent of the Waynesboro, Chambersburg and Greencastle Street Railway.

PROPOSALS.

POST OFFICE, MANCHESTER, N. H.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 13, 1910, for the construction (complete) of the extension to the United States Post Office and Court House at Manchester, N. H., in accordance with the drawings and specifications, copies of which may be had at the office of the custodian at Manchester, N. H., or at the Supervising Architect's office.

POST OFFICE, EMPORIA, KAN.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 14, 1910, for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Emporia, Kan., in accordance with the drawings and specifications, copies of which may be had from the Custodian at Emporia, Kan., or at the Supervising Architect's office.

POST OFFICE, HENDERSON, N. C.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 17, 1910, and then opened, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Henderson, N. C., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Henderson, N. C., or at the Supervising Architect's office.

POST OFFICE, LA CROSSE, WIS.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 19, 1910, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of an extension, remodeling, etc., to the United States Post Office and Court House at La Crosse, Wis., in accordance with drawings and specifications, copies of which may be obtained from the Custodian at La Crosse, Wis., or at the Supervising Architect's office.

NEW PUBLICATIONS.

JOURNAL OF THE UNITED STATES ARTILLERY.—With Vol. 32, No. 3 (November-December, 1909) of this publication is issued a supplementary volume devoted to an "Index to Current Military Literature" which covers a big field of American and foreign journals and other publications. A large number of electrical entries are included. The regular issue of the Journal contains the usual variety of articles of special interest to artillery men, together with various abstracts and translations from contemporaneous technical literature under the head of "Professional Notes," among which are some articles of direct electrical interest.

UNIVERSITY OF ILLINOIS, MINING DEPARTMENT.—The department of mining engineering of the University of Illinois has recently issued a circular descriptive of the course of mining engineering lately established at the university. This circular can be obtained by applying to the registrar of the University, Urbana, Ill. The department of mining is especially fortunate in having located at the University of Illinois the first substation of the general testing station of the Technologic Branch of the United States Geological Survey. At this station mine bosses and others are trained in the use of oxygen helmets. The station is a great advantage to the students in mining engineering, as it brings them in contact with the men engaged in mining practice from all parts of Illinois and the surrounding states.

NEW INCORPORATIONS.

CHICAGO, ILL.—The Reliable Electric Company has been incorporated to manufacture electrical supplies and equipment, with a capital of $30,000. The incorporators are: F. W. McNeal, O. C. Junge and G. W. Dodormer.

JERSEY CITY, N. J.—The American "Z" Electric Lamp Company has been incorporated to manufacture electric lamps. The capital is $1,000,000, and the incorporators are: H. Brunner, A. Romberg, Paris, France; B. Treacy, Jersey City.

CAMDEN, N. J.—The Automatic Street Railway Switch Company has been incorporated to manufacture automatic railway switches. The incorporators are: A. M. Haldeman, J. G. Ryan, C. Blake, of Philadelphia. The capital is $50,000.

ATLANTIC CITY, N. J.—The Cuthbert Transmission Syndicate, Incorporated, has been incorporated to manufacture power and speed transmission appliances. The capital is $75,000, and the incorporators are E. F. Hall, A. F. Hall and H. A. Locha, Atlantic City.

NEW YORK, N. Y.—The Friedrich Electric and Manufacturing Company has been incorporated to manufacture X-ray tubes, interrupters, etc., and to engage in electrical work. The capital stock is $60,000, and the incorporators are: J. J. Sullivan, H. E. von Pein and T. Faber, New York city.

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NEW YORK, N. Y.—The S. K. F. Ball Bearing Company has been incorporated to do a mechanical and electrical engineering business, with a capital of $50,000. The incorporators are: S. T. Hubbard, Yonkers; F. H. Poor, Morristown, N. J.; A. Calander, Gothenburg, Sweden.

NEW HAVEN, CONN.—The New Haven Electric Manufacturing Company, of North Haven, has filed a certificate of incorporation in the office of the Secretary of State. The company is capitalized at $50,000, but will begin business with $5,000. The incorporators are John Frum of Cheshire, Harry C. Barber of Plainville, and Epaphroditus Peck of Bristol.

WHITE PLAINS, N. Y.—The Standard Connector Company has been incorporated with the Secretary of State, to make and sell electric connectors. The capital stock is placed at $30,000, consisting of shares of $100 each and the directors for the first year are Samuel L. Chamberlain, of New York city; Frederick J. Danks, of Brooklyn; Herbert C. Chamberlain, of Yonkers, and F. N. Brundage and C. S. Ashley, of Cranford, N. J.

LEGAL NOTES.

JUDICIAL APPROVAL OF IMPORTANT NEW USE OF TELEPHONE—The use of the telephone in business has given rise to some new and interesting legal questions. Already there have been a number of cases in which conversations over the telephone have been held admissible in evidence. Another, apparently new, and very important question is the subject of decision in the recent case of Gilpin vs. Savage, 112 New York Supplement, 802, where the question was as to whether a presentment or demand for payment of a note, made over the telephone, was a sufficient presentation, and whether the bank was relieved of the obligation, under the facts, of actually going to the makers' house, where the note was payable, and making a further presentation and demand there. The Supreme Court of New York, trial term, Erie County, says that the researches of counsel and the court were unable to discover any decided case directly in point. But it seems to the court that all the essentials of a good presentation were met. The use of the modern invention of the telephone, the court says, is recognized by the courts. Commercial transactions and conversations had over the telephone have been recognized as of the same binding force as where the parties talked face to face. The telephone is simply an instrument by which two persons may talk directly to each other. Suppose the holder of a note should call to the maker from across a street, as the maker stood in his doorway, and notify him that he had his note and ask payment. Would not such a demand be deemed in law a proper presentment, although the street separated the person holding the note and the actual place of payment? Can it make any substantial difference because the person holding the note happens to be some blocks away, provided he is able to reach the maker over the telephone and talk directly to him in that way?

POWER OF MUNICIPALITY TO EXCLUDE TELEPHONE COMPANY FROM PARTICULAR STREET—The only question before the Supreme Court of Michigan in the case of Village of Jonesville vs. Southern Michigan Telephone Company, 118 Northwestern Reporter, 736, was, assuming that the council of said village had a right to impose such reasonable regulations as it saw fit, as a condition precedent to the entry of the defendant company, whether or not it could, as one of such reasonable regulations, absolutely prohibit the company from going upon a particular street. There was cited a decision in which it was stated that under the police power municipalities may prohibit the erection of poles in places, and in a manner which will injure or incommode the public. Does this power, so defined, confer upon the municipality the right to wholly exclude the poles and wires from a single block of a single street? The court thinks it does, unless it is made to appear that by the adoption of such a regulation the telephone company is cut off from communication with persons it desires to reach and whom by law it is obliged to serve. The complainant in this case urged that this one block was its main business block, and that to permit it to be incumbered with poles and wires would not only render it unsightly, but would appreciably increase the risk from fire by making it more difficult for the fire department to erect ladders and reach a conflagration. The mere fact that the route designated by the municipality was less convenient or involved on the part of the telephone company a larger expenditure was of no consequence so long as the company was not thereby prevented from reaching all those it desired to serve or who desired service from it. Where a municipality, in the exercise of its inherent police power, prescribes the manner, character or place of construction of a contemplated line, the telephone company must comply with such regulation and exercise its right of entry under the general powers conferred by the state subject to them.

RIGHT OF RAILROAD COMPANIES TO CONSTRUCT PARTNERSHIP TELEPHONE OR TELEGRAPH LINES ON QUALIFIED RIGHTS-OF-WAY—The St. Louis Court of Appeals says, in the case of the St. Louis, Iron Mountain & Southern Railway Company vs. Cape Girardeau Bell Telephone Company, 114 Southwestern Reporter, 586, that in Missouri the estate of a railroad company in land acquired for railroad purposes, right-of-way, etc., amounts to an easement only. The fee to lands thus occupied continues to reside in the adjacent landowners. But the telegraph and telephone are conveniences so essential, if not indispensable, to the purpose of a railroad, that a railroad company may establish and construct one or both along the line of its right-of-way to be used in the prosecution of its business in operating the road, and such use, essential as it is, is not an additional servitude upon the fee. In other words, such conveniences essential to the prosecution of the calling for which the railroad right-of-way was acquired are within the contemplation of the original grant for railroad purposes, and therefore regarded as not an additional servitude upon the fee of the adjacent landowner. Authorities to this effect are numerous and sound in principle. The railroad company therefore may construct and maintain such telephone or telegraph line on the right-of-way for its own purpose, or it may contract with another to erect and maintain the line and furnish the required service to the end of transmitting intelligence with respect to the operation of its trains and other needs of its calling. In such circumstances the telephone is not an additional servitude upon the fee of the adjacent owner, but is viewed as a legitimate development of the easement acquired for railroad purposes. Nevertheless, in so far as the telegraph or telephone company thus rightfully occupying the right-of-way serves the general public as a commercial enterprise, distinct from the avocation of the railroad, it constitutes a use of the right-of-way easement other than for railroad purposes, and it is therefore a servitude not contemplated in the original grant and a burden upon the fee of which the adjacent owner may rightfully complain. But another railroad company, which likewise has but an easement to use the adjoining land for railroad purposes, cannot, as an abutter, complain of such commercial use of the telephone for the reason that its easement for railroad purposes only is in no way impaired or infringed thereby.

INDUSTRIAL ITEMS.

THE AUTOMATIC ELECTRIC COMPANY, Chicago, Ill., is distributing a booklet describing and illustrating automatic traffic distributors in connection with manual telephone equipment.

THE BUCKEYE ELECTRIC COMPANY, Cleveland, Ohio, is distributing a unique and attractive folder containing an article relative to the business policy of the Buckeye Company and giving convincing reasons why Buckeye lamps should be used.

THE ECONOMY DRAWING TABLE COMPANY, Toledo, Ohio, is distributing a catalogue devoted to drawing tables, sectional filing cases, and other furniture of this nature. It contains illustrations and descriptions of various drawing tables, engineers' desks, drawing files, etc.

THE H. T. PAISTE COMPANY, Philadelphia, Pa., has recently distributed the December number of its publication entitled "Paistery." This issue contains illustrated descriptions of sign receptacles, sockets, pull sockets, wooden panel boxes, panel cut outs for rotary snap switches in addition to the customary interesting editorials.

THE STEEL CITY ELECTRICAL COMPANY, 1207-19 Washington Avenue, Pittsburg, Pa., has recently distributed a folder describing and illustrating Star bushings. These bushings, according to the circular, are made of malleable iron, are rust-proof, have wide finger grips and are accurately threaded. They are shipped in boxes containing 100 each.

THE ROCK ISLAND BATTERY COMPANY, Cincinnati, O., has recently sent out a catalogue devoted to Rock Island Dry cells. The publication contains descriptions and illustrations of the various types of cells dealing fully with "Sparker" special cells for use on automobiles. The catalogue contains a description of the Rock Island battery ammeter ranging from zero to thirty amperes.

THE MINNEAPOLIS STEEL AND MACHINERY COMPANY, Minneapolis, Minn., has secured a contract to equip a mining plant at Parral, Mex., and will install the following electrical machinery: Three 250-kilowatt, 480-volt engine type alternators and one 500-kilowatt alernator, with switchboards and exciters. The equipment is to be furnished by the Allis-Chalmers Company, also of Milwaukee.

THE BATTERY COMPANY, Milwaukee, Wis., has recently distributed Bulletin No. 1, which gives descriptions and prices of battery lighting plants using the Gugler primary battery lighting system. This system is a new method of generating electrical energy, as adopted to electric lighting, which has been reduced to commercial practice. The bulletin illustrates applications of this system for both lighting and power purposes; gives views of the equipment supplied with each system and other interesting data in connection with the subject.

THE SPRAGUE ELECTRIC COMPANY, New York, N. Y., is sending out an attractive folder, No. 434, describing and listing its line of stamped steel knockout boxes known as Multilets. As the name implies, one box is intended for many uses. Multilets are made in two sizes with a set of covers for each size. Multilets can thus be used for any necessary combination with rigid conduit, Greenfield flexible steel conduit or BX conductors. They accommodate standard fittings and do not require special fittings for special work.

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THE AMERICAN GAS AND ELECTRIC COMPANY, of Atlantic City, N. J., has selected Babcock & Wilcox boilers for its new power house. Each of the four 500-horsepower boilers is to be equipped with a six-retort Taylor gravity underfeed stoker.

THE H. W. JOHNS-MANVILLE COMPANY, New York, N. Y., has recently appointed H. H. Seaman, assistant manager of its New York electrical department. For seven years, Mr. Seaman was associated with the Electric Storage Battery Company at Philadelphia, Detroit and Cleveland, and for the past two years, has been manager of their Atlanta office.

THE PHOENIX GLASS COMPANY, Pittsburg, Pa., has recently sent out Catalogue C describing the new Pheno system of illumination with tungsten lamps. This system consists of a line of carefully designed, scientifically correct illuminating devices. These devices known as Pheno Reflectors are claimed to have perfect diffusion combined with strong reflecting qualities. This catalogue also describes and illustrates the Deep Tungsten Holder to be used in connection with Pheno reflectors.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is distributing Bulletin No. 89 which describes type BW polyphase induction motors. These motors combine wound rotor starting characteristics, high starting torque, minimum starting current, squirrel cage operating characteristics and simplicity of control. They are suitable for practically all installations in which squirrel cage motors can be used and this bulletin contains several views of the application of them. It also contains curves and diagrams of general interest.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, O., announces the removal of its office and factory to (Oakley) Cincinnati, O., where greatly increased facilities enable it to satisfactorily meet the requirements of its customers. It also announces that it has purchased the foundry of the Model Foundry Company and with the added facilities obtained expect to produce even better work than heretofore. This company is also distributing two interesting booklets devoted to isolated lighting plants and electricity in a modern bakery respectively.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., has sent out the December issue of "Trumbull Cheer," its regular monthly publication. It contains several interesting Christmas stories, some good editorials and in addition an illustrated description of the improvements and changes made in Trumbull switches during the past few months. This company is also sending out a Christmas token in the form of a Lincoln penny and offers fifty dollars in prizes for those who, according to a competent corps of judges make the best use of this penny.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing three new circulars descriptive of conduletes and their application. A number of illustrations show the method of employing conduletes in connection with pole type transformers, interior lighting, etc. This company is also distributing a circular descriptive of its type A meter connecting blocks, intended for use in installing and testing induction type service meters, and a circular devoted to a description to alphaduct flexible conduit. Particular attention is called to the fact that this conduit is flexible, moisture proof and will withstand any climatic changes.

THE EXCELLO ARC LAMP COMPANY, New York and Chicago, has recently distributed a booklet entitled "Modern Business Street Lighting." This publication contains a brief history of the arc lamp and describes the extent to which the flaming arc lamp is used in Europe. It contains curves showing the distribution of light from Excello Flaming arc lamps and also a comprehensive table comparing the expenses incurred in maintaining one Excello lamp and three enclosed arc lamps. Curves showing the comparison of expenses and the comparison of illumination are also reproduced. The booklet also calls attention to a reproduction of a photograph of a Chicago business street illuminated by Excello flaming arc lamps.

THE CROWN WOVEN WIRE BRUSH COMPANY, Salem, Mass., manufacturers of woven wire dynamo brushes, composite brushes and wire specialties, has recently sent out a catalogue and price list devoted to these products. There have been many changes in the use of dynamo brushes but for low voltage use Crown brushes have been extensively used. These brushes have also been extensively used on machines used in the manufacture of electro-chemical products. Also a very large demand has been created in the automobile industry for Crown brushes for use on magneto igniters. All of these types of brushes are described and illustrated in the catalogue. The company announces that large quantities of its brushes are being shipped to Canada, England, Germany and other foreign countries.

THE ALLIS-CHALMERS COMPANY, of Milwaukee, Wis., announces that its San Francisco office has been moved from 599 Mission Street to the Byron Jackson Building, 160 Second Street, corner Natoma Street, in order to accommodate its increased selling force. The territory is in charge of R. B. Elder, who has been engaged in engineering on the Pacific Coast for the past fourteen years. An attractive office has been provided with greatly increased facilities for the handling of the company's products, and with the advantages of a warehouse containing a complete assortment of small machinery such as breakers, motors, transformers, repair parts, etc., prompt and satisfactory service is assured. The large West Allis Works and other plants of the company are equipped to ship to the Coast on short notice, any type of prime mover, including steam turbines, gas engines and hydraulic turbines, electrical machinery of all kinds, mining, crushing and cement machinery, saw mill, flour mill and power transmitting machinery.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has just issued Bulletin No. 4702 showing the various advantages to be gained by the use of the Horizontal Curtis Steam Turbine in connection with the pumping equipment of fire boats. This turbine is especially adapted to such work since it operates most efficiently at the high peripheral speed necessary to obtain the maximum output with centrifugal pumps. Two pamphlets are also being sent out which should be of special interest to owners of either electric or gasoline automobiles. The one illustrates and describes the method of charging electric automobiles from alternating-current circuits by means of the General Electric rectifiers, the other shows the advantage of the use of not only electric light in connection with gasoline cars, but the use of the tungsten lamp to produce this light. The pamphlet contains a wiring diagram which will be of assistance to one contemplating the wiring of his machine. The number of these pamphlets are 3878 and 3874 respectively. Bulletin No. 4708, just issued by the same company, describes in more or less detail an instrument recently placed upon the market by them for use in the testing of wattmeters. The meter here described possesses all the requirements for rapid and accurate testing. It is portable and is inclosed in a neat wooden case which is provided with a leather handle.

DATES AHEAD.

South Dakota State Independent Telephone Association, Hudson, South Dakota, Jan. 11-13, 1910.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

Wisconsin Electrical Association. Annual convention, Milwaukee, Wis., January 19 and 20, 1910.

San Francisco Electrical Exposition, January 29, February 5, 1910.

Toledo Electrical Show, Coliseum, Toledo, Ohio, January 31-February 5, 1910.

Philadelphia Electrical Exposition, Philadelphia, Pa., February 14-26, 1910.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) December 14, 1909.

942,885. METHOD OF AND APPARATUS FOR REPEATING TELEPHONE-CURRENTS. Percy A. Campbell, Bloomfield, N. J. Filed July 20, 1909. A series of condensers are charged in turn from an incoming circuit, the plates of the charged condensers are mechanically separated in turn, and the condensers are finally discharged in turn in an outgoing circuit.

942,894. ELECTRIC HEATER. Robert Farren and Charles T. Clark, Cleveland, Ohio. Filed December 3, 1908. An electric water-heating device comprises a chamber having in it an arrangement of circulating pipes associated with the heating elements.

942,897. APPARATUS FOR RECEIVING SUBMARINE SOUNDS. Thomas A. Garrett, Reigate, and William Lucas, Crouch End, England. Filed August 31, 1909. Variations in the magnetism of a rod (connected at one end to the side of a vessel and carrying a mass at the other end) are detected by a telephone receiver, etc.

942,901. APPARATUS FOR ELECTRICALLY IGNITING GAS-BURNERS. Alfred J. Hill, Woodford Green, and Frederick C. D. Mann, Hayes, England. Filed January 4, 1909. Utilizes a spark gap and high-tension current.

942,911. SPEED-CHANGING MECHANISM. Emil E. Keller, Pittsburg, Pa. Filed November 14, 1905. A torque-controlled mechanism is dependent upon the operation of a number of

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independently operative electrically controlled clutches which separately transmit power.

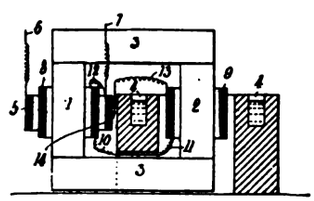
942,936. TIMING AND IGNITION DEVICE. William H. Saunders, New London, Conn. Filed August 31, 1908. Describes the make-and-break device and its connections associated with the spark plug of an internal-combustion engine.

942,960. STARTING-SWITCH FOR ELECTRIC MOTORS. Edmund Garside, Darlington, England, assignor to Engineering Instruments Limited, Darlington, England. Filed September 8, 1909. A contact on a carriage fixed to the piston of a dashpot engages with the resistance terminals. The carriage may be connected at will to the operating switch arm.

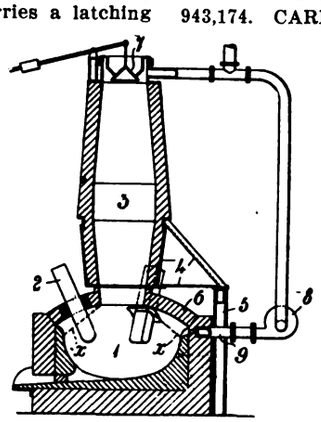
942,961. TRANSFORMER-FURNACE. Eugen A. A. Grönwall, Axel R. Lindblad, and Otto Stålhane, Ludvika, Sweden. Filed May 2, 1907. Coils placed in the path of the leaking lines of force are devised so that the magnetomotive force generated by the coils will counteract the leaking lines of force from the primary coil of the furnace.

942,964. ELECTRIC-LIGHTING ATTACHMENT FOR BURGLAR-ALARM SYSTEMS. Maximilian F. Juruick, New York, N. Y., assignor to Electric Bank Protection Company. Filed August 16, 1907. One automatic drop operates an alarm and another the switch of a lighting circuit.

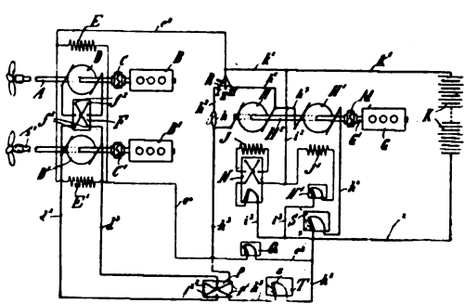
942,968. SAFETY DEVICE FOR ELEVATORS. John A. Miller, Baltimore, Md., assignor to John M. Thurston, trustee, Washington, D. C. Filed March 5, 1907. Renewed August 14, 1909. A normally closed safety circuit includes a series of door switches and a solenoid the core of which carries a latching detent to engage with a catch notch on a lock wheel mounted on the elevator shaft.



942,961.—TRANSFORMER-FURNACE.



943,224.—ELECTRIC FURNACE.



943,434.—SHIP'S SCREW-DRIVING MECHANISM FOR SUBMARINE BOATS.

942,981. ELECTRIC CONTROLLER. Clarence L. Taylor, Alliance, Ohio, assignor to The Morgan Engineering Company, Alliance, Ohio. Filed March 6, 1909. Resistance elements are sustained by the arms of a series of conducting bars supported in the frame.

942,990. STORAGE-BATTERY TANK. Theodore A. Willard, Cleveland, Ohio. Filed May 14, 1907. Between the outer casing of wood and the internal lining of lead are interposed layers of protective material of relatively high and low melting points.

943,011. CONTROL SYSTEM FOR ELECTRIC MOTORS. Arthur C. Eastwood, Cleveland, Ohio. Filed May 24, 1909. The fields for two or more armatures (arranged in parallel) are arranged in series with each other and with one only of the armatures.

943,016. ELECTRIC SWITCH. Monroe Guett, Hartford, Conn., assignor to The Hart & Hegeman Manufacturing Company, Hartford, Conn. Filed February 7, 1906. The faceplate has separate apertures in alinement with the contacts; there is a pair of shutter plates under the surface of the plate and movable transversely of these apertures, etc.

943,033. TELEPHONE-RECEIVER SUPPORT. William J. Mogridge, Spokane, Wash. Filed September 28, 1908. Describes an arrangement of clamp and supporting arm, etc. ,for a telephone receiver.

943,066. ALLOY FOR ELECTRICAL RESISTANCE. Wilbur B. Driver, East Orange, N. J. Filed April 6, 1906. Gives proportions for various nickel-manganese alloys.

943,078. MEANS FOR LOCKING ELECTRIC SOCKETS TO FIXTURES. Harvey Hubbell, Bridgeport, Conn. Filed September 4, 1909. Describes an arrangement of a flanged cap and bushings, etc.

943,081. TELEPHONE-CALL-REGISTERING SYSTEM. Willard J. Kibbe, Canandaigua, N. Y. Filed April 22, 1908. An electromagnetically operated call-registering device is connected to the answering and calling switchboard cords.

943,115. SELECTIVE SIGNALING APPARATUS. Oscar M. Leich, Rochester, N. Y., assignor of one-third to J. G. Ihmsen and one-third to Max W. Zabel, Chicago, Ill. Filed February 3, 1905. A selective signaling apparatus is associated with an electric circuit, with which is also associated an electrically nontuned signaling apparatus having a bridge impedance device causing it to operate on a frequency other than that which operates the first-named apparatus and to be nonresponsive to currents adapted to operate this apparatus.

943,134. POST OR TELEGRAPH AND TELEPHONE POLE. Herbert E. Atchison, Ogden, Utah, assignor to The American Post and Pole Company. Filed April 10, 1908. A bar has angularly disposed sides and flukes projecting upward from its lower extremity, in a plane with the vertex of the angle.

943,149. MOUTHPIECE FOR TELEPHONE-TRANSMITTERS. John A. Jameison, Harrison, N. J. Filed June 8, 1909. Has a trumpet member secured by a kind of gooseneck device to the transmitter.

943,155. ELECTRIC MOTOR. Louden A. McCoubrie and Charles F. Raydure, Philadelphia, Pa. Filed April 29, 1909. Has special kind of brush-holders.

943,166. ELECTRIC CONTROLLING APPARATUS. William Schwagermann, Yonkers, N. Y., assignor to Ward Leonard Electric Company. Filed July 31, 1907. A reversing rheostat for a motor has two armature-controlling independently movable elements controlling the direction of rotation of the motor armature, and two no-voltage protective windings connected in a closed circuit containing a field winding of the motor.

943,174. CARRIAGE FOR ELECTRIC LAMPS. Robert S. Beard, Warwick, N. Y., assignor of one-half to L. A. Riley, 2d, Warwick, N. Y. Filed April 26, 1909. The carriage runs on two wireways.

943,187. ELECTROLYTIC WATER-PURIFYING APPARATUS. Harry B. Hartman, Pittsburg, Pa., assignor to McDowell Manufacturing Company, Pittsburg, Pa. Filed March 2, 1908. Periodically reserved current flows through vertical electrodes.

943,188. METHOD OF PURIFYING WATER ELECTROLYTICALLY. Harry B. Hartman, Pittsburg, Pa., assignor to McDowell Manufacturing Company, Pittsburg, Pa. Filed March 2, 1908. Similar to the preceding, but the flows of liquid and current are synchronously interrupted.

943,190. ELECTRIC CHAIN-LINK-WELDING APPARATUS. Carlton L. Hoff, York, Pa., assignor to Standard Chain Company, York, Pa. Filed December 5, 1907. Welding jaws movable toward and away from each other have between them a guide for positioning the link to be heated and removable from it when the heating is taking place.

943,196. ELECTRIC-RAILWAY SYSTEM. George H. Maire, Seattle, Wash. Filed November 29, 1907. Means operated by a car open and close a switch for connecting a normally open feed section with the line circuit.

943,215. ELECTRIC SWITCH. Henry J. Carrigan and Arthur J. Sangster, Buffalo, N. Y., assignors to Auto Safety Specialty Company. Filed September 22, 1908. Two rotatable contact arms engage independently with fixed contacts.

943,224. ELECTRIC FURNACE. Eugen A. A. Grönwall, Axel R. Lindblad, and Otto Stålhane, Ludvika, Sweden. Filed July 28, 1909. The electric furnace comprises a heating chamber, and stack communicating therewith (the chamber being organized to provide a free space between the charge and the top of the heating chamber when the charge is introduced into the chamber and into the lower portion of the stack), electrodes arranged to enter through the top wall of the heating chamber and extended down into the heating chamber to pass through the free space with their lower ends immersed in the charge, and means for introducing gas into the free space portion of the furnace.

943,246. ELECTRICALLY-ILLUMINATED SIGN. John H. Goehst,

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Chicago, Ill., assignor to Federal Electric Company, Chicago, Ill. Filed June 11, 1909. The sign is carried by a bracket arm which has lamps placed suitably for illuminating the sign.

943,272. ELECTRIC TEMPERING-FURNACE. Vernon Roye and Vernon E. Royle, Paterson, N. J. Filed May 12, 1908. The tools to be tempered are automatically passed one after another into and out of an endless receptacle for fusible salts. Electric current is applied to the receptacle.

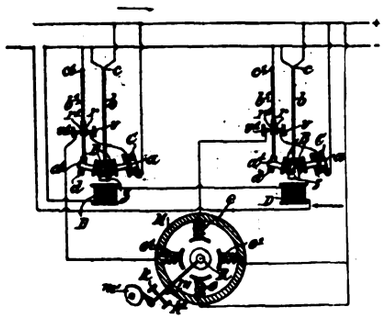
942,273. ELECTRIC-LIGHT SOCKET. Ralph A. Schoenberg, New York, N. Y., assignor to Ida S. Rosenheim, New York, N. Y. Filed February 20, 1909. The bared ends of the feed wires may be located and removably held in apertures and grooves adjacent to the contacts carried by the lamp.

943,275. BATTERY-ELEMENT SUPPORT. Charles B. Schoenmehl, Waterbury, Conn. Filed April 1, 1909. Two or more transverse channel strips are mounted on a pair of guide wires, and a sheet-metal spring is arranged beneath the lower channel strips to hold the plate intermediately between the strips.

943,281. ELECTRICAL CONTACT DEVICE. James M. Smith, Philadelphia, Pa., assignor of one-half to Wilson D. Craig Wright, Philadelphia, Pa. Filed January 13, 1909. Has a stationary and a revolving element.

943,287. CONDUIT-CAP FOR ELECTRIC INSTALLATION. Wheeler H. Vibber, New London, Conn., assignor of one-half to The Gillette-Vibber Company, New London, Conn. Filed May 10, 1909. The frame has a hub extension on one side and arms for the insulators, etc., on the other.

943,290. ELECTRIC FURNACE. Charles E. Wilson, Hood River, Ore. Filed February 1, 1909. A stationary electrode extends downward into the furnace, and the other electrode is carried by the base. The furnace has removable sides and means for raising and lowering it.



943,531.—PENDULUM ELECTRICITY-METER.

943,305. ILLUMINATED TELEPHONE-DIAL. Rufus B. Hallock, Portland, Ore. Filed February 18, 1909. Describes illumination details for an automatic-telephone dial.

943,324. SPARKING DEVICE FOR GAS OR OIL ENGINES. Waldemar M. Stempel, Urbana, Ill. Filed March 1, 1909. The spark points of the spark plug are electromagnetically put into and out of contact with each other.

943,345. STORAGE BATTERY. Louis H. Flanders, Wilkinsburg, Pa., assignor, by mesne assignments, to Westinghouse Storage Battery Company. Filed February 23, 1905. A separator comprises a sort of latticework of two superimposed series of diagonally crossing strips.

943,352. ELECRICALY-OPERATED RAILWAY-CROSSING GATE. Thomas Hummel, Dallas, Tex. Filed March 6, 1909. Is actuated by means of a solenoid device.

943,368. BURGLAR-ALARM SCREEN. Peter Orance, Newark, N. J. Filed August 4, 1908. Contacts are made when any of several wires under tension is broken.

943,383. APPARATUS FOR FIRING EXPLOSIVES IN WELLS. Luke H. Broadwater, Findlay, Ohio, assignor to The E. I. du Pont de Nemours Powder Company, Wilmington, Del. Filed December 30, 1908. Renewed November 3, 1909. An electric device, in circuit with the firing wires, controls the action of the cutters.

943,384. ELECTRIC HEATER. Roy W. Brown, Amsterdam, N. Y. Filed October 22, 1908. A helicoidal heater is imbedded in a reinforced cement body.

943,386. SANITARY TELEPHONE-TRANSMITTER. Marvin Y. Calcutt, Seattle, Wash. Filed April 12, 1909. An auxiliary diaphragm is secured to the transmitter casing, and a cleaning pad carried by the cover may be brought into contact with the diaphragm.

943,403. MELTING-HEARTH FOR ELECTRIC INDUCTION-FURNACES. Carl Grunwald, Bredeney, Germany. Filed May 7, 1909. The trough is of a shape admitting of inspection of and access to the entire surface of the bars in the trough through serving openings.

943,434. SHIP'S-SCREW-DRIVING MECHANISM FOR SUBMARINE BOATS. Wilhelm Maier, Stuttgart, Germany, assignor to Fried. Krupp Aktiengesellschaft Germaniawerft, Kiel-Gaarden, Germany. Filed August 15, 1908. Comprises a driving engine and an electric motor for each shaft; means adapting the engine and motor to act separately or together upon the propeller shaft; an auxiliary power plant consisting of two generators connected in series and an engine for driving the same; an electric accumulator for exciting the fields of all the aforesaid electric machines; a circuit through which the accumulator can be made to drive the first-mentioned motors, another circuit through which the accumulator can be made to drive one of the generators as a motor; and a switch for closing and opening the circuits.

943,438. MANUFACTURE OF RAIL-BONDS. George A. Mead, Mansfield, Ohio. Filed November 2, 1906. The bond is compressed after welding.

943,440. ALARM APPARATUS. Frank P. Moyer, Utica, N. Y. Filed January 22, 1909. Diaphragms covered with a catalytic substance co-operate with an electric alarm as for detecting gas.

943,483. ELECTRICALLY-HEATED TOOL. George E. Stevens, Lynn, Mass., assignor to General Electric Company. Filed August 4, 1908. The current is automatically switched on when the tool handle is grasped.

943,503. DYNAMO-ELECTRIC MACHINE. John B. Wiard, Lynn, Mass., assignor to General Electric Company. Filed December 6, 1905. The armature core has a special construction which is described in detail.

943,509. ELECTRICAL CABLEWAY SYSTEM. Otto Adam, Dresden, Germany. Filed April 20, 1908. A compensating generator is driven by the straining-rope operating element of the motor, and energizes a compensating winding in the motor circuit.

943,531. PENDULUM ELECTRICITY-METER. Charles Féry, Paris, France. Filed January 12, 1909. The meter comprises two frictionless electric pendulums having metallic connections at their points of suspension only, an auxiliary pendulum to each of these pendulums, mechanism whereby the auxiliary pendulum is oscillated by the main pendulum without contact therewith, contacts adapted to be closed by the auxiliary pendulum during its oscillations, and mechanism whereby the oscillations of the main pendulum are maintained owing to current traversing the contacts.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 20, 1909:

488,179. TROLLEY STAND FOR ELECTRIC CARS. Edward M. Bentley, Boston, Mass.

488,198. ELECTRICAL DISTRIBUTION BOX. Wm. H. Hart, Brooklyn, N. Y.

488,222. INCANDESCENT ELECTRIC LAMP BASE. Frederick C. Rockwell, Hartford, Conn.

488,225. RAILWAY SIGNAL. Edmund Shaefer, Lynchburg, Va.

488,233. STORAGE BATTERY. Geo. A. Washburn, Cleveland, Ohio.

488,261. DYNAMO REGULATOR. Chas. J. Bogue, New York, N. Y.

488,285. SIGNAL REPEATER. Thomas H. Patenall, Rahway, N. J.

488,298. DEVICE FOR RAISING OR LOWERING SUSPENDED ELECTRIC LIGHTS. Franklin P. Welsh, Omaha, Neb.

488,305. ELECTRIC MOTOR. Chas. S. Bradley, Yonkers, N. Y.

488,306. ALTERNATING-CURRENT MOTOR. Chas. S. Bradley, Avon, N. Y.

488,307. SYSTEM OF DISTRIBUTION FOR POLYPHASE ALTERNATING CURRENTS. Chas. S. Bradley, Avon, N. Y.

488,329. ELECTRIC ARC LAMP. Albert De Puydt, Liege, Belgium.

488,351. CLOSED CONDUIT FOR ELECTRIC RAILWAYS. Leon O. Dion, Natick, Mass.

488,367. TELEPHONE. Parnell Rabbidge, Sydney, New South Wales.

488,385. GUARD FOR TELEPHONES. Edward B. Chase, Philadelphia, Pa.

488,466. ELECTRIC FORGE. Geo. D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

488,467. ELECTRIC METAL-HEATING APPARATUS. Geo. D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

488,468. ELECTRIC METAL-WORKING APPARATUS. Geo. D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

488,469. ELECTRIC METAL-HEATING APPARATUS. Geo. D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

488,502. TELEPHONE SYSTEM. Chas. C. Jennings, Chicago, Ill.

488,520. ELECTRICALLY-OPERATED STRINGED MUSICAL INSTRUMENT. Willard H. Gillman, Boston, Mass.

488,532. ELECTRICAL SWITCHBOARD. James W. Lyon, Brooklyn, N. Y.

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CLASSIFIED INDEX, PAGE 48

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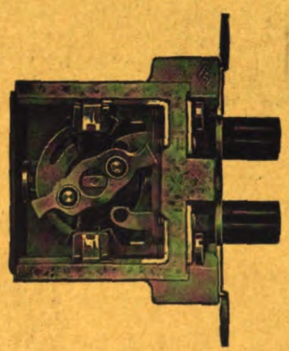

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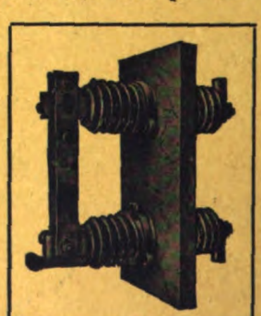

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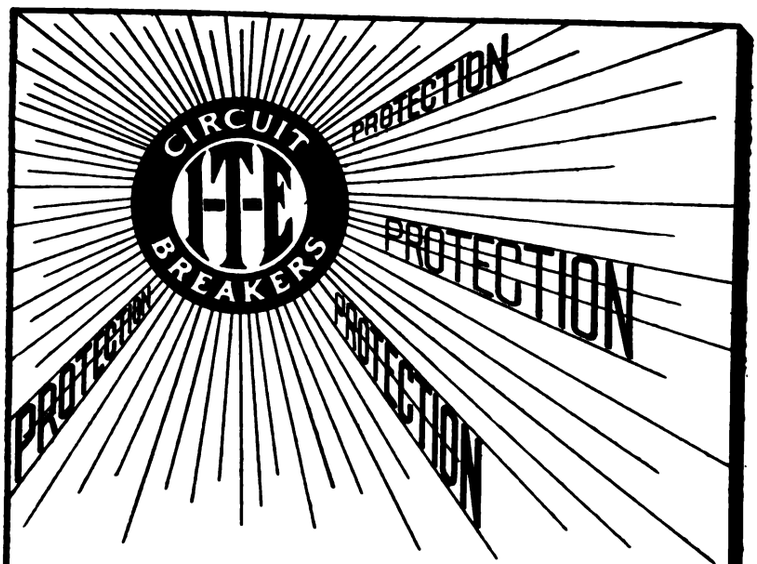

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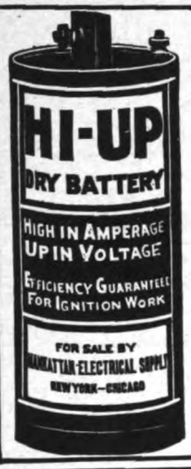

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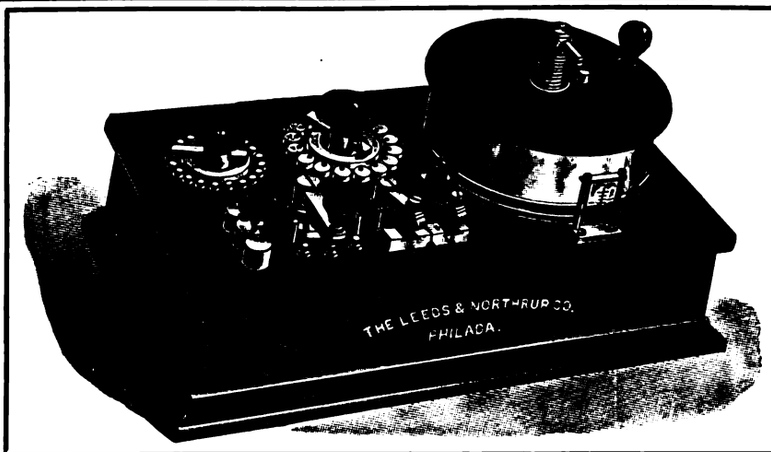

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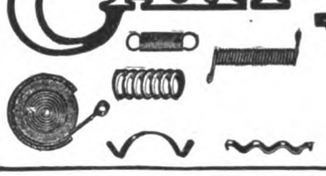

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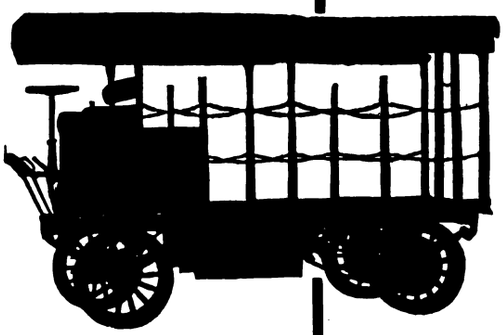

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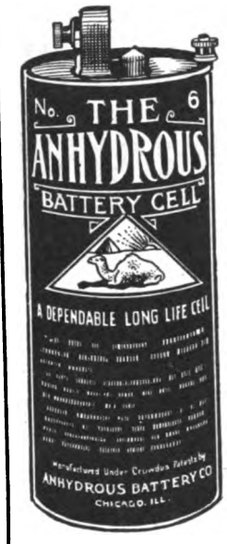

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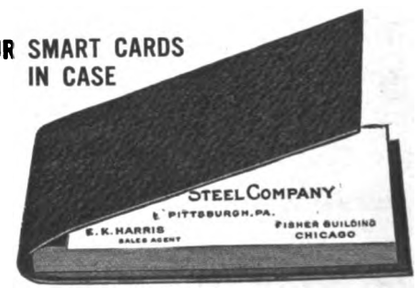

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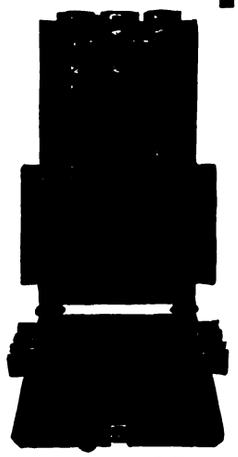
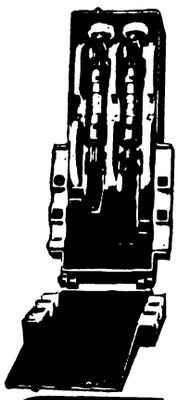


As shown by illustrations the inside of these **"Noark" Branch Boxes** consists of a porcelain branch block having contacts for the reception of fuses and main line conductors. The design of the main line conductors, with the use of split bushings, as shown, permits installation of the box without cutting main wires. Connection can be made by simply removing the insulation.



Conduit fittings are furnished for mains and branches when desired.

"Noark" Branch Boxes are furnished in three sizes, having ampere capacities of 0--30, 31--60 and 61--100 amperes.

Write nearest Branch for Catalog No. 405—or simply write your name and address on margin of this advertisement and mail it to us.

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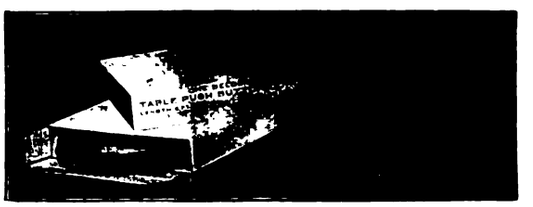

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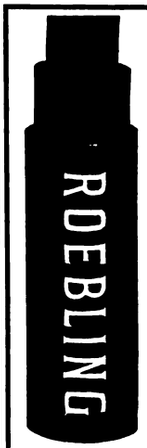

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Fittings are made of the same material and pressed into the different forms—Tees, Caps, Reducer Couplings, Couplings, Crosses, and Elbows—dried, impregnated and cut on lathe as socket sleeve or screw connection.

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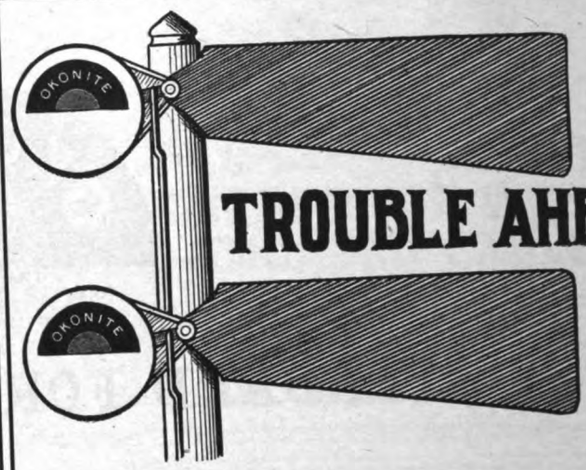

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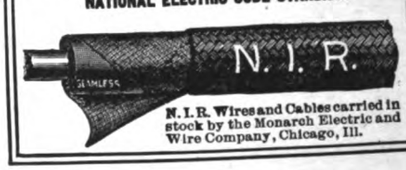

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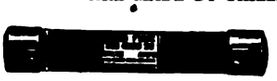

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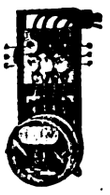

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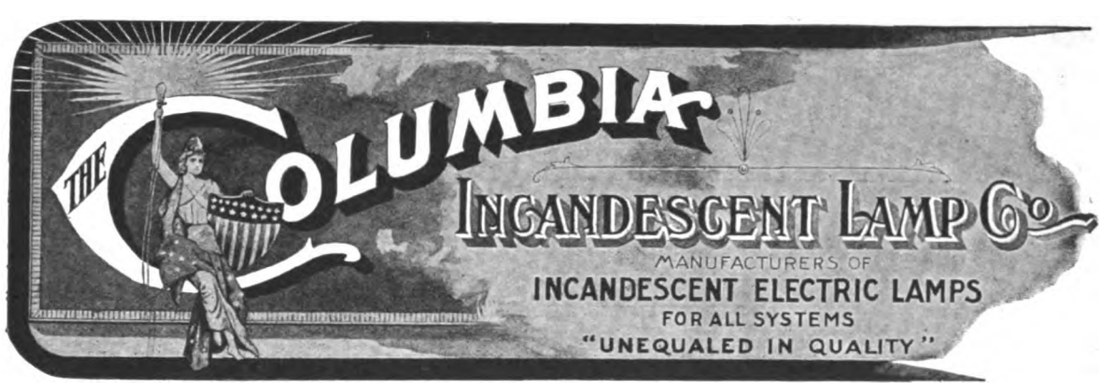

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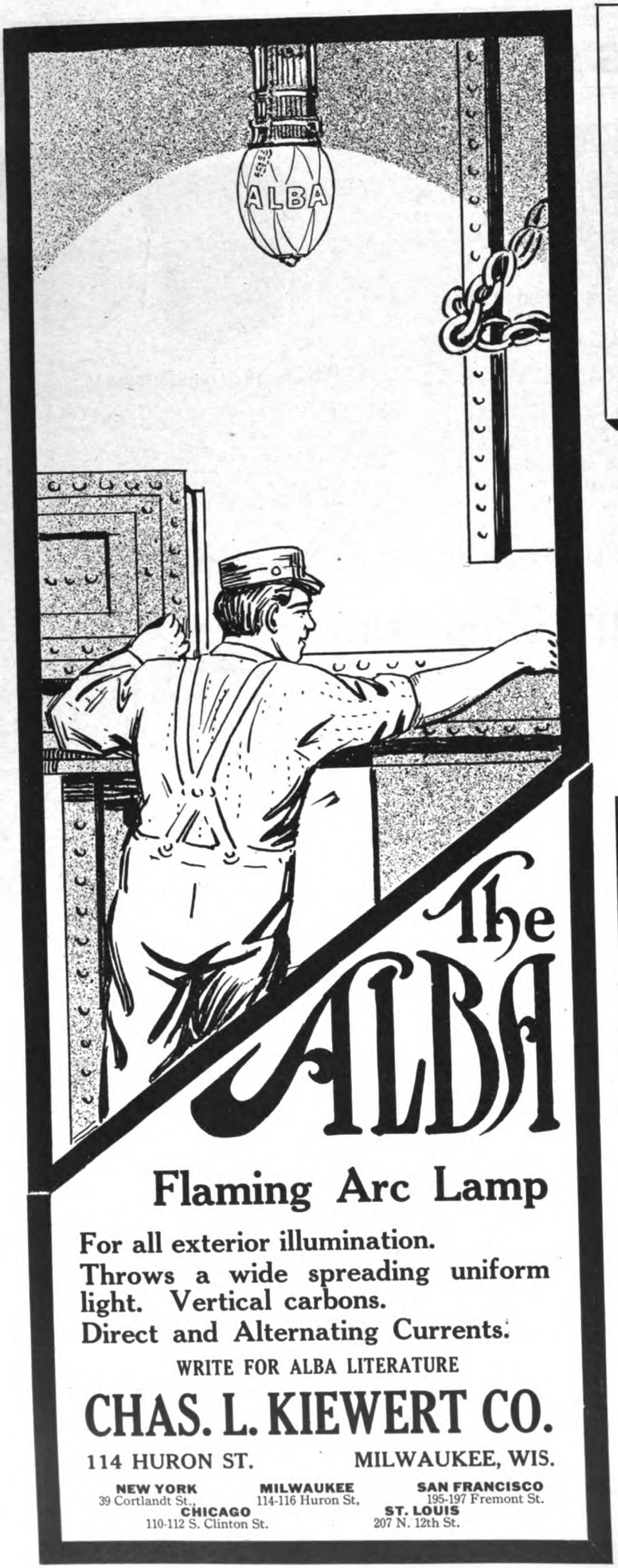

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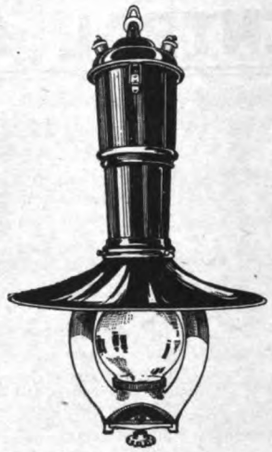

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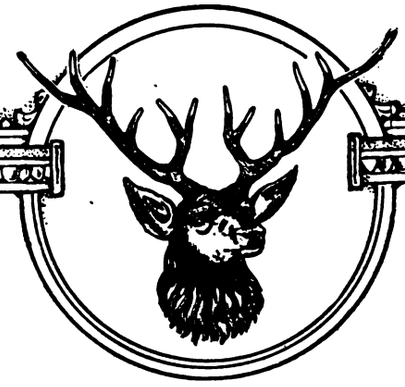

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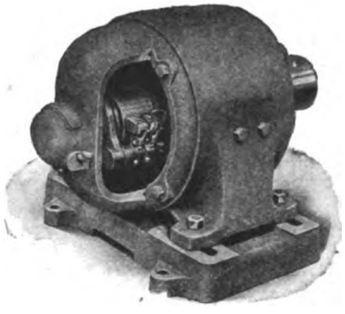

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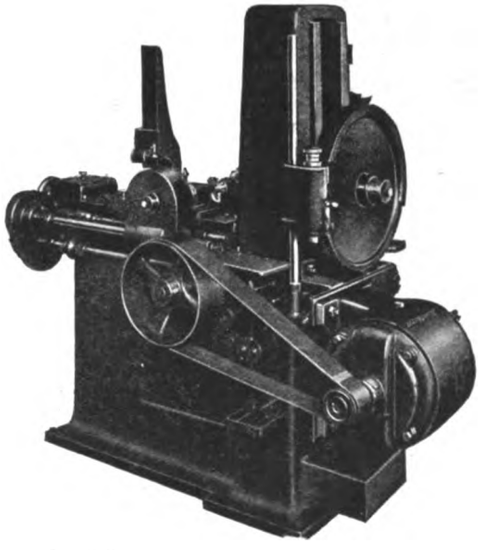

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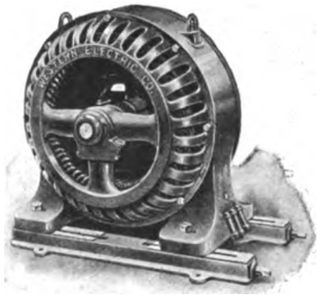

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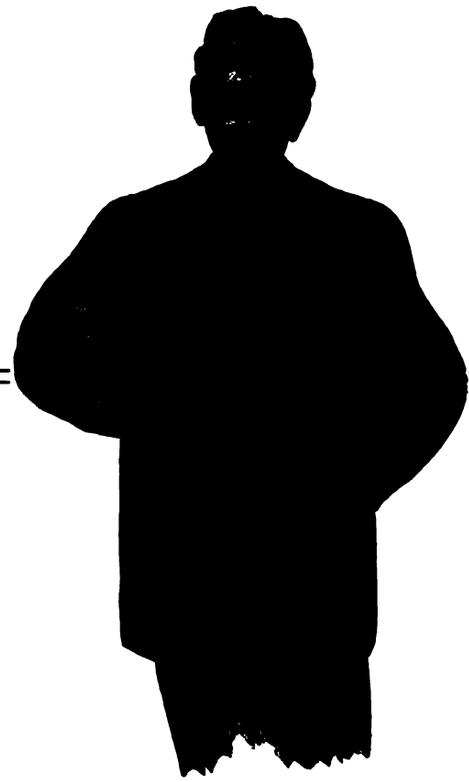

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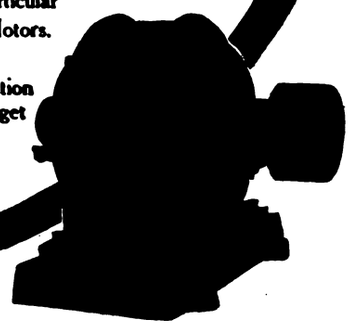

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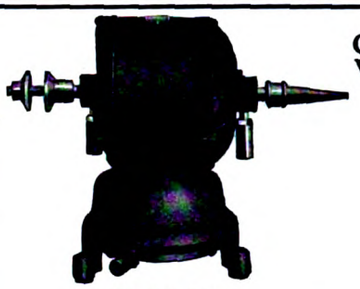

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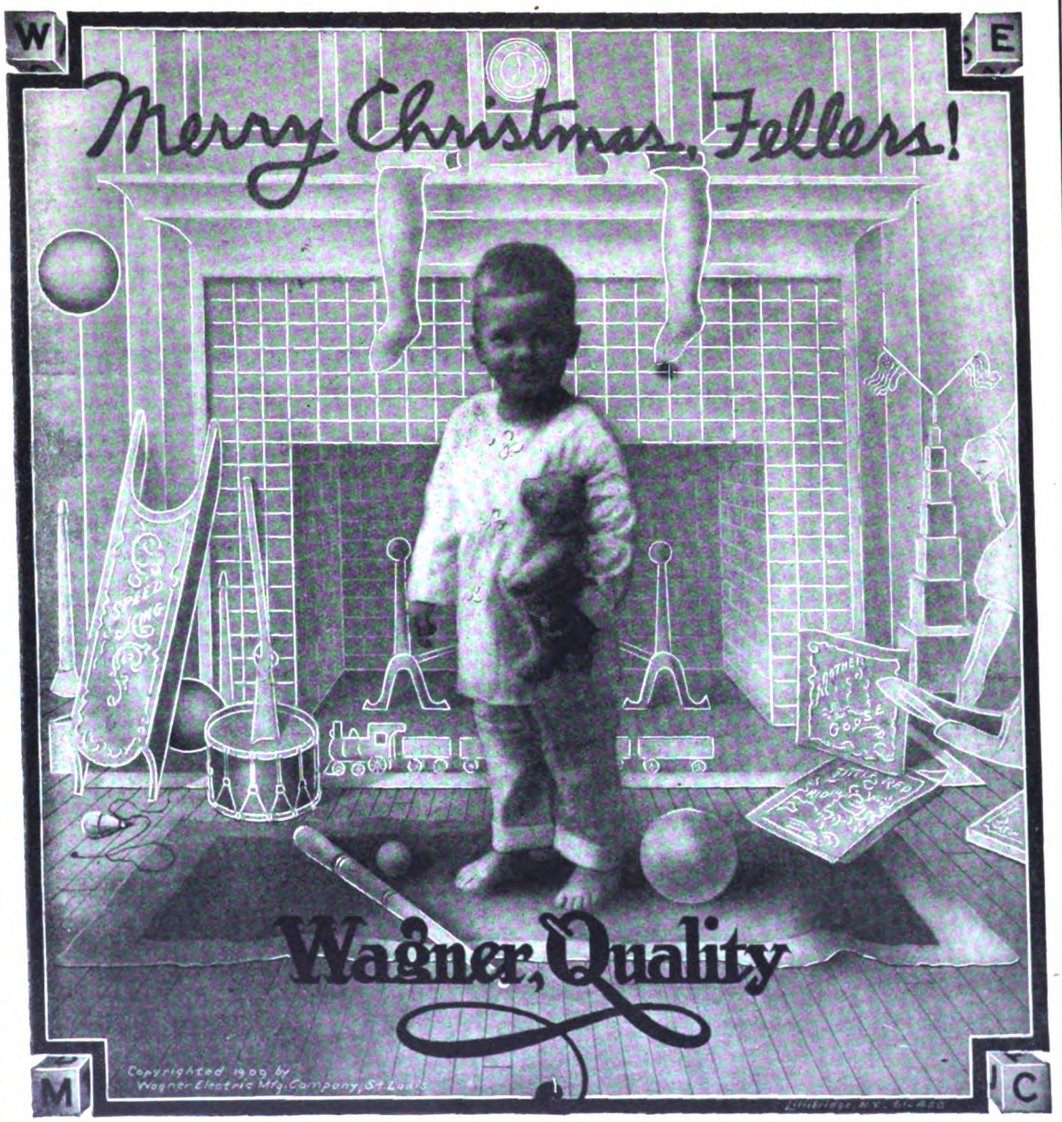

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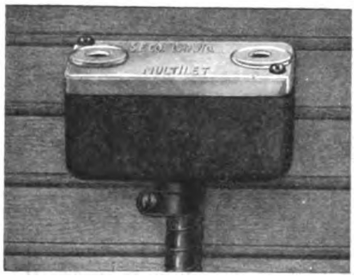

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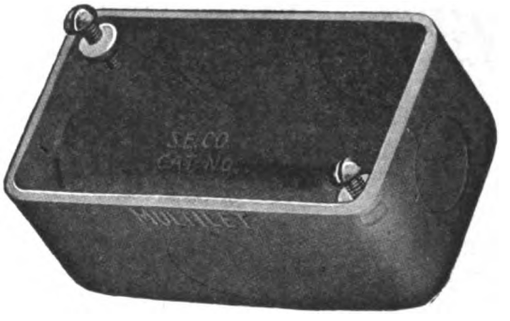

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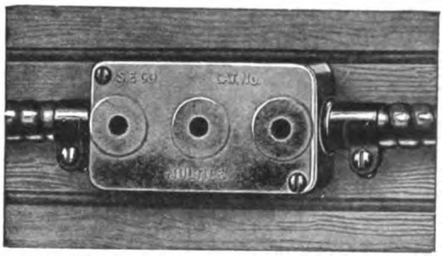

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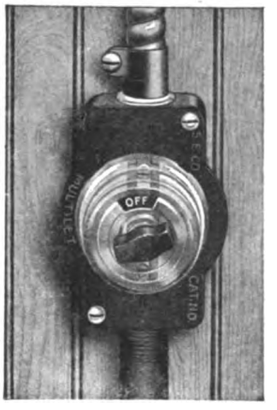

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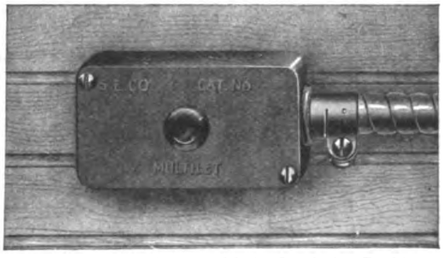

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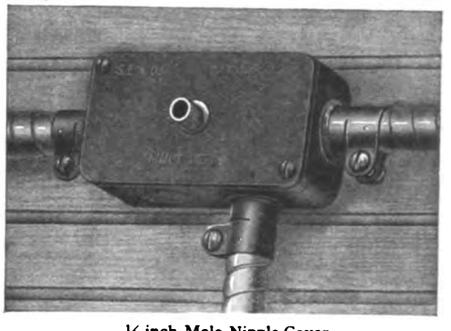

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New Year's Number

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

January 1, 1910

Special Features

"General Review of Electrical Developments"

A number of leaders in every field of endeavor have contributed their opinions and suggestions for the compilation of this review respecting what has been essentially the most important developments during the past year. This presentation will reflect in an authentic and comprehensive manner the progress that has been made in pure and applied electricity in its many phases, including the practical application of scientific attainment in telegraphy and telephony, cable systems, central-station operation, lighting, street and interurban railroading, and electrification of trunk lines.

"Estimate of the Value of the Output of Manufacturers of Electrical and Allied Apparatus"

This tabulation is being arranged from reports gathered from every source where reliable information is available, and the statistics presented will antedate the census reports by a considerable period.

"Review of Electrical Progress in Great Britain," by Albert H. Bridge

Mr. Bridge will present a clean-cut and very interesting summary of the important developments which have marked progress in the electrical industry in Great Britain during the past year.

"Review of Electrical Progress on the Continent," by C. L. Durand

Mr. Durand is a keen observer and close student of current events, and his review of the developments on the Continent will bring up to date those features which have pre-eminently marked the enlarging field of usefulness of electrical operations abroad.

"The Latest Methods of Manufacturing Metallic Lamp Filaments," by B. Duschnitz

This is a careful and comprehensive translation of a very important article which was published recently in several numbers of one of our leading foreign contemporaries, "The Electrotechnischer Anzeiger." This article sketches briefly the chronological development of methods of making metallic lamp filaments, and goes into great detail respecting the utilization of organic substances, the making of filaments from substances free from carbon by the wet process, and the use of metallic masses free of carbon without the use of fluids.

"Some Notes on Coal and Ashes Handling Equipment," by David Gaehr

This is an illustrated description of methods of handling coal and ashes, together with an analysis of the costs of installation and operation, dealing with several specific installations.

"A New System of Telautography," by T. Thorne Baker

This is a brief description of a new system of reproducing illustrations at a distance by means of a conducting electrical circuit. There are a number of very interesting illustrations showing the excellence of the reproductions thus far secured.

"Public Lighting in New York City," by H. T. Owens

This is an illustrated article dealing with a particular phase of public lighting in New York, and including the author's critical comments on the installations thus described.

"Uses of Electricity in the New White House Offices," by Waldon Fawcett

The greatest possible utilization of electricity has been made in connection with the equipment of the new office building recently completed for the use of the President of the United States. The Executive Building, which was erected adjoining the Presidential mansion during the Roosevelt administration, has been enlarged at a considerable outlay, and no feature has received more attention than the electrical equipment.

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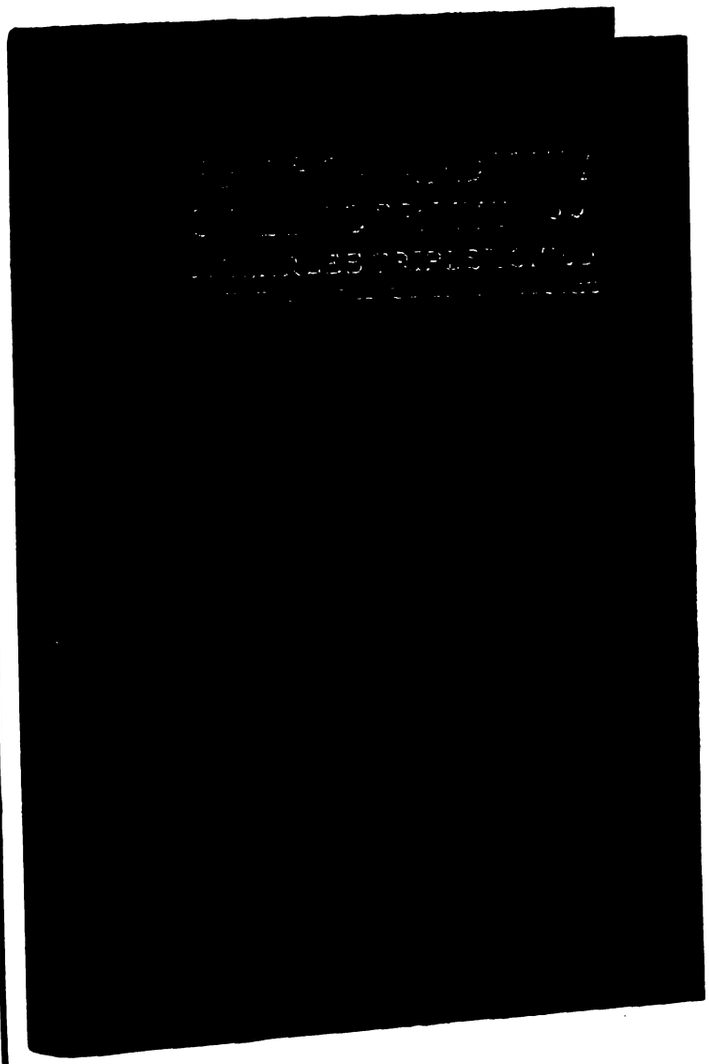

WHILE the added matter has brought the volume up to date in every phase of this study, the original text, as prepared by its brilliant author, remains to entrance the reader. New illustrations have been made where it was deemed possible to further illuminate the explanatory matter. The book contains no mathematics. The phenomena of electricity are treated in splendidly arranged word pictures, and the engineer, the student and the non-technical reader, alike, may be benefited and entertained by this book.

CONTENTS

CHAPTER

Preface
I The Electric Current
II The Electric Battery
III The Effects of Electric Flow in the Circuit—Heat and Chemical Action
IV The Effects of Electric Flow Outside the Circuit—Magnetism and Induction—The Electrical Units
V Electromagnets—The Telegraph
VI Electric Signaling Apparatus
VII The Relations Between Magnets and Electric Currents
VIII Induction and Reactive Coils
IX The Telephone
X Telephone Accessories
XI The Mechanical Generation of Electricity
XII The Dynamo Machine
XIII Various Types of Dynamo Machines
XIV Alternators—Polyphase Currents
XV The Electric Motor
XVI The Electric Railway
XVII Polyphase Currents and Motors
XVIII Electrical Power Transmission
XIX The Incandescent Light
XX The Arc Light
XXI Electrochemistry—Storage Batteries
XXII Wireless Telegraphy
XXIII Radiation—X-Rays
XXIV Recent Theories

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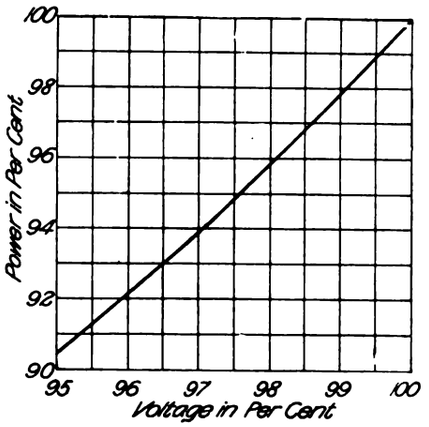

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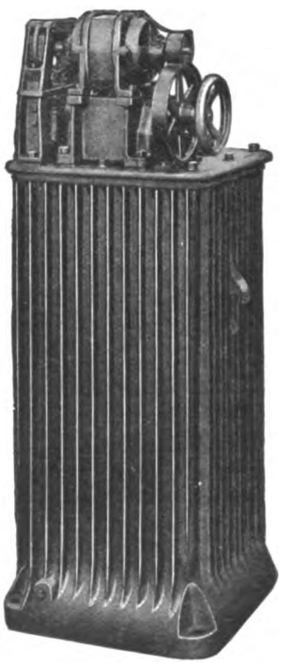

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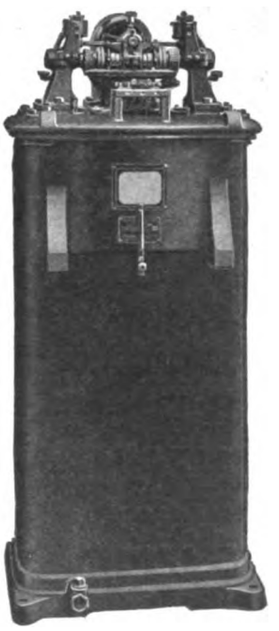

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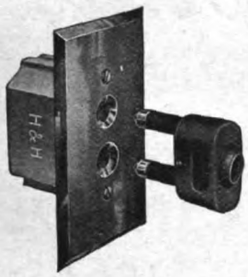
"H & H" Flush Receptacle



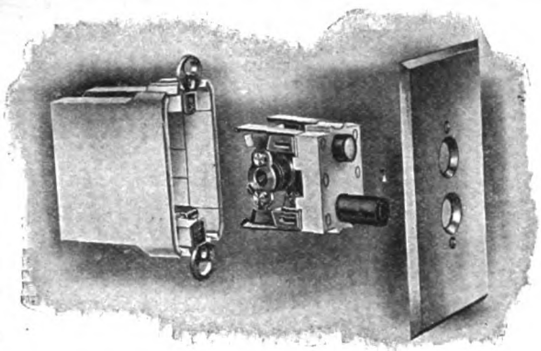
Receptacles with exposed contacts are subject, because of nearness to floor, to being clogged up with dust and sweepings, and are frequently short-circuited by young children. Apertures in face-plate of the "H & H" Receptacle are tightly and automatically closed upon withdrawal of plug, and contacts are thus rendered dust-proof and child-proof.

Most Receptacles are installed in dark and inaccessible places — such as under tables, behind furniture and in corners — and ease of connection of the plug is of practical convenience to the householder. The "H & H" Plug can be inserted at any angle by one hand without the aid of the eye and without having to pry open shutters or align a guiding pin.

Send for Descriptive Circular "B"

THE HART AND HEGEMAN MFG. CO.

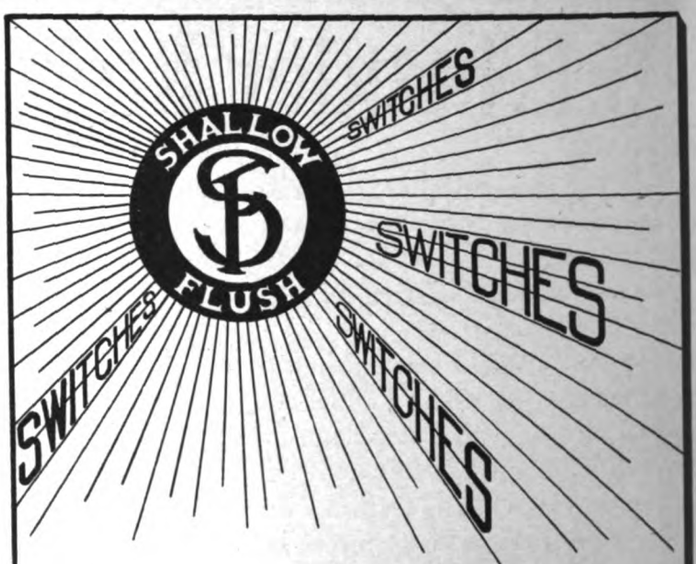
Hartford - - Conn.



PROOF IS IN THE COMPARISON

The old method of installing the mechanism and box in a one-piece apparatus is giving way to the improved new porcelain push-button detachable switch. We make a plug mechanism that can be quickly repaired or replaced without disturbing the connections, and does not have to be inserted in the porcelain box until the building is completed. This insures perfect order, free from dirt or injury and positive proof that your switch is right when ready for use.

Metropolitan Switchboard Co.
540 West 22d St., New York



"For thin partition work it's just what I want." *Opinion of Engineer*

THE CUTTER COMPANY, PHILADELPHIA

Richard Wick, 356 Dearborn St., Chicago, Ill.
J. H. Waugh & Co., 707 Ferguson Bldg., Pittsburg, Pa.
A. Hall Berry, 97 Warren St., New York City
Geo. P. Hardy, Empire Bldg., Atlanta, Ga.
John R. Cole Co., 766 Folsom St., San Francisco, Cal.

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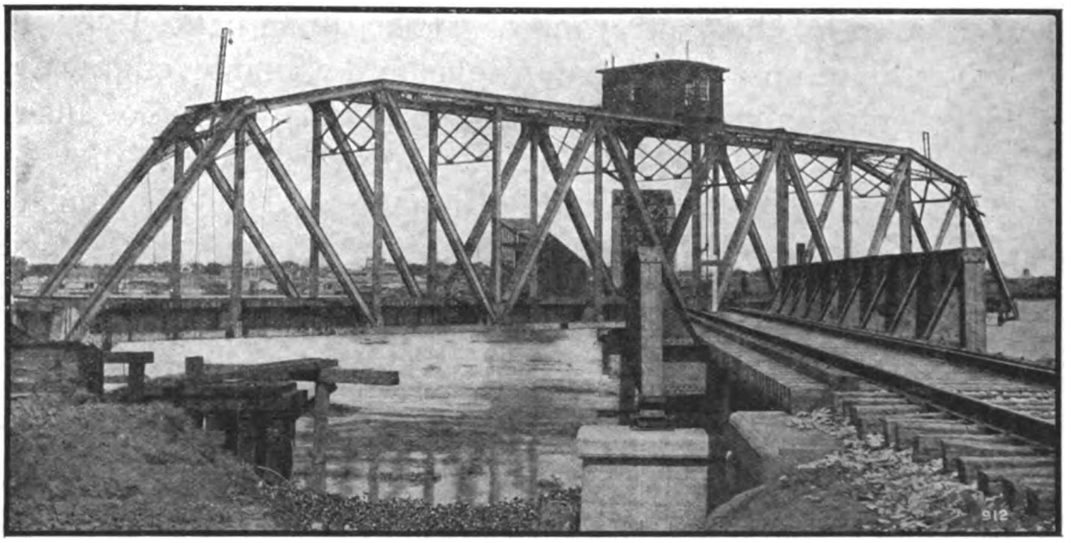
American Bridge Company of New York



SOUTHERN PACIFIC RAILROAD, MORGAN CITY, LA.

Structural Steel For Every Purpose

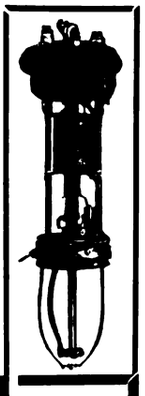
General Offices: Hudson Terminal, 30 Church Street, New York

WASTE MEANS LOSS

You can't afford to lose and you will not with the

HEANY ARC LAMP

It insures absolute reliability and efficiency. Service proves its quality. The many features of this arc lamp will interest you.



Write for Bulletin

LORD ELECTRIC CO.

213 W. 40TH STREET NEW YORK

112 WATER STREET BOSTON, MASS.

THE SCHWERDTLE STAMP CO.

STEEL STAMPS & DIES

BRIDGEPORT, CONN.

"ARKLESS" INDICATING FUSES

"THEY NEVER FAIL"

ABSOLUTELY GUARANTEED

We will replace free of charge, without words or argument, every "Arkless" Fuse that fails to indicate when blown.

DETROIT FUSE & MFG. CO., Detroit, Mich.

New York, San Francisco, Birmingham, Dallas, St. Louis

Sachs Fuses

Blow when they ought to and at no other time because strips are accurately sized and made of pure metal (no alloy), surrounded by a filling material of unchanging composition, compounded with great care.

Indicate positively and by direct action; no labels to burn, no exposed live parts between terminals.

Have rigidly held and accurately sized and surfaced contacts. Ferrule contacts not bowed by crimping and without projections on contact surface. Knife blade contacts have rounded edges and are securely fastened, yet conforming to slight misalignment of clips.

Quality Unsurpassed

Price Right

Sachs Cut-Outs

Have porcelain bases with protective barriers between poles, and on outsides of 1, 2 or 3 pole blocks to 100 amps. Slate bases on larger sizes.

Clips and circuit connection of highest grade spring bronze or pure tempered copper, made of one piece on blocks up to 100 amps. and securely soldered on larger blocks, resulting in elimination of loose contacts.

Lugs do not project beyond ends of base and are held by two screws or bolts in all sizes.

For branch work, main line clamp is hinged and screws upset, eliminating loose parts.

THE SACHS CO., Hartford, Conn.

BRANCHES: NEW YORK BOSTON CHICAGO ST. LOUIS SAN FRANCISCO LOS ANGELES NEW ORLEANS TORONTO, CAN. LONDON, ENG.

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New Weston Eclipse

Direct-Current Switchboards, Ammeters, Milli-Ammeters and Voltmeters

are of the "soft-iron" or "Electromagnetic" type, but they possess so many novel and valuable characteristics as to practically constitute a new type of instrument. Their cost is exceedingly low, but they are remarkably accurate, well-made and nicely finished instruments and are admirably adapted for general use in small plants, the cost of which is frequently an important consideration.

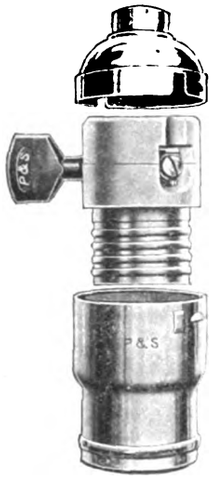
Correspondence concerning these new Weston Instruments is solicited by the

Weston Electrical Instrument Company

Waverly Park, NEWARK, NEW JERSEY

List of Selling Agencies and Branch Offices:

New York, 114 Liberty Street
Chicago, 1504 Monadnock Block
Philadelphia, 346 Mint Arcade
Boston, 176 Federal Street
St. Louis, 915 Olive Street
Denver, 1725 California Street
San Francisco, Bride Bldg., 682-684 Mission Street
Cleveland, 314 Caxton Bldg.
Mexico, Cadena, 10
Montreal, 13 St. John Street
Toronto, 6 Wellington Street
London, Audrey House, Ely Place, Holborn
Berlin, 68 Ritterstrasse
Paris, 12 Rue St. Georges (3)



P & S No. 100412, showing Cap raised

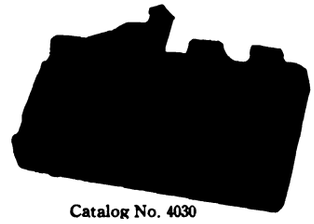
P & S PASSMOUR STYLE

The New Snap Cap Socket

Send for booklet No. 550 showing the Passmour and Proctectus Sockets

PASS & SEYMOUR, INC.
SOLVAY NEW YORK CHICAGO

Entrance Switches



Catalog No. 4030

Using N. E. Code Enclosed Fuses and Entrance Switches using Plug Fuses, of all kinds, are in the PAISTE Line. We make them right in every way: Strength, Design, Price. ¶ Are you on our mailing list for our monthly "PAISTERY?" This keeps you informed as to what is newest and best. Let us know.

H. T. PAISTE CO., - - Philadelphia, Pa.
New York Boston Chicago

COAL TESTING ANNOUNCEMENT

We take pleasure in announcing that in addition to general electrical and photometrical testing, we are prepared to make calorific determinations and approximate analyses of coal, accurately, promptly and at very reasonable prices.

The importance of the fuel question to the Central Station manager is generally appreciated. That the solution of the problem is to buy coal under specifications which include a "bonus-penalty" calorific value clause, is evident, provided the necessary tests can be made at a reasonable cost. We would be glad to correspond with any one interested in the subject of coal specifications, preparation of samples, charges for testing, etc.

ELECTRICAL TESTING LABORATORIES

"Electrical and Photometrical Tests of Every Description" **80th Street and East End Avenue, NEW YORK, N. Y.**

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CUTLER-HAMMER

IN thousands of industrial plants throughout the country, in steel mills and cotton mills, in foundries and machine shops, in mines, in printing establishments, in apartment houses, hotels and private residences there are electric motors at work—motors that drive pumps, ventilating fans, machine tools, presses, elevators, cranes, laundry machines, ice cream freezers and an endless number of other labor-saving devices. If it were possible to check over the controllers used with these motors it is probable that a large majority of them would be found to bear the Cutler-Hammer name-plate.

A. C. Motor Starter

* * *

Quite probable.

Because, The Cutler-Hammer Mfg. Co. is the largest producer of electric controlling devices in the world.

Because, the leading motor manufacturers are our best customers, purchasing tens of thousands of starting rheostats and speed regulators yearly for use with motors of their own manufacture.

Self-Starter for D. C. Motor

Because, the leading manufacturers of machine tools, ventilating fans, pumps, printing presses, etc., are also good customers of ours, to say nothing of the host of consulting engineers and electrical contractors who specify and purchase Cutler-Hammer controllers.

* * *

No matter what make of motor or motor-driven machine a purchaser buys there is more than an even chance that he will get a Cutler-Hammer controller with it, a fact that is significant as indicating what experts think of Cutler-Hammer apparatus, for there are cheaper controllers on the market—controllers on which the motor manufacturer, or manufacturer of motor-driven machinery, could make a larger profit if he were willing to furnish with his own apparatus any but the best controller made.

D. C. Motor Starter

A HEART TO HEART TALK WITH THE MAN IN THE MARKET

These statements are not mere advertising talk, but facts—facts that the reader can substantiate by inquiry among manufacturers of motors, machine tools, pumps, ventilating fans, printing presses, etc.; by inquiring of consulting engineers and electrical contractors, or by noting for himself the controllers that are mostly used in his own vicinity.

Self-Starter for A. C. Motor.

* * *

Carry the investigation a little further and inquire of those who are directly interested in some other make of controller, and almost without exception they will tell you that *next to their own apparatus* Cutler-Hammer controllers are the best made.

* * *

The Man in the Market is interested in knowing what products are recognized by experts as the best of their kind. He may not always purchase the best, but he wants to know what *is* best, if only for the purpose of having a standard by which to measure the value of similar products.

Gauge-Type Pressure Regulator used with Self-Starter—Closed Tank Systems

Cutler-Hammer controllers are the standard by which other electric controlling devices are measured. The price lists of competing manufacturers are based on the Cutler-Hammer price list and are in general a tacit admission of the *superior quality* of Cutler-Hammer apparatus.

* * *

If this advertisement induces the reader to investigate for himself the merits of the various lines of controlling devices on the market it will have accomplished its purpose. It is not published with the idea that it will bring any direct response, but in the hope that it *will* induce the occasional purchaser of rheostats to *investigate* before he buys. It isn't difficult to sell Cutler-Hammer controllers to the man who is buying electric controlling devices every day and who knows what's what, but it is heart-breaking to reflect on the number of orders we lose because so many *occasional* purchasers of starting rheostats, speed regulators self-starters, etc., mistakenly believe that there isn't very much difference between one make of rheostat and another.

Printing Press Controller

Machine Tool Controller

If we can bring home to the Man in the Market a realization of the fact that all controllers are *not* alike, we shall have taken a long step toward securing that man's business.

* * *

If you are not yet numbered among the users of Cutler-Hammer apparatus, we want you to drop us a line the next time you are in the market for an electric controlling device of any kind, or are confronted with some problem involving the starting, stopping or speed regulation of an electric motor. It will cost you only a two-cent stamp to put your problem up to us, and our suggestions—based on the experience gained in many years of work along this one line—may prove of considerable value to you.

Self-Starters for Electric Elevator

We are always glad to answer such inquiries fully and freely, because we have learned that orders have a way of gravitating to the concern that is never too busy to lend a helping hand to the prospective customer.

THE CUTLER-HAMMER MFG. CO.

MILWAUKEE, WIS.

New York Office:
Hudson Terminal, 50 Church St.
Chicago Office . . . . . Monadnock Block
Boston Office . . . . . 176 Federal St.
Pittsburg Office . . . Farmers' Bank Bldg.
Pacific Coast Agents: Otis & Squires
111 New Montgomery St., San Francisco

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POSITIONS WANTED

The rate for "Positions Wanted" advertisements of forty words or less is one dollar an insertion; additional words two cents each, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 507 Marquette Building, Chicago, or 13-21 Park Row, New York.

POSITION WANTED—Technical electrician with eight years' practical experience on all classes of construction and maintenance work, would take charge of lighting plant or accept any position with good prospects. Can handle men and produce results. Address Box 1201, care of Electrical Review and Western Electrician, Chicago.

POSITION WANTED—As chief electrician or construction foreman of large power or light company. Experienced and capable of handling any kind of work. Address Box 1206, care of Electrical Review and Western Electrician, Chicago.

HELP WANTED

The rate for "Help Wanted" advertisements of forty words or less is one dollar and fifty cents an insertion; additional words three cents each, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 507 Marquette Building, Chicago, or 13-21 Park Row, New York.

WANTED—Meter testers to send for our new meter-testing book, giving full information on connecting and testing meters. This book, sent free upon request, will enable you to increase the efficiency of the meter department. Central Electric Co., Chicago.

WANTED—Designer, a particularly able designer of generators and motors, for a leading position in a well-known electrical manufacturing company near New York. Address Box 1176, care of Electric Review and Western Electrician, Chicago.

WANTED—Technical men interested in transformer engineering should apply for admission to a short preparatory course of shop and testing work at this factory. A good recommendation required. J. M. Gilmore, General Electric Co., Pittsfield, Mass.

WANTED—By a well-established firm of electrical engineers, a man with experience in construction work. Must be quick and accurate in estimating. Give references and salary expected. Address Box 1203, care of Electrical Review and Western Electrician, Chicago.

WANTED—By an Eastern Manufacturing company, a Chicago representative. There is a splendid opportunity for the right man. One with an acquaintance among the Western architects and engineers preferred. Write stating references and previous experience. Address Box 1204, care of Electrical Review and Western Electrician, Chicago.

WANTED—Draftsman. Exceptional opportunity for a first-class man capable of designing small electrical apparatus. A man with at least 10 years practical experience preferred. Write, stating age and experience, to Box 1205, care of Electrical Review and Western Electrician, Chicago.

PROPOSALS

The rate for "Proposal" advertisements is 15 cents per line, nonpareil measurement, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Department of the Interior, Washington, D. C., December 16, 1909. Sealed proposals in duplicate will be received at the Department until 2 o'clock p. m., Friday, January 21, 1910, for remodeling the power plant, Government Hospital for the Insane, Washington, D. C., in accordance with the drawings and specifications, copies of which, with form of proposal, may be had on application at the Department. The right is reserved to reject any or all bids, waive technical defects, or to accept one part and reject the other, as the interests of the Government may require. Proposals must be marked "Proposals for remodeling power plant, Government Hospital for the Insane." J. E. Wilson, Assistant Secretary.

MISCELLANEOUS

The rate for "Miscellaneous" advertisements of forty words or less is one dollar and fifty cents an insertion; additional words three cents each, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 507 Marquette Building, Chicago, or 13-21 Park Row, New York.

WANTED TO BUY—75 H. P. Gas Producer outfit. Must be in perfect condition. State net price. Address Box 1202, care of Electrical Review and Western Electrician, Chicago.

FOR SALE—One 18 by 42 Reynolds Corliss Engine. Engine will be removed next June. This engine must be removed to be replaced by one taking less floor space. Address Cherokee Electric Co., Cherokee, Iowa.

FOR SALE—A quantity of shop worn books in good condition, but whose salableness is affected by their appearance. We offer these books at exactly one-half list prices and will quote better prices on quantities. Write for a list. Electrical Review Publishing Co., 507 Marquette Bldg., Chicago.

FOR SALE IMMEDIATE SHIPMENT—One 250 K.W., 2-Phase, 60-cycle, 2,400-volt, 325-RPM, Westinghouse revolving armature type belted alternator. We pay cash for arc dynamos and lamps. National Machinery & Wrecking Co., 1914-16 Scranton Road, Cleveland, O.

FOR SALE, 220 D. C. MOTORS

H.P.		MAKE	SPEED
1	2	Fidelity, MP	1000
1	2	Crocker-Wheeler, Type C	950
28	2	Watson, MP, new	1200
1	2	Stanley, G. I., new	1150
1	2	Western Elec., type E	675
1	2	Northern, MP, vertical	550
1	2½	Northern, MP	1500
1	2½	Northern, MP	1000
1	3	Peerless, MP	1450
2	3	General Electric	1800
12	3	National, MP, new	1450
1	3	Excelsior, MP, enclosed	1000
2	3	Watson, MP	1050
22	3	National, MP, new	1000
1	3½	Westinghouse, MP, type M	1050
1	4	Gen. Elec., type C. E.	725
4	5	National, MP, new	1000
1	5	Northern, MP, new	1450
2	5	Gen. Elec., MP, type C. E.	1230

We are willing to ship *any motor* in our stock on 30 *days' approval* to responsible parties. Send for our *Monthly Bargain Sheet* showing complete stock with net prices. Motors rented. Motors sold on monthly installments.

GREGORY ELECTRIC COMPANY
The Pioneer Electrical Bargain House
16th and Lincoln Sts., CHICAGO, ILL.

WANTED

50 Cts. per Stick $5.00 per Dozen
For Sale by all Supply Houses, or
FREE, Sample Stick

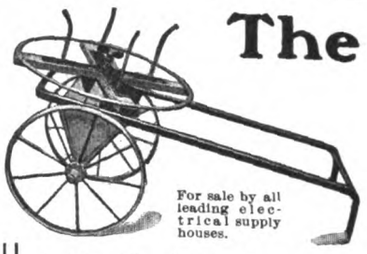
You Who Are Troubled With Sparking and Cutting of Commutators to Use

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes

It will put that high gloss on the commutator you have so long sought after.

K. McLENNAN & CO.
Sole Manufacturers
Room 409, Boyce Bldg.,
112 Dearborn St., Chicago, Ill.



For sale by all leading electrical supply houses.

The WASSON REEL

Points Guaranteed to Stick:

1. Doesn't "reel" as it reels.
2. Made of iron and "stands the racket."
3. Anchors to the ground.
4. Needs no attention, but has a tension; pays out its own wire, and pays for itself in a week.
5. Made for telephone, electric light, telegraph and fence wire.
6. Other points of interest on application.
7. Price: $12.00, net 30 days, f. o. b., Clinton, Ill., U. S. A., or Winnipeg, Manitoba, Canada.

WASSON REEL COMPANY, Clinton, Illinois

Back Copies of Trade Publications

Trade Paper Filing Bureau
504 Dearborn Ave., CHICAGO, ILL.

Complete stock of back copies of Technical Periodicals, sets, volumes and single copies.

Prompt Services & Reasonable Prices
COPIES BOUGHT AND SOLD

SUBSCRIBE FOR THE

Inventive Age
ONE DOLLAR A YEAR

Contains index of all patents issued each week, and other useful information. Address

INVENTIVE AGE PUBLISHING COMPANY
National Union Bldg.
Washington, - D. C.

FOR SALE

A TWO PANEL MARBLE SWITCHBOARD

size 5¼ ft. x 4½ ft. with circuit breaker, ground detector, pilot lamp, and ten double pole switches on the face, back fully equipped with bus bars and fuses.

A Positive Bargain

THE MONARCH TYPEWRITER WORKS, UNION TYPEWRITER COMPANY, Syracuse, N. Y.

250 Volt Direct Connected Units

1 250 K. W. G. E. d. c. Corliss engine.
1 200 K. W. Wghse d. c. Erie Ball engine.
1 100 K. W. C. W. d. c. Payne engine.
1 50 K. W. Triumph d. c. Buffalo Forge Engine.

250 Volt Belted

1 100 K. W. Westinghouse 6 pole.
1 75 K. W. General Electric.
1 50 K. W. General Electric.
1 40 K. W. Westinghouse.
2 30 K. W. Westinghouse.

A Find for Somebody

One 85 H. P. Westinghouse 3 cylinder Gas Engine, ready for immediate delivery. This engine is in the best of condition, practically new. Attractive price will be made.

Large stock of Motors, Generators, Engines, and Boilers. Correspondence solicited.

JOSEPH H. THOMPSON, Jr.
17 Battery Place, NEW YORK

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DEARBORN WATER TREATMENT

Prepared always scientifically to meet requirements of each individual case, is essential to the successful and economical operation of every boiler room. Cost of treatment per thousand gallons **VERY LOW.** Gallon of water required for analysis.

DEARBORN DRUG & CHEMICAL WORKS

ROBT F. CARR, President — General Offices and Laboratories, Postal Telegraph Bldg., CHICAGO

THE BABCOCK & WILCOX COMPANY, 85 Liberty Street, NEW YORK

Babcock & Wilcox, Stirling, A. & T., Horizontal, Rust

WATER TUBE STEAM BOILERS

Steam Superheaters — WORKS: BAYONNE, N. J.; BARBERTON, OHIO — Mechanical Stokers

BRANCH OFFICES:

BOSTON, Delta Building
PHILADELPHIA, North American Bldg.
PITTSBURG, Farmers' Deposit Nat'l Bank Bldg.
SAN FRANCISCO, 99 First Street
NEW ORLEANS, 533 Baronne Street
DENVER, 435 Seventeenth Street
SALT LAKE CITY, 313 Atlas Block
CHICAGO, Marquette Building
ATLANTA, GA., Candler Building
CLEVELAND, New England Building
CINCINNATI, O., Traction Building
PORTLAND, ORE., Wells-Fargo Building
SEATTLE, Mutual Life Building
MEXICO CITY, 7 Avenida Juarez
HAVANA, CUBA, 116½ Calle de la Habana
LOS ANGELES, Trust Building

Engineers and Contractors

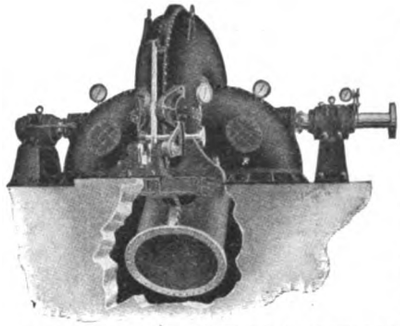
"CENTRAL STATION HEATING"

WRITE FOR DETAILED INFORMATION

American District Steam Co.

Lockport, N. Y. N. Tonawanda, N. Y. Chicago

HYDRAULIC TURBINES



Both Cylinder and Wicket Gate, giving enormous power, are used in hundreds of electric power plants throughout the world. Six pairs Francis Turbines, 7,000 H. P. per pair in spiral flumes, now in course of construction to drive generators in plant of Great Falls Townsite & Water Power Company, Great Falls, Mont.

S. MORGAN SMITH COMPANY, York, Pa., U. S. A.

Branch Offices: 176 Federal Street, BOSTON, MASS. 644 American Trust Bldg., CHICAGO, ILL.

FOR SALE

Dynamos Motors Meters

Arc Lamps Transformers

Electrical Supplies

¶ We rent Electrical machinery.

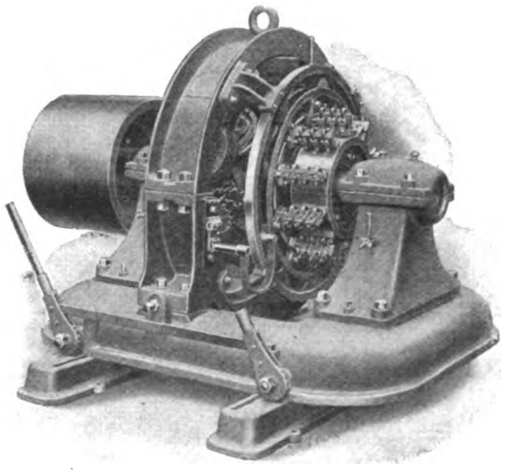
¶ We repair All Makes of Electrical Apparatus.

¶ Send for our latest complete bargain book and net prices.

Guarantee Electric Company

Edwin R. Rockwell
President and Gen. Manager

Adams and Clinton Streets, Chicago



Sparkless-Commutation with Fixed Brushes

is obtained at all loads, from no load to 100 per cent overload, by the use of balancing coils which completely neutralize the armature reaction.

Much of engineering value is contained in Bulletins 19, 20 and 21. *Write for them.*

RIDGWAY DYNAMO AND ENGINE CO.

RIDGWAY, PA., U. S. A.

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ALPHABETICAL INDEX TO ADVERTISERS

A

Adams-Bagnall Electric Co. 16
American Bridge Co. of New York 29
American Circular Loom Co. 13
American District Steam Co. 45
American Electrical Works. 60
American Platinum Works. 6
American Sewer Pipe Co. 13
American Steel & Wire Co. 10
Arnold Company 53
Atlantic Insulated Wire & Cable Co. 12

B

Babcock & Wilcox Co. 45
Badt & Co., F. B. 53
Bain, Foree 53
Baker & Co., Inc. 6
Barnes & Co., Wallace. 6
Bates, Putnam A. 53
Belden Manufacturing Co. 10
Bishop Gutta-Percha Co. 10
Bissell Co., F. 56
Blake Signal & Mfg. Co. 14
Bossert Electric Construction Co. 47
Boston Incandescent Lamp Co. 14
Brady, T. H. 57
Bridgeport Brass Co. 1
Bristol Co. 1-60
Brookfield Glass Co. 9
Brown, Eugene C. 53
Bryan-Marsh Co. 14
Buckeye Electric Co. 18
Buffalo Foundry & Machine Co. 47
Burnley Battery & Mfg. Co. 52
Byllesby & Co., H. M. 53

C

Cary Spring Works. 6
Central Electric Co. 15
Central Station Engineering Co. 53
Century Electric Co. 20
Chicago Fuse Wire & Mfg. Co. 14
Chicago Telephone Co. 55
Clay Product Co. 1
Clifton Mfg. Co. 60
Clement, Edward E. 53
Columbia Incandescent Lamp Co. 15
Columbia Meter Co. 6
Commonwealth Edison Co. 14-20
Condit Electrical Mfg. Co. 2
Coolidge-Schussler Mfg. Co. 57
Cravens, George W. 53
Crawford Cedar Co. 56
Crocker-Wheeler Co. 21
Cutler-Hammer Mfg. Co. 43
Cutter Co. 3-28

D

Dearborn Drug & Chemical Works 45
Detroit Fuse & Mfg. Co. 29
Detroit Insulated Wire Co. 60
Devine Co., J. P. 47
Diamond Rubber Co. 10
Dixon Crucible Co., Joseph. 60
Dodge & Day 53
Driver-Harris Wire Co. 3
Duluth Log Co. 56
Duncan Elec. Mfg. Co. 5
Duvall, E. S. 1

E

Electric Cable Co. 60
Electric Storage Battery Co. 7
Electrical Alloy Co. 6
Electrical Testing Laboratories. 30
Electrical Trades Exposition Co. 17
Emerson Electric Mfg. Co. 20
Esterline Co., The 47
Excello Arc Lamp Co. 14

F

Fancleve Specialty Co. 13
Fergus & Co., W. L. 53
Fibre Conduit Co. 12
For Sale 44
Fort Wayne Electric Works. 21
Fowle, Frank F. 53
Franklin Steel Co. 55
Frink, I. P. 60

G

General Electric Co. 27
General Vehicle Co. 7
Gest, G. M. 13
Goldmark, James 13
Gould Storage Battery Co. 4
Gregory Electric Co. 44
Guarantee Electric Co. 45

H

Hallberg, J. H. 53
Hammer, W. J. 53
Hart & Hegeman Mfg. Co. 28
Hart Mfg. Co. 2
Hazard Mfg. Co. 12
Help Wanted 44
Hemingray Glass Co. 9
Holmes Fibre-Graphite Mfg. Co. 47
Hotel Euclid 8
Hoyt Electrical Instrument Works 6
Humphrey, C. W. 53

I

Illinois Central R. R. 57
Indiana Rubber & Insulated Wire Co. 1
Inventive Age 44

J

Jackson, D. C. & Wm. B. 53
Jessop & Sons (Ltd.), Wm. 22
Johns-Manville Co., H. W. 9

K

Kellogg Switchboard & Supply Co. 55
Kelly Engineering Co., John F. 53
Kerite Insulated Wire & Cable Co. 1
Kettle River Quarries Co. 57
Keystone Electrical Instrument Co. 3
Kiewert Co., Chas. L. 16
Kitfield, Edward H. 53
Klein & Sons, Mathias. 55
Knowles, Edward R. 53
Kohler Bros. 53

L

Lawrence Electric Co., F. D. 12
Leclanche Battery Co. 1
Leeds & Northrup Co. 6
Le Mois Scientifique et Industriel. 52
Lindsley Bros. Co. 57
Lord Electric Co. 29
Lowell Insulated Wire Co. 1
Lyndon, Lamar 53

M

Manhattan Electrical Supply Co. 4
Manross, F. N. 6
Marshall, Albert J. 53
Marshall, William 53
Massachusetts Chemical Co. 3
McLennan & Co., K. 44
McMeen, Samuel G. 53
McRoy Clay Works. 13
Mershon, Ralph D. 53
Metropolitan Electrical Supply Co. 8
Metropolitan Switchboard Co. 28
Mica Insulator Co. 3
Miller, Kempster B. 53
Minerellac Electric Co. 4
Minneapolis Electric & Construction Co. 52
Minneapolis Steel & Machinery Co. 51
Moore, Alfred F. 1
Moore Electrical Co. 14

N

National Carbon Co. 5
National Conduit & Cable Co. 10
National India Rubber Co. 12
National Metal Molding Co. 60
National Pole Co. 57
Naugle Pole & Tie Co. 56
New England Butt Co. 10
New England Engineering Co. 53
New Process Raw Hide Co. 20
New York Insulated Wire Co. 1

O

Ohio Brass Co. 6
Okonite Co. 1-11
Oliver Typewriter Co. 52
Ostrander & Co., W. R. 47

P

Pacific Coast Pole Co. 57
Packard Electric Co. 47
Paiste Co., H. T. 30
Pass & Seymour, Inc. 30
Peerless Electric Co. 22
Phillips Insulated Wire Co. 60
Phoenix Glass Co. 1
Phosphor-Bronze Smelting Co. 12
Pillsbury, Chas. L. 53
Positions Wanted 44
Prentiss Clock Improvement Co. 1
Proposals 44

R

Rail Joint Co. 56
Reisinger, Hugo 17
Richmond Electric Co. 20
Ridgway Dynamo & Engine Co. 45
Rochester Machine Tool Works. 47
Roebling's Sons Co., John A. 10
Roentgen Mfg. Co. 6
Rome Wire Co. 1
Roth Bros. & Co. 22

S

Sachs Co., The 29
Safety Insulated Wire & Cable Co. 60
St. Louis Smelting & Refining Co. 8
Samson Cordage Works. 47
Sangamo Electric Co. 5
Schwerdtle Stamp Co. 29
Siggers & Siggers. 60
Simplex Electrical Co. 1
Simplex Electric Heating Co. 8
Smith Co., S. Morgan. 45
Speer Carbon Co. 47
Sprague Electric Co. 23
Standard Paint Co. 4
Standard Underground Cable Co. 1
Stanley & Patterson. 13
Sunray Elec. Lamp Mfg. Co. 17

T

Taunton-New Bedford Copper Co. 4
Taylor & Co., J. B. 53
Thompson, Jr., Jos. H. 44
Torrey Cedar Co. 57
Trade Paper Filing Bureau. 44
Triumph Electric Co. 21
Trumbull Electric Mfg. Co. 4

U

U. S. Electrical Tool Co. 20
United States Light & Heating Co 7

V

Valentine-Clark Co. 56
Vindex Electric Co. 4

W

Wagner Electric Mfg. Co. 22
Want Advertisements 44, 47
Ward Leonard Elec. Co. 47
Waterbury Company 60
Western Electric Co. 19
Western Engineering & Construction Co. 53
Westinghouse Electric & Manufacturing Co. 58-59
Westinghouse Machine Co. 58
Weston Elec. Instrument Co. 30
White & Co., J. G. 53
Wiggins Co., John B. 8
Willard Storage Battery Co. 4
Wittenberg Cedar Co. 57
Worcester Co., C. H. 57

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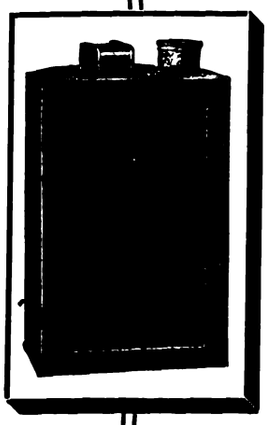

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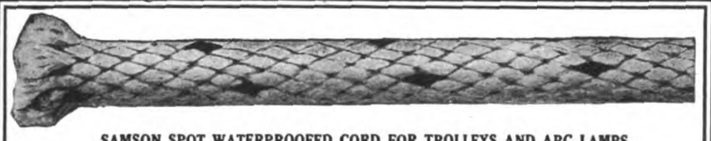

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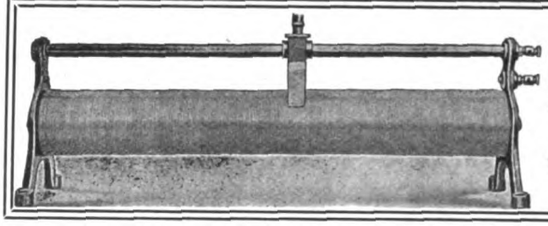

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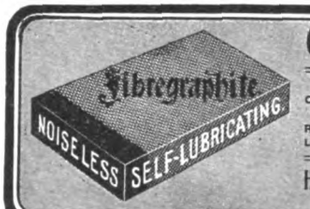

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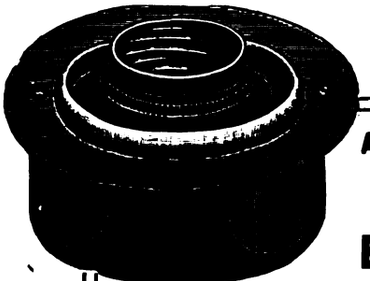

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Westinghouse Electric & Mfg. Co.

ANCHORS, GUY
Johns-Manville Co., H. W.
Lawrence Electric Co., F. D.
Western Electric Co.

ANNUNCIATORS
Central Electric Co.
Electric Goods Mfg. Co.
Goettmann, O. J.
Manhattan Electrical Supply Co.
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Stanley & Patterson.
Western Electric Co.

ARCHITECTURAL ENGINEERS
Dodge & Day

ASBESTOS PRODUCTS
Johns-Manville Co., H. W.

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Bissell Co., The F.
Burnley Battery & Mfg. Co.
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Electric Goods Mfg. Co.
Lawrence Electric Co., F. D.
Leclanche Battery Co.
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Electric Storage Battery Co.
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Manhattan Electrical Supply Co.
Ostrander & Co., W. R.
Partrick, Carter & Wilkins Co.
Western Electric Co.

BELT DRESSING
Dixon Crucible Co., Joseph.

BELTING
Shultz Belting Co.

BENDERS, CONDUIT
Fibre Conduit Co.

BLOWERS
Emerson Electric Mfg. Co.

BOILER FRONTS AND CASTINGS
Minneapolis Steel & Machinery Co.

BOILERS
Babcock & Wilcox Co., The
Minneapolis Steel & Machy. Co.
Morgan Smith Co., S.
Westinghouse, Church, Kerr & Co.

BOLTS, EXPANSION, TOGGLE and HANGER
Star Expansion Bolt Co.
Wrigley Co., Thos.

BOOKS, TECHNICAL
Electrical Review Pub. Co.

BOOSTERS
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Crocker-Wheeler Co.
General Electric Co.
Ridgway Dynamo & Engine Co.
Western Electric Co.

BOXES, JUNCTION
Bossert Elect. Const. Co.
Condit Electrical Mfg. Co.

BOXES, WOOD, CUT-OUT
Ashland Electric Co.

BRACKETS
Western Electric Co.

BRAKES, ELECTRIC
Electric Controller and Mfg. Co.

BRIDGES
American Bridge Co. of New York

BRIDLE RINGS
Bissell Co., The F.
Star Expansion Bolt Co.

BRUSHES, DYNAMO
Central Electric Co.
Crown Woven Wire Brush Co.
Dixon Crucible Co., Joseph
Holmes Fibre Graphite Co.
Speer Carbon Co.
Western Electric Co.

BULBS, INCANDESCENT LAMP
Lippincott Glass Co., The

BUSHINGS
Bossert Electric Construction Co.
Condit Electrical Mfg. Co.
Federal Electric Co.
Massachusetts Chemical Co.

CABINETS
Lang Electric Co., J.
Taunton-New Bedford Copper Co.

CABLE DOGS
Star Expansion Bolt Co.

CABLE HANGERS
Bissell Co., The F.
Condit Electric Mfg. Co.
Cope, T. J.
Standard Underground Cable Co.
Star Expansion Bolt Co.
Western Electric Co.

CABLE TROLLEYS
Bissell Co., The F.

CABLING MACHINES
New England Butt Co.

CAR HEATERS, ELECTRIC
Simplex Electric Heating Co.

CARBONS
Badt & Co., F. B.
Chicago Carbon Co.
Kiewert Co., Chas. L.
National Carbon Co.
Reisinger, Hugo.
Western Electric Co.

CARBON BRUSHES
Central Electric Co.
Speer Carbon Co.
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CASTINGS
Minneapolis Steel & Machinery Co.
New England Butt Co.
Ohio Brass Co.
Phosphor-Bronze Smelting Co.

CEMENT, CABLE TRANSFORMER
Massachusetts Chemical Co.

CHANDELIERS
Beardslee Chandelier Mfg. Co.

CHOKE COILS
Lord Electric Co.

CIRCUIT-BREAKERS
Badt & Co., F. B.
Condit Electrical Mfg. Co.
Cutler-Hammer Mfg. Co.
Cutter Electric Mfg. Co.
Electric Controller and Mfg. Co.
Fort Wayne Electric Works
General Electric Co.
Ward Leonard Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

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Condit Electrical Mfg. Co.

CLEATS
Blake Signal & Mfg. Co.

CLIMBERS
Klein & Son, Mathias
Western Electric Co.

CLUSTERS
Benjamin Electric Mfg. Co.
Federal Electric Co.
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Minneapolis Steel & Machinery Co.

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Belden Mfg. Co.
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COILS, INDUCTION
Electric Goods Mfg. Co.
Ostrander & Co., W. R.
Roentgen Mfg. Co.
Western Electric Co.

COILS AND MAGNETS
Western Electric Co.

COLORING LAMP
Lacquer Radiant Co.

COMMUTATOR LUBRICANT
Dixon Crucible Co., Joseph
McLennan & Co., K.

COMPOSITION (MOULDED)
Pardee, F. W.

COMPOUNDS, BOILER
Dearborn Drug & Chem. Wks.
Johns-Manville Co., H. W.

COMPOUND, INS. AND SPLICING
Massachusetts Chemical Co.
Standard Paint Co., The
Western Electric Co.

CONDENSERS, ELECTRIC
Leeds & Northrup Co.
Marshall, William

CONDENSERS, STEAM
Allis-Chalmers Co.
Minneapolis Steel & Machinery Co.
Western Electric Co.

CONDUITS
American Circular Loom Co.
American Sewer Pipe Co.
Camp Co., H. B.
Clay Product Co.
Clifton Mfg. Co.
Fibre Conduit Co.
Johns-Manville Co., H. W.
McRoy Clay Works.
National Conduit & Cable Co.
National Metal Molding Co.
Sprague Electric Co.

CONDUIT BENDERS
Fibre Conduit Co., The

CONDUIT RODS
Bissell Co., The F.
Cope, T. J.
Western Electric Co.

CONDUIT SYSTEMS
Gest, G. M.

CONSTRUCTION
Arnold Co., The
Bates, Putnam A.
Byllesby & Co., H. M.
Central Station Engineering Co.
Dodge & Day
Fergus & Co., W. L.
Kelly Eng. Co., John F.
New England Engineering Co.
White & Co., J. G.

CONSTRUCTION SUPPLIES
Bissell Co., The F.
Brady, T. H.
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CONTROLLERS
Allis-Chalmers Co.
Badt & Co., F. B.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
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Pardee, F. W.
Simplex Electric Heating Co.
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Belden Mfg. Co.

CRANE MOTORS
Crocker-Wheeler Co.
General Electric Co.
Western Electric Co.

CREOSOTED LUMBER
Western Electric Co.

CROSS-ARMS, BRACKETS, PINS, CLIMBERS, ETC.
Bissell Co., The
Brady, T. H.
Central Electric Co.
Kettle River Quarries Co.
Klein & Sons, Mathias
Lindsley Bros. Co., The
Manhattan Elec. Supply Co.
Naugle Pole & Tie Co.
Ohio Brass Co.
Western Electric Co.

CURRENT TAPS
Electric Goods Mfg. Co.

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Massachusetts Chemical Co.

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Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Fuse Wire & Mfg. Co.
Commonwealth Edison Co.
Cutler-Hammer Mfg. Co.
D. & W. Fuse Co.
Ft. Wayne Elec. Wks.
General Electric Co.
Hart Manufacturing Co.
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DIMMERS
Cutler-Hammer Mfg. Co.
Ward-Leonard Electric Co.

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Western Electric Co.

DISCONNECTING SWITCHES
Lord Electric Co.

DRILLS
Star Expansion Bolt Co.
United States Electrical Tool Co.

DRYING MACHINERY
Buffalo Foundry & Mach. Co.
Devine Co., J. P.

DYNAMOS AND MOTORS
Allis-Chalmers Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Commonwealth-Edison Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Eck Dynamo & Motor Co.
Emerson Electric Manufacturing Co.
Fort Wayne Electric Works.
Garwood Electric Co.
General Electric Co.
Gregory Electric Co.
Guarantee Electric Co.
Peerless Electric Co.
Richmond Electric Co.
Ridgway Dynamo & Engine Co.
Roth Bros. & Co.
Sprague Electric Co.
Stow Mfg. Co.
Triumph Electric Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

ELECTRIC ARC WELDERS
Electric Controller & Mfg. Co., The

ELECTRIC COOKING APPARATUS
American Electrical Heater Co.
General Electric Co.
Simplex Electric Heating Co.
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ELECTRIC FAULT FINDER
Electric Controller and Mfg. Co.

ELECTRIC GAS LIGHTING
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ELECTRIC IRONS
American Electrical Heater Co.
Simplex Elec. Heating Co.
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ELECTRIC LIGHTERS
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ELECTRIC LOCOMOTIVES
General Electric Co.
Westinghouse Electric & Mfg. Co.

ELECTRIC RAILWAYS
Allis-Chalmers Co.
Arnold Co., The
Byllesby & Co., H. M.
Dodge & Day
Fergus & Co., W. L.
General Electric Co.
Hallberg, J. H.
Hammer, Wm. J.
Kelly Eng. Co., John F.
Kitfield, Edw. H.
Knowles, Edw. R.
Mershon, Ralph D.
New England Eng. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.
White & Co., J. G.

ELECTRICAL SUPPLIES
Bates, Putnam A.
Bissell Co., The F.
Central Electric Co.
Condit Electrical Mfg. Co.

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CLASSIFIED INDEX—Continued.

ELECTRICAL SUPPLIES--Continued
Commonwealth Edison Co.
Crocker-Wheeler Co.
Electric Goods Mfg. Co.
General Electric Co.
Goettmann, O. J.
Johns-Manville Co., H. W.
Lawrence Electric Co., F. D.
Manhattan Electrical Supply Co.
Metropolitan Electrical Supply Co.
Ohio Brass Co.
Paiste Co., H. T.
Partrick, Carter & Wilkins Co.
Stanley & Patterson.
Western Electric Co.
Weston Electrical Instrument Co.

ELECTROMAGNETS
Western Electric Co.
Westinghouse Electric & Mfg. Co.

ELECTRO-PLATING MACHINERY
Crocker-Wheeler Co.
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ENGINES, GAS, GASOLINE AND OIL
Allis-Chalmers Co.
Minneapolis Steel & Machinery Co.
Westinghouse Machine Co.

ENGINES, STEAM
Allis-Chalmers Co.
Minneapolis Steel & Machinery Co.
Ridgway Dynamo & Engine Co.
Rochester Machine Tool Works
Thompson, Jos. H., Jr.
Westinghouse Machine Co.

ENGINEERS AND CONTRACTORS
American Bridge Co.
Arnold Co., The
Badt & Co., F. B.
Bates, Putnam A.
Brown, Eugene C.
Byllesby & Co., H. M.
Central Station Engineering Co.
Clement, Edward E.
Cravens, Geo. W.
Dodge & Day
Electro-Mechanical Engineering Co.
Fergus & Co., W. L.
Fowle, Frank F.
Hallberg, J. H.
Hammer, Wm. J.
Humphrey, C. W.
Jackson, D. C. & W. B.
Kelly Engineering Co., John F.
Kitfield, Edward H.
Knowles, Edward R.
Kohler Bros.
Lyndon, Lamar
McMeen, Samuel G.
Marshall, Albert J.
Mershon, Ralph D.
Miller, Kempster B.
New England Engineering Co.
Newgard & Co., Henry
Pillsbury, Chas. A.
Sargent & Lundy
Taylor & Co., J. B.
Western Electric Co.
Western Engineering & Const. Co.
White & Co., J. G.

FANS AND FAN MOTORS
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Commonwealth Edison Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
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Badt & Co., F. B.
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Federal Electric Co.
Pardee, F. W.
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Western Electric Co.

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General Electric Co.
Johns-Manville Co., H. W.
Lawrence Electric Co., F. D.
Manhattan Electrical Supply Co.
Sachs Co., The
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Condit Electrical Mfg. Co.
General Electric Co.
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Crocker-Wheeler Co.
Garwood Electric Co.
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Ridgway Dynamo & Engine Co.
Triumph Electric Co.
Western Electric Co.

GLASS TUBINGS
Lippincott Glass Co., The

GLOBES, SHADES, ETC.
Central Electric Co.
Fostoria Glass Specialty Co.
Holophane Co.
Lippincott Glass Co., The
Phoenix Glass Co.
Western Electric Co.

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Dixon Crucible Co., Joseph
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United States Electrical Tool Co.

GRINDERS, ELECTRIC, (Surface)
United States Electrical Tool Co.

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Lord Electric Co.

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Johns-Manville Co., H. W.
Simplex Electric Heating Co.
Ward Leonard Electric Co.
Western Electric Co.

HEATING (EXHAUST STEAM)
American District Steam Co.

HOISTING MACHINERY
Allis-Chalmers Co.

HYDRAULIC MACHINERY
Allis-Chalmers Co.

IMPREGNATING APPARATUS
Buffalo Foundry & Machine Co.
Devine & Co., J. P.

INNER GLOBES
Fostoria Glass Specialty Co.
Phoenix Glass Co.
Western Electric Co.

INSTRUMENTS
Badt & Co., F. B.
Bristol Co.
Columbia Meter Co.
Cutter Electrical Mfg. Co.
Duncan Electric Mfg. Co.
Esterline Co.
Fort Wayne Electric Works
General Electric Co.
Hoyt Electrical Instrument Works
Johns-Manville Co., H. W.
Keystone Electrical Instrument Co.
Leeds & Northrup Co.
Pignolet, Louis M.
Sangamo Electric Co.
Wagner Electric Mfg. Co.
Westinghouse Electric & Mfg. Co.
Western Electric Co.
Weston Electrical Instrument Co.

INSULATING CEMENTS
Bowdlear Co., W. H.
Massachusetts Chemical Co.

INSULATING COMPOUNDS
Bowdlear Co., W. H.
Electric Cable Co.
General Electric Co.
Massachusetts Chemical Co.
Mineralac Electric Co.
Ohio Brass Co.
Western Electric Co.

INSULATING MACHINERY
New England Butt Co.

INSULATING PAINTS
Massachusetts Chemical Co.
Standard Paint Co.

INSULATORS AND INSULATING MATERIAL
American Electrical Works
Brixey, W. R.
Brookfield Glass Co.
Central Electric Co.
Commonwealth Edison Co.
Detroit Insulated Wire Co.
General Electric Co.
Hemingray Glass Co.
Indiana Rubber & Insulated Wire Co.
Johns-Manville Co., H. W.
Massachusetts Chemical Co.
Mica Insulator Co.
Mineralac Electric Co.
Munsell & Co., Eugene
New York Insulated Wire Co.
Okonite Co.
Ohio Brass Co.
Packard Electric Co.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Paint Co.
Standard Underground Cable Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

IRIDIO PLATINUM, WIRE AND SHEET
Baker & Co., Inc.

IRONS, ELECTRIC
American Electrical Heater Co.
General Electric Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

JOINTS, WIRE
Western Electric Co.

JUNCTION BOXES
Bossert Electric Construction Co.
D. & W. Fuse Co.
Western Electric Co.

LAMP ADJUSTERS, INCANDESCENT
Edgerton, E. E.
Illinois Appliance Co.

LAMP COLORING AND FROSTING
Lacquer Radiant Co.

LAMP-MAKING MACHINERY
Dwyer Machine Co.

LAMPS, ARC
Adams-Bagnall Electric Co.
Badt & Co., F. B.
Bissell Co., The F.
Central Electric Co.
Excello Arc Lamp Co.
Fort Wayne Electric Works
General Electric Co.
Kiewert Co., Chas. L.
Lord Electric Co.
Sunray Electric Lamp Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LAMPS, DECORATIVE
Central Electric Co.
General Electric Co.

LAMPS, INCANDESCENT
Badt & Co., F. B.
Banner Electric Co.
Boston Incandescent Lamp Co.
Brilliant Electric Co.
Bryan-Marsh Co.
Buckeye Electric Co.

LAMPS, INCANDESCENT
Central Electric Co.
Columbia Incandescent Lamp Co.
Colonial Electric Co.
Commonwealth Edison Co.
Economical Elec. Lamp Co.
Economy Electric Co.
Fort Wayne Electric Works
Fostoria Incandescent Lamp Co.
Franklin Electric Mfg. Co.
General Electric Co.
Goettmann, O. J.
Guarantee Electric Co.
Johns-Manville Co., H. W.
Liberty Electric Mfg. Co.
Nernst Lamp Co.
New York & Ohio Co.
Novelty Incandescent Lamp Co.
Safety Electric Co.
Sterling Electrical Mfg. Co.
Warren Electric & Specialty Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.
Westinghouse Lamp Co.

LAMPS, MERCURY-VAPOR
Cooper-Hewitt Electric Co.

LAMPS, VACUUM TUBE
Moore Electrical Co.

LIFTING MAGNETS
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Western Electric Co.

LIGHTING PLANTS
Allis-Chalmers Co.
Crocker-Wheeler Co.
Fort Wayne Electric Works
General Electric Co.
Stanley & Patterson
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LIGHTNING ARRESTERS
D. & W. Fuse Co.
General Electric Co.
Lord Electric Co.
National Electric Specialty Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LINE MATERIAL
Bissell Co., The F.
General Electric Co.
Johns-Manville Co., H. W.
Klein & Sons, Mathias
Ohio Brass Co.
Western Electric Co.

LOCOMOTIVES, ELECTRIC
General Electric Co.

LUBRICANTS
Dearborn Drug & Chem. Works
International Acheson Graphite Co.

MACHINE TOOLS AND MACHINERY
Allis-Chalmers Co.
New England Butt Co.

MACHINES, WIRE MEASURING
Minneapolis Elec. & Construction Co.

MAGNETS
Esterline Co.
D. & W. Fuse Co.

MAGNET WIRES
(See Wires and Cables)

MAGNETIC SOLENOIDS
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.,

MAGNETIC SWITCH CONTROLLERS FOR LARGE MOTORS
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.,

MAST-ARMS
Bissell Co., The F.
Brady, T. H.

METALS
Baker & Co., Inc.
Phosphor-Bronze Smelting Co.

METERS
Central Laboratory Supply Co.
Columbia Meter Co.
Duncan Electric Mfg. Co.
Fort Wayne Electric Works
General Electric Co.
Johns-Manville Co., H. W.
Pignolet, L. M.
Sangamo Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

MICA
Mica Ins. Co.
Munsell & Co., Eugene

MINING MACHINERY
Allis-Chalmers Co.

MOTORS
(See Dynamos & Motors)

MOULDING
Fancleve Specialty Co.

NAME PLATES
Schwerdtle Stamp Co., The

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OUTLET BOXES AND COVERS
Bossert Electric Construction Co.
Condit Electrical Mfg. Co.
Chicago Fuse Wire & Mfg. Co.
Western Electric Co.

OUTLET BOX RECEPTACLES
Benjamin Electric Mfg. Co.
Western Electric Co.

PAINTS, INSULATING
Dixon Crucible Co., Joseph
Massachusetts Chemical Co.
Standard Paint Co.
Western Electric Co.

PANEL-BOARDS
General Electric Co.
Taunton-New Bedford Copper Co.
Trumbull Electric Mfg. Co.
Western Electric Co.

PATENT SOLICITORS
Bain, Foree
Clement, Edward E.
Duvall, Edw. S.
Siggers & Siggers

PHOSPHOR-BRONZE
Phosphor-Bronze Smelting Co.

PHOTOMETER
Dwyer Machine Co.

PHOTOMETER STANDARDS
Electrical Testing Laboratories

PIGTAILS, CARBON BRUSH
Belden Mfg. Co.

PINIONS
New Process Rawhide Co.

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American Platinum Works
Baker & Co., Inc.

PLATINUM WIRE AND SHEET, PLATINUM CRUCIBLES AND DISHES, PLATINUM RIVETS
American Platinum Works
Baker & Co., Inc.

PLUGS, ATTACHMENT
Electric Goods Mfg. Co.
Electro-Ad Co.
General Electric Co.
Western Electric Co.

PLUGS, FUSE
General Electric Co.
Pass & Seymour, Inc.
Western Electric Co.

POLES, BRACKETS, PINS, TIES, CROSS-ARMS, CLIMBERS, ETC.
Bissell Co., The F.
Brady, T. H.
Coolidge-Schussler Co.
Crawford Cedar Co.
Duluth Log Co.
Franklin Steel Co.
Johns-Manville Co., H. W.
Kellogg Switchboard & Sup. Co.
Kettle River Quarries Co.
Klein & Sons, Mathias
Lindsley Bros. Co., The
National Pole Co.
Naugle Pole & Tie Co.
Pacific Coast Pole Co.
Torrey Cedar Co.
Valentine-Clark Co.
Western Electric Co.
Wittenberg Cedar Co.
Worcester Co., C. H.

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Morris Co., Elmer P.

POLE STEPS
American Steel and Wire Co.

POTENTIOMETERS
Leeds & Northrup Co.

PUMPING MACHINERY
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Minneapolis Steel & Machinery Co.

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Cutler-Hammer Mfg. Co.
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Partrick, Carter & Wilkins Co.
Ward Leonard Electric Co.
Western Electric Co.

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United States Electrical Tool Co.

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Condit Electrical Mfg. Co.
General Electric Co.
Johns-Manville Co., H. W.
Lord Electric Co.
Ohio Brass Co.
Roebling's Sons Co., John A.
Western Electric Co.

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Rail Joint Co.
Western Electric Co.

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Blake Signal & Mfg. Co.
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General Electric Co.
Johns-Manville Co., H. W.
Ohio Brass Co.
Rail Joint Co., The
Western Electric Co.
Westinghouse Electric & Mfg. Co.

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Frink, I. P.
Holophane Co.
National X-Ray Reflector Co.
Phoenix Glass Co.
Wheeler Reflector Co.

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Gregory Electric Co.
Guarantee Electric Co.
Waterbury Co.

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General Electric Co.
Ward Leonard Electric Co.
Western Electric Co.

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General Electric Co.
Simplex Electric Heating Co.
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Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Cutter Electrical & Mfg. Co.
Esterline Co.
General Electric Co.
Pardee, F. W.
Simplex Electric Heating Co.
Ward Leonard Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

RUBBER, MOLDED
Massachusetts Chemical Co.

SCHOOLS AND COLLEGES
American School of Correspondence
Highland Park College

SEALS
Schwerdtle Stamp Co., The

SECOND-HAND MACHINERY
Bissell Co., The F.
Gregory Electric Co.
Guarantee Electric Co.
Thompson, Jos. H., Jr.

SHADEHOLDERS
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Western Electric Co.

SIGNS, ELECTRIC
Federal Electric Co.
Haller Sign Works, Inc.

SLATE
Edward Bonville

SLEEVINGS
Belden Mfg. Co.

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St. Louis Smelting & Refining Co.

SMOKESTACKS, STEEL
Minneapolis Steel & Machinery Co.

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Federal Electric Co.
General Electric Co.
Paiste Co., H. T.
Pass & Seymour, Inc.
Trumbull Electric Mfg. Co.
Western Electric Co.

SOCKETS, FLASHING
Schneider & Co., C. O.

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Belden Mfg. Co.
Blake Signal & Mfg. Co.
Burnley Battery & Mfg. Co.
Condit Electrical Mfg. Co.
Western Electric Co.

SOLENOIDS
Ward Leonard Electric Co.

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Manhattan Electrical Supply Co.
Western Electric Co.

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Baker & Co., Inc.

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Manhattan Electrical Supply Co.
Ostrander & Co., W. R.
Western Electric Co.

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General Electric Co.
Ward Leonard Electric Co.

SPECIALTIES
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Benjamin Electric Mfg. Co.
Condit Electrical Mfg. Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Paiste Co., H. T.
Pass & Seymour, Inc.

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Weston Electrical Inst. Co.

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Massachusetts Chemical Co.

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Cary Spring Works
Manross, F. N.

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Leeds & Northrup Co.
Weston Electrical Instrument Co.

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Blake Signal & Mfg. Co.
Goldmark, James

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Electric Controller and Mfg. Co.

STEAM SPECIALTIES
American District Steam Co.
New Process Raw Hide Co.

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American Bridge Co.
Franklin Steel Co.
Jessop & Sons, Ltd., Wm.

STEEL STAMPS
Schwerdtle Stamp Co., The

STENCILS
Schwerdtle Stamp Co., The

STOKERS
Babcock & Wilcox Co.
Westinghouse Machine Co.

STORAGE BATTERIES
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.
United States Light & Heating Co.
Western Electric Co.
Westinghouse Storage Battery Co.
Willard Storage Battery Co.

SUPPLIES, GENERAL ELECTRICAL
Bissell Co., The F.
Central Electric Co.
Condit Electrical Mfg. Co.
Commonwealth Edison Co.
General Electric Co.
Goettmann, O. J.
Manhattan Elec. Supply Co.
Stanley & Patterson.
Western Electric Co.

SWITCHBOARDS
Allis-Chalmers Co.
Bissell Co., The F.
Bossert Electric Construction Co.
Crocker-Wheeler Co.
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Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

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Massachusetts Chemical Co.

SWITCHES, ETC.
Central Electric Co.
Cutler-Hammer Mfg. Co.
Cutter Electrical Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Hart & Hegeman Mfg. Co.
Hart Mfg. Co.
Lawrence Electric Co., F. D.
Lord Electric Co.
Metropolitan Switchboard Co.
Ohio Brass Co.
Partrick, Carter & Wilkins Co.
Pass & Seymour, Inc.
Taunton-New Bedford Copper Co.
Trumbull Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

SWITCH BOXES
Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Co.

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General Electric Co.
Johns-Manville Co., H. W.
Massachusetts Chemical Co.
Okonite Co.
Western Electric Co.

TAPES
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General Electric Co.
Johns-Manville Co., H. W.
Packard Electric Co.
Western Electric Co.

TELEPHONES
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Electric Goods Mfg. Co.
Kellogg Switchboard & Supply Co.
Manhattan Electrical Supply Co.
Stanley & Patterson
Western Electric Co.

TELEPHONE SERVICE
Chicago Telephone Co.

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Electrical Testing Laboratories
Electro-Mechanical Engineering Co.
Esterline Co.

THEATER DIMMERS
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Cutler-Hammer Mfg. Co.
Simplex Electric Heating Co.
Ward Leonard Electric Co.

THERMOMETERS, ELECTRIC
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Leeds & Northrup Co.

TIES, CROSS-ARMS, BRACKETS, PINS, CLIMBERS, ETC.
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Brady, T. H.
Central Electric Co.
Klein & Sons, Mathias
Western Electric Co.

TIME SWITCHES
Bissell Co., The F.
General Electric Co.
Hartford Time Switch Co.
Manhattan Electrical Supply Co.
Western Electric Co.

TOOL STEEL
Jessop & Sons, Ltd., Wm.

TOOLS
Klein & Sons, Mathias
Oshkosh Logging Tool Co.
Wasson Reel Co.

TRANSFORMERS
Allis-Chalmers Co.
Crocker-Wheeler Co.
Duncan Electric Mfg. Co.
Fort Wayne Electric Works
General Electric Co.
Goettmann, O. J.
Kuhlman Electric Co.
Packard Electric Co.
Vindex Electric Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

TROLLEY CATCHERS
Lord Electric Co.

TROLLEY RETRIEVERS
Lord Electric Co.

TROLLEY WHEELS
Johns-Manville Co., H. W.

TRUCKS, STORAGE BATTERY AUTO
General Vehicle Co.

TUBES
Fibre Conduit Co.

TURBINE GOVERNORS
Allis-Chalmers Co.

TURBINES, STEAM
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General Electric Co.
Smith Co., S. Morgan
Western Electric Co.
Westinghouse Machine Co.

TURBINES, WATER
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Smith Co., S. Morgan.

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Devine Co., J. P.

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Massachusetts Chemical Co.
Standard Paint Co.

VEHICLES, ELECTRIC
General Vehicle Co.

WATER-WHEELS
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Smith Co., S. Morgan.

WATER-WHEEL GOVERNORS
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WINDERS, ELECTROMAGNET
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WIRE REELS
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Bissell Co., The F.
Bridgeport Brass Co.
Brixey, W. R.
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Chicago Fuse Wire & Mfg. Co.
D. & W. Fuse Co.
Detroit Insulated Wire Co.
Diamond Rubber Co.
Driver-Harris Wire Co.
Electric Cable Co.
Electrical Alloy Co.
General Electric Co.
Habirshaw Wire Co.
Hazard Mfg. Co.
Heany Fire-Proof Wire Co.
Indiana Rubber & Insulated Wire Co.
Kerite Insulated Wire & Cable Co.
Lawrence Electric Co., F. D.
Lowell Insulated Wire Co.
Moore, Alfred F.
National Conduit & Cable Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The
Pardee, F W.
Partrick, Carter & Wilkins Co
Phillips, Eugene F.
Phillips Insulated Wire Co.
Phosphor-Bronze Smelting Co.
Roebling's Sons Co, John A.
Rome Wire Co
Safety Insulated Wire & Cable Co
Simplex Electrical Co.
Standard Underground Cable Co.
Waterbury Co.
Western Electric Co

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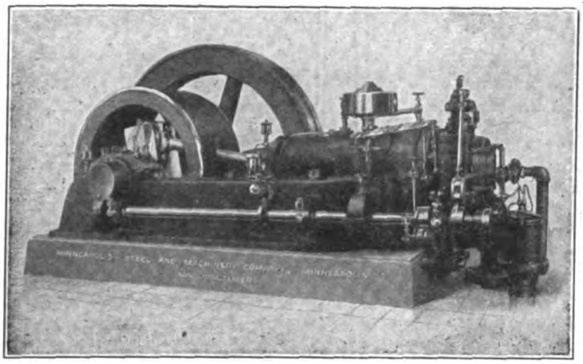

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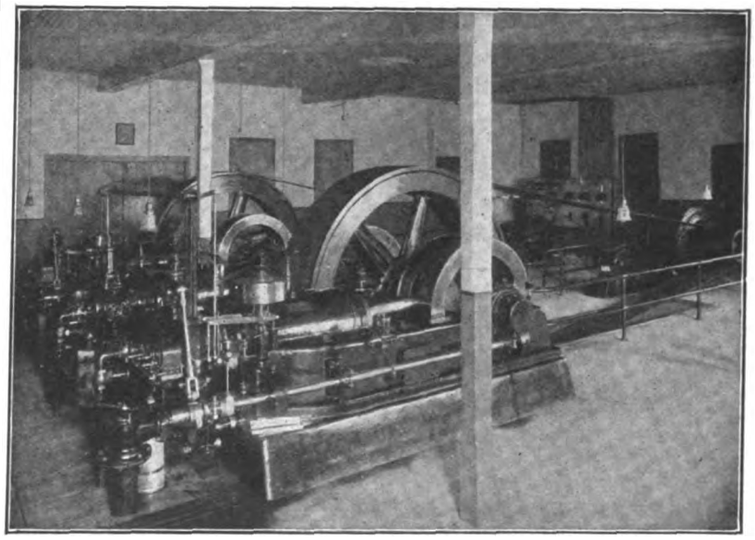

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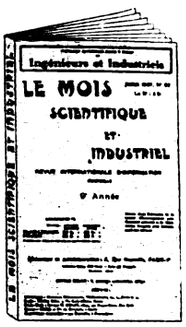
The Oliver Typewriter Company

47-55 Dearborn Street - - CHICAGO, ILLINOIS



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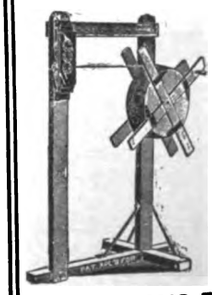

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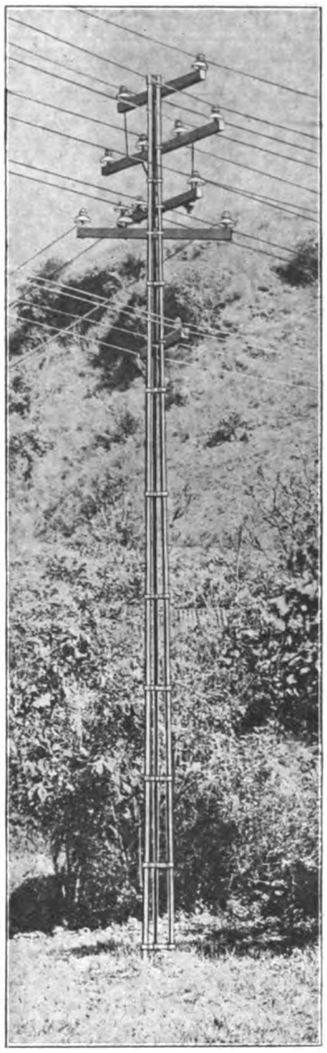

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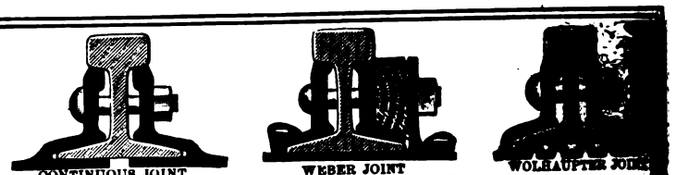

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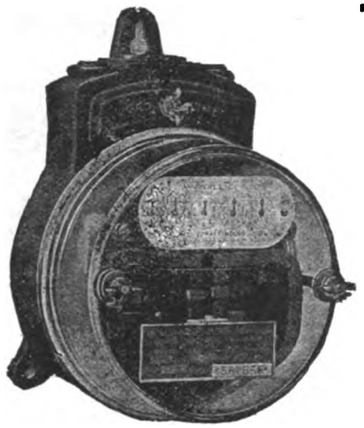

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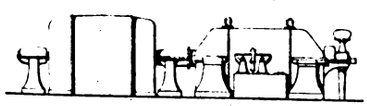

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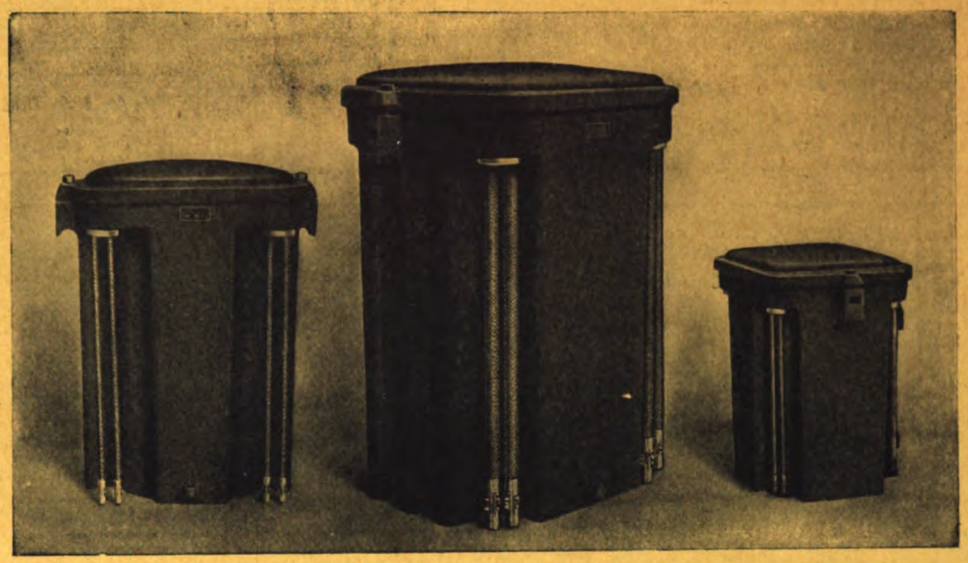

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